SPNHC
ADVANCING COLLECTIONS CARE

GREEN MUSEUM – HOW TO PRACTICE WHAT WE PREACH?

2016 SPNHC conference

31st Annual Meeting
June 20–25, 2016
Berlin, Germany

2nd, revised edition

museum für naturkunde berlin

Leibniz-Gemeinschaft

BG BM Botanischer Garten & Botanisches Museum Berlin

Freie Universität Berlin

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Freie Universität Berlin

SPNHC 2016
Contents

WELCOME
from your Berlin hosts

SPNHC 2016 – Welcome

The Museum für Naturkunde and the Botanic Garden and Botanical Museum Berlin welcome you to the 31st annual meeting of the Society for the Preservation of Natural History Collections and the 2nd Global Genome Biodiversity Network conference. We are proud to be the first in Germany to host these events, where professionals from natural history collections originating from 31 countries come together and share their knowledge, discuss ideas and develop projects. Berlin, the largest city in Germany with its history both in politics and science is an exciting choice for this event and we wish you a very pleasant stay during the congress week.

Sharing a mutual history of scientific research and serving the community in the education of the general public, the two institutions, the Museum and the Garden, pursuit similar purposes but have different origins. Whereas the collections of the Museum für Naturkunde were founded as a central part of the new Berlin University (Alma mater berolinensis, now Humboldt University Berlin) in 1810, the Botanical Garden and Botanical Museum Berlin predated the University by more than a century. It can be traced back to the kitchen garden of the Berlin palace of 1679 via a model agricultural garden in a then suburban location (the Kleistpark Schöneberg) to the present location in Dahlem. Due to the growth of the collections and the scientific impact, both institutions had to relocate at the turn of the last century. The zoological, anatomical, paleontological, and mineralogical collections of the Berlin University (renamed Friedrich Wilhelm Universität in 1828) were united in 1889 and established the Museum für Naturkunde at its present Invalidenstraße location. There, the collections have grown tremendously, now encompassing more than 30 million specimens, the largest number of specimens in one location for any German natural history institution. In 2009, the Museum für Naturkunde left the Humboldt University and joined the Leibniz Association, a science organization which – due to the national and international status and importance of its institutions – is jointly funded by the Federation and the Länder. The Botanic Garden moved in 1910 to its present location in order to accommodate the growing Herbarium, a Museum and the living collection. Together with the foundation of institutes of the Kaiser-Wilhelm Gesellschaft it created a science campus in Dahlem in the south-west of Berlin. With 20,000 different species of plants on 43 hectares the Berlin Botanic Garden and Museum houses the largest botanical collections in Germany, today complemented by a DNA bank and a seed bank. Its location in the American Sector of post World War II Berlin led to an affiliation with the Freie Universität Berlin at its establishment in 1948. There, the Botanic Garden and Botanical Museum Berlin now has the status of a Zentraleinrichtung.

Both institutions have closely worked together in many projects and initiatives and now have joined forces to host this year's SPNHC and GGBN meetings. Each conference has an exciting program with keynote lectures, symposia, demo camps and workshops along with social activities where both conferences come together. We wish you a successful conference, exciting field trips and interesting workshops – welcome to Berlin!

Professor Johannes Vogel, Ph.D.
Director General
Museum für Naturkunde
Leibniz Institute for Evolution and
Biodiversity Science

Professor Dr. Thomas Borsch
Director
Botanic Garden and
Botanical Museum Berlin
Freie Universität Berlin

HERZLICH WILLKOMMEN!

Welcome from the SPNHC 2016 Local Organizing Committee

It is our great pleasure to welcome you to Germany and the City of Berlin.
This is the first time that the Society for the Preservation of Natural History Collections has come to meet in Germany. The Museum für Naturkunde and the Botanic Garden and Botanical Museum Berlin are proud to host the 31st annual meeting of the Society. Delegates from more than 30 countries have made their trip to SPNHC 2016. To all of you a very warm welcome to Berlin. – Herzlich Willkommen in Berlin!

This year's theme "Green Museum – How to practice what we preach?" reflects in many ways the challenges and changes natural history collections are facing at the moment.
In a world of climate change and ever decreasing biodiversity, sustainability should be the criterion that determines all planning and decisions, ranging from field work to construction projects, from ethical aspects to cost-benefit analyses. In practice this often is compromised by constraints beyond the control of the institution, be it monetary, legal or other.
The rapidly growing digital world has long reached the natural history collections. Digitization is the key word for opening up hidden treasures and information – for scientific questions as well as societal challenges, and a fascinated public. Digitization changes the way of how we look at collections and how we work with them. It leads to new users and uses and novel types of collections along with new requirements. Digital mobilization of collections from processes to databases and standards for their integration in research and education has become a whole world in its own. This is also reflected by the SPNHC 2016 conference.
The same is true for new analytical methods and research fields such as molecular systematics. DNA and tissue collections (so called 'cold archives') are standard in research institution holding collections. The work of the Global Genome Biodiversity Network (GGBN) focuses on standards and best practice of these collections and the exchange and use of material according to international regulations. It was more than logic to bring together both societies for their meetings to stimulate exchange and common understanding.

A conference of this size would not be possible without the support from many sides. It all starts at the hosting institutions. Without an enthusiastic home base from director to student it simply would not be possible to organize a SPNHC conference.
A big THANKYOU from all of us goes to our sponsors and vendors for their significant financial support. Please use the opportunities during the breaks and vendors lunch on Thursday to visit them at the Rubin conference hall.
Right from the beginning, all the way down from our first thoughts about SPNHC in Berlin to the actual event, it has always been your enthusiasm as SPNHC members, conference attendees, and colleagues with common understanding that has carried us and driven us forward. In these times of immense changes in our world of natural history collections it is even more important to come together, share knowledge, learn from each other and join forces regardless from which country in the world you come. We think, SPNHC is an excellent place for this, and we hope that SPNHC 2016 will contribute to this spirit.

In this sense we wish all of us a fruitful meeting and a lot of fun!

Enjoy SPNHC 2016 and don't forget to take some time for your very own Berlin experience.

Christiane Quaisser
Chair, SPNHC 2016 Local Organizing Committee

SPNHC 2016 Local Organizing Committee

Team MfN
Peter Giere
Christiane Quaisser
Daniela Schwarz
Manja Voss

Team BGBM
Eva Häffner
Lena Kempener
Cornelia Löhne
Patricia Rahemipour

Team Agentur Konsens
Karlheinz Blackert
Susanne Kessler
Kirsten Merdanovic
Constanze Sürken

We would like thank all who have contributed to the success of the SPNHC 2016 conference!

WELCOME
TO SPNHC 2016!!

On behalf of SPNHC Council, it gives me great pleasure to welcome all participants to Berlin, Germany for our 31st Annual Meeting. Once again we spread our wings internationally by visiting the European continent and hope that this provides an interactive and collaborative environment for all of our members. Our annual meetings provides us the opportunity to network with colleagues, learn more about advancing techniques in collection management, highlight and celebrate our accomplishments and socialize in a unique setting.

Once again, the Local Organizing Committee from Berlin has done a tremendous job of providing a full and engaging program of events including exciting and engaging oral and poster sessions, informative workshops and some fun social events. We thank them for the huge amount of work they have put in to make this event a success. The conference theme "Green Museums – How to Practice what we Preach?" is very timely as we all feel the effects of climate change and environmental degradation and attempt to find ways to combat its effects not only on the specimens we collect and preserve, but also in our day to day practices as museum professionals. This is an interesting time for collections with both challenges and opportunities presenting themselves at every turn. Budgetary restrictions are necessitating new and innovative mechanisms of caring for our collections while the world-wide digitization initiative and ongoing community collaboration is providing new and exciting opportunities for collections use by an ever growing external user community. Collections advocacy and exposure in public and social media is also highlighting collections role in predictive modeling, climate change and many of the core environmental problems of our day.

Meetings such as these would not be possible without the valued financial support of our vendors and sponsors. We thank them for their continued support and encourage you to do the same by visiting their booths at the vendor show to see their new products and technologies.

The society as a hole functions through the valuable work of its committees and I would encourage all of you to become involved in the work of the society by volunteering your time with one of our many committees. If there is a committee you are interested in please attend their meeting on Tuesday morning and offer up your help with their important work. If you are a member of another like-minded society, consider becoming a representative from and to that society and SPNHC so that we can continue our work of building a powerful collections community.

If you are new to the Society we welcome you to your first meeting and hope that you will take advantage of all our meetings have to offer. Engage with established and new members through our Emerging Professionals Committee to find out ways in which you can become involved and get the most out of the meeting or find a Council member who will be happy to assist you navigate the meeting.

Our Travel Grant assistance has once again assisted in funding the attendance of five members who will be mentored by established collections professionals who will assist before, during and after the meeting. We thank our mentors for their help.
If you need any assistance during the meeting please find one of the members of the Local Organizing Committee or a Council member who are all identified on their name tags.

All that remains is for me to wish you a productive, engaging, fun-filled meeting.

Andrew Bentley
President
Society for the Preservation of Natural History Collections (SPNHC)

SPNHC 2016
ABOUT SPNHC

SPNHC
ADVANCING COLLECTIONS CARE

The Society for the Preservation of Natural History Collections [SPNHC] is an international society whose mission is to improve the preservation, conservation and management of natural history collections to ensure their continuing value to society. SPNHC takes a leading role in promoting collections care issues to the academic community, governments, and the general public. Our members are dedicated to training and mentoring the next generation of collections professionals.

The Society hosts annual meetings and maintains an active roster of publications, including Collection Forum, a journal that accepts submissions on all aspects of natural history collections management and conservation, a bi-annual Newsletter, and books that examine various aspects of natural history collections care, development and management. SPNHC is led by a talented group of individuals who are elected by the membership. Much of our work is accomplished through our committees, which form the backbone of our Society.

SPNHC 2016
Travel Grant Recipients and Mentors

SPNHC 2016 Travel Grant Recipients and Mentors

Christine Allen Travel Grant Recipient

Mariana Di Giacomo
University of Delaware, Department of Art Conservation, Newark, DE, 19716, United States
Conference Mentor: Matt Brown

Fitzgerald Travel Grant Recipients

Julian Carter
National Museum Wales, Dept of Collection Services, Cardiff, CF10 3NP, UK
Conference Mentor: Miranda Lowe

Erica Krimmel
Chicago Academy of Sciences / Peggy Notebaert Nature Museum, Biology, Chicago, 60614, United States
Conference Mentor: Elana Benamy

Suzie Li Wan Po
Cambridge University Museum of Zoology, Conservation, Cambridge, CB2 3EJ, UK
Conference Mentor: Cathy Hawks

Brian Rankin
University of California, Museum of Paleontology, Berkeley, California, 94720, United States
Conference Mentor: Ann Molineux

SPNHC and the 2016 Local Organizing Committee would like to congratulate all recipients and welcome them to this year's conference. We would also like to thank the reviewing team and the mentors of this year's travel grant recipients for their efforts.

SPNHC 2016
TRADESHOW AND SPONSORS

We thank all conference sponsors and vendors who contribute towards the 31st Annual Meeting of the Society for the Preservation of Natural History Collections.

DIAMOND
› Delta Designs Ltd.
› Synthesys c/o Natural History Museum

PLATINUM
› Axiell ALM Germany GmBH

GOLD
› iDigBio
› JSTOR
› Picturae B.V.

SILVER
› Anton Paar GmbH
› Global Biodiversity Information Facility (GBIF)
› Testo AG

BRONZE
› Alcomon Company
› Biologische Beratung Ltd.
› CollectionSpace
› Digitarium, University of Eastern Finland
› Panko Set Bartlomiej Pankowski

SUPPORTING PARNERS
› Springer Verlag
› University Products, Inc.

LITERATURE TABLE
› Bruynzeel Archiv & Bürosysteme GmbH
› Rowman & Littlefield

FLYER/INFORMATION MATERIAL ONSITE
› Kodex, Inc. X-Ray Associates East LLC

EP LUNCHEON
› All Packaging Company, Inc.
› Hollinger Metal Edge, Inc.
› iDigBio

PROMOTIONAL ITEMS
› Schweizerbart / Borntraeger Science Publisher

SPNHC
DENVER COLORADO | 2017

THE NEXT GENERATION IN BEST PRACTICES
JUNE 18 – 24, 2017

The local organizing committee, a partnership between the Denver Museum of Nature & Science and the Denver Botanic Gardens, is honored to host the 32nd annual meeting of the Society for the Preservation of Natural History Collections. Kelly Tomajko, SPNHC Member-at-Large, will chair the committee, and it will include Society members who are already active participants in the Society's annual meetings and activities.

The theme of the meeting is "The Next Generation in Best Practices." This broad theme is intended to reflect the core aim of SPNHC to codify and disseminate best practices for the development, management, and care of natural history collections. Stay tuned for meeting information at www.spnhc2017denver.org.

Conveniently located, Denver is the gateway to both the Rocky Mountains and the eastern plains. It has a great deal to offer those who wish to explore its vibrant cultural community as well as those who are interested in more remote areas of Colorado. To learn more about travel in Denver and across Colorado, please see Visit Denver at www.denver.org.

HOSTED BY

DENVER MUSEUM OF NATURE & SCIENCE

DENVER BOTANIC GARDENS

SPNHC 2016
GENERAL CONFERENCE INFORMATION

SPNHC 2016 – General Information

SPNHC AND GGBN – TWO CONFERENCES, ONE LOCATION?
The Local Organizing Committees of these two conferences have linked these conferences so that people who wish to attend both conferences can easily switch between venues. However, due to different requirements of each conference, they were not combined. Yet, wherever possible and useful, a combined audience is planned, e.g. in social activities, workshops, and the opening sessions. Please be reminded, that the lanyards of your name tag identifies you as a SPNHC attendee. As such, you are entitled to participate in sessions of the GGBN conference (venue: Onyx, basement level).

VENUE
The 31st Annual Meeting of the Society for the Preservation of Natural History Collections including all symposia, trade show, poster presentations and breaks will take place in andel's Hotel, Landsberger Allee 106, 10369 Berlin (52.5283926 | 13.457035799999971). Catering during coffee breaks and lunch are included in the registration fee.

REGISTRATION BOOTH
Please visit the registration booth prior to attending a session to check in and pick up your badge and conference bag. Badges should be worn at any time while attending the conference. Presenting their badge, conference participants will have free admission to the Museum für Naturkunde and the Botanischer Garten und Botanisches Museum Berlin throughout the conference. The registration booth will be located in andel's Hotel in the lobby of the conference area. The opening hours of the registration booth are:

Tuesday, June 21:	**8:00 AM - 6:30 PM**
Wednesday, June 22:	**8:00 AM - 6:00 PM**
Thursday, June 23:	**7:30 AM - 5:30 PM**
Friday, June 24:	**7:30 AM - 4:00 PM**

Please do not hesitate to consult the people at the registration booth with any question you have on the conference, on social events and in general with any problem you might encounter.

CONFERENCE COMMITTEE
For all inquiries, the conference committee can be reached via:

SPNHC 2016 hotline:	+49 157 54188533
Email:	spnhc2016@mfn-berlin.de

Other important numbers

andel's Hotel:	+49 30 4530530
Museum für Naturkunde:	+49 30 2093 8591
Botanical Garden and Botanical Museum Berlin:	+49 30 838 50100
Ambulance/fire brigade:	112
Police	110

WIFI
Wireless internet access will be available throughout the conference venue. Access information will be provided in the conference bag.

INFORMATION FOR PRESENTERS

Papers/Talks

Talks are scheduled in 20 minutes time slots including any time for questions. This will be rigorously enforced to accommodate concurrent session needs, courtesy for presenters and attendees who may need to move between meeting rooms. Presenters should plan to use their time slot with 15 min of presenting and 5 minutes for audience questions Presentation slides should be prepared and saved as either PowerPoint or PDF.
Authors have been informed about session and time slot of their presentation. If there are any doubts please contact the Local Organizing Committee beforehand.
Computer on place are exclusively Windows based systems. Your presentation should be submitted prior to your scheduled session (this is: either on the day before, during coffee breaks prior to the session) for upload to these computers, and there will be staff available to assist you. Alternatively, you can bring your own computer, for example if you prefer using a MacIntosh computer, but *please do not forget the adapter*.

Posters

Poster should be maximum A0 upright format and cannot exceed these dimensions. The format corresponds to a maximum of 84.1 cm (33'1") horizontal width and 118.9 cm (46'8") vertical height. Presenters will be provided with boards and thumbtacks, so all you have to do is to bring your poster.
Poster will be presented at the Rubin. Set up starts on Tuesday morning, breakdown on Friday afternoon. Poster session is scheduled on Wednesday, June 22, during the afternoon break (3:10-4:00 PM). We would like to ask all poster presenters to be present during this session.

VENDOR'S INFORMATION

Vendors are advised to set-up on Monday, June 20. The breakdown of the tradeshow will be on Friday, June 24 in theafternoon. Each vendor will be informed individually on further details.

VENDOR'S LUNCH

The vendors will be given the opportunity for a very brief presentation of their products prior to the Vendor's Lunch. These presentations are scheduled for Thursday, June 23 at noon in Onyx, the following Vendor's Lunch will be in neighbouring Rubin. Please do not miss this opportunity to get in touch with our sponsors.

SOCIAL MEDIA

The Local Organizing Committee decided not to take part in social media activities.

GUIDED TOURS BEHIND THE SCENES OF THE HOSTING INSTITUTIONS

Guided tours will be available during the Icebreaker on Monday, June 20 for the collections and exhibitions of the Museum für Naturkunde and prior the conference dinner for the Botanisches Museum und BotanischerGarten Berlin. For transport see social events.
Tours for either institution will also be offered on Friday, June 24, after the SPNHC Annual Business Meeting. Please enquire at the information counter or at the registration booth for more information.

SPNHC ANNUAL BUSINESS MEETING

The 2016 Annual Business Meeting of the Society for the Preservation of Natural History Collections will take place on June 24, 2016 between noon and 2 PM at andel's Hotel. The Venue is *Saphir 1*. A light lunch will be provided in the room for your convenience.

SPECIAL INTEREST GROUPS

Special Interest Groups will meet from 2:00 – 4:00 PM on Friday, June 24 at andel's Hotel in various venues. Please check the information provided at the registration booth for more information.

SPNHC 2016 – General Information

WORKSHOPS

The workshops are mainly scheduled for Saturday, June 25 (see list of workshops in this volume) either at the Botanischer Garten und Botanisches Museum Berlin or at the Museum für Naturkunde. However, there is one two-day workshop scheduled for June 25-26 in Botanischer Garten und Botanisches Museum Berlin (*Museum environments: managing risk and sustainability*). Some SPNHC 2016 attendees also signed up for workshops offered by GGBN (*Documentation of environmental samples and eDNA* and *GGI Gardens*) on Monday, June 20, at the Botanischer Garten und Botanisches Museum Berlin or on Tuesday, June 21, at the Museum für Naturkunde (*Advances in cryopreservation methods for microorganisms and plants*). For these workshops, please contact the GGBN hosts for more information. The meeting point for the workshops at the Museum für Naturkunde will be the staff entrance (see map in this volume). The meeting point for the workshops in the Botanischer Garten und Botanisches Museum Berlin will be at the entrance to the Botanical Museum (see map in this volume).

FIELD TRIPS

The field trips start at June 19 or June 20, respectively, at andel's Hotel (meeting point: lobby of the hotel) and aim to be back in time for the Icebreaker at the Museum für Naturkunde. Participants will be provided with more information individually via e-mail.

SOCIAL EVENTS

The **Icebreaker** will take place in the Museum für Naturkunde in Invalidenstraße 43, 10115 Berlin (52.52994 | 13.379553) on Monday, June 20. It starts with a get-together and guided tours at 5:00 PM, followed by an official welcome at 7:00 PM. The meeting point will be at the Museum für Naturkunde, main entrance. For your convenience, fieldtrips will end in front of the museum. For getting from the andel's Hotel to the museum, please take *Tram* M5 or *Tram* M8 (direction *Hauptbahnhof*) which start directly at the andel's hotel. For more information see entries *Venues* (above) and *Getting around* (below).
The Icebreaker will include a meet-and-greet of first time attendees, travel grant recipients and their mentors, the SPNHC Council and Local Organizing Committee. More information will be provided individually.

The **Congress Banquet** will be at the glass houses of the Botanischer Garten und Botanisches Museum Berlin, Königin Luise Straße 6-8, 14195 Berlin (52.458657 | 13.304611) on Thursday, June 23. Botanischer Garten und Botanisches MuseumThere will be a bus transfer to the Botanic Garden and back. The busses will leave at the andel's Hotel bus stop (east side of the hotel at *Storkower Straße*) between 5:30 PM and 6:00 PM. Buses for the andel's Hotel will leave the Botanischer Garten und Botanisches Museum Berlin between 10:00 PM and midnight.

The **sightseeing by bike** will leave on Wednesday, June 22, at 6:30 PM. Be aware that the meeting point will be at the Nikolaiviertel. Further information will be provided by the registration counter.

We plan for a **pub quiz** on Tuesday night (June 21, tbc).

GETTING AROUND

Berlin public transport (BVG and S-Bahn Berlin) is a good way to get around in Berlin. There are a few things you should know when using this system:

1. One ticket for all modes of transport: *S-Bahn, U-Bahn, Tram, Bus* (and even some ferries…)
2. Buy your ticket in advance, e.g. at the information desk at the andel's Hotel, on the platform (*S-Bahn* or *U-Bahn*, vending machines) or in the Bus/Tram (driver/ vending machines, no bills). Be sure to validate tickets bought in advance by inserting it into the slot of the ticket cancelling machine on the platform (*S-Bahn* or *U-Bahn*) or within the vehicle (*Bus/Tram*).
3. AB-Ticket (one way, all necessary transfers, valid up to two hours, all public transport within Berlin), Schönefeld Airport to andel's Hotel: ABC Ticket

For more information and specific requests, the information desk at the andel's Hotel is happy to assist you – or see http://www.bvg.de/en / download the BVG app, which can also be used for purchasing tickets.

PUBLIC TRANSPORT BETWEEN VENUES

andel's Hotel ▶ Museum für Naturkunde:

Take Tram M5 or M8 (direction *S+U Hauptbahnhof*) and exit at *U Naturkundemuseum*.
Ticket: AB, duration: ca. 30 minutes

Museum für Naturkunde ▶ andel's Hotel:

Take Tram M5 (direction *Hohenschönhausen, Zingster Str.*) or Tram M8 (direction *Ahrensfelde/Stadtgrenze*) and exit at S Landsberger Allee.
Ticket: AB, duration: ca. 30 minutes.

andel's Hotel ▶ Botanischer Garten und Botanisches Museum:

Take S41 (circular line, clockwise direction) to *S Schöneberg*,
transfer to S1 (direction *S Wannsee*) to *S+U Rathaus Steglitz*,
transfer to Bus X83 (direction *Königin Luise Str. / Clayallee*),
exit at *Königin Luise Platz / Botanischer Garten.*
Ticket: AB, duration: ca. 45 minutes

Botanischer Garten und Botanisches Museum ▶ andel's Hotel:

take Bus X83 (direction *Lichtenrade, Nahariyastr.*) to *S+U Rathaus Steglitz*,
transfer to S1 (direction *S Oranienburg*) to *S Schöneberg*,
transfer to S42 (circular line, counterclockwise direction),
exit at *S Landsberger Allee.*
Ticket: AB, duration ca. 45 minutes

PARKING

The andel's Hotel offers guest parking at an additional cost. Free parking may be found in the vicinity – the area surrounding the hotel is not a controlled parking zone.

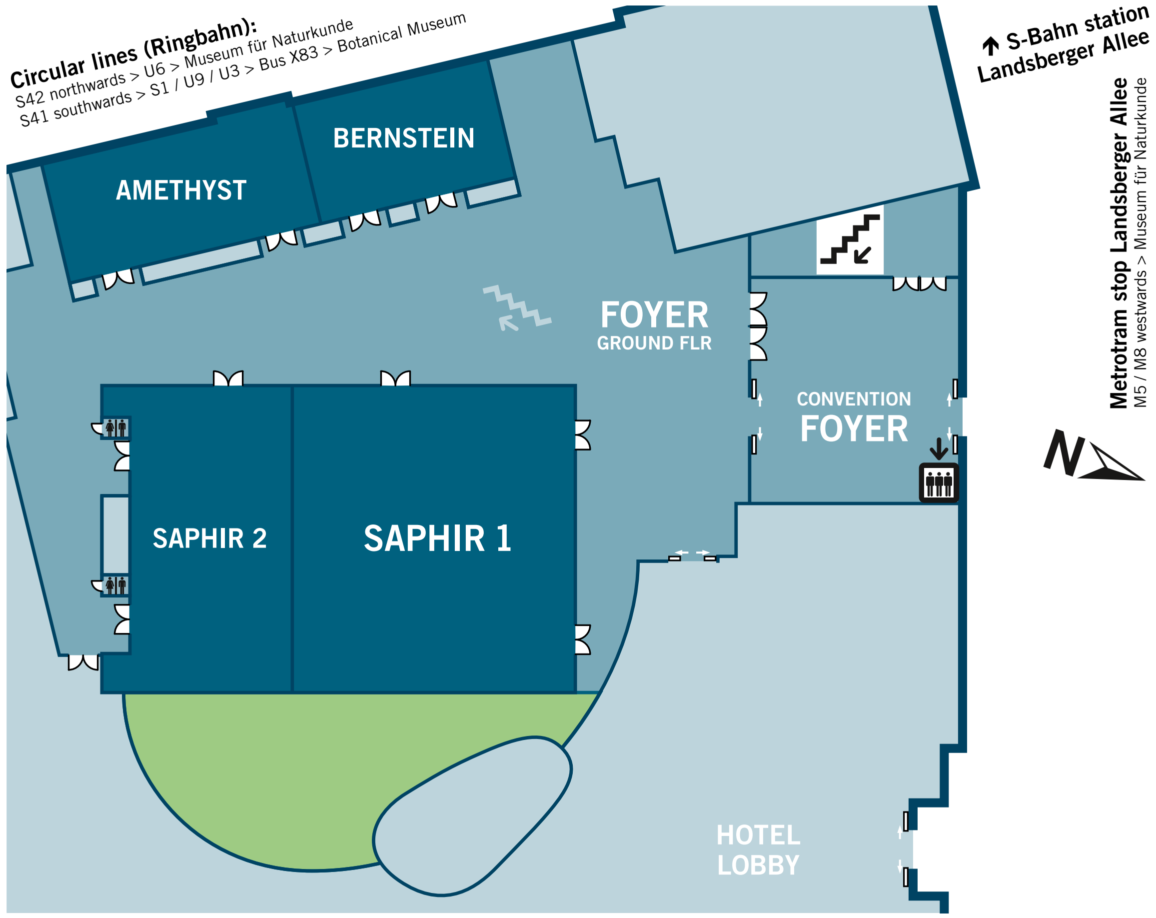
ELECTRICITY SUPPLY

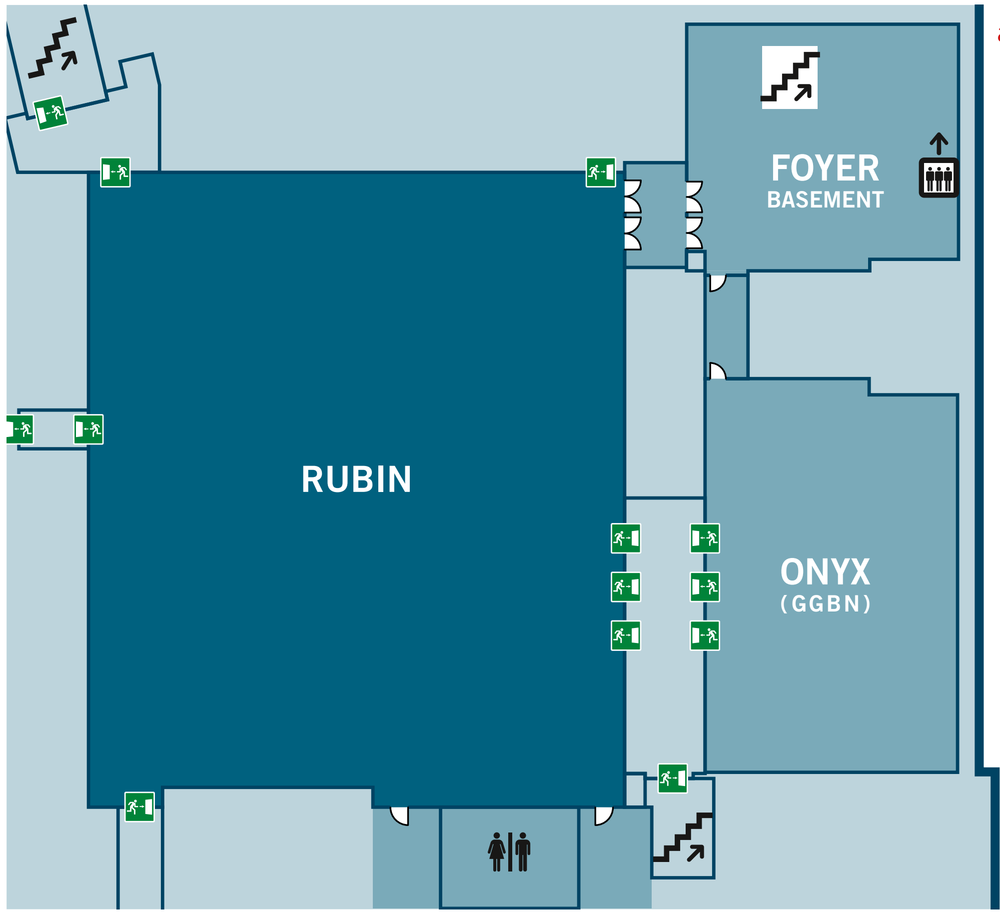
Electricity supply is 230 V – 50 HZ AC. Do not forget to bring an adapter for plug type F ("Schuko") or C (EURO).

DISCLAIMER

Neither of the legal entities involved in the organization and hosting of the conference can be held liable for any damage to persons or damage or loss of property during the conference in any of the conference venues and during associated activities elsewhere.

SPNHC 2016
LOCATIONS





andel's Hotel Berlin
by Vienna House
Landsberger Allee 106
10369 Berlin

MfN site plan

1 Main museum entrance

2 Barrier
Delivery

3 Portal III:
Wheelchair-accessible elevator

4 Freight elevator (wheelchair-accessible)

5 Main building, Portal V:
Staff entrance
Meeting point for workshops
in seminar room Zoology
and preparatory

5a Seminar room Zoology N 5411 (2nd mezzanine)

5b Preparatory (east wing top floor)

6 North building,
Adlerportal (Eagle portal):
Treppe (staircase) 12

6a Seminar room N 3221 (2nd floor):
Coffee and lunch breaks
Transit to lecture hall 8

6b Lecture hall 8 (2nd floor)

6c Seminar room N 3330 (3rd floor)

7 Freight elevator North building
(wheelchair-accessible)

Construction site

M Hotel Mercure

Surrounding area, connections

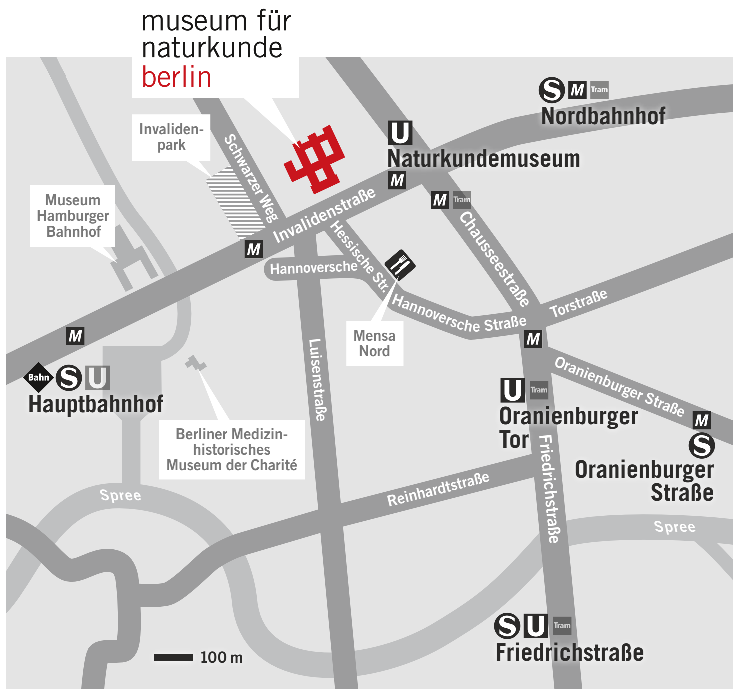
Junction of long distance trains,
regional express trains, regional trains,
U-Bahn to Brandenburg Gate, and S-Bahn:
Hauptbahnhof

S-Landsberger Allee > S8 / S9 / circular line S41 >
S-Ostkreuz > city lines S5 / S7 / S75 >
S-Friedrichstraße, S-Hauptbahnhof

S-Landsberger Allee > circular line S42 >
S-Gesundbrunnen > city lines S1 / S2 / S25 >
S-Nordbahnhof, S-Oranienburger Straße

S-Landsberger Allee > circular line S42 >
S+U-Wedding > subway line U6 >
U-Naturkundemuseum, U-Friedrichstraße

Landsberger Allee > metrotram M5 via S-Alexanderplatz /
metrotram M8 via S-Nordbahnhof >
Metrotramstop Naturkundemuseum



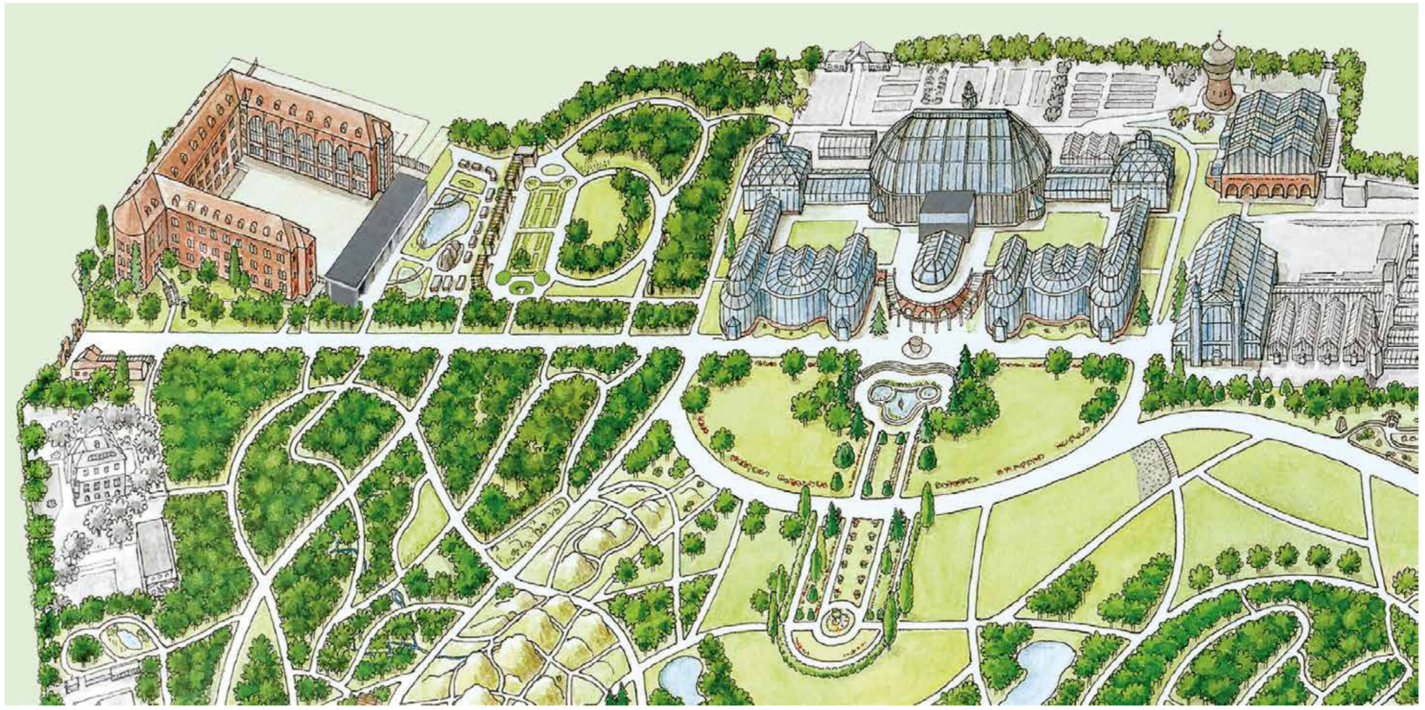
BGBM site plan, directions

Museum entrance: Königin-Luise-Straße 6–8

S-Bahn station Landsberger Allee > circular line S41 >
S-Bahn station Schöneberg > city line S1 >
S-Bahn station Rathaus Steglitz > Bus X83 "Königin-Luise-Str." >
Königin-Luise-Platz/Botanischer Garten

S-Bahn station Landsberger Allee > circular line S41 >
S- and U-Bahn station Bundesplatz > subway line U9 >
U-Bahn station Rathaus Steglitz > Bus X83 "Königin-Luise-Str." >
Königin-Luise-Platz/Botanischer Garten

S-Bahn station Landsberger Allee > circular line S41 >
S- and U-Bahn station Heidelberger Platz > subway line U3 >
U-Bahn station Dahlem Dorf > Bus X83 "Lichtenrade" >
Königin-Luise-Platz/Botanischer Garten



SPNHC 2016
FIELD TRIPS

FIELD TRIP

Senckenberg, Forschungsinstitut und Naturmuseum Frankfurt/Main and Messel Research Station

Time: two days, June 19-20, 2016

Departure: June 19, 7:15 AM; arrival: June 20, 7:30 PM

Bus pick up location: lobby of the andel's hotel

With about 37 million objects, the Senckenberg network constitutes the biggest natural history collection in Germany. The network partners are distributed over whole Germany with comprehensive collections in the natural history museums in Dresden, Görlitz and Frankfurt and the German Entomological Institute in Müncheberg and additional research institutions focusing e.g. on climate change and marine science. A well-known member of the Senckenberg community is the Messel Pit (Grube Messel). It was a bituminous shale mine and became almost a landfill but strong local resistance fortunately stopped these plans at the end. In 1995 it was declared a UNESCO World Heritage site because of the abundance of extraordinary (Eocene) fossils, e.g. Darwinius masillae. Until today, significant scientific discoveries are still being made.
The two-day field trip offers a unique chance to get a deep insight in both, the Senckenberg headquarter in Frankfurt with its wonderful exhibitions and valuable collections and the famous Messel Pit. Starting on Sunday morning at the andel's hotel we will go by train to Frankfurt where the colleagues from the Senckenberg Naturmuseum will take us on a tour through the exhibition and collections (with focus on paleontological collections). At the end of this first exciting day, a bus will bring us to our hotel, the Jagdschloss Kranichstein. It is situated just a few minutes from the Messel Pit in Darmstadt. Monday morning will be spent on an excursion at the Messel Pit World Heritage Site. We will have the chance to experience live excavation and preparation activities and will have look at the visitors' center. After lunch a bus shuttle will bring us to the train station to get back to Berlin. To make sure that you can fully relax and enjoy the whole field trip from start to end, we will take of everything and arranged an all-inclusive-package.

FIELD TRIP

Darß, Stralsund and Deutsches Meeresmuseum Stralsund

Time: two days, June 19-20, 2016

Departure: June 19, 7:30 AM; arrival: June 20, 7:00 PM

Bus pick up location: lobby of the andel's hotel

The fieldtrip will guide you through the historic town of Stralsund, the impressive Meeresmuseum and Ozeaneum and will make a trip to the beautiful coast of the Baltic Sea. We will start by bus in Berlin and go directly to Prerow, on the Fischland-Darß-Zingst peninsula. After a light walk through the unique forest environment that is part of the national reservation Vorpommersche Boddenlandschaft, we will visit the lighthouse and Museum Natureum on the northern top of the peninsula. A "Kremser" (covered char-a-bank) trip will take us back to the bus from where we go to Stralsund, one of the old hanseatic cities along the Baltic Sea. On the next day, we will visit the Ozeaneum/maritime museum. With its different buildings the maritime museum is embedded in the beautiful historic city of Stralsund. Most famous is the Ozeaneum with its giant sea water tanks that will take you on an exceptional journey through the underwater world of the northern seas that is unique throughout Europe.

FIELD TRIP

Spreewald punt tour

Time: one day, June 19, 2016

Departure: 7:15 AM; arrival: 6:45 PM

Bus pick up location: lobby of the andel's hotel

About 100 km south-east of Berlin is the UNESCO biosphere reserve Spreewald. It is known for its traditional irrigation system, which consists of more than 200 small canals, and is traditionally and best travelled by punts. The landscape was shaped during the Ice Age. Alder forests on wetlands and pine forests on sandy dry areas are characteristic for the region.
This field trip will take you on a punt tour and walk to discover a unique combination of untouched nature and cultural traditions. Starting directly from the andel's hotel, we will go first to Lübbenau by bus, from where we enter the punts. At lunchtime, we will stop at the restaurant "Wofschofska" and continue afterwards our punt tour to the outdoor museum in Lehde. After returning to Lübbenau, we will go back to Berlin by bus again.

FIELD TRIP

Steppe birds and grassland restoration in the Rhin-Havel River drainage basin

Time: one day, June 19, 2016

Departure: 6:00 AM; arrival: 6:00 PM

Bus pick up location: lobby of the andel's hotel

This field trip will lead us to the grasslands and marshes of the "Havelländisches Luch" and Havel River valley some 70 kilometres west of Berlin. The marshes have been drained and degraded for agricultural purpose in the 1970s but are now in a state of restoration. The "Havelländisches Luch" is the main site for the Great Bustard Otis tarda in Germany. Moreover it is home of many other threatened grassland species such as Corncrake, Quail, Montague's Harrier etc. We will also visit the nearby Bird Conservation Centre belonging to the Brandenburg State office of Environment. In the afternoon, we will visit Gülper See, a shallow lake with adjacent meadows and streams which is a hotspot for marsh birds, waterfowl and raptors such as the White-tailed Eagle. Binoculars are mandatory. The field trip is restricted to 15 participants and includes lunch boxes. We will travel with small buses.

SPNHC 2016 – Conference programme

SCHEDULE
AT A GLANCE

Day	Time	Programme	Venue
Sunday, June 19			
		Field trips	
	Departure 7:15 AM	Senckenberg, Forschungsinstitut und Naturmuseum Frankfurt/Main and Messel Research Station	
	Departure 7:30 AM	Stralsund and the Deutsches Meeresmuseum Stralsund	
Monday, June 20			
		Field trips	
	Arrival 7:30 PM	Senckenberg, Forschungsinstitut und Naturmuseum Frankfurt/Main and Messel Research Station	
	Arrival 7:00 PM	Stralsund and the Deutsches Meeresmuseum Stralsund	
	7:15 AM - 6:45 PM	Spreewald punt tour	
	6:00 AM - 6:00 PM	Steppe birds and grassland restoration in the Rhin-Havel River drainage basin	
		Guided tours and Icebreaker	Museum für Naturkunde
	5:00 - 7:00 PM	Come together and guided tours behind the scene collections and exhibit tours	
	7:00 - 9:00 PM	Welcome and Icebreaker reception	
Tuesday, June 21			andel's Hotel Landsberger Allee
	8:00 AM - 6:30 PM	Registration	Registration Desk, Lobby
	8:30 AM - 6:30 PM	Trade show	Rubin
	8:30 AM - 6:30 PM	Poster set up	Rubin
	9:00 - 10:00 AM	SPNHC Committee meetings	Amethyst 1, Amethyst 2, Bernstein 1, Bernstein 2
	10:00 - 10:30 AM	Break	Rubin
	10:30 AM - 12:30 PM	SPNHC Committee meetings	Amethyst 1, Amethyst 2, Bernstein 1, Bernstein 2
	12:30 - 13:30 PM	Lunch	Rubin

Day	Time	Programme	Venue
	2:00 - 3:00 PM	Official Opening	Saphir
	3:00 - 4:00 PM	Keynote Speaker SPNHC	Saphir
	4:00 - 4:30 PM	Break	Rubin
	4:30 - 5:30 PM	Keynote Speaker GGBN	Saphir
	5:30 - 7:30 PM	SPNHC Council Meeting	Bernstein
	7:30 PM - open end	Optional Social Event	tba
Wednes-day, June 22			andel's Hotel Landsberger Allee
	8:00 AM - 6:00 PM	Registration	Registration Desk, Lobby
	8:30 AM - 5:30 PM	Trade show	Rubin
	8:30 AM - 5:30 PM	Poster display	Rubin
	9:00 - 10:00 AM	Keynote Green Museum	Saphir 1
	10:00 - 10:30 AM	Break	Rubin
	10:30 AM - 12:10 PM	Green Museum Session	Saphir 1
	12:10 - 1:20 PM	Lunch	Rubin
	12:10 - 1:20 PM	Emerging Professionals Luncheon	Bernstein
	1:20 - 3:10 PM	Technical Sessions (concurrent)	
		iDigBio Symposium: An International Conversation on Mobilizing Natural History Collections (NHC) Data and Integrating Data for Research	Saphir 1
		Green Museum Session	Amethyst
	3:10 - 4:00 PM	Break & Poster Session	Rubin
	4:00 - 5:20 PM	Technical Sessions (concurrent)	
		iDigBio Symposium: An International Conversation on Mobilizing Natural History Collections (NHC) Data and Integrating Data for Research	Saphir 1
		Green Museum Session	Amethyst
	6:30 - 9:30 PM	Optional Social Event: Sightseeing by bike	Nikolaiviertel

SPNHC 2016 – Conference programme

Day	Time	Programme	Venue
Thursday, June 23			andel's Hotel Landsberger Allee
	7:30 AM - 5:30 PM	Registration	Registration Desk, Lobby
	8:30 AM - 5:00 PM	Trade show	Rubin
	8:30 AM - 5:00 PM	Poster display	Rubin
	8:30 - 9:50 AM	Technical Sessions (concurrent)	
		SYNTHESYS Symposium: Enabling Infrastructure: Future Collections, Data & Informatics	Saphir 1
		Digitizing and Imaging Collections: New Methods, Ideas, and Uses	Saphir 2
		Green Museum Session	Amethyst
	9:50 - 10:20 AM	Break	Rubin
	10:20 AM - 12:00 PM	Technical Sessions (concurrent)	
		SYNTHESYS Symposium: Enabling Infrastructure: Future Collections, Data & Informatics	Saphir 1
		Digitizing and Imaging Collections: New Methods, Ideas, and Uses	Saphir 2
		iDigBio Symposium 1: Small Collections Symposium: Blending the educational resources of small and large collections for training the next generation of museum professionals.	Amethyst
		Preventive Conservation & Material Science	Bernstein
	12:00 - 1:10 PM	Vendors' Lunch	Rubin
	1:10 - 2:50 PM	Technical Sessions (concurrent)	
		SYNTHESYS Symposium: Enabling Infrastructure: Future Collections, Data & Informatics	Saphir 1
		Digitizing and Imaging Collections: New Methods, Ideas, and Uses	Saphir 2
		iDigBio Symposium 1: Small Collections Symposium: Blending the educational resources of small and large collections for training the next generation of museum professionals.	Amethyst
		Preventive Conservation & Material Science	Bernstein
	2:50 - 3:20 PM	Break	Rubin

Day	Time	Programme	Venue
	3:20 - 5:00 PM	Technical Sessions (concurrent)	
		GBIF TF Symposium: Setting global and local digitization priorities	Saphir 1
		Digitizing and Imaging Collections: New Methods, Ideas, and Uses	Saphir 2
		Collections for the future – Future of collections	Amethyst
		Preventive Conservation & Material Science	Bernstein
		Guided Tours and Congress Banquet	Botanischer Garten und Botanisches Museum
	5:30 - 6:00 PM	Busses leaving for the BGBM	
	6:30 - 7:30 PM	Come together and guided tours behind the scene collections and green houses	
	7:30 PM - Midnight	Welcome, dinner and dancing	
	10:00 PM - Midnight	Busses leaving for the andel's Hotel	
Friday, June 24			andel's Hotel Landsberger Allee
	7:30 AM - 4:00 PM	Registration	Registration Desk, Lobby
	8:30 AM - 2:00 PM	Trade show	Rubin
	8:30 AM - 2:00 PM	Poster display	Rubin
	2:00 - 4:00 PM	Poster removal	Rubin
	8:30 - 9:50 AM	Technical Sessions (concurrent)	
		SYNTHESYS Symposium: Developing a global research infrastructure framework for bio-collections	Saphir 1
		DemoCamp	Saphir 2
		Collections for the future – Future of collections	Amethyst
	9:50 - 10:20 AM	Break	Rubin
	10:20 - 11:40 AM	Technical Sessions (concurrent)	
		SYNTHESYS Symposium: Developing a global research infrastructure framework for bio-collections	Saphir 1
		DemoCamp	Saphir 2

Day	Time	Programme	Venue
		Collections stewardship and policies	Amethyst
	12:00 - 2:00 PM	SPNHC Annual Business Meeting Luncheon (open to all)	Saphir 1
	2:00 - 4:00 PM	Optional: Special Interest Groups, collection tours, etc.	tba
	4:00 PM	Closure of the Conference	
Saturday, June 25			
		Workshops (Coffee and lunch breaks included in registration)	
Full day	9:00 AM - 5:00 PM	Museum environments: Managing risk and sustainability (Moderators: Rob Waller, Jeremy Linden)	Botanischer Garten und Botanisches Museum
	9:00 AM - 5:00 PM	Synthesys-iDigBio: Digitisation Software Training Workshop: Inselect, Symbiota & ABBYY FineReader (Moderators: Elspeth Haston, Deborah Paul)	Botanischer Garten und Botanisches Museum
	9:00 AM - 5:00 PM	Cost-efficient large-scale surface digitizing via photogrammetry – approaches for small and large collections (Moderator: Heinrich Mallison)	Museum für Naturkunde
Half day	9:00 AM - 12:00 PM	Fluid collections – conservation techniques (Moderators: Dirk Neumann, Julian Carter)	Museum für Naturkunde
	9:00 AM - 12:00 PM	Cleaning – repairing – restoring of historical mounted bird specimens (Moderator: Jürgen Fiebig)	Museum für Naturkunde
	1:30 - 4:30 PM	"Access and Benefit Sharing" in Natural History Collections – implementation and practical management (Moderators: Dirk Neumann, Peter Giere)	Museum für Naturkunde
	1:30 - 4:30 PM	Proper sealing in fluid collections (Moderators: Klaus Wechsler, Christoph Meier)	Museum für Naturkunde
Sunday, June 26			
		Workshops (Coffee and lunch breaks included in registration)	
	9:00 AM - 5:00 PM	Museum environments: Managing risk and sustainability (Moderators: Rob Waller, Jeremy Linden)	Botanischer Garten und Botanisches Museum

SPNHC 2016 – Conference programme

CONFERENCE PROGRAMME
AT ANDEL'S HOTEL

TUESDAY, JUNE 21

SPNHC 2016 – Conference programme

TUESDAY, JUNE 21

Time	Slot	Programme	Saphir 1	Saphir 2	Amethyst	Bernstein	Rubin
9:00 AM		Committee meetings			Amethyst 1: Legislation & Regulations (Chair: Dirk Neumann), Amethyst 2: Long Range Planning (Chair: Linda Ford)	Bernstein 1: Membership (Chair: Tiffany Adrain)	
10:00 AM		Break					
10:30 AM		Committee meetings			Amethyst 1: Professional Development (Chairs: Jeff Stephenson, Jennifer Strotman), Amethyst 2: Conservation (Chairs: Armando Mendez, Rebecca Newberry, Cindy Opitz)	Bernstein 1: Best Practices/Documentation (Chairs: Breda Zimkus, Jessica Cundiff), Bernstein 2: International Relations (Chair: Susan Ryder)	
11:30 AM		Committee meetings			Amethyst 1: Emerging Professionals (Chair: Kari Harris) , Amethyst 2: Publications (Chair: Christine Johnson)	Bernstein 1: Conference (Chair: Linda Ford), Bernstein 2: Web (Chair: Ann Molineaux)	
12:30 PM		Lunch					
2:00 PM		Opening	Welcome and opening remarks				
			Christiane Quaisser, SPNHC LOC				
			Andrew Bentley, President, SPNHC council				
			Johannes C. Vogel, Director General, MfN				
			Thomas Borsch, Director, BGBM				
			Gabriele Droege, GGBN host				
			Ole Seberg, GGBN chair				
3:00 PM		Keynote SPNHC	Michael Braungardt: The 'cradle to cradle' design concept				
4:00 PM		Break					
4:30 PM		Keynote GGBN	Ole Seberg: Preserving a Cross Section of the Tree of Life				
5:30 PM						SPNHC Council Meeting	

WEDNESDAY, JUNE 22

SPNHC 2016 – Conference programme

WEDNESDAY, JUNE 22

Time	Slot	Programme	Saphir 1	Saphir 2	Amethyst	Bernstein	Rubin
9:00 AM		General Session	Green Museum				
	9:00 AM	Keynote General Session	Timothy Fridtjof Flannery: Optimising museum research towards sustainability				
10:00 AM		Break					
10:30 AM		General Session	Green Museum				
	10:30 AM		Stefan Simon: Sustainable conservation on the way to the green museum				
	11:00 AM		Stefan Simon, Tim White, Rob Waller, Walt Crimm, Johanna Leissner & Lukasz Bratasz: On the Way to the Green Museum: Managing Risk and Sustainability. Panel Discussion				
12:10 PM		Lunch				Emerging Professionals Luncheon	
1:20 PM		Technical Sessions	One Collection: pathways to integration		Green Museum		
	1:20 PM		Vincent Smith: Introduction to One Collection: pathways to integration				
			iDigBio Symposium: An International Conversation on Mobilizing Natural History Collections (NHC) Data and Integrating Data for Research				
	1:30 PM		Sarah Phillips, Alan Paton, Laura Green & Sandy Knapp: Lessons learnt from a herbarium specimen mass digitisation pilot		Constanze Fuhrmann & Johanna Leissner: Sustainable Museum – more than just "going green"		
	1:50 PM		Erica Krimmel & Dawn Roberts: Evaluating collection management systems for interdisciplinary natural history collections		Friedhelm Haas: Restoring the Large Tropical Conservatory ("Großes Tropenhaus") in the Botanic Garden of Berlin to energy efficiency while considering aspects of monument preservation		

WEDNESDAY, JUNE 22

SPNHC 2016 – Conference programme

WEDNESDAY, JUNE 22

Time	Slot	Programme	Saphir 1	Saphir 2	Amethyst	Bernstein	Rubin
	2:10 PM		Philippa Brewer, Liadan Stevens, Emma L Bernard, Sandra Chapman, Lorna Steel, Anna Taylor, Lyndsey Douglas, David Godfrey, Francesca Taylor, Vladimir Blagoderov, Lawrence N. Hudson, David Smith & Molly Clery: eMesozoic: an alternative approach to digitising palaeontological collections		Peter Bartsch, Ulrich Struck & Detlef Willborn: Climate monitoring and perspectives for a sensible use of a marvelous old building		
					Part I: Design specifications and strategies to ensure environmentally and institutionally sustainable preservation		
	2:30 PM		Gabriela M. Hogue: The Art of Georeferencing: A case study at the North Carolina Museum of Natural Sciences		Catherine Hawks: The collection environment		
	2:50 PM		David Lazarus, Jeremy Young, Shanan Peters & Johan Renaudie: Paleontologic collection data in the broader context of paleontologic research data systems		Jeff Hirsch: Understanding cost management		
3:10 PM		Break					Poster Presentation
4:00 PM		Technical Sessions	iDigBio Symposium: An International Conversation on Mobilizing Natural History Collections (NHC) Data and Integrating Data for Research		Green Museum		
	4:00 PM		Susan Butts, Talia Karim, Chris Norris & Dena Smith: iDigPaleo and ePANDDA: digital infrastructure and tools for collection discovery and use		Walt Crimm: Design strategies for sustainable solutions		
					Part II: Planning and assessment as key components of environmentally and institutionally sustainable preservation		
	4:20 PM		Paul Mayer: How digitization helped tame the Tully monster		Kelly Tomajko: Collection planning		

WEDNESDAY, JUNE 22

SPNHC 2016 – Conference programme

WEDNESDAY, JUNE 22

Time	Slot	Programme	Saphir 1	Saphir 2	Amethyst	Bernstein	Rubin
	4:40 PM		Shelley A James: Field to database to aggregator and beyond: documenting the flora of Melanesia		Rob Waller & Jude Southward: Collection Risk Assessment		
	5:00 PM		Brian Westra: Data Librarianship and Small Collections Support		Jeff Weatherston: Collection space planning		
6:30 - 9:30 PM		Optional Social Event					

THURSDAY, JUNE 23

THURSDAY, JUNE 23

Time	Slot	Programme	Saphir 1	Saphir 2	Amethyst	Bernstein	Rubin
8:30 AM		Technical Sessions	SYNTHESYS Symposium: Enabling Infrastructure: Future Collections, Data & Informatics	Digitizing and Imaging Collections: New Methods, Ideas, and Uses	Green Museum		
	8:30 AM		Greg Riccardi: Digitization Infrastructure in the US	Dawn Roberts & Erica Krimmel: Assessing the initial implementation of Arctos in interdisciplinary natural history collections	Susan H. Butts, Richard Boardman, Amber Garrard, David Skelly, Tim White & Kimberley Zolvik: Yale Peabody Museum's sustainability action plan		
	8:50 AM		Robert Guralnick, Michael Denslow & Austin Mast: Notes from Nature 2.0: Citizen science at scale	Andrew Doran & Holly Forbes: Connecting Conservation and Collections: The On-line Resources of the University & Jepson Herbaria and the UC Botanical Garden at Berkeley	Lukasz Bratasz, Tim White, Catherine Sease, Nathan Uthrup, Susan Butts, Richard Boardman & Stefan Simon: Evaluation of climate control in Yale Peabody Museum of Natural History – energy consumption and risk assessment		
	9:10 AM		Jiri Frank & Carolyn Sheffield: Harnessing biodiversity literature for Natural History collections curation and research – a digital library perspective	Vladimir Blagoderov, E. Louise Allan, Alex Ball, Benjamin Price, Rebecca Summerfield, Emma Sherlock, Flavia Toloni & Peter Wing: "To slide or not to slide"—How do we scan the Natural History Museum's slide collections?	Christel Schollaardt, Mark Nesbitt & Roxali Bijmoer: New uses for old collections: rediscovering and redefining economic botany		
	9:30 AM		Matthew Collins : Text Mining Whole Museum Datasets for Expanding Understanding of Collections with the GUODA Service	Nelson Rios & Henry L. Bart Jr.: COPIS: Prototyping a Computer Operated Photogrammetric Imaging System	Pasquale Ciliberti: To kill or not to kill: ethics of collecting insects		

THURSDAY, JUNE 23

SPNHC 2016 – Conference programme

THURSDAY, JUNE 23

Time	Slot	Programme	Saphir 1	Saphir 2	Amethyst	Bernstein	Rubin
9:50 AM		Break					
10:20 AM		Technical Sessions	SYNTHESYS Symposium: Enabling Infrastructure: Future Collections, Data & Informatics	Digitizing and Imaging Collections: New Methods, Ideas, and Uses	iDigBio Symposium 1: Small Collections Symposium: Blending the educational resources of small and large collections for training the next generation of museum professionals.	Preventive Conservation & Material Science	
	10:20 AM		Elspeth Haston, Laurent Albenga, Simon Chagnoux, Robert Cubey, Robyn Drinkwater, James Durrant, Ed Gilbert, Falko Glöckler, Laura Green, David Harris, Jörg Holetschek, Lawrence Hudson, Philip Kahle, Sally King, Agnes Kirchhoff, Alexander Kroupa, Jiří Kvaček, Gwénaël Le Bras, Laurence Livermore, Günter Mühlberger, Deborah Paul, Sarah Phillips, Larissa Smirnova & František Vacek: Automating capture of metadata for natural history specimens	Natalie Dale-Skey : Streamlining specimens digitisation through the use of Inselect - a curator's perspective	Anna K. Monfils, Libby Ellwood, Debra Linton, Molly Phillips, Joseph A. Cook, Joseph Kerski, Tracy Barbaro, Sam Donovan, Karen Powers, L. Alan Prather & Rob Guralnick: Integrating Natural History Collections into Undergraduate Education: Creating the Resources and Growing the Community	Meghann Toner: A Smithsonian Institution case study: Managing the movement of bulky collections	
	10:40 AM		Vincent Smith, Ben Scott & Ed Baker: Data Portal and the Graph of Life	Robyn Drinkwater, Elspeth Haston, Sally King & Erzsebet Gyongy: Using OCR for QC in the digitisation workflow of RBGE herbarium	Mare Nazaire: Preservation of natural history collections through student engagement: the internship experience at Rancho Santa Ana Botanic Garden	Majken Them Tøttrup: Moving of the geological and botanical collections at NHMD	
	11:00 AM		Matt Woodburn & Laurence Livermore: The Great Migration: Negotiating the path from physical object to digital surrogate		Randy Singer: Small collections can make big waves in education and outreach	Paul Callomon & Gary Rosenberg: The plain of jars: rehousing the Malacology alcohol collection at the Academy of Natural Sciences in Philadelphia	
	11:20 AM		Robert Cubey: Are people using natural history specimen data? A comparison of usage from an institutional website versus large data aggregators	Douglas G. D. Russell, Zoë Varley, Lawrence Brooks & Jörn P. W. Scharlemann: Digital transcription improves access to egg collections and mobilizes phenological data	Elizabeth R. Ellwood, Paul Kimberly, Paul Flemons, Robert Guralnick, Kevin Love & Austin R. Mast: Educational opportunities for small and large collections with the Worldwide Engagement for Digitizing Biocollections Event, WeDigBio 2016	Arianna Bernucci, Lorraine Cornish & Cheryl Lynn: Blue Whale on the move: Dismantling a 125 year-old specimen	

THURSDAY, JUNE 23

SPNHC 2016 – Conference programme

THURSDAY, JUNE 23

Time	Slot	Programme	Saphir 1	Saphir 2	Amethyst	Bernstein	Rubin
	11:40 AM		Paul J Morris, James Hanken, David B. Lowery, Bertram Ludäscher, James A. Macklin, Timothy McPhillips, Robert A. Morris, Antonio Mauro Saraiva, Tianhong Song, Allan Koch Veiga & John Wieczorek: Error? What Error? Expectation management in reporting data quality issues to data curators.	Sylke Frahnert: Improving the collecting data of historical museum specimens	Emily Gillespie: The Marshall University Herbarium: A model for engaging student curators in small herbarium digitization efforts	Julian Carter & Dirk Neumann: 'Avoiding a pickle'- Developing standards for the sustainable care and conservation of fluid preserved collections	
12:00 PM		Lunch					Vendor's Lunch
1:10 PM		Technical Sessions	SYNTHESYS Symposium: Enabling Infrastructure: Future Collections, Data & Informatics	Digitizing and Imaging Collections: New Methods, Ideas, and Uses	iDigBio Symposium 1: Small Collections Symposium: Blending the educational resources of small and large collections for training the next generation of museum professionals.	Preventive Conservation & Material Science	
	1:10 PM		Deirdre Ryan & Barbara Thiers: Global Plants: A Model of International Collaboration		Kari M. Harris & Travis D. Marsico: Involving undergraduates in the digital community: Leveraging collections preservation, research, and outreach through a network of natural history collections clubs	Gregory J. Watkins-Colwell: From body bags to boxes of bones; Herpetology and ichthyology skeletal preparation at Yale Peabody Museum of Natural History	
	1:30 PM		Gisela Baumann, Wolf-Henning Kusber, Jörg Holetschek, Anton Güntsch, Walter G. Berendsohn: Natural history online - An efficient data publication framework for museum collections	Henry L. Bart Jr. & Nelson E. Rios: Enhancing FishNet2 to Increase Access of Developing Country Scientists to Fish Specimens Records in Developed Country Museums	Andrew Doran & Holly Forbes: Training the next generation of botanists: small collections at the University of California, Berkeley Herbaria and Botanical Garden	Véronique Rouchon: Preserving iron sulfate bearing papers	
	1:50 PM		Riitta Tegelberg, Janne Karppinen, Zhengzhe Wu, Jere Kahanpää & Hannu Saarenmaa: Automating the Insect Digitization – Speed and Costs	Kate Andrew, Daniel Lockett, Jackie Tweddle & Michael Rosenbaum: Releasing the potential of a significant regional geology collection through digitisation and working with partners that include an experimental game designer	Deborah L. Paul, Matthew Collins, Laurence Livermore & Dimitrios Koureas: Museum and Collections Biodiversity Informatics: Meeting skills needs for creating, sharing, and using the digital relatives of museum specimens	Steffen Bock: Deterioration processes in skins and hides of mammal collections	
	2:10 PM		Mira Silanova: WITIKON: Mass 3D digitisation at a national scale	Richard K. Rabeler: Using specimen portals for floristics research	Zack Murrell: Development of a human infrastructure: SERNEC as a case study	Magdalena Grenda-Kurmanow: Challenges of conservation treatment of historic herbaria	

THURSDAY, JUNE 23

SPNHC 2016 – Conference programme

THURSDAY, JUNE 23

Time	Slot	Programme	Saphir 1	Saphir 2	Amethyst	Bernstein	Rubin
	2:30 PM		Deb Paul, Philip van Heerden, Vince Smith, Laurence Livermore & Ehsan Alavi Fazel: A Bridge from Enabling Infrastructure to Digitization Priorities, a view from industry	Yvette Harvey & Jonathan Gregson: Recreating a long-lost herbarium	Mary Beth Prondzinski: Engaging student awareness of museum collections	Pascal Querner: Integrated Pest Management in Austrian Natural History Museums - A sustainable approach	
2:50 PM		Break					
3:20 PM		Technical Sessions	GBIF TF Symposium: Setting global and local digitization priorities	Digitizing and Imaging Collections: New Methods, Ideas, and Uses	Collections for the future - Future of collections -	Preventive Conservation & Material Science	
	3:20 PM		Leonard Krishtalka: The Digitization Dilemma: Setting "demand-driven" priorities and why it matters	Patricia Nutter & Erin Bilyeu: Digitization in the office of the registrar: Saving our documents for the future		Tom Strang & Jeremy Jacobs: Seeing is believing, a fourteen year study on efficacy and economics of visual inspections to protect a large mammal collection	
	3:40 PM		Barbara M. Thiers: Principles for Setting Digitization Priorities for Herbaria	Kamal Khidas & Stéphanie Tessier: Building next-generation collections: Challenges in digitizing already digitized collections	Amanda Lawrence & Leslie Hale: A rock without data is just a rock: The importance of systematically integrating orphaned collections	Fran Ritchie, Julia Sybalsky, Caitlin Richeson & Kelly McCauley: Performing a condition survey of historic mammalian taxidermy	
	4:00 PM		Masanori Nakae & Tsuyoshi Hosoya: Prioritization in digitization of natural history collections in Asia – the cases of some Asian countries	Jennifer Thomas : Bringing dark data to light – how do we keep the lights on?	Travis D. Marsico, Jennifer N. Reed, Samantha Worthy, Lauren Whitehurst, Kevin S. Burgess & Rima D. Lucardi: Small herbaria as repositories for invasive species and federal noxious weed vouchers in collaborative research	Amy Trafford & Lu Allington-Jones: Combining digitisation and sustainable conservation: The Airless Project	
	4:20 PM		Deborah Paul, Siro Masinde, Shari Ellis, Leonard Krishtalka, Barbara Thiers, Jean Ganglo, Eduardo Dalcin & Masanori Nakae: A global survey of natural history collections	Josefina Barreiro, Celia M. Santos-Mazorra, Marisol Alonso & Marian Ramos: Preliminary analysis of effectiveness and accuracy of crowdsourcing vs in-situ digitisation methods	Ann Bogaerts, Steven Janssens, Dakis-Yaoba Ouédraogo, Peter Hietz, Adeline Fayolle, Anaïs-Pasiphaé Gorel, Brecht Verstraeten, Sofie De Smedt & Piet Stoffelen: New technologies lead to new uses in the herbarium of the Botanic Garden Meise	Luc Willemse & Max Caspers: Permanent storage of Lepidoptera in glassine envelopes: reducing resources while optimizing accessibility	
	4:40 PM		Ian Owens: The new enlightenment: digital collections and the re-invention of large natural history museums	Travis D. Marsico & Kari M. Harris: Frank discussion of small herbarium digitization options for the lost, confused, weary, under-budgeted, and over-stimulated	Eileen Graham & David Schindel: Scientific collections and food security: their role in predicting and protecting our future food supply	Walt Crimm: External forces on collections care & storage spaces: Recommendations for balancing with equal and non-oppositional forces	
6:30 PM - Midnight		Guided Tours and Congress Banquet, BGBM					

FRIDAY, JUNE 24

SPNHC 2016 – Conference programme

FRIDAY, JUNE 24

Time	Slot	Programme	Saphir 1	Saphir 2	Amethyst	Bernstein	Rubin
8:30 AM		Technical Sessions	SYNTHESYS Symposium: Developing a global research infrastructure framework for bio-collections	DemoCamp	Collections for the future - Future of collections -		
	8:30 AM		Dimitris Koureas & Ana Casino: Introduction / Scoping / Expectations	Paul J. Morris, James Hanken, David B. Lowery, Bertram Ludäscher, James A. Macklin, Timothy McPhillips, Robert A. Morris, John Wieczorek & Qian Zhang: Kurator: Extensible and accessible tools for quality assessment of biodiversity data	Jeanine Vélez Gavilán: Building systems and capacity to monitor and conserve BVI's flora		
	8:50 AM		Maarten Heerlien: Building the pan-European Natural History Collections Research Infrastructure	Jason Best & Tiana Rehman: Rapid collection inventories	Emma Sherlock, Keiron D. Brown & Duncan Sivell: Museums, keys, recording schemes and amateur naturalists. Why museums underpin the recording movement and why its crucial they continue		
	9:10 AM		Barbara Thiers: The Biodiversity Collections Network (BCoN): Promoting the Use of Digitized Biocollections Data for Research and Education	Martin Pullan & Robert Cubey: Rapid filtering application design and implementation			
	9:30 AM		Donald Hobern: Challenges and Needs at the Global Scale – Sharing Resources and Expertise	Lawrence N Hudson, Elizabeth Louise Allan, Vladimir Blagoderov, Natalie Dale-Skey, Alice Heaton, Pieter Holtzhausen, Laurence Livermore, Benjamin W Price, Emma Sherlock, Stéfan van der Walt & Vincent S Smith: Inselect - applying computer vision to facilitate rapid record creation and metadata capture	Britta Horstmann: The Leibniz Association and its eight research museums		
9:50 AM		Break					

FRIDAY, JUNE 24

Time	Slot	Programme	Saphir 1	Saphir 2	Amethyst	Bernstein	Rubin
10:20 AM		Technical Sessions	SYNTHESYS Symposium: Developing a global research infrastructure framework for bio-collections	DemoCamp	Collections stewardship and policies		
	10:20 AM		Helen Glaves: Integrating e-infrastructures to support environmental research: a use case from the marine domain	Adele Crane, Eileen Graham & David Schindel: Global Registry of Scientific Collections (GRSciColl): Function and application	Christiane Quaisser: Wind of change – Collections stewardship at the Museum für Naturkunde Berlin between tradition and cultural change		
	10:40 AM		Norman Morrison: FAIR-trading. Promoting data exchange through ELIXIR Interoperability tools and services	Kessy Abarenkov, Urmas Kõljalg, Allan Zirk & Veljo Runnel: PlutoF – online solution for the common biological data management and Open Data	Peter Giere, Dirk Neumann & Conny Löhne: Access and Benefit Sharing: implementation and implications		
	11:00 AM		Panel and open discussion	Timothy McPhillips, Qian Zhang, Bertram Ludäscher, James Hanken, David B. Lowery, James A. Macklin, Paul J. Morris, Robert A. Morris, Laura Russell & John Wieczorek: Using YesWorkflow to explore the results of cleaning a dataset using a script	Erika M. Gardner & Rusty Russell: From policy to procedures: designing, constructing and documenting a complete herbarium procedure manual		
	11:20 AM		Panel and open discussion	Matthew Collins, Jorrit Poelen & Alexander Thompson: Whole-dataset processing of biological collections and other data sources as a service - Demonstration of GUODA	Wendy van Bohemen & Nicolien Sol: Loaning without moaning		
12:00 PM		Lunch	Annual Business Meeting Luncheon				
2:00 PM		Optional: Special Interest Groups, collection tours, etc.					
4:00 PM		Closure of the Conference					

SPNHC 2016 – Conference programme

FRIDAY, JUNE 24

LIST
POSTER PRESENTATIONS

Re-housing bird eggs and nests at the Michigan State University Museum.
Laura Abraczinskas and Barbara Lundrigan

Challenges in curating two fossil plant collections at the University of Iowa Paleontology Repository
Tiffany S. Adrain, Maja Stina Sunleaf, and Kaitlin Schlotfelt

Making sustainability work
Gretchen Anderson, Amy Covell-Murthy, Deborah Harding, and Amy Henrici

Curating the Royal Botanic Gardens, Kew Spirit Collection
Melissa Bavington

Preserving iron sulfate specimens
Oulfa Belhadj Cristiano Ferraris, Jean Marc Fourcault and Véronique Rouchon

AnnoSys: A generic online annotation system for scientific collections
Walter G. Berendsohn, Lutz Suhrbier, Wolf-Henning Kusber, and Anton Güntsch

Integrating diverse resources at the New York Botanical Garden for specimen-based botanical research
Lisa Campbell, Kimberly Watson, Melissa Tulig

Updates on whole-dataset analyses using Spark and the GUODA data service
Matthew Collins, Jorrit Poelen, and Alexander Thompson

To fade or not to fade… Monitoring exhibit light levels and color changes to manage risk of light damage
Maureen DaRos White Paul Whitmore, and Catherine Sease

Rehousing Tapa – a project to repair, photograph and improve the storage conditions of barkcloths at the Yale Peabody Museum
Rebekah DeAngelo, Aliza Taft, Catherine Sease

Natural resins sold today: are they correct and pure?
Louise Decq, Vincent Cattersel, Piet Stoffelen, Viviane Leyman, Charles Indekeu, Delphine Steyaert, Emile Van Binnebeke, Wim Fremout, Steven Saverwyns

DOE! Mass digitisation of the BR Herbarium at Botanic Garden Meise
Sofie De Smedt, Ann Bogaerts, Piet Stoffelen, Quentin Groom, Henry Engledow, Marc Sosef, Paul Van Wambeke and Steven Dessein

The effect of light on vertebrate fossils: Exhibition, collection and artificial aging
Mariana Di Giacomo

Zipped up: sealing large formalin specimens for storage and transport.
Esther Dondorp

Clear as glass: digitizing 100,000 glass slides from the Naturalis collection using an online crowdsourcing platform
Karen van Dorp

See something, say something. Using visiting researchers to help locate deteriorating avian study specimens
Christina A. Gebhard

Brief Summary of the National Herbarium (ETH)
Fiseha Getachew

"Zentrum für Sammlungen" – a Berlin network of museums and museum related institutions
Peter Giere, Dorothee Haffner and Alexandra Jeberien for the members of the network

What do users want from a herbarium's web portal?
Quentin Groom, Henry Engledow, Sofie De Smedt and Paul Van Wambeke

The preservation and display of a 'black smoker' hydrothermal vent at University Museum of Zoology Cambridge
Natalie Jones

Pigment based ink-jet printers: Use in collection management at the National Museum of Natural History, Smithsonian Institution
W. Geoff Keel, Diane E. Pitassy, and William E. Moser

Information Extraction from Herbarium Sheets – The StanDAP-Herb Project
Agnes Kirchhoff, Dominik Röpert, Anton Güntsch, Walter G. Berendsohn, E. Santamaria, U. Bügel, F. Chaves-S., C. Guan, H. Zheng, and K.-H. Steinke

CollectionsEducation.org: Connecting students to citizen science and curated collections
Erica R. Krimmel, Debra L. Linton, Travis D. Marsico, Anna K. Monfils, Ashley B. Morris, Brad R. Ruhfel

Palms and Carl von Martius in the Botanic Garden Meise
Viviane Leyman, Sofie De Smedt, and Piet Stoffelen

Needle felting fills: Creating fills for areas of fur loss using needle felting as a technique
Suzie Li Wan Po

Digitization Status of the East African Herbarium
Itambo Malombe, Brenda Nyaboke and Jonathan Ayayo

The IPM quarantine facilities at the NHM
Armando Mendez, Roberto Portela Miguez and Suzanne Ryder

AQUiLA – a platform for biodiversity data Generic data model and full-featured text search engine– a good match?
Lothar Menner and Andreas Allspach

Test, extend and improve initial best practice for georeferencing of specimen data and also georeference your own collection data with freely accessible IT tools
Steven van der Mije and Wilfred Gerritsen

The Value of DNA Barcoding for Collections Management
Christopher M. Milensky Christopher J. Huddleston, and David Schindel

Using Laponite gel for removing papyrus backings of poor quality cardboard
Amr Moustafa, Moamen Othman, Mohamed Abdel-Rahman Ahmed Tarek

Comparison of two lid types for museum fluid collections
Kirsten E. Nicholson and Lillian Hendricks

The type collection at the National Herbarium of Mexico (MEXU): a very dynamic and active collection
Helga Ochoterena and María del Rosario García Peña

Historic collections going global: Digitization at the University of Iowa Museum of Natural History.
Cindy Opitz and Trina E. Roberts

Incorporating Genetic Sampling into a Traditional Botanical Voucher Workflow
Melinda Peters and Amanda Devine

Extant Brazilian mammals in scientific collections of Europe: an update
Alexandra Maria Ramos Bezerra

Digitzing eocene fossil collections for global change research
Brian Rankin and Patricia Holroyd

Mobilizing biodiversity data in a megadiverse country: the online collections of Colombia's Instituto de Ciencias Naturales
Lauren Raz, Henry D. Agudelo-Zamora, and Andrés E. Páez Torres

Filling feather loss: Tricks & tips
Fran Ritchie and Julia Sybalsky

Low-quality images to manage scientific collections of fossils: the case of Paleobotany and fossil invertebrate collection of the MNCN-CSIC
Celia M. Santos-Mazorra

Data-basing of the mineral and rock/ore collection at Museum für Naturkunde Berlin – looking backward and forward
Ralf T. Schmitt and Regina Brückner

Greenovations! Benefits and drawbacks to the LEED Silver Certification Renovations of Pod 3
Leslie Schuhmann and Christine Geer Chagnon

Natural history education using marine debris: A hands-on beachcombing museum display
Akihiko Suzuki and Takafumi Enya

Building systems and capacity to monitor and conserve the flora of the British Virgin Islands
Jeanine Vélez Gavilán Martin Hamilton, Sara Barrios, Thomas Heller, José Sustache, Omar Monsegur, Nancy Woodfield-Pascoe, Natasha Harrigan

Crowdsourcing specimen labels — the Crab Shack experience
Regina Wetzer and N. Dean Pentcheff

Digitization of Dearness Fungal Type Collection
Jennifer Wilkinson and Scott Redhead

Butterflies in bags: saving time, space and money
Luc Willemse and Max Caspers

How green thinking is practiced when shipping specimens.
Robert Wilson

SPNHC 2016 – Abstracts

SPNHC 2016
ABSTRACTS

SPNHC 2016
KEYNOTE LECTURES

KEYNOTE LECTURE SPNHC

The 'cradle to cradle' design concept

Michael Braungart* [1]

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“The need for true innovation has never been more profound then now. Deep-rooted structures and systems are being challenged to change. Just to be less bad, is simply not good enough. We are capable to think circular and create high-quality alternatives which are effective and beneficial for humans and nature. With this message Cradle to Cradle supports people to go beyond our traditional patterns and mindsets. If the future can be positive, why choose differently?”

For decades, Prof. Dr. Michael Braungart has pioneered the Cradle to Cradle design concept. He co-authored (with William McDonough) the bestselling book of the same name, and has lectured at universities in Europe, America and Asia. His expertise has been published in numerous international magazines and journals. He has worked with several scientific institutes and companies across a range of industries, and has developed tools for designing eco-effective products, business systems and intelligent materials pooling. This approach paves the way to a new economic system for which, innovation, positivity, quality and creativity are key. That this can work, show hundreds of products that have been developed according to this principle. Nature is for Prof. Dr. Michael Braungart a source of inspiration and shows us how we can increase our positive footprint and celebrate life.

KEYNOTE LECTURE GGBN

Preserving a Cross Section of the Tree of Life

Ole Seberg* [1]

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* oles@snm.ku.dk

The Global Genome Biodiversity Network (GGBN) was formed with the principal aim of making high-quality well-documented collections storing genomic samples (e.g. DNA, RNA and whole tissues) of biodiversity, discoverable for research.
However, with in excess of 1.4-1.8 million known and 11-14 million unknown species, the task of creating an intelligent subsampling of this diversity is a formidable one. Even worse, information on existing genomic samples spread across biodiversity biobanks has proven to be fragmented, inhibiting scientific research and discovery. Accordingly many scientists consider a lack in availability of high quality genomic samples a serious bottle-neck to their research. To alleviate these problems and help humanity to store an intelligent subset of the world’s biodiversity, the Global Genome Biodiversity Network (GGBN) was created in 2011.
Thus, the aims of GGBN are to foster a shared interest in long-term preservation of genomic samples that represent the diversity of non-human life on Earth. GGBN provides a platform for biodiversity biobanks from across the world to:

- Collaborate to ensure consistent quality standards for DNA and tissue collections,
- Improve best practices for the preservation and use of such collections,
- Harmonize exchange and use of genetic materials in accordance with national and international legislation and conventions.

By making Genomic Collections discoverable for research through a trusted and networked community of biorepositories GGBN will enable a targeted sampling of life on Earth for the benefit of generations to come.

KEYNOTE LECTURE GREEN MUSEUM – HOW TO PRACTICE WHAT WE PREACH? (GENERAL SESSION)

Optimising museum research towards sustainability.

Timothy Fridtjof Flannery* [1]

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* timothy.flannery@unimelb.edu.au

The biological collections held in natural history museums are a unique asset. Properly interrogated, they can provide key data in regard to the biological response to climate change, ocean acidification, epidemic diseases, their spread and host switching, and genetic and morphological changes over time. They are also a unique repository of information regarding the ecology and genetics of extinct taxa.

The challenges to sustainability have never been so complex, nor the potential solutions so varied. From managing genetic diversity in relict populations, to responding to the pressures of climate change and the 're-wilding' of landscapes, the natural history museum, its collections and research capacities are increasingly vital.

Some examples from Australia and elsewhere will be discussed to illustrate these points.

SPNHC 2016
SYMPOSIA AND PANEL DISCUSSIONS

PANEL DISCUSSION

On the way to the Green Museum: Managing risk and sustainability

Chairs: Stefan Simon [1]; Tim White [2], Rob Waller [3], Walt Crimm [4], Johanna Leissner [5] and Lukasz Bratasz [6]

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2 Yale Peabody Museum, Office of Collections and Operations, New Haven, CT, 06520, United States of America;
3 Protect Heritage Corp., 622 Simoneau Way, Ottawa K4A 1P4, Canada;
4 Walt Crimm Associates, 6868 Scotforth Road, Philadelphia, 19119, United States of America;
5 Fraunhofer EU Office Brussels, Rue Royale 94, 1000 Brussels, Belgium;
6 Institute for the Preservation of Cultural Heritage (IPCH), Yale University, P.O. Box 27395, West Haven, CT 06516-7395, United States of America

ABSTRACT
Sustainable development —the concept of meeting the worlds current needs without compromising the ability of future generations to do the same—is of growing importance in times of rapid social transformations, global climate change, and economic uncertainty. Negotiating the interchange and tradeoffs between preservation of cultural heritage and environmental protection is the manifestation of sustainability, but it inherently produces conflicts. Difficult decisions must be made at all levels, whether in having to privilege one type of cultural heritage over another to minimize environmental impacts, or in allowing a part of the museum collection to decline due to limited resources.

The panel discussion will convene representatives of various disciplines and discuss the progress under various angles the pathways towards the “green museum” – a museum which incorporates and implements the concept of sustainability in its program, its activities and its physical presence. In particular, the panelists will address existing frameworks to identify, evaluate and manage risks, benefits, requirements and impacts in order to define priorities and propose solutions which decrease environmental and economic costs of preservation.

LINKED SYMPOSIA

One Collection: pathways to integration

SUMMARY

SYNTHESYS3, GBIF, CETAF, iDigBio, and others are working together to create this series of symposia to foster a unified conversation at SPNHC 2016 directed at coordinating efforts to realize global digitization and global data access for biological collections. The goals of these integrated symposia are to discuss:

- lessons learned so far, including new developments and data use examples;
- strategies for worldwide access to the means to digitize collections data;
- guidelines to aid prioritization of collections' digitization and future collecting; and
- the necessary human resources, hardware and software infrastructure for global creation of and access to this much-needed data.

Abstracts of oral and poster presentations submitted to this series are included in abstract section of this conference book under the name of the first author and referring to the symposium they will be held.

SYMPOSIUM 1

An international conversation on mobilizing natural history collections data and integrating data for research

Primary Organizer: Integrated Digitized Biocollections (iDigBio), SYNTHESYS3, University of Oregon

Chairs: Deborah Paul (iDigBio) [1]; Elspeth Haston (SYNTHESYS3) [2] and Brian Westra (University of Oregon, USA) [3]

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2 Royal Botanic Garden Edinburgh, Edinburgh, EH3 5LR, UK; E.Haston@rbge.ac.uk
3 University of Oregon, Science Library, Eugene, 97408, US; bwestra@uoregon.edu

ABSTRACT

Natural History Collection (NHC) data are being mobilized all over the world. A recent preliminary worldwide survey data suggests the trend is growing. As digitization begins to become an every-day part of collections, many compelling issues vie for attention. For example, cost, prioritization, sustainability, and rates of digitization are four such issues. And, many uses for NHC data are well-known and fairly well-understood. But issues exist with the data, and there is still much legacy data to be digitally captured – before it can be shared with the world's researchers.

We invite presentations from anyone in the collections and biodiversity informatics community who is involved in the mobilization and use of NHC data. We envision an assortment of talks covering three areas:

1. digitization (including imaging) lessons learned and outstanding questions,
2. new and emerging technologies/models, and cross-discipline collaborations for digitization and georeferencing, and
3. collections data-in-action.

Our speakers may be, for example, those doing the digitization and mobilization of the data; museum collection administrators actively incorporating digitization into their museum's mission and vision; computer, information, and library scientists supporting digitization and research efforts; education and outreach staff working with citizen scientists to digitize and georeference; or those using collections data in research.

Key topics

- Digitization Lessons Learned
- New Technology, New Strategies
- Collections Data-In-Action

SYMPOSIUM 2

Enabling infrastructure: Future collections, data & informatics

Primary Organizer: SYNTHESYS3

Chairs: Vince Smith and Laurence Livermore [1]

1 Diversity and Informatics, Natural History Museum, London, SW7 5BD, UK; vince@vsmith.info, l.livermore@nhm.ac.uk

ABSTRACT

Digital technologies are having a profound influence on how we manage, access and use our collections. These services have the potential to generate efficiencies that will transform traditional collection management and create opportunities to integrate our activities across and beyond institutional boundaries.

In this session we invite speakers to present on the systems and technologies that will be required to develop a common digitisation infrastructure across collections-based institutions.

Key topics

- Data mobilisation – infrastructures aiding the digitisation of collections at scale.
- Data aggregators & data portals – linking institutional data portals to common digital gateways to enable semantic enrichment of our data
- Next generation collection management systems, models & data services – moving towards a service-driven architecture in collections management systems, the supporting tools (e.g. API-based services, taxonomic name matching, checklist production, authority files, georeferencing, forecasting and analytical tools) and required new and extended data models
- Data consensus – systems and standards for community data curation and attribution

SYMPOSIUM 3

Setting global and local digitisation priorities

Primary Organizer: GBIF Task Force on Accelerating the Discovery of Biocollections Data

Chair: Leonard Krishtalka [1]

1 Biodiversity Institute, University of Kansas, Dyche Hall, 1345 Jayhawk Blvd, Lawrence, KS 66045, United States of America; Krishtalka@ku.edu

ABSTRACT

Who are the future users of the digital network and how do we develop common priorities to service these needs? From a purely economic standpoint, the simplest and cheapest way to prioritize digitization is to use the A-Z approach, that is, start from one end of a collection moving sequentially to the last end. With this approach there is little trouble tracking or skipping, it is neutral and can be easily industrialised by using conveyer belt systems. However, in the majority of situations, resources are scarce, sizes and the different kinds of collections are overwhelming, research is ongoing, urgent and important questions need to be answered hence the need to set digitization priorities based for example on taxonomy, geography, habitats, research needs, preservation methods, societal needs, and so on. Priorities may be set at the individual, institutional, local, regional, national or international levels, and furthermore they need not be uniform so long as they are fit for purpose. Strategic prioritization is essential in order to make the biggest impact on biodiversity science, policy, decisions, take advantage of funding opportunities, and leverage the best partnerships. Despite the concerted efforts and the deployment of significant resources in the last decade, it is estimated that only about 10% of the world's c. 3 billion natural history collection specimens (NHCs) have been digitised with most of the efforts concentrated in North America and Western Europe. Furthermore, only some of the digitised collections are fully mobilised in terms of being findable, accessible, interoperable and reusable. Past, current and planned digitisation projects that did not follow the A-Z approach and were not just opportunistic had to prioritise what they digitise and can provide important lessons to the biocollections community. This symposium aims to provide a roadmap for setting digitisation priorities.

Key topics

- Prioritizing collections for digitization—which collections, what should come first, and what is the progression, etc;
- Effective, best practices;
- Bridging the digitization gap between the developed and developing countries;
- Potential partnerships;
- Funding – how to pay for it.

SYMPOSIUM 4

Developing a global research infrastructure framework for bio-collections

Primary Organizer: SYNTHESYS3

Chairs: Dimitris Koureas (SYNTHESYS3) [1] and Ana Casino (CETAF) [2]

1 Diversity and Informatics, Natural History Museum, London, SW7 5BD, UK; d.koureas@nhm.ac.uk
2 Consortium of European Taxonomic Facilities, 1000 Brussels, BE; ana.casino@cetaf.org

ABSTRACT

The future of biological collections lies in greater integration and cooperation to develop as a global Research Infrastructure (RI), with common practices, policy and systems. Achieving this requires mechanisms that enable us to draw on successful workflows, technologies and processes, and develop fair and efficient business models that ensure long-term sustainability of infrastructure. Building on the work of ADBC programme (http://www.nsf.gov/pubs/2015/nsf15576/nsf15576.htm) and coordinating groups like iDigBio, alongside the work of organisations and projects such as CETAF, GBIF, TDWG, NSCA and SYNTHESYS, this session will bring together key stakeholders to coordinate actions relevant to the development of a global RI on bio-collections.
At European level, the European Strategic Framework for Research Infrastructures (ESFRI) sets the top-level priorities for developing robust and sustainable RIs. Inclusion of bio-collections in the ESFRI roadmap would place bio-collections at the heart of the European RIs, enhancing physical and virtual access to collections, promoting large scale international collaborations and opening up new opportunities for attracting funding from both national and regional public and private sources.

This is a by-invitation Component of the Symposium. Conference attendees are invited to contribute to the discussion part of the session.

Key topics

- Established distributed Research Infrastructures: Lessons learned;
- Bio-collections in Europe: ESFRI roadmap update preparatory activities;
- Links to related regional initiatives (e.g. iDigBio, ENVRI+, LifeWatch, ELIXIR);
- International collaboration between major programmes;
- Sustainability and business models: What is available and what is possible?;
- Training and capacity building programmes;
- Wrap-up discussion: "How do we proceed?" – Action items.

IDIGBIO SYMPOSIUM

Small Collections Symposium: Blending the educational resources of small and large collections for training the next generation of museum professionals

Organizer: Integrated Digitized Biocollections (iDigBio), Small Collections Network (SCNet)

Chairs: Anna Monfils [1] and Gil Nelson [2]

1 Central Michigan University, Biology, Mount Pleasant, 48859, USA; monfi1ak@cmich.edu
2 Florida State University, Tallahassee, FL, 32306, USA; gnelson@bio.fsu.edu

ABSTRACT

Recent national and global digitization initiatives have led to a resurgence of interest in natural history collections (NHCs), the data they contain, and the potential to use NHC data to address large scale questions related to climate change, invasive species, and anthropogenic disturbance. This influx of energy into NHCs, emerging databases, emphasis on big data and data literacy, and the changing skill sets required to manage NHCs begs to examine the training of the next generation of scientists. The Implementation Plan for the Network Integrated Biocollections Alliance (USA) pointed to two emerging goals for the collections community that relate directly to education: 1) enhancing the training of existing collections staff and create the next generation of biodiversity information managers, and 2) infusing specimen-based learning and exploration into formal and informal science education. With the publication of Vision and Change in Undergraduate Biology: A Call to Action, there has been a renewed interest in creating authentic research experiences. The next generation of college graduates needs to be competent in communication and collaboration, have quantitative competency, and the ability to understand and interpret data. The future workforce of biologists must be comfortable working with large databases. Specimens and data from NHCs can serve a unique role in workforce training as NHC specimens are uniquely qualified to teach about the iterative process of science, data literacy, quantitative biology, and biodiversity informatics.

This symposium invites presentations from small and large institutions on current museum-based educational and workforce training initiatives, the development and sharing of novel educational or training modules and resources, graduate and undergraduate internships and courses focused on experiential learning in collections management and curation, and future directions for natural history museum workforce development focused on students and early career professionals.

Abstracts of oral and poster presentations submitted to this symposium are included in abstract section of this conference book under the name of the first author and referring to the symposium.

SPNHC 2016 – Abstracts

DEMOCAMP

Organizer: Society for the Preservation of Natural History Collections (SPNHC)

Chair: Jennifer Strotman [1]

1 Smithsonian Institution, Washington, DC 20560, USA; StrotmanJ@si.edu

ABSTRACT

DemoCamp provides a venue for creators to promote their technological solutions to advance the field of museum curation with broad applications for biology and biodiversity informatics. This is a popular and well-attended session at SPNHC and good participation is expected.

Computer demonstrations are welcomed in any technologies relevant to natural history scientists, collections managers, or biodiversity information managers. Technologies demonstrated may include, among other things, collections/ transaction management software, geo-referencing web-based applications, and programs for analysis of data/ images. DemoCamp presentations should feature some of the latest developments in currently available products/ software/ applications as well as ongoing research projects and prototypes. Live demonstrations of these technologies will raise awareness of new (and improved) tools available for data acquisition, documentation, and synthesis. Demonstrations will also provide a venue for idea exchange and feedback from potential users. DemoCamp abstracts will appear in the conference proceedings.

Abstracts of oral and poster presentations submitted to this symposium are included in abstract section of this conference book under the name of the first author and referring to the symposium.

SPNHC 2016
WORKSHOPS

WORKSHOP 1

Museum environments: managing risk and sustainability

Presented by: Robert Waller (Protect Heritage Corporation) and Jeremy Linden (Image Permanence Institute)

ABSTRACT. This dynamic and participatory workshop will foster broad perspectives and creative thinking about managing risks and sustainability within collection holding institutions. The goal is to understand the real value of environmental control for collection preservation and to identify opportunities for improved preservation, reduced energy costs, or both simultaneously. It is intended for both recent graduates and mid-career professionals in positions ranging from technical assistance to senior management.

Time: June 25 and 26, 2016, 9:00 AM – 5:00 PM
Venue: Botanischer Garten und Botanisches Museum

WORKSHOP 2

Cost-efficient large-scale surface digitizing via photogrammetry – approaches for small and large collections

Presented by: Heinrich Mallison (Museum für Naturkunde, Leibniz Institute for Evolution and Biodiversity Science, Berlin, Germany)

ABSTRACT. Photogrammetry is a powerful and relatively inexpensive tool for documentation of the appearance and condition of specimens during any step of the curatorial process. The purpose of this workshop is to familiarize participants with the methodology, applications, and products of photogrammetry as it relates to collection, preparation and curation of natural history collections. Also, costs and benefits of various typical scenarios for large-scale collection digitizing will be discussed.

Time: June 25, 2016, 9:00 AM – 5:00 PM
Venue: Museum für Naturkunde

WORKSHOP 3

Fluid collections – conservation techniques

Presented by: Dirk Neumann (The Bavarian State Collection of Zoology, Munich, Germany) and Julian Carter (Amgueddfa Cymru – National Museum Wales, Cardiff, Wales)

ABSTRACT. In 2012 a project was established to develop baseline standards for fluid preserved collections. This workshop will build on the findings of this project by comparing different standards and techniques used or recommended for fluid collections. It will focus on the development and understanding of terminology and the process, with particular reference to the chemistry of wet collections, their fixation and preservation, and the control of deterioration mechanisms. The workshop will combine theoretic concepts with practical collection care and management issues.

Time: June 25, 2016, 9:00 AM – 12:00 PM
Venue: Museum für Naturkunde

WORKSHOP 4

Cleaning – repairing – restoring of historical mounted bird specimens

Presented by: Jürgen Fiebig (Museum für Naturkunde, Leibniz Institute for Evolution and Biodiversity Science, Berlin, Germany)

ABSTRACT. Selected examples of the largest German bird collection illustrate how badly damaged but valuable exhibits can be preserved and saved. Apart from demonstrating the working steps, repaired and restored exhibits of the Berlin bird collection will be presented and different methods and experiences will be discussed. This three-hour workshop will take place in the new preparation facility of the Museum für Naturkunde and will include a tour into the bird collection. Participants will be provided with handouts including recipes, lists of materials, providers and references.

Time: June 25, 2016, 9:00 AM – 12:00 PM
Venue: Museum für Naturkunde

SPNHC 2016 – Abstracts

WORKSHOP 4

"Access and Benefit Sharing" in Natural History Collections – implementation and practical management

Presented by: Jürgen Fiebig (Museum für Naturkunde, Leibniz Institute for Evolution and Biodiversity Science, Berlin, Germany)

Originally intended as a tool against "biopiracy", Access and Benefit Sharing (ABS) has become a reality over the past years for collection managers and researchers alike. In order to obtain access to specimens in the field, legally binding agreements need to be signed in countries with access legislation and these contracts stipulate the scope of all subsequent utilization of the material collected. The agreements made under ABS need to be carefully observed and have to remain traceable with the respective collection specimens. This workshop looks into the nature of ABS and its origins, the Convention of Biological Diversity and the Nagoya Protocol and provides practical advice for those, who work with specimens collected in signatory countries after 2014.

Time: June 25, 2016, 1:30 PM – 4:30 PM
Venue: Museum für Naturkunde

WORKSHOP 6

Proper sealing in fluid collections

Presented by: Klaus Wechsler (Bremen, Germany) and Christoph Meier (formerly Naturhistorisches Museum Basel, Switzerland)

ABSTRACT. Proper sealing of jars in fluid collections is crucial for long term prevention of fluid loss and thus for long term preservation. In a hands on workshop, sealing techniques for different jar types – including an innovative technique for twist off jars – will be presented and participants will get first hand experience in all techniques demonstrated. Jars include twist off jars (including a newly developed borosilicate version), ground glass stopper jars and jars sealed with bees wax/collophonium or other sealing agents.

Time: June 25, 2016, 1:30 PM – 4:30 PM
Venue: Museum für Naturkunde

WORKSHOP 7

Synthesys-iDigBio: Digitisation Software Training Workshop: Inselect, Symbiota & ABBYY FineReader

Presented by: Elspeth Haston (Synthesys3, Royal Botanic Garden Edinburgh, UK), Deborah Paul (iDigBio, Florida State University, Tallahassee, Florida, USA)

ABSTRACT. This workshop is jointly hosted by the EU-based SYNTHESYS3 project and the US-based iDigBio project. It will be a mix of informative presentations, practical training and open discussion with an aim to make these tools more accessible to institutes of all sizes. Inselect currently supports automated recognition, cropping and annotation of scanned images of items such as drawers of pinned insects and trays of microscope slides. ABBYY FineReader is an OCR tool which has been found to perform well for specimens, enabling the automated capture of specimen label data. Symbiota is a virtual platform which incorporates OCR, NLP and crowdsourced transcription modules.

Time: June 25, 2016, 9:00 AM – 5:00 PM
Venue: Botanischer Garten und Botanisches Museum

SPNHC 2016 – Oral and poster presentations, sorted alphabetically by first author

SPNHC 2016
ORAL AND POSTER PRESENTATIONS

A

ORAL PRESENTATION

DemoCamp

PlutoF – online solution for the common biological data management and Open Data

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ABSTRACT. PlutoF platform (https://plutof.ut.ee) provides online services to create, manage, analyse and publish biology-related databases and projects. Platform users include natural history collections, international, regional or institutional workgroups developing common databases, individual researchers and students, as well as Citizen Scientists. PlutoF brings together, into a single online workbench, datasets that are usually spread over different solutions and therefore difficult to access or work with. Our system allows to manage most of biology-related data like specimens and other taxon occurrences, DNA sequences, traits, locality, habitat, projects, agents, etc. in one place. Sharing, exporting and importing, and publishing your data is easy and logical. There are plenty of options to publish datasets as Open Data – data can be displayed in any portal via API connection, Digital Object Identifiers can be requested internally, data can be released to GBIF (http://www.gbif.org/), etc. There are currently over 2,000 registered users from 75 countries.

MAIN TEXT. The main concept behind PlutoF is to provide services where the entire data life cycle can be managed online and on one workbench. The very first version of the PlutoF was built in 2001-2002 for the specimen and associated DNA sequence datasets. These first datasets were released publicly by the UNITE community in 2003 as an online DNA sequence key for the fungi (Kõljalg et al. 2005; https://unite.ut.ee). Since then the system has been expanded and new data types have been added to the platform. Soon after the first version was developed, natural history collections started to exploit PlutoF for their institutional databases and transactions. Early users also included ecologists, taxonomists and Citizen Scientists by bringing different datasets into the system. The first online PlutoF workbench was released in 2005 (Abarenkov et al. 2010).

The current version of PlutoF incorporated several modules **(Fig. 1)** which allow to create and manage databases across disciplines. Specimen data in collection databases are available for external annotations with DNA sequences, new identifications, traits, multimedia, references, etc. Data can flow vice versa when databased specimen of a specific study is lodged in the collection. Only ownership and location of the specimen must be updated. The same applies to environmental samples. There are projects which develop databases of taxon occurrences covering different Kingdoms, their interactions and traits.

PlutoF provides specific tools for third-party annotations of different datasets from external databases. One such example includes developing regional reference based taxon checklists where taxon occurrences from published literature can be complemented with diverse geographical and ecological information. The UNITE community is using these tools to annotate and improve the quality of fungal ITS sequences in International Nucleotide Sequence Databases (INSD: GenBank, ENA, DDBJ). The local copy of INSD dataset is updated on a regular basis. Any third-party annotation added to the INSD dataset (e.g. locality, habitat, source, traits, taxon identifications, and interacting taxa) is made publicly available to the research community through web services and on UNITE homepage (Nilsson et al. 2016). Other PlutoF communities and users may start their own projects where external datasets are imported and annotated.

There are specific modules on the workbench to help users with importing their data from CSV files, exporting in various formats (e.g. CSV, JSON, PDF for specimen labels, FASTA for DNA sequences), and displaying data on the maps.

PlutoF supports Open Data and data publishing in various ways – support for Digital Object Identifiers is provided by direct link to DataCite (https://www.datacite.org), publishing to GBIF can be set up on demand, and publishing in Pensoft journals (http://www.pensoft.net/) is made easy through import options in ARPHA writing tool (http://arpha.pensoft.net/) and automated creation of Ecological Metadata Language (EML) formatted metadata for datasets.

The PlutoF platform is built using the following web technologies – Django REST Framework (DRF), Ember.js. Database management system involves PostgreSQL+PostGIS. Public RESTful web services are provided by DRF, the software packages of the analysis module are written on Perl and Python languages.

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REFERENCES

Abarenkov K, L. Tedersoo, R. H. Nilsson, K. Vellak, I.-Saar, V. Veldre, E. Parmasto, M. Prous, A.. Aan, M. Ots, O. Kurina, I. Ostonen, J. Jõgeva, S. Halapuu, K. Põldmaa, M. Toots, J. Truu, K.-H. Larsson, & U. Kõljalg. 2010. PlutoF - a Web Based Workbench for Ecological and Taxonomic Research, with an Online Implementation for Fungal ITS Sequences. Evolutionary Bioinformatics 6:189-196.

Kõljalg U, R. H. Nilsson, K. Abarenkov, L. Tedersoo, A.. F. S. Taylor, M. Bahram, S. T. Bates, T. D. Bruns, J. Bengtsson-Palme, T. M. Callaghan, B. Douglas, T. Drenkhan, U. Eberhardt, M. Dueñas, T. Grebenc, G. W. Griffith, M. Hartmann, P. M. Kirk, P. Kohout, E. Larsson, B. D. Lindahl, R. Lücking, M. P. Martín, P. B. Matheny, N. H. Nguyen, T. Niskanen, J. Oja, K. G. Peay, U. Peintner, M. Peterson, K. Põldmaa, L. Saag, I. Saar, A. Schüßler, J. A. Scott, C. Senés, M. E. Smith, A. Suija, D. L. Taylor, M. T. Telleria, M. Weiß, & K.-H.Larsson 2013. Towards a unified paradigm for sequence-based identification of Fungi. Molecular Ecology 22(21): 5271-5277.

Kõjalg U, K.-H.Larsson, K. Abarenkov, R. H. Nilsson, I. J. Alexander, U. Eberhardt, S. Erland, K. Høiland, R. Kjøller, E. Larsson, T- Pennanen, R. Sen, A. F. S. Taylor, L. Tedersoo, T. Vrålstad & B. M. Ursing. 2005. UNITE: a database providing web-based methods for the molecular identification of ectomycorrhizal fungi. New Phytologist 166: 1063-1068.

Nilsson RH, C. Wurzbacher, M. Bahram, V. R. M. Coimbra, E. Larsson, L. Tedersoo, J. Eriksson, C. D. Ritter, S. Svantesson, M. Sánchez-Garzľ a, M. Ryberg, E. Kristiansson & K. Abarenkov. 2016. Top 50 most wanted fungi. MycoKeys 12: 29-40.

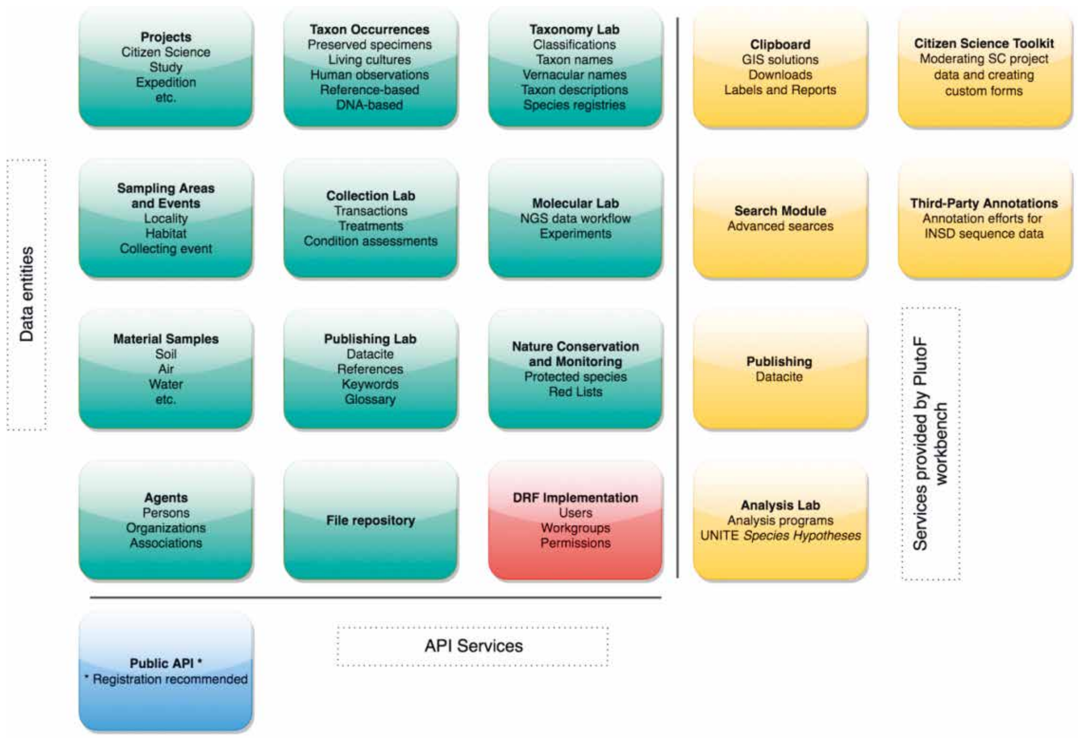

Figure 1. Data entities and services on PlutoF platform.

SPNHC 2016 – Oral and poster presentations, sorted alphabetically by first author

A

POSTER

Preventive conservation and material science

Re-housing bird eggs and nests at the Michigan State University Museum

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ABSTRACT. Established in 1857, the Michigan State University (MSU) Museum houses over 111,000 vertebrate specimens dating from 1844. Over the past 26 years, the MSU Museum has successfully completed 11 grant-funded re-housing projects for both wet and dry vertebrate specimens. In October 2014, the MSU Museum received two-years of funding from the U.S. *Institute of Museum and Library Services* to improve safety, environmental conditions, and accessibility of more than 28,500 vertebrate specimens, including egg sets and nests that had been stored in substandard wooden cupboards or other inappropriate housing. Many of the specimens lacked a protective box. The eggs and nests were at risk of damage or loss from crowding, exposure to ultraviolet and visible light as well as contaminants such as dust and acid migration from wooden furniture and shelves. To date, 439 egg sets and nests have been re-housed into new cabinets with archival boxes and storage materials. Styles of boxes included tan board clear-view window boxes and clear polyester boxes with metal edge construction. Box height extenders were constructed from 100% cotton blotter paper and installed in the corners of the box bottoms (where needed). MSU undergraduate students assisted with all aspects of this re-housing project.

POSTER

Preventive conservation and material science

Challenges in curating two fossil plant collections at the University of Iowa Paleontology Repository

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ABSTRACT. In 2014, the University of Iowa Paleontology Repository received a grant from the National Science Foundation to rehouse and curate a fossil plant collection acquired in 2001. This collection, of over 20,000 specimen lots, includes two collections that require more specialized curation than the regular "hand" fossil specimens. These are the Quaternary Plant Macrofossil Collection and the Coal Ball Collection. The Quaternary plant collection contains hundreds of vials of samples, some separated into species, from many localities in the US Midwest, the focus of over 26 scientific publications. The coal ball collection contains rough cut coal balls in multiple orientations, with associated coal ball peels. There is no locality data for these coal balls and pieces from individual coal balls are disassociated. Some coal balls are at risk from pyrite decay. Both collections pose challenges in storage, documentation and digitization. Two Museum Studies undergraduate students are curating the collections, supported by Iowa Center for Research by Undergraduates Fellowships. Their tasks involve collection assessments, inventory, documentation, rehousing, organizing, compiling data, cataloguing, preservation and digitization.

INTRODUCTION & METHODS. In 2001, the University of Iowa Paleontology Repository (UIPR) received a collection of fossil plants (>20,000 specimen lots) from the Department of Biology. At short notice, specimens were transfered to a room in a building adjacent to the UIPR, into old wooden and metal cabinets salvaged from a recent storage upgrade. The material included a substantial collection of compression fossils from the Pennsylvanian of the Midwest USA, historic collections of cycadeoid fossils and coal balls, a comprehensive teaching collection, representative collections of Cenozoic paleobotany, and 400 microscope slide boxes of modern cleared leaves. The collection complemented the UIPR's existing paleobotany collection of Cretaceous leaves from Kansas collected in the late 1800s by Charles H. Sternberg, Mazon Creek nodules and Pennsylvanian floras collected by F. O. Thompson, a large slide collection of Pennsylvanian spores, and an active Quaternary plant macrofossil research collection. Unfortunately, the emergency facilities were not appropriate for the newly acquired collections, neither in terms of environment, nor pest control, and damage in the form of pyrite decay and label destruction by cockroaches justified new cabinets to house the collection more securely. A major project to renovate and reinvigorate the paleobotany collection, funded by the National Science Foundation (NSF), has been underway since Fall 2014.

RESULTS. Under the NSF-funded project, all paleobotany collections were brought together in newly assigned space and rehoused in new museum-grade cabinets. Undergraduate student assistants each selected a collection sub-unit to curate, re-boxing, organizing and inventorying specimens and preserving labels. Collection assessments (Adrain et al. 2006) were made at the beginning and end of the projects to document curation progress, and to allow students to see how their work contributed to the ongoing process of curation.

Two collections, the Quaternary Plant Macrofossil Collection and the rough-cut coal ball collection, pose particular curation challenges. These are the subject of more in-depth projects, supported through University of Iowa Center for Research by Undergraduates (ICRU) Fellowships.

The Quaternary Plant Macrofossil Collection consists of multiple specimens housed in glass vials according to species, organized by site. Individual specimens are not cited in publications and reports, but species are reported as present in floral lists. Should these specimens be considered as cited specimens? Many vials are crowded into boxes or gathered together with tape. Specimens are stored in ordinary stationery envelopes, and in open trays and glass dishes. Specimen vials are labeled with cryptic shorthand information. The coal ball collection poses different challenges. The collection consists of rough cut coal balls from multiple coal mines. Precise specimen provenance is unknown. Is there a way to determine the provenance of the coal balls? Prior to acquisition, coal balls were cut in different orientations and peels were made from some sections. Coal balls were not marked in any way to signify which coal ball pieces and peels are associated. This creates a challenge for cataloguing, although some peels were still attached or loosely wrapped around the coal ball. The preservation of peels, and the prevention of pyrite decay in the coal balls is a challenge. What is the best way to preserve these collections? What is the best way to digitize these collections?

Figure 1. Vials of Quaternary plant macrofossils secured in foam in new housing.

DISCUSSION & CONCLUSIONS. Maja Stina Sunleaf is working with Dr. Richard G. Baker to curate the Quaternary Plant Macrofossil Collection, moving the collection to new storage, preserving the original organization and associations. After curation assessment, and prioritizing of curation requirements, temporary labeling was applied and all the associated publications and reports were located. A basic inventory was compiled of all the localities represented in each drawer, and all associated publications. Vials were reorganized for improved handling and preservation. Trays were lined with Plastozote foam to secure vials and prevent their falling over, moving around, or becoming separated. Each vial was located in a specific hole in the foam with a specimen number (unique to each vial) marked on the foam for quick audit and inventory. Soil samples stored at the off-site collections facility will be cross-referenced with the collection. A photographic collection that serves as a reference for Dr. Baker's plant identifications will be digitized and made available on-line.

Kaitlin Schlotfelt is curating the coal ball collection, organizing specimens and creating temporary labels for coal ball pieces, re-associating pieces where possible and separating the peels, which are cross-referenced before being rehoused in acid-free envelopes. An inventory of every coal ball piece assigns a temporary number based on what drawer it was in, to preserve any accidental or fortuitous associations. An initial curation assessment provides a benchmark for curation progress. Several specimens show signs of pyrite decay due to high relative humidity. All coal balls will be monitored for decay in the new storage and a condition report completed for each drawer. A photo will be taken of each drawer with close-ups of any existing decay. Specimens will be checked regularly and the environment in the room and the cabinet monitored with a PEM and eClimateNotebook. If any change is detected, low relative humidity or oxygen-free microenvironments will be created for at-risk specimens. In addition to developing a standard for cataloguing each associated coal ball piece and related peels, techniques and procedures for digitizing the material will be investigated. We will investigate whether a geochemical fingerprint can be detected that will determine provenance.

ACKNOWLEDGEMENTS. Support for this project is provided by a National Science Foundation grant DBI-1348322 (2 yrs., 5/01/14-4/30/16, $196,751); "CSBR: Natural History Collections: Critical renovation and revitalization of the University of Iowa Fossil Plant Collection" (PI = A. F. Budd, Co-PIs = T. S. Adrain, H. J. Sims, J. M. Adrain), the University of Iowa Center for Research by Undergraduates, UI Department of Earth and Environmental Sciences, and the UI Mary Louise Kelley Professional Development Award.

REFERENCES

Adrain, T. S., D. N. Lewis and M. M. Horton. 2006. Improving curation standards in paleontology collections through the application of "McGinley Levels." Collection Forum 21(1-2): 19-32.

A

POSTER

Green museum – How to practice what we preach? (General session)

Making sustainability work

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ABSTRACT. Developing sustainable practices is always a challenge, but no more so than working in an old building, with aging environmental systems and old storage methods. New, creative approaches are needed. Teams with open idea exchanges need to be developed and their new ideas tested. In 2015 the Carnegie Museum of Natural History embarked on two major grant-funded collection storage improvement projects. The first project, funded by the Institute for Museum and Library Services, addresses storage and environmental concerns for the holotype specimens in the Vertebrate Paleontology collections. Goals of the second project, funded through National Endowment for the Humanities, are to improve storage, environment and accessibility of the archaeology collection. Both projects use similar methods: new storage cabinets, microclimates, improved storage mounts, as well as close collaboration with the facilities and operations departments to achieve improved sustainability.

The ultimate goal is to better protect the collection, while making it more accessible and with improved environmental conditions at a lower cost. We are now about half-way through both projects.

This poster highlights initial improvements, some results were anticipated and others unexpected.

ORAL PRESENTATION

Digitization and imaging collections: new methods, ideas, and uses

Releasing the potential of a significant regional geology collection through digitisation and working with partners that include an experimental game designer

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ABSTRACT. The Friends of Ludlow Museum secured funding during 2015 for the FISH project (Fossils In Shropshire) to digitise parts of the 41,500 specimens that form the Shropshire county geological collection held at the ShropshireMuseum Resource Centre. This collection was started in 1833 by the Ludlow Natural History Society; in addition to being one of the oldest established museums in the region, the geology collection is also the second largest in the West Midlands region of the UK. The collection is richest in Lower Palaeozoic invertebrates and early fish but also contains some surprises such as Tertiary fauna from the Siwalik Hills of the outer Himalayas. The consultant team were appointed in March 2016 and commenced with a collection familiarisation exercise in order to plan the digitisation approach in detail. Raising awareness of and releasing the potential of the collection through creating high quality digital images is the principal desired outcome of the project for the Friends of Ludlow Museum. Additional funding has enabled the consultant team to work in partnership with John Sears, a game designer specialising in interactive installations for public spaces, so that the project can develop and deliver an experimental, collaborative game-like output.

INTRODUCTION AND BACKGROUND. Shropshire Museum Resource Centre (SMRC), located in the medieval town of Ludlow, houses the collections of the county Museum Service. The collection was started in 1833 by the Ludlow Natural History Society, a small group of amateur naturalists living in south Shropshire and north Herefordshire (Lloyd, 1983). The collections of Shrewsbury Museum, which had been similarly founded in 1836, were transferred to the SMRC from 2014 onwards, but are not yet fully assimilated.

The Friends of Ludlow Museum were established in 1968, to support the SMRC through volunteer work and fund raising. This support was instrumental in building the current collections facility, the SMRC. The SMRC, opened by H.M The Queen in 2003, is a flagship structure for the curation of collections, and was designed to minimize risks from the ten agents of decay (Waller, 1994; Andrew, 2006).

Material from the collections is on exhibition at a number of venues including the Music Hall Museum, Shrewsbury, opened in 2015.

Historic connections. Ludlow Natural History Society members included the Rev T.T. Lewis and Dr T. Lloyd who demonstrated to Murchison the sequence of zone fossils in what is now known as the Ludlow Series of the Silurian System, enabling Murchison's breakthrough in understanding the stratigraphy (Murchison, 1839; Sinclair & Fenn, 1999).

Society membership also included Colonel John Colvin of the Bengal Engineers and John Rocke. Colvin and his brother-in-law Major Baker donated a substantial collection of specimens and casts of fauna including *Sivatherium*, from the Siwalik Hills (Baker, 1850). Rocke, father-in-law to Rev T.T. Lewis' daughter, formed a systematic collection of birds, including a Great Auk. He also wrote "Birds of Shropshire" (Rocke, 1865a, b).

Important 20th century collections. A century later research again became focussed on the geological stratigraphy. A group of academics founded the Ludlow Research Group (LRG) to refine the research undertaken by Murchison, in particular recognising the influences of environment and evolution. Commencing in 1951, by the end of the 1970s the LRG had enabled significant growth of the collection (Rosenbaum, 2008). Much of the collecting was undertaken by the late John Norton, curator of the SMRC and honorary member of the LRG. Then, in 1986, the Condover mammoths were discovered in a kettle hole within fluvioglacial deposits just south of the county town of Shrewsbury; these are the youngest mammoth specimens known from the UK and Western Europe. (Coope, 1988, Lister, 2009).

Figure 1. Exterior view of the Shropshire Museum Resource Centre

IMPLEMENTING THE FOSSILS IN SHROPSHIRE FISH PROJECT. From 2008, with the current wave of austerity, cuts to local government funding have hit regional British museums hard especially since 2012. The resultant loss of specialist collections staff has reduced the ability of museums to provide informed access to collections. The Friends of Ludlow Museum therefore sought funding to digitise this important regional geological collection. The principal aim has been to secure virtual access that can be delivered over the long term even if physical access is restricted. The funding was secured from central Government under a project title of FISH (Fossils In Shropshire). However, all aspects of the collection are to be digitally captured, not only the fossils but also the rocks and minerals and the supporting literature (books, journals, theses and maps.

Figure 2. Rhinoceros lower jaw, Siwalik Hills. From the Colvin and Baker Collection (Collection Number G.03402)

The consultant team commenced with a review of the collections in order to define a project plan. With limited funds and a time scale of no more than three years, this exercise has allowed the team to prioritise those parts of the collections for priority digitisation and identify where further expertise is required to support the process.

The development of long-term access will be based on the existing database protocols provided by Orange Leaf on behalf of Shropshire Council. The public interface is provided by the Discovering Shropshire History web site which is driven by the AdLib collections database used by Shropshire Museum Service. Access by the scientific community is facilitated by sharing this database with the national GB3D type fossils database hosted by the British Geological Survey and contributed to by a consortium of regionally important museums as well as the Natural History Museum.

In order to broaden accessibility to the information, the FISH consultants are working in partnership with John Sear, a games designer specialising in interactive installations. This is providing mentoring support to ensure that the images are of sufficient quality and accompanied by accessible textual descriptions. This has enabled the team to think imaginatively and avoid inadvertently limiting accessibility and usage of the digital information. With the project at an early stage, the exact nature of the digital output from this partnership is still emerging but based track record; it should be both interactive and magical.

ACKNOWLEDGEMENTS. Funding for the FISH project was awarded to The Friends of Ludlow Museum by the Libor fund held by the Treasury of HM Government. The funds are administered through the Natural History Museum London. The digital mentoring scheme is funded by Arts Council England via West Midlands Museum Development.

B

REFERENCES

Andrew, K.J. 2006. Minimizing the risks from the ten agents of deterioration at two new West Midlands Museum Resource Centres, UK. Collections Forum 2006 21:1-2.

Baker, W.E. 1850. *Of the Fossil Remains presented by Himself and Colonel Colvin C.B. to the Museum of Natural History at Ludlow.* Published by E.J. Partridge, Ludlow.

Coope, R. 1988. The Condover Mammoths. Proceedings of the Shropshire Geological Society 7:20-21.

Lister, A. 2009. Late-glacial mammoth skeletons (Mammuthus primigenius) from Condover (Shropshire, UK): anatomy, pathology, taphonomy and chronological significance. Geological Journal 44(4):447-479.

Lloyd, D.J. 1983. *The history of Ludlow Museum (1833-1983).* Ludlow Historical Research Group

Murchison, R.I. 1839. *The Silurian System founded on geological researches in the counties of Salop, Hereford, Radnor, Montgomery, Caermarthen, Brecon, Pembroke, Monmouth, Gloucester, Worcester, and Stafford: with descriptions of the coal-fields and overlying formations.* John Murray, Albermarle Street, London.

Rocke, J. 1865a. Birds of Shropshire. The Zoologist 23:9683-9688.

Rocke, J. 1865b. Birds of Shropshire. The Zoologist 24:76-84, 161-166.

Rosenbaum, M.S. 2008. The future for geology in the Marches. Proceedings of the Shropshire Geological Society 13:95-98.

Sinclair, J.B. & Fenn, R.W.D. 1999. Geology and the Border Squires. The Transactions of the Radnorshire Society 69: 143-172.

Waller, R. 1994. Conservation risk assessment: a strategy for managing resources for preventive conservation. Pp 12-16 in: *Preventive conservation practice, theory and research, London.* (Ashok, R. & Smith, P. eds.) The International Institute for Conservation of Historic and Artistic Works.

ORAL PRESENTATION

Digitization and imaging collections: new methods, ideas, and uses

Preliminary analysis of effectiveness and accuracy of crowdsourcing vs in-situ digitisation methods

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ABSTRACT. Data entry from images of the data sources (museum documentation, specimens and labels), in computers located remotely, through on line platforms, and potentially open to public participation, is an *ex-situ* collections digitisation method that is related to the wide development of information and communication technologies (TIC), the Internet, and the citizen science concept. The idea, named crowdsourcing, is very recent and is being explored by European natural history museums through the SYNTHESYS3 project. We have not found any literature comparing, in this specific context, effectiveness and accuracy between crowdsourcing and *in-situ* methods by using images. We aim to find answers, based on experimental data from two partners of the project, to draw some preliminary conclusions that intend to contribute to the development of a European crowdsourcing website. Preliminary results indicate that this crowdsourcing platform is less accurate than *in-situ* method, but much more efficient. Identifying the most effective types of quality controls, and understand more about the remote users' motivations are now a priority of the project, because they increase accuracy.

Digitisation	Which the data source is	Where to digitise	Who digitise	How to learn
Step 1	primary: documents, specimens and labels	museum location (in situ)	staff, students, volunteers	directly instructions and supervision
Step 2	images	museum location (in situ)	staff, students, volunteers	directly instructions and supervision
Step 3	images	wherever online (ex situ)	potentially open to everyone	remote instructions and supervision

Table 1. Digitisation process evolution.

Palaeonthology (MNCN-CSIC)	Ornithology (NHM)
Ubicación (original data location identifier)	filename (original data location identifier)
	top_percent
Fecha_Modif	created_at
Modificado	user_name
	page_number
Identifica (specimen identifier)	registration_number (specimen identifier)
Taxon	scientific_name
Población:Provincia:Paisnivel2:Pais	location
	date_collected

Table 2. Fields of Datasets. Palaeontology transcribers must complete all fields. Fields in light blue background, in ornithology dataset, are automatics.

INTRODUCTION & METHODS. The digitisation of data associated with natural history collections is a huge task impossible to achieve in the short term only with the ordinary resources of museums. Since the early nineties, the tasks associated to digitisation of the natural history collections documentation have gone through three steps, whose characteristics are summarized in **Table 1**. We have not found any literature comparing, in this context, effectiveness and accuracy between crowdsourcing and in-situ methods using images. We aim to find answers, based on experimental data from two partners of the SYNTHESYS3 project. This preliminary analysis compares digitisation of ornithological register by crowdsourcing (The Natural History Museum, London, NHM), to digitisation of fossil collections performed in-situ with digital images (Museo Nacional de Ciencias Naturales, Madrid, MNCN-CSIC). These data are not entirely comparable, but have allowed us to draw some preliminary conclusions. **Table 2** shows fields in each dataset.

	In-situ MNCN-CSIC		Crowdsourcing NHM		
	Temporary staff	Students	SuperUser	Registered	Anonyms
Number of users	2	9	1	883	989
Number of records	10,677	3,700	234,443	80,019	13,673
Period time (months)	27	13.5	16	20	20

Table 3. Number of users and rows (records) transcribed, and period of time (months) employed by all type of in-situ and crowdsourcing users.

Table 3 shows number of users and rows (records) transcribed by all type of *in-situ* and crowdsourcing users, and period of time (months) employed. In MNCN-CSIC 14,377 records were obtained by temporary staff and students. In NHM 328,135 records were obtained by registered and anonym-users. One of the users, here named SuperUser, transcribed a 71% of the rows, modifying the actual result. As this type of user is a deviation that must be rejected from the analysis of overall outcome, the number of useful digitised records was then 93,692. The SuperUser work was analysed apart.

In the context of this analysis, we used the word "effectiveness" to refer efficiency of transcriptions per time unit. To compare effectiveness between methods we quantified the number of records transcribed per month by the several types of collaborators. Accuracy refers here to the correct completion of tasks, according to explicit or implicit criteria defined by the requester. Evaluating accuracy is a way to evaluate quality or fitness for use. Kulkarni *et al.* (2012) identified three types of problems why systems may provide inaccurate outcomes:

- Human error problem: this error has been calculated to identifier fields in both datasets. "Error" means here that data are missing or incomplete, so it was impossible to locate the original source.
- Task specification problem: workers are properly motivated to do a task correctly, but the task may be unclear. Problems related with gaps in the guidelines were detected.
- Incentive problem: online workers may not want to do what they are being asked to do, due to lack of motivation. Incentive problem can be quantified in the NHM data set, by the rate of empty records in the downloaded file, users went into the platform and then they decided not to transcribe records. MNCN collaborators had no incentive problem, as defined here because they were hired to do that task.

	In-situ MNCN-CSIC		Crowdsourcing NHM		
	Temporary staff	Students	SuperUser	Registered	Anonyms
Records/month	395	274	14,652	4001	684
Error Identifier (%)	0.24	0.59	0.15	2.73	12.93
Error page-number (%)	not applicable	not applicable	0.11	0.5	1.0
Empty records (%)	0	0	0.05	2.42	10.68

Table 4. Comparative data of records/month, errors and empty records rate, by all type of in-situ and crowdsourcing users.

RESULTS. The results of the analysis are shown in **Table 4**.

Effectiveness. The amount of data transcribed per month through crowdsourcing (4,001/684) was higher than in *in-situ* (395/274). Nevertheless, the actual effectiveness of NHM was not 100% because NHM-dataset included replicated records.

B

Accuracy. Data showed that the accuracy of crowdsourcing (NHM) was much smaller than the accuracy of the data obtained *in-situ* at the MNCN-CSIC. In case of data obtained by crowdsourcing, the error rate in identifier field was very high, although significantly lower in registered (2.73%) than in anonym-users (12.93%). Error rate in *in-situ* transcriptions was much smaller than in crowdsourcing, and was higher in the group of students (0.59%) than among temporary staff (0.24%), although these last differences were not significant. To assess if error in NHN-records was only due to a human error, the error rate in the field page_number was calculated as well. In this field the error rate was a lot lower than before, 0.5% for registered users (lower than *in-situ*-students at MNCN-CSIC) and 1.0% for anonym-users. This means that high error rate in identifier NHM was due not only human error.
In natural history collections, there is a great deal of handwritten documentation which is not easily recognizable with automatic systems like OCR. Digitising these documents requires human intervention, to interpret or translate some special characters (quotation marks, missing alphanumeric characters) (**Table 5**). Some kinds of problems were detected, so the crowdsourcing tutorial should have specified how to make a good digitisation, not only a transcription, in order to get accurate data.
Regarding incentive problem, in NHM was higher in anonym-users than in registered ones. 80% of NHM users did not complete any pages, and 38.6% only digitised one row. To compare motivation over time, number of digitised rows was quantified for the same period of time, in two successive years 2014 and 2015. The huge difference in the number of digitised rows in these two years (4,503 vs 596) confirmed that the motivation of the crowd decreased over time.
The SuperUser (NHM) was much more effective and accurate than the rest of collaborator (including *in-situ* MNCN-CSIC, Table 4), and he or she seems to be very motivated.

registration_number	scientific_name	location	date_collected
AUTOMATIC: OCR			
1886-9-8-4163	Ruticilla caeruleocephala	Simla	18/11/1980
4	“ “	Maouri	
5	“ “	“	
HUMAN: logical perception / trained / expert transcriber			
1886-9-8-4163	Ruticilla caeruleocephala	Simla	18/11/1980
1886-9-8-4164	Ruticilla caeruleocephala	Maouri	
1886-9-8-4165	Ruticilla caeruleocephala	Maouri	

Table 5. The three first lines of one NHM ornithological register, ideally transcribed by two systems: automatic vs human.

CONCLUSIONS. Preliminary results indicate that this crowdsourcing platform is less accurate than *in-situ* method, but much more efficient, since the task of digitising data associated with natural history collections takes less time using the portal. Avoiding replicate records would have improved its effectiveness. Accuracy has been affected by problems related with lack of adequate filtering of users, inadequate definition of some tasks, and unknown incentive problems. The accuracy of outcomes in this crowdsourcing platform would have been improved through refining task description and guidelines, avoiding unregistered users, controlling who can digitise and who cannot, and by creating open and clear reviewing procedures. Identifying the most effective types of control, and understand more about the superusers' motivations is now a priority in the project.

ACKNOWLEDGMENTS. These results have been possible thanks to the collaboration of the Natural History Museum, London and the funding by SYNTHESYS3 FP7 EU.

REFERENCES

Kulkarni, A., P. Gutheim, P. Narula, D. Rolnitzky, T. Parikh, & B. Hartmann. 2012. MobileWorks: Designing for Quality in a Managed Crowdsourcing Architecture. IEEE Internet Computing 16(5): 28-35.

SPNHC 2016 – Oral and poster presentations, sorted alphabetically by first author

ORAL PRESENTATION

Digitization and imaging collections: new methods, ideas, and uses

Enhancing FishNet2 to increase access of developing country scientists to fish specimens records in developed country museums

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ABSTRACT. FishNet2 (http://www.FishNet2.net) is a highly-regarded, global network for sharing information in fish collection databases with researchers around the world. However, the FishNet2 provider list is heavily weighted toward fish collections in the U.S., Canada, Australia and Japan (http://www.FishNet2.net/providerList.aspx). Few European collections are represented in the network, only a single South American collection is represented, and no African or Asian collections are represented. Fish collections in Europe house large numbers of specimens from developing countries in Africa and Southeast Asia. The paucity of data in FishNet2 from European fish collections, and the very small numbers of fish collections in Africa and Southeast Asia with published data in FishNet2 or available elsewhere, presents a particular problem for researchers engaged in taxonomic, ecological and conservation studies in developing African and Asian countries. The ability to visualize specimens remotely, especially name-bearing type specimens, is a valuable service to researchers in the developing world, who would otherwise have to travel to the museums to examine the specimens. Adding specimen visualization capability to FishNet2 and computer tools for taking measurements from specimen images would benefit researchers in developing countries. We present a plan for expanding and enhancing Fishnet2 to give developing country scientists increased access to the network.

ORAL PRESENTATION

Green Museum – How to practice what we preach? (General session)

Climate monitoring and perspectives for a sensible use of a marvelous old building

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ABSTRACT. Climate monitoring of collection rooms allows for analysis of climate cycles, causes and influences of the building structure as well as modelling and prognostics of certain constructional and organizational measures. Existing long-term records of temperature and humidity in untreated collection rooms reflect both, the impact of external (weather) and human induced variations of the storage conditions which might affect the long-term stability of the collections for future research. The application of time series analysis of the datasets provides a basis for aimed experimental studies identifying potentially destructive factors for difficult types of organic and inorganic collection materials and indications of least-destructive environments. A sustainable long-term preservation strategy of the vastly different materials of natural history collection objects must respect differentiation of materials and collection types. This may be in conflict with biological systematics and coincide with severe logistic problems of scientific use of the collections. These have to be considered in the planning of a construction project far in advance. In the current second phase of reconstruction of our building we aim at improvement of conservational climate needs. But, it is also demonstrated that there are clear limits of the combined, multifunctional use of a protected building monument of 1889.

ORAL PRESENTATION

Enabling Infrastructure: Future Collections, Data & Informatics (Synthesys Symposium)

Natural history online - An efficient data publication framework for museum collections

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ABSTRACT. The Natural History community developed a capable global infrastructure for publishing Natural History collection information on the Internet. With networks such as GBIF and BioCASE specimen multimedia objects and metadata can be retrieved instantly and freely. Digital libraries have started similar efforts with focus on cultural history content. A prominent example is the cross-domain portal Europeana (www.europeana.eu) with its vision to make Europe's cultural heritage as easily accessible and as freely reusable as possible.
A growing number of Natural History Museums realised that publishing their data on multiple portals serving different user communities significantly increases their visibility and reputation towards research funding organizations and within society. However, in particular smaller museums often fail to feed multiple publication channels.
We have developed an efficient framework for publishing Natural History collection data – both in biodiversity information networks and Europeana with minimum effort. Museums just have to configure one of the data provider packages IPT or BPS, which directly implement the connectivity to biodiversity portals. In addition, harvesting, aggregation, and transformation components built by the EU-project OpenUp! establish a second pipeline for data search and display in the Europeana Portal. New provider installations are supported by the helpdesk of the BioCASE network (www.biocase.org).

B

POSTER
Preventive conservation and material science
Curating the Royal Botanic Gardens, Kew Spirit Collection

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ABSTRACT. The Spirit Collection at the Royal Botanic Gardens Kew is the largest fluid preserved botanical collection in the UK. The collection currently stands at 73,000 specimens and continues to accept new accessions from overseas fieldwork, Kew's Living Collection and occasional donors, with approximately 1,000 new accessions a year. About half of the collection are orchid specimens, but more than 370 families are represented. The Spirit Collection does not stand isolated from the other Kew collections and many specimens have associated herbarium sheets, carpological material and DNA voucher specimens in the Herbarium and Jodrell Laboratory. The oldest material dates from 1805 and the collection requires constant monitoring and occasional topping up of the fluid in the jar. It is primarily used in scientific research and the specimens are kept in easily accessible jars. The collection is kept in moveable storage in a temperature controlled room and has additional systems in place for fire prevention and monitoring toxicity levels. The specimens are preserved in 53% IMS (industrial methylated spirit [90% methylated ethyl alcohol]); 37% water (not distilled); 5% formaldehyde solution (40% HCHO); 5% glycerol and is referred to as Kew Mix.

POSTER
Preventive conservation and material science
Preserving iron sulfate specimens

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ABSTRACT. This works deals with a survey undertaken on the collection of iron sulfate minerals of the Museum National d'Histoire Naturelle, France. This collection has a high significance with respect of Acid Mine Drainage phenomena. Yet differences are sometimes noticed between the mineralogical phases present in a specimen and those that are mentioned on its label. These differences are not only attributable to knowledge evolution in mineralogy but also to physical evolution of the specimen itself. Indeed iron sulfate minerals may present a great instability when exposed to inappropriate humidity and temperature conditions. These aspects are poorly documented in the literature, but remain of great relevance to preserve the collection and to understand sulfate formation pathways.
This paper presents the progress report of this survey that first focuses on melanterite ($Fe^{II}SO_4 \cdot 7H_2O$) specimens.

INTRODUCTION. Iron sulfate forms a large mineralogical family that stimulated in the past decade strong interest in the material science community. Indeed, iron and sulfate can be found in a great variety of crystals, growing naturally in metal sulfide mines. These crystals result from the oxidation of sulfides provoked by a combined impact of water and oxygen. They have been collected (and also synthetized) since antiquity. They show different aspects (color, shape) and their names changed from one era to another, leading to numerous confusions and misinterpretations. Moreover, many of these crystals are relatively unstable: in ambient conditions they may go through hydration/dehydration phenomena and ferrous iron may oxidize to ferric iron. Relatively little knowledge is available regarding environmental conditions (temperature/humidity) that guarantee their stability. Therefore conservation of iron sulfate specimens remains a challenge.
This work deals with the characterization of iron sulfate specimens housed at the Museum National d'Histoire Naturelle (MNHN), Paris. It aims to document more precisely the collection and thus increase its value. Comparison of present and initial compositions should also, in the long run, help to identify possible pathways of iron sulfate formations.

METHODS

Sample. Specimens classified under the appellation "mélanterite" were chosen for several reasons : firstly, during pyrite oxidation in humid environment, melanterite ($Fe^{II}SO_4 \cdot 7H_2O$) is one of the first formed phase; secondly, its stability domain is relatively well documented [Chou 2002]; thirdly, it may form in mines spectacular blue to green stalactites that were easily collected by mineralogists (**Figure 1**, right); fourthly, it can include many metal impurities (copper, magnesium, zinc) as it forms solid solutions with boothite ($Cu^{II}SO_4 \cdot 7H_2O$), epsomite ($MgSO_4 \cdot 7H_2O$) or goslarite ($Zn^{II}SO_4 \cdot 7H_2O$) phases [Jambor et al 2000]; and last but not least, many of the specimens had obviously turned into other iron sulfate phases (**Figure 1, left**).

Analysis. Micro Raman spectrometry is a powerful tool for the speciation of sulfate minerals (Sobron and Alpers 2013). It is used for the characterization of damaged specimens taking advantage of the fact that (i) it does not damage the sample provided the use of a sufficiently low beam power and (ii) the analysis, performed on an area of a few micron-squares, enables the distinction between several components that are mixed into a thin powder. Samples are also characterized with a Raman microscope (inVia, Renishaw, UK; 532 nm, 0.5 to 2.5 mW, 50x objective) following a protocol already described elsewhere (Rouchon et al., 2012).

Control of environmental conditions. The building that receives mineralogical collections has no air conditioning, meaning that the specimens are subjected to substantial variations of temperature and humidity conditions. These variations obviously affect phase transformations and are thus measured by the use of small sensors (Hygrobutton, ProgesPlus, USA).

RESULTS AND PERSPECTIVES. A progress report of this work will be presented. It appeared that some of the melanterite specimens have dehydrated into rozenite ($Fe^{II}SO_4 \cdot 4H_2O$) and szomolnokite ($Fe^{II}SO_4 \cdot H_2O$) powders, probably because the MNHN environment is relatively dry all over the year. These altered melanterite specimens may also contain FeIII bearing sulfates albeit in relatively small amounts, meaning that iron is poorly oxidized, despite the fact that specimens were exposed to air for several decades. Interestingly, some of the specimens, stored in closed vessels seem relatively unaltered, probably because the specimen was acting as a moisture buffer inside the vessel. On some of these specimens, the airtightness of the wax joint appears questionable, meaning that some re-housing option should be considered taking into account the physical constrains of the building and storage furniture.

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REFERENCES

Chou, I.M., R. R. Seal & B. S. Hemingway. 2002. Determination of melanterite-rozenite and chalcanthite-bonattite equilibria by humidity measurements at 0.1 MPa. American Mineralogist 87:108-114.
Jambor, J.L., D. K. Nordstrom & C. N. Alpers. 2000. Metal-sulfate Salts from Sulfide Mineral Oxidation. Pp 302-350, in: *Sulfate Minerals : Crystallography, Geochemistry, and Environmental Significance* (Jambor, J.L., D. K. Nordstrom & C. .N. Alpers, eds.), Mineralogical Society of America, Washington DC.
Rouchon, V., H. Badet, O. Belhadj, O. Bonnerot, B. Lavédrine, J. G. Michard, & S. Miska. 2012. Raman and FTIR spectroscopy applied to the conservation report of paleontological collections : identification of Raman and FTIR signatures of several iron sulfate species such as ferrinatrite and sideronatrite. Journal of Raman Spectroscopy 43:1265-1274.
Sobron, P. & C. N. Alpers. 2013. *Raman Spectroscopy of Efflorescent Sulfate Salts from Iron Mountain Mine Superfund Site, California*. Astrobiology 13, 270-278.

Figure 1. Melanterite specimens of the MNHN collection.
Left: relatively well preserved specimen (MIN110.231, 1910) in a closed vessel sealed with a wax joint. Right : altered specimen (MIN117.16, 1917) that mainly turned into rozenite and szomolnokite.

B

ORAL PRESENTATION

Developing a global research infrastructure framework for bio-collections

Biodiversity Collections Network (BCoN) Research Coordination Network (RCN): Sustainability, advocacy and community

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ABSTRACT. Some time back a Network Integrated Biocollections Alliance (NIBA) was created to establish a framework for leveraging the wealth of resources represented by the nation's biocollections through digitization of specimens and associated metadata, creating a massive, distributed tool for addressing grand challenges across a wide range of scientific endeavor. Significant progress has been made toward the implementation of NIBA, by iDigBio and others, but much more work remains. In 2014, the National Science Foundation funded a Research Coordination Network (RCN) grant to support efforts to foster the continued engagement with and development of a sustainable, networked community of practice. The Biodiversity Collections Network (BCoN) RCN is working with the community to evaluate current and future needs. However, our first step is to identify this community, engage them in the work of the RCN and work together on collections advocacy and a sustainable infrastructure to support future work. This community is comprised of not only existing national and international collections initiatives within our community but a broad ranging list of external user groups. It also includes publishers and funding agencies. This talk will provide an update on BCoN activities and set the scene for impending initiatives.

POSTER

Collections for the future – future of collections

AnnoSys: A generic online annotation system for scientific collections

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ABSTRACT. AnnoSys is a web-based system for correcting and enriching biodiversity data in publicly available data portals. The current release of AnnoSys (https://annosys.bgbm.org/) establishes a number of workflows enabling online annotations using the example of biological collection and observation data. Currently, it is integrated into a dozen biodiversity data portals and provides means to edit, manage and publish annotations referring to these data via its web-based user interface. Additionally, the web interface enables curators to communicate decisions with regard to the acceptance or rejection of annotations referring to data objects in their collections. It aims at stimulating further demands for integrating its functionality from additional data portals, at the same time fostering the support of additional data standards as well as new use cases and applications.
Based on a generic annotation context model, which is implemented using the W3C Open Annotation Data Model, the AnnoSys repository archives annotations and the related original collection data. The resulting annotation records are publicly retrievable and integrable with other systems through Linked Data mechanisms, REST- and SPARQL-based web services. Beyond that, a customised subscription-based message system permits registered AnnoSys users (curators and researchers) to be informed by email about annotation related events.

ORAL PRESENTATION

Preventive conservation and material science

Blue Whale on the move: Dismantling a 125 year-old specimen

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ABSTRACT. The Natural History Museum (London, UK) intends to suspend a 25 metre-long, blue whale (*Balaenoptera musculus*) from its central Hintze Hall. Alongside other specimens which are to be put on open display in this space the environment was looked at in terms of sustainable improvements. Works are being undertaken to improve the conditions by utilizing natural ventilation and re-using existing duct work.

This specimen, acquired by the Museum in 1891, was suspended from the ceiling of the Mammal Hall, where it has been on display since 1934. Conservators worked with a specialist specimen handling company to carefully dismantle and remove each of the 220 bones from its original mount. The skull required a special frame and a precise calculation of movement to dismantle it and remove it. Many complex decisions were made during this process – as each bone removal did not dictate what the next would bring. During the dismantling phase, the conservation team have had to address the many requirements of curators, researchers, senior management and the media.

INTRODUCTION. A 25-metre long blue whale (*Balaenoptera musculus*) skeleton has been suspended in the Natural History Museum's (London, UK) Mammals and Blue Whale gallery since 1934 (**Figure 1**). Following months of careful consideration this specimen was chosen to take centre stage in Hintze Hall, to give an introduction that illustrates the museum's research into the rich biodiversity of life on Earth and a sustainable future, as well as the origins and evolution of that life. This also meant that it had to be completely dismantled and removed for conservation treatment to then be re-suspended.

The whale beached at Wexford, Ireland in 1891 and was thought to be about 5yrs of age at time of death. The skeleton was purchased by the NHM in 1891 for £250. It was held in storage as part of the NHM's Cetacea research collection until 1934 when it was placed into the Mammals Hall on public display (R. Sabin, pers. Comm. 03 Sept 2015).


Figure 1. The blue whale skeleton suspended in the Mammals Gallery prior to dismantling.

PLANNING AND PREPARATION. A particularly crucial aspect of moving the blue whale skeleton was whether or not it could actually withstand the strains and stresses of dismantling, transportation and remounting. Due to the complicated and high-risk nature of this project, many specialists were involved, including conservators, curators, project managers, scaffolders, structural engineers, specimen handlers and mount makers.

Environmental Conditions. Alongside other specimens which are to be put on open display in this space the environment was looked at in terms of sustainable improvements. Works are being undertaken to improve the conditions by utilizing natural ventilation and re-using existing duct work. This will help to minimise fluctuations and high temperatures exhibited in the summer months.


Figure 2. A thick layer of dust had settled on the surface of the blue whale skeleton. This was obscuring details regarding its condition to inform the dismantling process.

Cleaning. Cleaning was necessary to inform the dismantling process about the condition of the blue whale skeleton, (as a thick layer of dust had accumulated) (**Figure 2**). A low-suction vacuum with a soft brush was used to gently remove dust – a total of 1.3kgs of dust was collected from a surface area of approximately 110.4 m2.

Documentation. Digital images, videos, analytical samples, drawings and reports were used to capture as much information regarding specimen condition as possible. Each skeletal element was inspected with a particular emphasis on signs of fragility and weakness which was then recorded in a condition report used to inform the dismantling process. Labels were attached to bone features with polytetrafluoroethylene (PTFE) tape to ensure that correct articulation would be maintained during re-mounting of the specimen (**Figure 3**).


Figure 3. Each bone had to be carefully labelled to ensure that the correct articulation will be maintained in the new pose.

DISMANTLING THE SPECIMEN. Dismantling was carried out in several phases beginning with the smallest caudal vertebra. As more skeletal elements were removed the complexity, volume and weight increased.

Postcranial skeleton. As there was little documentation associated with how the specimen had been mounted, each bone presented an unknown challenge. The first discovery was two steel metal rods embedded through the first caudal vertebrae. Both had been fashioned into a loop at the posterior end to prevent it from being removed or sliding off easily (**Figure 4**). This was remedied by using a small hacksaw and carefully cutting off the first loop. The internal armature of the remaining vertebrae was a rectangular iron bar bolted in sections, that ran throughout the length of the vertebral column.

Figure 4. Removal of the first caudal vertebra revealed two metal rods terminating in a loop at the posterior end of the specimen.

Once the first 8 caudal vertebrae were successfully removed, the cable suspension metalwork that was bolted into the armature had to be removed as it effectively blocked the removal of more vertebrae. A support gantry was wheeled into place and a sling was placed under the exposed metal armature to support the structure as the first cable was uncoupled (**Figure 5**).

Further along the vertebral column, other skeletal elements had to be removed to ensure progress towards the skull, including the chevrons, pelvic bones, scapula, radius, ulna, phalanges, ribs, stenebra and hyoids. Each was bolted onto the armature or had additional armature attached and had to be removed in a specific order so that other bones could then be safely removed. For example, the pectoral fins could not be removed until the ribs were completely dismantled.

B

Figure 5. A large gantry was used to support the main armature while vertebrae were removed and cables were uncoupled.

Figure 6. Each intervertebral disc was composed of plaster of Paris, newspaper and wood blocks.

Figure 7. Each mandible was carefully packed into a bespoke wooden cradle and then lowered to the ground.

Figure 8. Due to the complex and high-risk nature of removing the whale skull, it required a specialist frame for support.

During the dismantling process, it was discovered that the intervertebral discs were composed of plaster of Paris, wood blocks and crumpled pieces of newspaper from the early 1930s (**Figure 6**).

Cranium and Mandibles. The final stages of dismantling involved removing the two mandible halves and the skull. The first challenge was to excavate around each bolt connection and uncouple the mandibles from the skull whilst providing full support to each element. Each mandible was then packed into a bespoke wooden frame so it could be carefully lowered down to the floor of the mammal gallery (Figure 7).

The skull is almost 6 metres in length and three metres at its widest point. It is highly complex in shape with over individual 40 elements fused or partly fused together. The first challenge was to lift and move it without placing any strain on the bone. The second challenge was that, due to existing cable supporting the whale model underneath (which could not be moved or removed), the skull was going to need to be rotated as we moved it, so that it would fit through the gap between the cable and the side of the scaffolding to enable it to be lowered to the ground floor of the gallery without causing any damage. A bespoke steel cradle had been designed to be placed underneath the skull and existing holes and bolted areas of the skull were used to attach it to the cradle (Figure 8). Crack monitor gauges had been placed at existing vulnerable parts of the skull to provide an additional recording mechanism for cracks opening up during the process. Extra removable sides were then added to the cradle, to provide extra protection for the rotation and subsequent move.

CONCLUSIONS. The skeletal elements are spread over three separate areas of the museum as there are about 220 bones in total. They will be undergoing conservation treatment over the next few months in the Darwin Centre gallery Pop up Conservation Studio (Figure 9).

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ORAL PRESENTATION

DemoCamp

Rapid collection inventories

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ABSTRACT. An accurate accounting of a biological collection's holdings can be used to prioritize digitization, expose specimens for scientific research, determine curatorial needs, and prioritize field work and acquisitions by identifying gaps in the collection. Unfortunately, many biocollection institutions have only an estimate of the number and taxonomic and geographic scope of the items in a collection. The Botanical Research Institute of Texas (BRIT) conducted an inventory of the herbarium collections in 2015 using a purpose-built web application called the BRIT Rapid Inventory of Specimen Collections (BRISC). BRISC allowed individuals with wireless tablets to inventory the contents of each cabinet, accounting for the number of specimens of each species as well as the geographic region of each specimen. Over the course of 11 months, 136 volunteers, interns, and BRIT staff members spent 241 person-days inventorying the collection. The resulting dataset provides highly-accurate details of the herbarium's holdings which can be published, queried, and analyzed to inform digitization strategies, curation prioritization, and research activity. BRISC was developed using the Django web framework and the Python programming language and is released under an open-source license.

ORAL PRESENTATION

Digitization and imaging collections: new methods, ideas, and uses

"To slide or not to slide" – How do we scan the Natural History Museum's slide collections?

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ABSTRACT. Microscopic slides, although seemingly standard objects, may represent a challenge in digitisation. Our pilot project's two main objectives were to record collection data and to obtain high resolution images, are best achieved through two entirely different workflows; mass digitisation and high resolution. We describe use of multi-specimen imaging (SatScan) and image segmentation and annotation software (*Inselect*) for mass digitisation. High resolution digitisation requires automated systems to increase the rate of imaging (Zeiss Axioscan and Zeiss AxioZoom). We discuss these two digitisation workflows and the implications of using a volunteer workforce on costs and productivity.

ORAL PRESENTATION

Preventive conservation and material science

Deterioration processes in skins and hides of mammal collections

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ABSTRACT. Commonly, the loss of collection objects is caused by chemical processes that destroy these specimens slowly and inconspicuously. My master's thesis focuses on the deterioration of skins and hides in the mammal collection at Museum für Naturkunde Berlin, Germany. The skins and hides are easily tearable and often torn or damaged. Studies concerning deterioration processes in mammal collections are rare and only few publications are available. Comparable studies can be found in projects of leather research. In my thesis unpublished knowledge of taxidermists, tanners, and researchers of interdisciplinary special fields from Germany, France, Sweden and Switzerland is gathered, matched and compared with available publications. Acid-induced decay caused by inadequate conservation techniques seems to be the main reason for deterioration. Sulfuric acid demolishes structures in the skin and reduces the tear strength. Poor storage conditions accelerate the deterioration processes. Measurements were made in the mammal collection of Museum für Naturkunde in Berlin, Germany (MfN) and Zoologisches Forschungsmuseum Alexander Koenig in Bonn, Germany (ZFMK). Parameters, like tear strength, pH and age, were taken and compared in skins of *Lepus europaeus*, *Meles meles* and *Vulpes vulpes*. There is a significant correlation between tear strength, surface pH and age of the specimens. On average, 80 % of the skins of *L. europaeus* and *V. vulpes* show vastly reduced tear strength in MfN. Extrapolated, 24,000 skins and hides are affected by deterioration in the whole mammal collection in MfN.

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B

ORAL PRESENTATION

Collections for the future – Future of collections

New technologies lead to new uses in the herbarium of the Botanic Garden Meise

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ABSTRACT. The Botanic Garden Meise monitors the different uses of its African Herbarium since 2013. The inventoried studies can be grouped into six different topics: taxonomy & systematics, morphology & anatomy, identification & vouchers, molecular research, traits & global change, traits, ecology & distribution, and phenology. Due to recent progresses in analytical techniques and information technology it is clear that the African Herbarium of the Botanic Garden Meise harbours a collection that can be used for a wide range of disciplines other than the traditional ones. Carefully monitoring and documenting these new uses illustrates the potential of the collections and proofs the ongoing relevance of collections for the future.

INTRODUCTION. The origin of herbaria traces back to the 16th century. The word *herbarium* referred to a book about medicinal plants. Herbaria were initially used as a tool to identify and illustrate medical plants. Since the Renaissance, Botanical Gardens and Universities were founded throughout Europe. They promulgated the importance of making herbaria. The early years' focus changed in the 17th century when new continents were explored and an overwhelming biodiversity was discovered. Botany gradually established its independence from medicine. Today ca. 3,000 herbaria are registered in Index Herbariorum and contain over 350 million specimens. Herbaria cover a wide range of taxonomic lineages, from plants to fungi, algae and myxomycetes. The main objective of herbaria is to document, identify and describe 'plant' diversity, however herbaria contain a huge potential for cutting edge research in other disciplines as well.

MATERIAL AND METHODS. The Botanic Garden Meise houses approximately 4 million herbarium specimens with a worldwide scope. The African Herbarium holds 1 million specimens collected during 140 years. The focus is on the D.R. Congo with ca. 500,000 specimens, equal to ca. 85% of collections ever made there. Many specimens are linked with wood samples, liquid collections, seedlings, fruits, etc. The African Herbarium is intensively studied by taxonomists.
We reviewed the uses of the African Herbarium since 2013 and grouped them according to the following topics: taxonomy & systematics, morphology & anatomy, identification & vouchers, molecular research, traits & global change, traits, ecology & distribution, and phenology. The four last mentioned uses are discussed here in order to illustrate the potential of herbaria. The studies are on-going and results are still unpublished.

RESULTS AND DISCUSSION
1. Molecular research. During the last decades, molecular technologies were revolutionised. Improved protocols allow extracting DNA from 50 year old herbarium samples with an average success of 60% for non-alcohol dried specimens. Even specimens up to 100 years old, treated with mercury-chloride have a 10% success rate. This makes herbaria an important source for phylogenetic and genetic studies and barcoding. Barcoding provides a complementary tool for identification and was used to verify identifications of rainforest trees in the Biosphere Reserve Yangambi (D.R. Congo). Many samples could not be identified with traditional methods because of the lack of fruits and flowers. A new approach combining herbarium-based identification and barcoding, allowed identifying sterile samples from 46%, over 60% to 89% (field, herbarium and combined identifications respectively). In another study, herbarium samples revealed genetic variability of robusta-coffee from remote areas in Africa for which no recent samples exist.
2. Plant traits and global change. Leaves respond to their environment. While some adaptations disappear when dried, others are conserved and can be studied in herbarium specimens. If the effects of various environmental parameters on leaves are understood, their imprint on the structure and chemical composition of leaves is used to study the effect of the environment on plants over time. In times of rapid anthropogenic changes, understanding the effect of past changes is important to predict future plant responses. Herbaria, particularly from collections when human impact on environment was smaller, represent an under-utilized treasure. We used herbaria from the Luki Biosphere Reserve (D.R. Congo) collected between 1903 and 1959 and compared these with leaves from the same species and locality collected recently. These suggest that trees responded to the 30% increase of atmospheric CO2 with reducting stomatal density and leaf mass per area. Even though the site is located far from major nitrogen emission, the increase in nitrogen deposition may have resulted in higher N-concentrations in leaves.
3. Plant traits, ecology and distribution. The locations of herbarium specimens combined with genetic samples are used to model the distribution of *Erythrophleum* species and genetic pools, and to specifically identify the environmental factors that limit the distribution of species and genetic pools. Two hypotheses are tested: 1) the forest refuge hypothesis: a differentiation that has occurred in the absence of ecological niche divergence and 2) the environmental filtering hypothesis: the role of ecological gradients in the speciation of *Erythrophleum* species. Environmental Niche Models for *Erythrophleum ivorense*, *E. suaveolens* and *E. africanum*, and two genepools for *E. ivorense*, three for *E. suaveolens* are generated using the Maxent Algorithm and BIOCLIM data (altitude and climate) as environmental predictors. All models had significant validation support. Using an index of niche overlap and similarity tests, strong differences in environmental niches between species show the affinity of E. ivorense, *E. suaveolens* and *E. africanum* for wet evergreen forests, moist forests and dry forests and woody savannas respectively. Within genetic pools only significant differences in environmental niches between the two Northern and Southern pools of *E. suaveolens* were identified, and it is suspected that there is a differentiation due to specific environmental condition, partly because they show the same phenological behaviour. In a similar study on *Guibourtia* species, it was possible by using herbaria to link the inflorescence position (terminal or axial) to species habitat (wet or dry).
4. Plant phenology. Herbaria are alternative sources for comparative plant phenological research, especially for tropical regions where surveys are lacking for most species. Herbarium data are used to determine the flowering (or fruiting) pattern (annual, sub-annual, supra-annual, or continuous). For species or populations with annual phenological patterns, herbarium records are used to estimate the mean time of occurrence of the reproductive event, as well as the concentration of phenological activity. This enables exploring inter- and intra-specific variations in phenology relative to seasonal conditions throughout the whole species range.

CONCLUSION. Recent progress in analytical techniques and information technology increased the diversity of users and uses of herbaria significantly. Based on the large amount of different studies using herbarium samples from the Garden, it is clear that the institute harbours a collection useful for a wide range of disciplines, bringing scientific disciplines together. Carefully monitoring and documenting these activities, actively promoting new uses, prospecting opportunities and participating in research projects by curators, significantly increases uses and helps collections to proof their relevance. It offers collections perspectives for the future.

ORAL PRESENTATION

Green Museum – How to practice what we preach?

Evaluation of climate control in Yale Peabody Museum of Natural History – energy consumption and risk assessment

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ABSTRACT. Abstract. Yale's Peabody Museum of Natural History (YPM) has a long tradition of improving the environmental conditions for preserving its collection of more than 13 million objects. However, results are unexpected and far from what the museum hoped for as was shown by an analysis of the current environmental conditions in three museum buildings, built in 1925, 1963 and 2001. Analysis of energy use for climate control showed that the Environmental Studies Center, the most modern Peabody Museum building, is the least energy efficient of the three. Therefore, YPM decided to reevaluate its current climate control strategy towards a more practical and responsible approach, which takes into account the historic character of the buildings and the high cost of climate control. The assessment of climate related risks to collections was the main element in the transformation process towards a new strategy of climate control. It allowed preservation priorities of the YPM collections to be identified. Finally, guiding principles of climate control were proposed that meet the preservation targets of the museum's vast collections and at the same time reduce energy consumption and lower CO^2 emissions.

B

ORAL PRESENTATION

An International Conversation on Mobilizing Natural History Collections Data and Integrating Data for Research (iDigBio Symposium)

eMesozoic: an alternative approach to digitising palaeontological collections

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ABSTRACT. Digitising large palaeontological collections with complex histories presents many challenges. To address this, the Natural History Museum, London (NHM), funded a pilot project (eMesozoic) to develop workflows and gain insight into the issues and cost of digitising such collections.

As part of the eMesozoic workflow, a series of apps were developed to rename images for ingestion into our specimen database, to associate images with catalogue records and to transcribe data on labels and in accession registers. High quality site, stratigraphic and taxonomic data were filtered through to the transcription app for attaching to specimen records. This reduced transcription time and ensured high quality data was immediately available via the data portal on our website.

Major take home lessons from this project include the critical importance of pre-digitisation collection preparation and the slow speed (and therefore high cost) of digitising palaeontological specimens, particularly collections with complex histories and curatorial practices. Imaging rates varied widely depending on specimen size, type, storage conditions and curation history. The compilation and use of high quality site, stratigraphic and taxonomic data could be developed further, enabling digitisation and research programmes to work together to share metadata, reducing the burden and increasing the benefits of digitisation.

INTRODUCTION & METHODS

Background. eMesozoic was a pilot digitisation project based at the Natural History Museum (NHM), London. The aim of this project was to develop efficient workflows for digitising palaeontological collections with complex histories. To achieve this we needed to solve a number of key problems:

- Address the wide range of specimen sizes (sub-millimetre to several in length) and efficiently image a wide range of complex 3D shapes
- Develop imaging set ups and workflows that were flexible enough to use in, and move between, a variety of storage locations
- Efficiently capture differing sources of specimen information (e.g., labels versus accession registers)
- Incorporate both registered and unregistered specimens into our workflow and deal with complex and inconsistent historical curation practices, including a complex system of prefixes and suffixes appended to registration numbers
- Incorporate bulk registered specimens (multiple specimens given the same registration number, but later split up) and multipart specimens (e.g., multiple elements from a single skeleton)
- Develop a methodology for handling specimens which were well-, poorly- or completely un-documented on our Collection Management System (CMS)
- Find an alternative to entering data directly into our CMS, which is inefficient and requires a high level of expertise
- Filter records from our CMS, to remove duplicates and poor quality or unverified data
- Minimise the time from imaging to data being available on the web, without creating post-project legacy issues

To address these issues, we concentrated on British Mesozoic vertebrate specimens. These are encompassed by collections looked after by four curators, contain a mix of new and historical material, and have high potential for sharing metadata and expertise between collections. The estimated number of specimens (c. 20,000) seemed like a realistic number to digitise in one year with three full-time digitisers and one project support assistant.

Workflow. The workflow consisted of 7 stages (**Figure 1**). Stage 1 (Preparation) requires a significant lead time. Stages 1 to 4 are the core stages as they collect the primary data. The remaining stages simply re-organise the data to make it easier to access and use. The creation of an initial set of master records for key metadata can start in Stage 1 (**Figure 1**).

Imaging (Stage 2) was divided into multiple workflows depending on the size of the specimen. Images were renamed with the specimen barcode and the collections location barcode. During ingestion of these renamed images into the CMS (Stage 3), a stub record was created which contained the specimen barcode and project name, the collection location and the images

attached as multimedia records. This was then associated (Stage 4) with the correct catalogue record using a web-based form developed in conjunction with Axiell which communicated directly with our CMS (EMu). If there was no existing catalogue record then a new one was created based on the stub record. Post-association, records were pushed through to a second web-based form for transcribing (Stage 5).

The Transcription App retrieved from the CMS all data and images associated with each catalogue record, which could then be supplemented with data collected as part of Stages 1 and 2. Metadata records (presented as lookups) were filtered through to the Transcription App so only high quality pre-validated records (master records) can be seen and associated with specimen records. If no relevant master records were retrieved, data was entered verbatim, reviewed by the project support assistant (Stage 6) and used as the basis for creating additional master records (Stage 7). In this way, transcription became increasingly efficient over time as more master records were available for association. Transcription was based on labels imaged at the same time as specimens (Stage 2) and images of accession registers attached to catalogue records (Stage 1).

RESULTS. On average 1.3 images were taken per specimen (one specimen image with labels and additional images of labels if necessary). During Stage 2, 76 specimens were imaged on average per person per day across all workflows. The breakdown for different specimen sizes is provided in **Table 1**. The large ranges are due to different specimen types and storage conditions. The higher numbers were for specimens which had been extensively pre-curated prior to digitisation. An average of 448 records were associated per person per day, and 161 records were transcribed on average per person per day. The project support assistant was able to deal with about 90 issues per day resulting from lack of master records or issues associated with transcribed records.

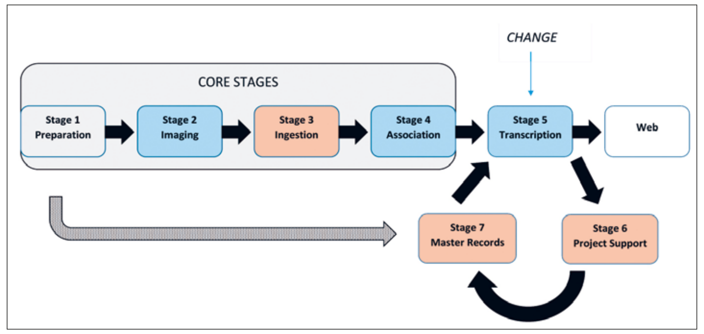

Figure 1. eMesozoic workflow. Blue indicates stages entirely undertaken by digitisers, red by the project support assistant or data manager. See text for explanation.

	Average per day per person	Range (minimum)	Range (maximum)
Small imaging workflow (specimens up to 30 cm in length)	96	18	267
Medium imaging workflow (specimens between 30 and 60 cm in length)	35	8	90
Large imaging workflow (specimens greater than 60 cm in length)	23	5	53

Table 1. Number of specimens imaged for each workflow

DISCUSSION & CONCLUSIONS. For imaging (Stage 2), the biggest influencing factors are the size of the specimens and the degree of pre-curation they have undergone. Specimens, which have been extensively vetted for digitisation and are in the range 1 cm to 10 cm are ideal candidates for digitisation. As expected the cost of digitising palaeontology collection is high.

Collections preparation was essential to the workflow and was severely underestimated in this project. To maximise digitisation efficiency and minimise the number of post-project legacy issues, we recommend that at least the same amount of time is spent on preparation (Stage 1), as all other stages combined (Stages 2 to 7). Project management takes a substantial amount of time and this needs to be built into the timeline.

Using master records is potentially useful for collections, which are relatively homogenous, or for projects that aim to share metadata. The benefits of this need to explored further, particularly for co-ordinated digitisation programmes and large-scale data mining projects.

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B

ORAL PRESENTATION
Collections stewardship and policies
Loaning without moaning

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ABSTRACT. This presentation deals with issues concerning incoming and outgoing loans such as:

- How to deal with long overdue or lost loans.
- How to improve the safety of the objects on loan.
- How to cope with the costs of voluminous collections (especially herbarium sheets).
- How to make it easier for institutes to send or return the specimens: difficulties with customs, Nagoya Protocol, CITES etc.
- How to deal with researchers who ask for loans by themselves, without notifying the loans office.

Some possible solutions are given and collaboration between institutes is encouraged, all to make this a safer, easier and better manageable process for researchers, collection managers, exhibition makers and loans officers.

ORAL PRESENTATION
Green Museum – How to practice what we preach? (General session)
Yale Peabody Museum's sustainability action plan

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ABSTRACT. A specific directive of the Yale University Sustainability Strategic Plan (2013-2016) is a mandate for all Yale galleries and museums to execute sustainability strategic plans. The Yale Peabody Museum Sustainability Action Plan was conceived and created by the Peabody's "Green Team", a committee which originated from discussions during Peabody accreditation and tasked with promoting a culture of sustainability within the museum, with direction and input from the Yale Office of Sustainability. The Peabody plan, in alignment with the Yale University plan, identifies five areas in which to focus sustainability efforts: energy and greenhouse gas emissions, natural and built environment, materials management, food and well-being, and sustainability leadership and capacity building. We will discuss the features and highlights of our plan, strategies and challenges to implementation, and measures taken to ensure success.

MAIN TEXT. In line with the target areas in the Yale University Sustainability Strategic Plan 2013–2016 (Yale University, 2013), we have outlined areas in which we will achieve a more sustainable Peabody Museum: energy and greenhouse gas emissions, natural and built environment, materials management, food and well-being, and sustainability leadership and capacity building (Yale Peabody Museum, 2015). The emphasis in the energy and greenhouse gas emissions area is an audit of energy usage across the three Peabody buildings on our main campus. By working with the Yale Insitute for the Preservation of Cultural Heritage and the Office of Facilities, we hope to identify improvements to equipment efficiency and equipment use (i.e. night lighting) to reduce energy use in collections, research, and exhibition spaces. Natural and built environment goals include changing our exhibit construction practices and demonstrating lower resource landscaping options. Materials management seeks to reduce consumable office supplies and promotional/operational paper use by promoting electronic business practices and also by auditing and improving disposal and recycling practices. Food and well-being promotes sustainability by replacing bottled water with water filters and demonstrating sustainable event planning at our many museum events.

Our easiest target to address is sustainable leadership and capacity building. The 13 million specimens in the collections of the Yale Peabody Museum of Natural History (YPM) tell the story of 2 billion years of life on Earth. These collections provide a baseline for understanding climate and biodiversity through time. Scientists use our collections to gauge the effects of environmental and climate change on the quality and composition of life on Earth and make predictions for the future. This research is brought to the Yale community and the public through the Peabody Museum's exhibitions and events, through student and public engagement, and through leading by example as an institution. As a natural history museum we are not only stewards of the past, but can also promote, educate, and advocate for the natural future.

To ensure fulfillment of the program outlined in the action plan, management of the plan is broken into discrete tasks with target dates and the responsible party is identified. The progress is tracked semi-annually by the Green Team and progress is discussed on a yearly basis with staff from the Office of Sustainability, who also collaborate on development of the plans from all Yale museums and galleries. This has nurtured cross-pollination of ideas and strategies within Yale.

The success of the plan thus far has relied on several factors: responsible use of finances, administrative support, and voluntary effort. First, the goals contained in the plan intentionally require few resources, improve operational efficiency, and some have potential to save money – in particular, reductions in energy costs and supplies. Second, the directive was initiated by the Yale University President and support is provided through the Yale Office of Sustainability, the Department of Utilities and Engineering, and Central Facilities. Within the Peabody Museum, there is strong approval and support from the Director's Office and the Office of Collections and Operations, through which the majority of tasks can be accomplished. Finally, in lieu of staff dedicated to management of the strategic plan, the Peabody Green Team, consisting of collections, exhibitions, and operations staff, has taken on responsibility for implementing the plan.

REFERENCES

Yale University Sustainability Strategic Plan 2013-2016 [internet resource]. Available from: http://sustainability.yale.edu/sites/default/files/sustainabilitystrategicplan2013-16_0.pdf (Accessed: March 11, 2016 11:48AM).
Yale Peabody Museum of Natural History Sustainability Action Plan [internet resource]. Available from: http://sustainability.yale.edu/sites/default/files/files/peabody%20sustainability%20plan%20E-VIEW.pdf (Accessed March 11, 2016 11:49AM).

ORAL PRESENTATION
An International Conversation on Mobilizing Natural History Collections Data and Integrating Data for Research (iDigBio Symposium)
iDigPaleo and ePANDDA: digital infrastructure and tools for collection discovery and use.

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ABSTRACT. In order to fully realize the societal impacts of large scale access to digitized collections data, it will be necessary to develop tools for the use of these data outside traditional research settings. We describe two ongoing, interrelated projects that address this challenge. iDigPaleo aggregates data from fossil collections and makes them available for classroom usage. Web-based tools, developed in consultation with K-12 educators, allow students to work with collections data in the same way as professional researchers. In the near future, these data will be enriched with neontological and contextual information using the ePANDDA API, which will facilitate data exchange between iDigPaleo, iDigBio, and the Paleobiology Database. ePANDDA will allow developers to produce apps that draw on collections data and other information from multiple sources, facilitating seamless and greatly improved professional and public access to digital data

MAIN TEXT. The United States is currently engaged in a major effort to digitize data from the country's biological science collections (including paleontology) and to make these data available via the worldwide web. This project, which involves multiple participants in both the private and public sectors, envisages transformative effects on society that will be enabled by wider access to collections data.

Understandably, most of the efforts to date have focused on the enormous challenges of capturing and mobilizing data. Equally important, however, is the development of resources to facilitate the use of these data. Many of the tools under development are aimed at traditional research users from the organismal biology and paleontology communities, but if the effects of data mobilization are to be truly transformative, there is also a need to develop tools that enable usage in non-traditional settings.

iDigPaleo is a project aimed at bringing collections and collections data into primary and secondary education. At its core, it contains a dataset aggregated and regularly updated from multiple paleontological collections using IPT (Integrated Publishing Toolkit) providers. But the real strength of iDigPaleo is its associated toolkit, which lets collection users search the aggregated data via the web; filter, save, and share it, and use mapping, measuring, and annotation tools to employ these for education and outreach purposes.

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iDigPaleo is currently running with one pilot project, focusing on fossil insect collections. With the help of project partners from 11 institutions, over 500,000 fossil insect specimens will be digitized and made available through iDigPaleo. Project participants are working with K-12 educators to develop and refine curricula and classroom activities for middle and high school students that use collections data to explore topics in the U.S. Next Generation Science Standards (NGSS).

The applications of iDigPaleo extend beyond education usage. The ability to create, save, and share datasets that was designed for classroom activities also has the potential to support research collaborations. In addition, the annotation tool has a feedback mechanism to data providers, which can be used to support crowdsourced curation projects. These aspects will form the focus of future development projects. The beta version of iDigPaleo will be available to the public later this year.

iDigPaleo currently exposes only data from participating collections, but one of key facets of the national digitization program is the sharing of information – one shouldn't waste resources trying to capture information that someone else has already caught. With this in mind, over the next two years collaborators from iDigPaleo, iDigBio, the Geological Society of America, and the Paleobiology Database (PaleoDB) are going to be working on a new project called ePANDDA: Enhancing Paleontological and Neontological Data Discovery API.

ePANDDA addresses one of the major barriers to effective use of on-line collections data; specimen data are often separated from the contextual information needed to adequately interpret and analyze them. Although these resources are digitized, and contain common elements (e.g. taxonomic IDs) that would permit sharing of data, the data are contained within digital silos and combining datasets often requires time-consuming manual work.

For iDigPaleo, our collaboration with educators quickly identified a need for extensive access to neontological specimen data. These data are critical for comparative studies of fossils; for example, mapping changes in taxon distribution over time that might be associated with global climate change, or reconstructing the appearance of an extinct organism by reference to its living relatives. Such data access can be done on a local, institutional basis, as is currently the case for the pilot version of iDigPaleo, but a more efficient, long-term solution is to use the ePANDDA API to facilitate sharing with the U.S. national hub for biological collections, iDigBio. This will be one focus of the ePANDDA project.

The Paleobiology Database (PaleoDB) is an example of a non-specimen based data resource. PaleoDB is a crowdsourced, literature-based (including unpublished dissertations and theses) database. Taxa are tied to publications, not specimen records, even though the records in the publications are often derived from collections. PaleoDB currently contains over 1.2 million records, and includes authority files for taxonomic hierarchies and synonymies, multiple classification schemes, and multiple time scales. It is an extraordinarily rich resource, which was cited as a data source by nearly 3,000 academic papers in 2014. But with a very different architecture from iDigPaleo and iDigBio, linking its data to specimen records is not straightforward.

ePANDDA will facilitate this linkage by developing a set of application programming interfaces (APIs) that will enable iDigBio, iDigPaleo, and PaleoDB to seamlessly share data; neontological collections data from iDigBio, paleontological collections data from iDigPaleo, and research and publication-derived paleontological and geological data from PaleoDB. The project is also working at developing APIs and plug-ins (i.e. "widgets") that will allow sharing of data with other groups, including the Encyclopedia of Life, and provide resources for researchers and amateur collectors. Rollout of ePANDDA and associated APIs is scheduled for late 2017.

ACKNOWLEDGEMENTS. We are grateful to our ePANDDA collaborators from PaleoDB (Jocelyn Sessa & Mark Uhen), iDigBio (Shelley James & Gil Nelson) and Yale (Larry Gall & Harry Shyket), and to the members of the Fossil Insect Collaborative. Development of iDigPaleo is supported through NSF EF 1305027: Digitization TCN: Collaborative Research: Fossil Insect Collaborative: A deep-time approach to studying diversification and response to environmental change. ePANDDA is supported through NSF ICER 1540984: EarthCube IA. Collaborative Proposal: ePANDDA: Enhancing Paleontological and Neontological Data Discovery API. iDigPaleo progra mming and development by Seth Kaufman, Whirl-i-Gig.

ORAL PRESENTATION

Preventive conservation and material science

The plain of jars: rehousing the Malacology alcohol collection at the Academy of Natural Sciences in Philadelphia

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ABSTRACT. The mollusk collection of the Academy of Natural Sciences (ANSP) in Philadelphia is one of the largest in the world, with between eight and ten million specimens cataloged in roughly 475,000 lots representing roughly half of the known species of extant Mollusca. It dates back to the Academy's founding in 1812 and is now the oldest in North America. It is rich in type specimens, with about 18,000 type lots, and has more than 10,000 lots of endangered and extinct species.
The fluid preserved mollusk collection contains about 1.5 million specimens representing 140 countries and dating back to the 1860s. More than 1,000 lots and 200,000 specimens in fluid represent endangered or extinct species. The ANSP has never regularly used formalin to fix mollusks, so much of the fluid preserved collection is appropriate for DNA analysis. Ensuring that this material is properly archived supports research on mollusks throughout the world.
The last major rehousing of the collection took place when it was moved to its current location in 1976. In 2015 NSF funding was granted to inventory and rehouse 41,000 cataloged fluid-preserved mollusk lots and to integrate about 9,500 more that had been received from other institutions.
Many of the jar lids in the collection are made of Bakelite or steel, both materials known to be unstable in the long term, and others have liners that are not archival. An increasing failure rate among aging lids and seals was found to be jeopardizing the specimens. Catastrophic failure such as the cracking of a lid results in the fluid completely evaporating within a few months, so the standard maintenance cycle that involved checking fluid levels every three years was no longer sufficient to safeguard the collection. The chosen solution was to inspect every jar, make condition reports for each one and renew all closures, thereby time-stamping the entire collection 40 years after the previous overhaul.
At the same time, the arrangement of the containers is being changed from rows standing directly on shelves to a system of sliding metal trays that allow fluid levels to be checked by scanning batches rather than single jars. In addition to this increased efficiency, the compression achieved by reducing headspace above the jars has resulted in a considerable gain in capacity within the limited fire-rated storage space.
This presentation describes the initial research and testing carried out for the grant proposal, the design of the new equipment and the protocols currently being employed.

POSTER

Other topics

Integrating diverse resources at the New York Botanical Garden for specimen-based botanical research

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ABSTRACT. Here we report on a project to refurbish, database, image, and integrate a variety of natural history specimens, samples for laboratory research, and live plant images to promote efficient use of the collections for research on Ericaceae.

INTRODUCTION. From a research perspective the New York Botanical Garden (NYBG) is best known for its extensive and well curated herbarium. These dried, pressed specimens are the basis for systematic, floristic, and conservation research conducted at NYBG and throughout the world.
This resource is augmented by those housed in the LuEsther Mertz Library, the Plant Research Laboratory, and the living collections maintained at NYBG. The impetus for this project was a large donation of laboratory samples from Barbara Palser upon her retirement from Rutgers, the State University of New Jersey. The majority were of Ericaceae, a plant family that has been a focus of systematic research at NYBG since the late 1920s (e.g., Rusby, 1920). Laboratory samples include fluid-preserved, dried wood, tissues preserved to extract DNA, leaf clearings, and microscope slide and other preparations.
The plant family Ericaceae has a global distribution and comprises almost 4000 species in about 125 genera, including members of economic importance (e.g., blueberries, cranberries, lingonberries and rhododendrons). Ericaceae are diverse morphologically and anatomically: species are evergreen or deciduous; terrestrial or epiphytic; shrubs, lianas, trees, or herbs; they

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exhibit a variety of floral forms; and some species are achlorophyllous and mycotrophic (Stevens et al., 2004). Several major clades of Ericaceae, such as Vaccinieae (Kron et al., 2002), which has been a focus of NYBG research, are especially diverse in neotropical montane forests and occur in endangered Andean habitats (see Mast et al., 1999). Palser's collections came from around the world and include taxa from all eight subfamilies (see Stevens et al., 2004).

RESULTS & DISCUSSION

Collections refurbishment and integration. The majority of the Ericaceae Laboratory Collections were in lots that were organized separately by five researchers: Steven E. Clemants, James L. Luteyn, Palser, Paola Pedraza-Peñalosa, and Nelson Salinas. Fluid-preserved samples were transferred from plastic into glass containers, filled with 70% ethanol, and sealed with polypropylene foam lined lids. All collections were labeled with human and machine readable barcode labels, and re-organized into a single taxonomic sequence. The fluid-preserved samples are stored in plastic lidded boxes to maximize efficiency.

Databasing and imaging specimens. Database modules for an existing KE EMu application were enhanced to integrate laboratory collections with the existing herbarium specimen database.

Information about the nature, condition, and storage location of the laboratory sample was recorded and a record containing similar data for the associated herbarium specimen appended to it. All Ericaceae from the Chrysler Herbarium of Rutgers University (CHRB) were borrowed to capture specimen data that voucher the Palser laboratory donations. These data and high resolution images were given to CHRB. Voucher specimens for all Ericaceae laboratory collections were located, annotated as vouchers, and databased and imaged as needed, populating the growing database at NYBG with over 65,000 Ericaceae herbarium specimen records. Laboratory and herbarium specimen database records may include images of specimens, their derivates (e.g., micrographs), living plants (in situ or cultivated), and literatureand database (e.g., GenBank) references.

Conclusions. An Ericaceae collections website, pointed to by hyperlinks on several prominent NYBG portals, will enable searching these data and images by several criteria. The webpage will include information about Ericaceae biology and systematics, and will have broad research and teaching applications and will be useful to scientists, students, educators, government agencies, conservation organizations, and others interested in biodiversity. Moreover, the wealth of the resources both at NYBG and Rutgers, will be made readily accessible to scientists. The electronic resource now at Rutgers compliments their Philip E. Marucci Center for Blueberry and Cranberry Research and Extension. The curation techniques and database modules developed here for data and specimen management of laboratory collections can be replicated or tailored for use in other collections.

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No. (CSBR: 1203278). We thank the numerous technicians, interns, and volunteers who contributed to the project. The Curator and staff of the Chrysler Herbarium, Rutgers University, kindly facilitated a loan of their material.

REFERENCES

Kron, K.A., E. A. Powell & J. L. Luteyn 2002. Phylogenetic relationships within the blueberry tribe (Vaccinieae, Ericaceae) based on sequence data from *matK* and nuclear ribosomal ITS regions, with comments on the placement of *Satyria*. American Journal of Botany 89: 327–336.

Mast, R. B., J. V. Rodríguez-Maecha, R. A. Mittermeier & C. G. Mittermeier. 1999. Tropical Andes. Pp. 68–85, in: *Hotspots: Earth's Biologically Richest and Most Endangered Terrestrial Ecoregions* (R. A. Mittermeier, P. Robles-Gil & C. G. Mittermeier, eds.), CEMEX, Mexico.

Rusby, H. H. 1920. *Descriptions of Three Hundred New Species of South American Plants*. The author, NY.

Stevens, P. F., J. Luteyn, E. G. H. Oliver, T. L. Bell, E. A. Brown, R. K. Crowden, A. S. George, G. J. Jordan, P. Ladd, K. Lemson, C. B. McLean, Y. Menadue, J. S. Pate, H. M. Stace & C. M. Weiller. 2004. Ericaceae. Pp. 145–194, in: *The Families and Genera of Vascular Plants*. VI. Kubitzki, K. (ed.), Springer, Berlin

ORAL PRESENTATION

Preventive conservation and material science

'Avoiding a pickle' – Developing standards for the sustainable care and conservation of fluid preserved collections

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ABSTRACT. In 2013 a Clothworkers Foundation funded project was initiated by Chris Collins (then of the NHM London) to consider bringing together standards in a number of specialist natural science collection areas. This included looking at the challenges presented by fluid preserved collections (http://conservation.myspecies.info/node/33). This presentation will look at current work that is attempting to develop and progress the initial findings of the original Clothworkers Foundation project. Current challenges include significant areas where there are gaps in both consensus and knowledge regarding such collections. Developing a framework to address such issues and to produce a mechanism that the natural science community can use and feed into will be an important part of progressing the original project. The development of effective and achievable standards will in turn enable more cost effective and sustainable approaches for the care and conservation of fluid preserved collections to be achieved.

MAIN TEXT. In 2013 a project was initiated to look at developing standards in a number of specialist areas of natural science collections (Collins 2014). The project was funded by the UK based Clothworkers Foundation and brought together a number of expert groups to look at;

- Standards in the care of botanical collections.
- Standards in the care of skin and taxidermy collections.
- Standards in the care of wet collections.

The results of these expert reviews were then presented at the Society for the Preservation of Natural History Collections (SPNHC) annual meeting in 2014, and published online, http://conservation.myspecies.info/node/36.

The work of these groups provides a framework to further develop the concept of standards in each specialist collection area, and further provides a baseline for training and development. The project also highlights significant areas where there is either a lack in our knowledge, or a variance in consensus amongst the specialists in the collection community.

A good example of this is with the challenges presented by wet collections. As Simmons (2014) points out many of our 'standards' used with such collections have been derived by trial and error rather than specific research. Nevertheless some of these methods have now been in use for over 300 years, and preserve some of the oldest specimens found in our natural science collections. However there is still much that we do not understand about the preservation of these collections.

Thus the work presented by the Clothworkers Foundation project on wet collections is being used as a framework that can be developed to progress our understanding of their care and conservation. It is progressing this work that this presentation discusses within a topic that is often confusing and complex. As the resources and personnel become scarcer for the preservation, care and conservation of wet collections, then it is more important than ever to establish effective and achievable standards to support the natural science community.

The key question is how to bring this about? Within this presentation some of the key areas requiring greater consensus and research will be highlighted, and concepts of a framework to bring this together in an interactive way for the natural science museum community will be considered. Bringing together our knowledge and understanding of wet collections in a coherent way will do much to address the confusion within this field, and provide a more sustainable way forward for their care and conservation in the future.

REFERENCES

Collins, C. 2014. Clothworkers and Standards. http://conservation.myspecies.info/node/36

Simmons, J.E. 2014. *Fluid Preservation. A Comprehensive Reference*. Rowman and Littlefield.

C

ORAL PRESENTATION

Green Museum – How to practice what we preach? (General session)

To kill or not to kill: ethics of collecting insects

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ABSTRACT. As entomologists we study small animals. It also happens that our study objects are highly diversified. Insects are one of the largest group of animals on earth with approximately 1.000.000 species.
This means that related species are very similar and to identify them you need to look at small details. As a consequence it is rather impossible to identify insects in the field or from a picture (except perhaps bigger ones like dragonflies and butterflies).
Traditionally entomologists collect insects by killing them, pinning them and looking at the morphological characters under a microscope. Natural history museums have large entomological collections. You could think that there is enough material already and that there is no need to collect further. So why do entomologists still collect insects? First of all to study the DNA. DNA research is changing our concept of species and has given new insights in species delimitations. Second, many museum specimens are old and to study genital characters you need fresh material (it is very difficult to extract genitals from older specimens). Nevertheless we should try to avoid killing if not necessary.
In this presentation some of the pro and cons about this topic will be discussed.

ORAL PRESENTATION

Enabling Infrastructure: Future Collections, Data & Informatics (Synthesys Symposium)

Text mining whole museum datasets for expanding understanding of collections with the GUODA service

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ABSTRACT. Digitization of museum collections objects is a laborious task. While OCR and machine learning can assist with the manual keying of label information, the process of extracting properties from notes and descriptions requires both time and biological expertise. However keying and OCR can be used to simply transcribe additional label information and natural language processing algorithms can be used to perform some interpretation of the results. The formatting of notes and remarks data like the Darwin Core fieldNotes field varies widely from semi-structured attribute:value pairs to phrases to full sentences which complicate the automated analysis of these fields. Using text mining techniques such as entity recognition and libraries like Python's Natural Language Toolkit (NLTK), attributes and values as well as broader understanding can be extracted and ground-truthed to known data available from sources like the Encyclopedia of Life's TraitBank or previously expert-digitized specimens.

Computation engines like Apache Spark combined with whole datasets from multiple biodiversity data sources are ideal for performing these investigations. Global Unified Open Data Access (GUODA), hosted at iDigBio, provides resources where your Python, Scala, or R code can be run on a cluster to quickly explore algorithms and data at a scale not available previously.

ORAL PRESENTATION

DemoCamp

Whole-dataset processing of biological collections and other data sources as a service – Demonstration of GUODA

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ABSTRACT. Writing your own code to analyze snapshots of biodiversity data providers' entire datasets is an important capability: It allows broad questions to be asked across multiple data providers without needing to wait for the providers to develop unified data models and import each other's data or develop graphical interfaces or application programming interfaces (APIs) that perform the analyses you want to run. Drawbacks to large snapshot approaches include storage space, processing power, and programming expertise. This is where the Global Unified Open Data Access (GUODA) service, now in alpha status, aims to ease the systems administration and cognitive load burdens of large-scale data processing by providing a place to collect and run analyses code written for the Apache Spark data processing engine.

In this demo we very briefly introduce the computation ideas of Spark and the structure of the GUODA service. We will then show ways you can use GUODA to perform searching and matching, joins between datasets, and simple machine learning on and between the entire datasets stored at iDigBio including iDigBio (>55 million rows), TraitBank (>11 million rows) and GBIF (>640 million rows) using a few lines of Python, R, or Scala code.

POSTER

Enabling Infrastructure: Future Collections, Data & Informatics (Synthesys Symposium) (General session)

Updates on whole-dataset analyses using Spark and the GUODA data service

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ABSTRACT. Since the Taxonomic Databases Working Group (TDWG) meeting in September 2015, the authors have continued to develop processes for analyzing entire biodiversity data sets using Apache Spark. This collaboration has led to the development of the GUODA (Global Unified Open Data Access) service, now in alpha status, which aims to ease the systems administration and cognitive load burdens of large-scale data processing by providing a place to collect and run analysis code written for the Apache Spark data processing engine.

Jorrit Poelen has built a web service that compiles taxonomic checklists from geospatial, taxonomic, temporal, and trait constraints. He has also create a service called Fresh Data that sends notifications whenever new occurrence records are available that match user-specified queries.

Alex Thompson has been prototyping workflows that provide a communication channel back to the original sources of the data by using the iDigBio data quality assessment process to drive an annotation system at iDigBio.

While Spark removes an enormous amount of expertise traditionally required to make parallel analyses, it is not simple. Matthew Collins has been working on ways to make the power of GUODA available to bioinformatics researchers using libraries and interfaces in scripting language like R and Python.

ORAL PRESENTATION

DemoCamp

Global Registry of Scientific Collections (GRSciColl): Function and application

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ABSTRACT. GRSciColl (http://www.grscicoll.org) is an online registry for scientific collections-holding institutions around the world. This database contains records for institutions, institutional and personal collections, and staff members. Information available for the more than 7,000 institutional records includes staff, institutional and associated collections, and governance type. GRSciColl acts as an up-to-date resource which increases awareness and accessibility of collections.

GRSciColl is run by Scientific Collections International (SciColl) and the Consortium for the Barcode of Life (CBOL), which update the website and address user needs. GRSciColl is an expansion of the Global Registry of Biodiversity Repositories (GRBio) and includes a variety of scientific disciplines.

GRSciColl is a community curated clearinghouse and is therefore dependent upon curators, collection managers, researchers, and other staff members to provide summary-level information on these institutions. GRSciColl requires only basic contact and location information and checks for global uniqueness through institution codes and the collection codes within each institution. Once records are created or updated, these changes go into a moderator queue and become public after review, usually within five days.

ORAL PRESENTATION

Green Museum – How to practice what we preach? (General session)

Design strategies for sustainable solutions

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ABSTRACT. A sustainable collections facility is centered on opportunities during planning and design to use passive solutions (minimizing energy use, complicated mechanical systems and the associated system maintenance) rather than active solutions (requiring inputs of energy and regular maintenance) to perform to the project standards and mitigate risk to collections. Fewer active systems also provide fewer failure points in the case of an incident, whether fire, smoke, bulk water, changes in environmental conditions, pest infestation or theft). The design of space with a focus on passive design starts with understanding points of interaction with the collections: staff work protocols and access requirements and how new protocols will mitigate one level of risk and use less operational resources. By considering location with the facility and adjacencies of work spaces, another level of sustainability may be addressed. A sustainable facility would differentiate between places for people and collections and attempt to provide the necessary conditions for each. The building would also anticipate changes in programmatic development over its life and allow for a reallocation of space in the future to accommodate new institutional goals, with limited new investment in construction. This presentation focuses discussion on the Avenir Collections Center at the Denver Museum of Nature & Science as an extended case study (supplemented with other recent examples to confirm this trend) – a project that achieved very high levels of sustainability under major US metrics, as well as sustainability under non-measured metrics.

C/D

ORAL PRESENTATION
Preventive conservation and material science
External forces on collections care & storage spaces: Recommendations for balancing with equal and non-oppositional forces

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ABSTRACT. External forces are driving how collections care spaces are designed and collections are stored and accessed. Some of these forces challenge basic preventative conservation and safety protocols. Every force needs an equal and opposite force to maintain balance. An examination and understanding of each of these forces is fundamental to understand how to maintain preservation goals that may be in conflict with these other institutional priorities. Through active engagement during the planning and design process, collections care staff can maintain standards and navigate to solutions that respond constructively to these challenges.

MAIN TEXT. Active engagement, advocacy and education are needed by collections professionals when their institutions are planning and designing new space. To wait for design is to wait 'too long'. Work should begin before overall institutional planning is started. Preparation pays off by adopting clear protocols based on preventative conservation well in advance.

Even if it is collections space, the project may impact collections. Through current work with five natural history museums and informal benchmarking and discussions with others, consistent trends are emerging that impact preventative conservation. Understanding these trends and how other collections professionals are responding in their institutions provide constructive guidance to address these challenges.

Trending forces operating on collections care spaces:
- The 'back of house' label on being a project priority
- How 'invisibility' and 'visibility' hurts collections
- Decisions without representation
- Lack of fiscal resources and co-location of spaces
- Sustainability goals and work space
- Safety protocols – who and what types of equipment.

Solutions and points of discussion:
- Advance preparation and education
- Daylighting the 'real work' of the museum
- What can visitors see that is of interest
- How sustainability goals are aligned with best practice in collections access
- Tall collections storage solutions: What is the definition of 'tall'?
- Deferring first costs to address long-term needs.
- Flexibility in care and storage spaces

Images and diagrams will be used to illustrate how collections staff at various institutions are addressing these trends in various building projects.

INTRODUCTION & METHODS. Being prepared and being part of the discussion:
- Adopting best practices and standards
- Positioning representation at the leadership level.
- Understanding institutional goals and what you can contribute to desired outcomes

RESULTS. Engagement equals influence and impact:
- Alignment
- Gain added resources
- Easier to meet preservation goals

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ORAL PRESENTATION
Enabling Infrastructure: Future Collections, Data & Informatics (Synthesys Symposium)
Are people using natural history specimen data? A comparison of usage from an institutional website versus large data aggregators

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ABSTRACT. Over the last 15 years the Royal Botanic Garden Edinburgh (RBGE) has been making the digitised collection data from both the living collection of plants and herbarium collections available over the internet via our own website. In addition, over the last ten years we have been sharing these data with over 10 data aggregators (compilers) such as GBIF, BGCI and Europeana, to allow greater visibility and context for the data and to open our collections to new audiences.

Yet, in recent years we at RBGE have been asking questions like: What is the market for these aggregated data, who is using them and why is it worth doing? Also, there are issues of duplication of records, update cycles, secrecy of data & the devaluing of unique items of the collection.

In this study, we review the usage of RBGE data in two of the largest aggregators (GBIF & Europeana) as well as our own collections website for the month of January in the years 2014, 2015 & 2016. We also look at the ease of getting hold of these usage statistics and question if the websites are open to this type of query.

ACKNOWLEDGEMENTS. This work was carried out with funding from SYNTHESYS3 under EU 7th Framework Programme for Research (FP7). Project reference: 312253

ORAL PRESENTATION
Digitization and imaging collections: new methods, ideas, and uses
Streamlining specimens digitisation through the use of *Inselect* - a curator's perspective

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ABSTRACT. While the Entomology collections at the Natural History Museum, London, have been fully indexed at species level, specimen level digitisation has been used sporadically only. In the Chalcidoidea (Hymenoptera) collection, fully populated specimen records were typically created for unique specimens such as types or historic specimens, each record requiring a large time investment. More recently, as the emphasis shifted towards generating large numbers of records with basic information only, workflows and software geared towards mass digitisation have been developed. In parallel, specimen digitisation is still taking place on a smaller scale as part of curatorial work, and use of the program Inselect, an open-source desktop application developed originally for digitisation of drawers, has contributed to streamlining the process. I present a curator's perspective on how the Inselect program can be used outside of mass digitisation projects, and how the use of such tools can potentially change the way digitisation is done in the course of routine curatorial tasks.

POSTER
Preventive conservation and material science
To fade or not to fade… Monitoring exhibit light levels and color changes to manage risk of light damage

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ABSTRACT. Museums are rightly concerned about managing risks of damage when considering the display of organic materials, particularly of vulnerable colored materials. One of the main concerns is the potential for color loss due to exposure to light while a specimen is on exhibit. Recently the Yale Peabody Museum planned to display some Native American baskets with painted decorations in their temporary exhibit case located in the lobby of the museum. This case receives both direct and indirect natural and fluorescent lighting, and the mixed lighting and variable intensities make estimation of the light dose a challenge. In order to assess the risks to those objects we decided to measure the cumulative light exposure during the exhibition with dosimeters (Blue Wool fading standards). The impact of that light on the colored decorations of the baskets was also measured, using spectrophotometer readings before the exhibition and after its deinstallation. From this study we gained experience in estimating the light exposure dose in this complicated lighting environment, and in monitoring the color changes to track the impact of exhibition lighting on these objects.

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POSTER

Preventive conservation and material science

Rehousing Tapa – a project to repair, photograph and improve the storage conditions of barkcloths at the Yale Peabody Museum

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ABSTRACT. The Anthropology Division of the Yale Peabody Museum holds a collection of 180 Pacific tapa, or barkcloth. These wonderful examples of art and cultural heritage continue to be of interest to researchers and professors. Made from the bark of the paper mulberry tree and decorated with natural paints and dyes, they range in length from 1.5ft (0.5m) to 14ft (4m).

In 2014 the Division received a grant to rehouse 8,000+ objects in the Oceania Ethnographic collection from sub-standard conditions into modern storage at a new facility. During that process it was clear that these fragile objects had been either tightly rolled on narrow (1.5in or <4cm) tubes or folded into wooden drawers. They therefore needed a significant amount of care, and a new storage solution. With museum conservators, we undertook a project to systematically relax, mend, photograph, reroll, and add a protective cover to each before rehousing them on new hardware.

To make these objects visible to others, and limit the amount of handling to them in the future, photography was performed in the visible, ultraviolet and infrared spectra. The images are now available on the Peabody Museum's website: http://collections.peabody.yale.edu/search/

POSTER

Collections for the future – future of collections

Natural resins sold today: are they correct and pure?

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ABSTRACT. A wide variety of natural resins, such as mastic, sandarac, shellac and copals, have been traded and imported in Europe for centuries. These resins were of key importance for the production of European varnishes and lacquer. During the on-going four year research project "European lacquer in context – ELinC", resins available on today's market were chemically compared with specimen of historical collections, in order to verify correct labeling and purity.

INTRODUCTION. Oriental lacquerware was imported from Asia towards Europe starting from the 16th century. Soon after, their popularity stimulated European craftsmen to imitate these luxury items, using their own familiar materials and techniques. Although the basic raw materials used differ strongly - lacquer in Asia and conventional natural resins in Europe - the final visual aspect of European lacquer coatings resembles closely to that of their oriental equivalent. European lacquers are complex, multi-layered coatings mainly composed of various natural resins.

The "European lacquer in Context" project focuses on the technological evolution of European lacquers with special attention to a selected number of historical European lacquer objects in the collections of the Royal Museums of Art and History of Belgium (KMKG/MRAH), . Three Belgian partners are involved: the Royal Institute for Cultural Heritage (KIK/IRPA, Brussels), mainly for all chemical aspects; the University of Antwerp (UA), mainly for the technological study of lacquer recipes and physical aspects; and the Royal Museums for Art and History (KMKG/MRAH), mainly for all art historical aspects concerning the collection studied. Additionally, the Getty Conservation Institute (GCI) supports the project with their expertise on the analysis of lacquer. During this project, European lacquer is reconstructed following historical recipes and aged artificially. For the reconstruction experiments, bulk quantities of natural resins were bought on today's market.

METHODS. Before using commercially available natural resins to reconstruct historical lacquers, the raw materials were analyzed and compared to their respective reference samples in order to check the resin's purity and commercial labeling, using mainly gas chromatography mass spectrometry with thermally assisted hydrolysis and methylation (THM-GC/MS). All analyses were carried out on a TraceGC gas chromatograph (Thermo5), hyphenated with a PolarisQ Ion Trap mass spectrometer (Thermo). Pyrolysis was carried out at 550°C (later additionally at 480°C) during 12s in a helium atmosphere. The split/splitless injector of the chromatographic system was kept at 250°C. Separations were accomplished on a SLB-5ms capillary column (Supelco, 20 m x 0.18 mm i.d. x 0.18 µm film thickness) applying following temperature program: initially the oven temperature was maintained at 35°C for 1 minute during split injection (split ratio 20). Next, a 60°C min-1 gradient was applied until 110°C, followed by a 14°C min-1 gradient until 240°C; finally the column was heated to a temperature of 315°C at a rate of 6°C min-1; this temperature was maintained during 3 min. Carrier gas was helium at a constant flow of 0.9 mL min-1. Ionization was carried out in the ion volume of the ion trap mass spectrometer under the standard EI positive mode at 70 eV. The mass spectrometer was scanned in the 35–500 amu range, with a cycle time of 0.5 s.

57 resins were acquired on the commercial market to be analyzed, including different specimens of *Larix* 'Venetian' turpentine, fir and spruce resins, ambers, benzoin, camphor, colophony, copaiba balsam, copals from different locations (Congo, Kauri, Manila, South-American, Zanzibar), elemi, gamboge, mastic, sandarac and various types of shellac. These commercial samples were compared with samples granted by renowned historical resin collections (Botanic Garden Meise and Museum for Middle Africa, Tervuren), by literature review and –to a lesser extent- with samples granted by researchers of other cultural heritage institutions. At least two reference samples were used for every commercial resin to be controlled.

Figure 1. Small subset of the extensive historical collection of botanical material of the Van Heurck collection, conserved at the Botanic Garden Meise, Belgium (photo credit: Louise Decq, © KIK-IRPA).

THE HISTORICAL EXUDATES COLLECTION OF MEISE: A RICH SOURCE OF REFERENCE MATERIAL. Due to its variation and dimensions, the collection of resins, gums and other exudates in the Botanic Garden Meise was of the most important source of trustful reference material for this study. The collection, still in original glass jars and recently reinstated, dates back to the second half of the 19th century, and contains several hundreds of resin samples. They entered the Garden as part of different high quality herbarium collections.

The oldest collection, by Carl von Martius (1794-1868), was purchased in 1870 at the time of the foundation of the Botanic Garden. Later, the Botanic Garden benefitted from important contributions by Mr. Delacre, a pharmacist in Brussels, the Museum of (former) French Colonies in Paris, and Mr. Bernardin, the curator of the commercial-industrial Museum in Melle close by Ghent. In 2009, an extensive collection once belonging to the Botanical Museum of Henri Van Heurck (1838-1909), was acquired. Van Heurck networked intensively with the Antwerp Rigouts family, Planchon and Guibourt from the High School of Pharmacy in Paris, and E. Morren from the University of Liège, who obtained material from the second Universal Exhibition in Paris in 1867.

Figure 2. Writing desk decorated with European lacquer (early 19th century), part of the collection of the Museums for Art and History, Brussels (photo credit: Jonas Veenhoven, © KMKG-RMAH).

RESULTS AND DISCUSSION. This study revealed 19 out of 57 resins showing adulterations or mislabeling, including one specimen of copaiba balsam, Congo copal, Manila copal, benzoin, mastic, African elemi and Venetian turpentine, and not less than 12 specimens of sandarac, the resin produced by *Tetraclinis articulata* (Vahl) Mast. The reason for the observed deviations in composition is not clear. Some confusion exists with respect to the correct identification of a tree and its corresponding resin, possibly leading to mislabeling. Economic considerations, i.e. fraudulent practices, are not excluded. Adulterations, such as the addition of oils, might also be related to the enhancement of the natural product's properties for specific end-user purposes. For the production of sandarac, a different botanical source might be used nowadays than the one used historically.

CONCLUSIONS. Historical resin collections prove their usefulness in the quality control of natural resins sold today. Various resins sold today are impure, deliberately adulterated or mislabeled.

ACKNOWLEDGEMENTS. The authors kindly acknowledge the institutions for granting access to their resin collections and/or to collect a resin reference samples: the Botanic Garden Meise, Museum for Middle Africa Tervuren, RCE Amsterdam, Doerner Institute München, Getty Conservation Institute Los Angeles, Hochschule für Bildende Künste of Dresden.

REFERENCES

Cattersel, V., L. Decq, C. Indekeu, E. Van Binnebeke, D. Steyaert, W. Fremout, S. Saverwyns. 2015. European Lacquer in Context, an interdisciplinary and systematic approach to the study of the tradition of European lacquering. Pp 56-62, in: Furniture Finishes (Miko Vasques Dias ,ed.), Stichting Ebenist, Amsterdam.

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POSTER

An International Conversation on Mobilizing Natural History Collections Data and Integrating Data for Research (iDigBio Symposium)

DOE! Mass digitisation of the BR Herbarium at Botanic Garden Meise

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ABSTRACT. In 2014, Botanic Garden Meise received a grant from the Flemish Government to optimise its current digitisation infrastructure and digitize the entire Belgian Herbarium along with 500,000 specimens from the tropical African collection. The project was named DOE after the acronym of the project's title '*Digitale Ontsluiting Erfgoedcollecties*' (Digital Access to Cultural Heritage Collections). The work started in January 2015 and will be completed before the end of 2017.

The herbarium (BR) of the Botanic Garden Meise houses around 3.5 million specimens. The Vascular Plant Herbarium contains three main collections: the General Herbarium with more than one million specimens; the Belgian Herbarium with about 200,000 specimens; and the African Herbarium comprising at least one million specimens (of which over half are from central Africa). The 800,000 specimens in the Cryptogam Herbarium consist of mosses, lichens, algae, fungi and myxomycetes.

OPTIMISING THE CURRENT DIGITISATION INFRASTRUCTURE. Formally, our digitisation equipment consisted of two EPSON 10000 XL scanners on HerbScans and one Pentacon scan camera. In 2015, these systems were replaced by five imaging systems. Four of these will be used for photographing vascular plant herbarium specimens, fruits, seeds & wood collections. Each of these systems consists of a continuous light source and a PENTAX 645Z camera. The fifth system is a digital microscope, Keyence VHX 5000, which will be used to make images of lichens, myxomycetes and seeds etc. This optical microscope has a large depth of field and takes razor sharp images in seconds.

The new infrastructure has transformed the pace of work, enabling us to digitise specimens considerably faster than before and resulting in high resolution and high quality images.

THE DIGITISATION PROCESS OF THE BELGIAN AND AFRICAN COLLECTION. In February 2015, we developed a procedure to tackle this project. Sixteen of our herbarium technicians, volunteers and student workers, under the supervision of a curator, prepared the herbarium specimens for the imaging process. This required fixing a barcode to each specimen; re-mounting and restoring specimens where it was necessary and deciding which specimens to exclude from imaging. The unique barcode will link the specimen with its images and its transcribed data. So far, early in 2016, two thirds of the collection is ready for imaging.

We found a company to image up to 1,200,000 Belgian and African herbarium specimens by an open tendering process. The selected company will start imaging in spring 2016 and will do this in-house to reduce transportation costs and minimise damage to the collections.

Another important step in the digitisation process is transcribing label data into our database 'BG-Base'. Since June 2015, our herbarium technicians have been entering a minimal requirement for data, the barcode, filing name, collector, collector's number and country of origin. So far, more than 140,000 records have been entered in the database for the African collection. The remaining label data will be added to the database after digitisation. This will be done by retrieving information from the field notebooks of the collectors, via itineraries and using published specimen data from the Flora of central Africa and through the help of an external company which will be recruited during 2016. For the Belgian Herbarium we intend to recruit the general public in crowdsourcing the transcription of labels. The newly digitised images will be stored in TIFF format at the Flemish institute for Archiving (VIAA) at three locations. The Botanic Garden Meise will keep JPEG2000 and JPEG files for daily use.

Our final goal is to make all images and data available to the public on a new virtual herbarium. This portal will be fully operational by the end of 2017.

Figure 1. Logo of the DOE! Project

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POSTER

Preventive conservation and material science

The effect of light on vertebrate fossils: Exhibition, collection and artificial aging

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ABSTRACT. The effects of light on fossils have not been studied in depth. Visible light and ultraviolet radiation (UV) have been defined as agents of deterioration for adhesives and consolidants, including those used in paleontology, and have been described to be damaging for fossils as well. Light and UV are said to fade colors and to cause adhesives to yellow and become brittle. In this study, colorimetry was used to assess changes in fossils and their coatings/consolidants after long-term exposure to various light sources during exhibitions. Forty-nine specimens from the Smithsonian Institution's National Museum of Natural History were examined in the study. Five samples from the stored collection were coated and artificially aged to assess the effects coatings have on the colors of these fossils. A colorimeter was employed to take measurements of the colors in both exposed and non-exposed areas of the fossils from exhibition and the stored collection. The fossils from the exhibit halls and the collection showed less damage than the samples that were aged artificially, which in some cases showed darkening after aging.

INTRODUCTION & METHODS. The effects of visible light and ultraviolet radiation (UV) on fossils have not been studied in depth, and there is little literature on the impact of these on the surface or internal structures of fossilized bone (Rogers and Krause 2007, Shelton 1994). There is some information on the impact of various wavelengths on minerals (Nassau 1992). A few sources describe the use of filters for lighting but do not explain the reasons for the filtration (Andrew 2006, Bertram 1967, Douglas 1972, Hall 1998, Pavlogeorgatos 2003).

Visible light and UV have been defined as an agent of deterioration for adhesives and consolidants in paleontology (Down et al. 1996) and has been described to be damaging for fossils as well, but there has been minimal research on this topic (Chadefaux et al. 2009, Richards et al. 2012). In these descriptions, light is said to fade colors and make adhesives yellow and brittle, suggesting that color change can be used to identify the damage.

Colorimetry is the discipline of studying colors and their perception by the human eye. The aim of this work was to study the effects of light on fossils with the use of colorimetry. Because visible light and UV have been said to make colors fade, colorimetry would detect these color differences in fossils that have been exposed to museum lighting for many years. If these assumptions are correct, fossils, particularly those with coatings/consolidants that have been exposed to high levels of light should appear lighter or at least, yellower, on the exposed surfaces.

Specimens from the Smithsonian National Museum of Natural History were used in this research; thirty-one of them had been exhibited in the fossil halls, thirteen were in collection storage on open shelving, and five were aged artificially. The times of exposure of these fossils to lighting varied but all, except for the artificially aged ones, spent over five years under those conditions. There was no UV filtration for the fluorescent lamps used in the storage area or for the broad array of lighting fixtures used in the exhibits. Parts of the five artificially aged specimens were coated in order to assess the effect of coatings on their aging. The adhesives employed were Ambroid, Glyptal and shellac, and the aging methodology was either in an oven or with UV.

Color change was assessed by measuring areas of the fossils that had been exposed and not exposed to the light sources, using a QPI-180D High-Quality Handheld colorimeter by Qualtech. The software used for the interpretation of the color differences was Qualtech Products Industry Colorimeter System Software. PatchTool was also employed to generate a map of the averaged colors. The statistical analyses were performed using Past software version 2.17b (Hammer et al. 2001).

RESULTS & DISCUSSION. In the case of the exhibited specimens, 45% of the samples (exposed side) were lighter than the standards (non-exposed side). In the case of the collection specimens, 62% of the samples were lighter than the standards, and in the artificially aged samples, 79% of the samples were lighter than the standards. The mean values for the three parameters measured (L*, a*, b*) show there is virtually no difference between the standards and the samples. However, by looking at the color simulations, it is easily observable that this is not entirely accurate.

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Vertebrate fossils are dynamic structures made of minerals and in some cases, collagen. These materials are present in different proportions throughout the specimen and are responsible for its color. It is possible that the areas measured as standards and samples within the same specimen were not comparable due to intrinsic color differences. Another factor is that the instrument measures the L parameter as the amount of black and white in the sample, suggesting a light or dark color. Because fossils have many colors in their surface, the instrument will see all those colors and average them. For this reason, by measuring different areas across the same specimen, it is possible to obtain darker colors from highly exposed areas than those in the unexposed areas.

In the artificially aged fossils, the standards and samples were taken in exactly the spots and are therefore, provide more reliable readings. Twenty-two out of twenty-eight samples were lighter than their respective standards after the artificial aging process. Of the six samples that were darker, three were just slightly darker. The remaining three were samples coated with shellac, which were the ones that were the darkest after aging. Prior research has suggested that this is indicative of poor aging properties for this coating (McGowan-Jackson 1992, Shelton and Chaney 1994).

CONCLUSIONS. The work demonstrates that light and UV radiation is are, indeed, agents of deterioration in vertebrate fossils and that additional studies are required to show the extent of the damage to the material. This could help in designing lighting in museums, as well as influence the decision to exhibit a real specimen or a replica. Although results for specimens exposed in either collection storage or via exhibition were not conclusive, the artificially aged specimens suggest that there will be damage, given enough time. This suggests the fossils do lighten in color after exposure to radiation, even after being coated with Glyptal and Ambroid. If coated with shellac, the specimens will darken. Further studies are required to assess the real damage to the structure of the fossils.

ACKNOWLEDGEMENTS. The conservation team at the Smithsonian National Museum of Natural History, including conservator Catharine Hawks and then Kress Fellow Rebecca Kaczkowski were crucial in helping me gather data and literature on this topic, and in hearing some of my complaints when technology was not on my side. The NMNH Paleobiology collections team was extremely helpful in finding the best specimens for my research.

REFERENCES

Andrew, K. J. 2006. Minimizing the Risks from the Ten Agents of Deterioration in Two New West Midlands Museum Resource Centres, UK. Collection Forum, 21(1-2):70-84.
Bertram, B. 1967. The Design of a New Hall of Fossils. Curator: The Museum Journal 10(2):164-176.
Chadefaux, C., C. Vignaud, E. Chalmin, J. Robles-Camacho, J. Arroyo-Cabrales, E. Johnson, & I. Reiche. 2009. Color origin and heat evidence of paleontological bones: Case study of blue and gray bones from San Josecito Cave, Mexico. American Mineralogist 94:27-33.
Douglas, R. A. 1972. A Commonsense Approach to Environmental Control. Curator: The Museum Journal 15(2):139-144.
Down, J.L., M.A. MacDonald, J. Tetreault, & R.S. Williams. 1996. Adhesive Testing At The Canadian Conservation Institute-An Evaluation Of Selected Poly (Vinyl Acetate) And Acrylic Adhesives. Studies in Conservation 41:19-44.
Hall, K. 1998. Storage Concerns for Geological Collections. Conserve O Gram 11(2):1-4.
Hammer, Ø., D.A.T. Harper, & P.D. Ryan. 2001. PAST: Paleontological statistics software package for education and data analysis. Palaeontologia Electronica 4(1):1-9.
McGowan-Jackson, H. 1992. Shellac in Conservation. AICCM Bulletin 18(1-2)29-32.
Nassau, K. 1992. Conserving light sensitive minerals and gems. Pp. 11-24, in: The Care and Conservation of Geological Material: Minerals, Rocks, Meteorites and Lunar Finds, ed. F. M. Howie. Oxford: Butterworth Heinemann.
Pavlogeorgatos, G. 2003. Environmental parameters in museums. Building and Environment 38:1457-1462.
Richards, G.D., R.S Jabbour, C.F. Horton, C.L. Ibarra, & A.A. MacDowell. 2012. Color Changes in Modern and Fossil Teeth Induced by Synchrotron Microtomography. American Journal of Physical Anthropology 149:172-180.
Rogers, R.R., & Krause, D.W. 2007. Tracking an ancient killer. Scientific American 296(2):42-51.
Shelton S.Y. 1994. Conservation of vertebrate paleontology collections. Pp. 3-33, in: Vertebrate Paleontological Techniques, Vol. One, ed. P. Leiggi and May, P. Cambridge: Cambridge University Press.
Shelton, S.Y., & D.S. Chaney. 1994. An evaluation of adhesives and consolidants recommended for fossil vertebrates. Pp. 35-45, in: Vertebrate Paleontological Techniques, Vol. One, ed. P. Leiggi and May, P. Cambridge: Cambridge University Press.

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POSTER

Preventive conservation and material science

Zipped up: sealing large formalin specimens for storage and transport.

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ABSTRACT. At Naturalis Biodiversity Center the largest fluid specimens (specimens up to 5-7 m.) have always been stored in formalin in a large steel tank outside the building. The advantages of this way of storing are the relatively low maintenance costs and efforts. By keeping them in formalin however, the accessibility of the specimens is greatly diminished. Working with formalin is considered unhealthy and there is a chance that it will eventually get banned from natural history collections wherever possible.

Because Naturalis Biodiversity Center is going to renew its entire museum, merging all the different locations together into one main building, and adding a completely new exhibition building in the coming years (2016-2018) the formalin tank was one of the things that had to be removed to make way for new labs and offices. This gave us the opportunity to find a better solution for the larger specimens, transferring them to a more workable environment where they could be better accessible. For short term storage and transport the specimens were vacuum sealed into plastic tube bags, made of a polyetheen innerlayer and a polyamide (nylon) outerlayer. For long term storage in the new situation the specimens were transferred to glycerin.

This project showed us that it can be very challenging to work with large specimens and to create a safe storage environment that still ensures their accessibility. For the future we have found a way to transport and store these large specimens and we made a part of our collection accessible again for research and education.

ORAL PRESENTATION

Digitization and imaging collections: new methods, ideas, and uses

Connecting Conservation and Collections: The On-line Resources of the University & Jepson Herbaria and the UC Botanical Garden at Berkeley

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ABSTRACT. These two natural history museums have collections from California dating back to David Douglas from the 1830's and some of the first records for living and preserved plants, algae, and fungi from this state. Early records, such as the state geological survey, have provided invaluable insight into the historic distribution of rare plants. A commitment to collecting, recording, and preserving specimens dates back to the inception of both museums and continues to this day with increased digital resources to connect and share data between them. This interoperability is enabled by CollectionSpace, a community source collections management system developed by a partnership of institutions and web applications built at Berkeley that leverage the CollectionSpace API and database.
Specific examples will be presented throughout the last two centuries to record, document, and conserve plant specimens. The resulting searchable database is a resource for botanists, conservationists, agencies, etc., to search and obtain information for use in research and conservation.

MAIN TEXT. The UC Botanical Garden and Herbaria have over 125 years of documenting plant collections and facilitating botanical research. The Botanical Garden, and Herbaria have always maintained detailed accession data making them some of the most well documented collections in the United States, particularly with regards to specimen label data and living collections with wild provenance. There has been a commitment to making vouchers from the garden since the garden was located on central campus and this has continued after it moved in the 1920's to Strawberry Canyon, up slope from the main campus. Directors of both museums have ensured that this commitment to data continues to this day and are forging ever closer links to research.

Figure 1. The Botanical Garden has a long history of vouchering from living collections and depositing specimens in the Herbaria supported by almost unrivalled provenance. Linking this relationship on-line is essential.

A potted history of the museums will introduce the audience to their commitment to data and the methodology that continues to enable these collections to be documented.

An attempt was made in the early 1990's to connect the two collections because of their overlapping nature but the two databases in use at that time did not communicate very effectively despite the museums continuing to work closely to physically document the collections. Ten years ago campus Information Services and Technology decided to collaborate in the development of a collections information management system that would work for campus museums and beyond. Now maintained by the non profit organization LYRASIS, CollectionSpace has a permanent home and has been adopted by a wide range of museums, including the Pheobe Hearst Museum of Anthropology and The Pacific Film Archive on the Berkeley campus, and in the Bay Area, the Oakland

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Museum of California, The Bonsai Garden at Lake Merritt, and the Bolinas Museum. Beyond California, we have users and developers working on sharing open source code and ideas between institutions. Specific specimen examples will be used to highlight the close working relationship between the museums.

We have achieved success in linking some of our archives such as literature, unpublished manuscripts, photographs, illustrations, correspondence, from field books to specimens. All this helps to piece together the bigger picture of California plants, algae, and fungi, past, present, and future.

ORAL PRESENTATION

Blending the educational resources of small and large collections for training the next generation of museum professionals (iDigBio Small Collections Symposium)

Training the next generation of botanists: small collections at the University of California, Berkeley Herbaria and Botanical Garden

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ABSTRACT. Through its commitment to conserving and serving data, the Botanical Garden and Herbaria at the University of California, Berkeley run courses and graduate assistantships to train undergraduates and graduate students in collection and preparation techniques and to gain experience in taking museum specimens through all the necessary digitization steps to making high quality museum data available on the web. This is done working on ambitious digitization projects, internships, seminars, classes in the use of specimens in research, donor funded projects, class projects, and graduate assistantships.
Students from varied University departments use digitization to learn skills needed to become the next generation of botanists and responsible leaders of botanical gardens and/or herbaria. Students learn about this often overlooked relationship, particularly when the Botanical Garden is a separate administrative unit. They learn digitization techniques in both museums so that they are prepared to take on the challenges and job market requirements for careers in botany today.

MAIN TEXT. The Herbaria are physically large as a whole, so projects have focused on subsets of our collections; Baja California Peninsula, west coast seaweeds, lichens, and bryophytes, the numerous small herbaria from our field stations, orphaned collections maintained separately such as The Charterhouse School Herbarium (GOD), and our Horticultural Herbarium. Small collections arriving as a result of us being part of a thematic collection network have ended up being digitized at the Herbaria such as Hopkins Marine Laboratory, and even John Muir's Herbarium, which is being digitized at Berkeley for the National Park Service who provided funding to put it online.

Figure 1. The Herbaria have trained more than 50 undergraduate students to enter specimen data and georeference over 35,000 specimens in the last 5 years and some have gone on to pursue graduate work in botany.

At the University & Jepson Herbaria and the University of California Botanical Garden, a long-term commitment to data has led to many projects, assisted by students and interns. University courses and seminars introduce and train students in digitization techniques as well as curatorial practices. Freshman seminars in biology introduce the museums to students arriving at Berkeley as well as the possibility of becoming work-study students in our digitization pipelines. Students are told about staff career paths in botany and the maintenance of living and preserved collections and why we maintain them. For several years, the Department of Integrative Biology has an undergraduate course called, Natural History Collections in Research and students have small assignments accompanied by presentations based on hypotheses or a small digitization project. Examples include digitization of historic, bound volumes to searching for missing voucher specimens, cited in floras but not seen. Projects at the graduate assistant level have been documenting historic gardens such as Beatrix Farrand's Reef Point Garden in Bar Harbor, Maine, and Adelante, now the Blake Garden in Berkeley managed by the College of Environmental Design. Covering such a diverse range of plant material is invaluable experience to graduate students who will be teaching assistants in courses such as Systematics of Vascular Plants, Introduction to California Plant Life, and Medical Ethnobotany. Graduate Assistantships are also available in the Botanical Garden, where students are paid to voucher the collections. The Botanical Garden has wild provenance for a high proportion of their collections and they work with the Curator to select material for accessioning into the Herbaria. The real value of doing this is not only to make high quality research specimens but also to make a permanent record of living accessions, which in many cases may be short lived.

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For undergraduates working in our digitization lab, we have employed well over 50 work-study (income supplemented by the University) students in the last 5 years. Students are interviewed, employed, and started on simple tasks such as barcoding and moved on to imaging, data entry, and eventually, geo-referencing, invaluable skills for enhancing geography and attention to detail, scientific nomenclature, history of science, etc.

Students are also employed in our archives, working to digitize media such as letters, slides, photographs, field books, and manuscripts. This project is set to enter a new phase with more collaborative approach across the Berkeley Natural History Museums because our archives have so much overlap across museums and departments.

POSTER

An International Conversation on Mobilizing Natural History Collections Data and Integrating Data for Research (iDigBio Symposium)

Clear as glass: digitizing 100,000 glass slides from the Naturalis collection using an online crowdsourcing platform

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ABSTRACT. Naturalis' collections hold approximately 37 million objects, of which one million are microorganisms fixated on glass slides. In 2013 Naturalis launched its first digitization project using an online crowdsourcing platform called 'Vele Handen' ('Many Hands'), presenting 100,000 pictures of glass slides on a website. Through this project 'Glashelder!' ('Clear as Glass!') the institute wanted to investigate if, and in what way, people would be interested in contributing to the digitization of this part of our natural history heritage.

Participants were presented pictures of slides and accompanying digital data forms, and were asked to transcribe data from the slides into concurrent fields. Slides were presented multiple times to different participants and transcribed data was verified by controllers. Support to participants was offered through an online forum and instructions.

Participants collected points for every glass slide that was transcribed, which could be exchanged for a Meet & Greet with collection managers or tours through the collection. At the same time, through digitization of the glass slide collections, the accessibility of these collections for research and education and a wider public in general is greatly enlarged - which is a great profit for Naturalis.

Figure 1. Glass slide from Oudemans collection with mite 'from brains of a coachman, Berlin, April 1927'

ORAL PRESENTATION

Digitization and imaging collections: new methods, ideas, and uses

Using OCR for QC in the digitisation workflow of RBGE herbarium

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ABSTRACT. Optical Character Recognition (OCR) is a standard part of the digitisation workflow at the Royal Botanic Garden Edinburgh (RBGE). It has primarily been used as a tool for adding further data to records, and for searching for 'keywords' within type written labels. We have recently successfully used OCR as a tool in our Quality Control process, by comparing the barcode 'read' by the OCR to that the specimen image is associated with. This method has allowed us to find records where the data record does not match that of the specimen in the image, a mismatch that we would otherwise have been unable to find. Around 50% of the records that were found to have mismatched barcodes were due to the OCR software not successfully reading the barcode, with the remaining records having a number of different problems which led to the mismatch in barcodes.

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ORAL PRESENTATION

Blending the educational resources of small and large collections for training the next generation of museum professionals (iDigBio Small Collections Symposium)

Educational opportunities for small and large collections with the Worldwide Engagement for Digitizing Biocollections Event, WeDigBio 2016

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ABSTRACT. During its inaugural year, the Worldwide Engagement for Digitizing Biocollections Event, WeDigBio 2015, involved thousands of citizen scientists from >50 countries in transcribing biodiversity specimen labels from a variety of taxonomic groups over four days. Participants at onsite events at museums, universities, and science classrooms, as well as those distributed individually throughout the world, used online platforms at DigiVol, Les Herbonautes, Notes from Nature, Smithsonian Institution's Transcription Center, and Symbiota to transcribe tens of thousands of specimen labels. We developed resources including an undergraduate lesson plan, a media kit, logistical documents, and planning tools for events hosts. During the event, participants learned about collections and biodiversity science, interacted with researchers, played games, shared experiences via social media, and contributed to the growing database of digital biocollections information.

For WeDigBio 2016, October 20-23, we aim to double the size of the event. We have developed new resources for educators, collections managers, and participants to help make the event even more educational, enjoyable, and productive. In this presentation, learn about these resources and how citizen scientists from around the world can help to transcribe images of specimens from your collection. We are enthusiastically recruiting hosts – join us for WeDigBio 2016

ORAL PRESENTATION

Digitization and imaging collections: new methods, ideas, and uses

Improving the collecting data of historical museum specimens

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ABSTRACT. The Museum für Naturkunde Berlin was founded as a scientific collection of the Friedrich-Wilhelms- University in 1810. The ornithological collection started with 600 specimens. A high amount of them was donated by Johann Centurius Graf von Hoffmannsegg. As the number of museum specimens increased rapidly in the following decades (around 15.000 bird specimens in the 1850s) the collection comprises a large stock of historical specimens today. Those specimens have been collected in a certain area and time. Therefore they are important voucher specimens of a former biodiversity and are used as a basis for diverse scientific studies today (Frahnert et al. 2013).
Information accompanying museum specimens greatly affects their scientific value. Thus locality and collection date are very important for most studies on taxonomy, distribution, migration, etc. However, interested scientists normally only find handwritten historical labels and/or catalogue entries with more or less equivocal data, unknown historical names or even missing or wrong information. Therefore the scientific potential of these historical specimens is often not adequately used in modern studies. These shortcomings in historical collections can be mitigated by analyzing and combining all available information from publications, notebooks, diaries, shipping lists, etc. Based on examples it will be demonstrated here how data related to historical bird specimens at the Museum für Naturkunde Berlin is being improved.

In a first step, the actualization of the name of the collecting locality and the print of new, readable labels of a standardized format take place within the process of data digitization. The declaration of more detailed information about locality and date can often be achieved within special projects on collectors and expeditions only. Collecting this information from libraries and archives is a process which requires detailed knowledge about the history and documentation of the collection. This is very time consuming but can change the knowledge about the origin of the specimens fundamentally. For instance the historical label of the desert finch (*Rhodospiza obsoleta*) ZMB 6910 was partially lost and gives only the species name and the information that it is a type specimen today. The catalogue entry for this type specimen gives Eversmann as a collector and Karaata as locality. No collection date is given. Based on the diary of Eduard Eversmann, Mlikovsky and Frahnert (2009) specified the locality to Chengeldy, Uzbekistan and gave as collection date April 9th 1821 (**Figure 1**).

Figure 1. Labels of the desert finch (Rhodospiza obsoleta) specimen ZMB 6910. Photo: MfN Berlin
Upside down oldest label, only partially available; printed label with the complete investigated information

To make the investigated information about collectors more easily available to a broader community a Wiki on collector data was created at the Museum für Naturkunde Berlin. For collectors which are relevant for the museum complete names, biographical data as well as information about collecting regions and the whereabouts of the collections are given. There are also links to other repositories as Wikipedia, Integrated Authority File (GND) of the German National Library, and other natural history collections (**Figure 2**).

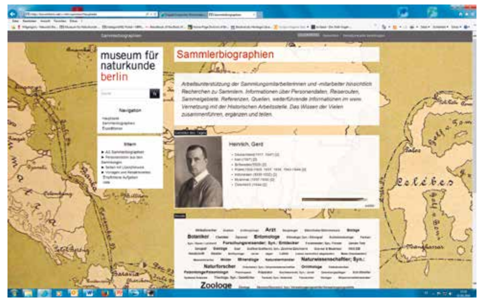

Figure 2. Wiki on collector information at the Museum für Naturkunde Berlin

REFERENCES

Frahnert, S., Päckert, M., Tietze D.T. & Töpfer, T. (2013): Aktuelle Schwerpunkte sammlungsbezogener Forschung in der Ornithologie. Vogelwarte 51: 185-191.
Mlíkovský, J. & Frahnert, S. (2009): Type specimens and type localities of birds collected during the Eduard Eversmann's and Christian Pander's expedition to Bukhara in 1820–1821. Zootaxa 2297: 15-26.

POSTER

Enabling Infrastructure: Future Collections, Data & Informatics (Synthesys Symposium)

Harnessing biodiversity literature for Natural History collections curation and research – a digital library perspective

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ABSTRACT. The Biodiversity Heritage Library is a complex initiative to provide global, open access to digitised Natural History (NH) literature. The digitisation workflow is based on an international partnership of over two-dozen institutions supporting the digitisation, ingestion, data mobilisation, and data mapping (including species names, localisation, paginations and figures) of NH literature. All digitised literature and associated data is openly available via a dedicated portal (http://www.biodiversitylibrary.org) with a robust API. Fundamental to the full exploitation of this literature is facilitating linkages with other data infrastructures such as the Encyclopaedia of Life (http://eol.org) and GBIF (http://www.gbif.org). Through these linkages we are exploring the role of digitisation on demand into BHL digitisation workflows to support the needs of professional researchers and citizen scientists. This presentation will include an overview of how data in the digitised literature, including field notebooks, might be harnessed and incorporated into NH collections institutional workflows.

ORAL PRESENTATION

Green Museum – How to practice what we preach? (General session)

Sustainable Museum – more than just "going green"

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ABSTRACT. Sustainable development is firmly established as a guiding principle in many areas of society since the United Nations Conference on Environment and Development (*UNCED*) in Rio de Janeiro in 1992. A systematic integration of economic, environmental and social aspects in the form of sustainability management has become a cornerstone of many companies and organizations. But in spite of this widespread adoption, the museum world still displays a lack of coherent und uniformly implemented sustainable practices. Several museums do interpret their societal role broader than the mere collection, interpretation and preservation of cultural heritage. Still, a holistic approach to sustainable development in collecting institutions is paid surprisingly little attention – even though sustainability is an intrinsic element of the museum mission. In most cases, a comprehensive sustainability strategy and reporting on par with those in other domains is lacking. Also, museums have not yet defined specific indicators to assess the implementation of long term improvements in accordance with GRI (*Global Reporting Initiative*), as set up by Fraunhofer-Gesellschaft for their institutes for example. Against this background, the paper discusses the need for implementing policy and guidelines allowing an optimized monitoring of sustainable processes in museums, to evaluate the current situation and to set clear priorities for future sustainability targets.

SPNHC 2016 – Oral and poster presentations, sorted alphabetically by first author

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ORAL PRESENTATION

Collections stewardship and policies

From policy to procedures: designing, constructing and documenting a complete herbarium procedure manual

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ABSTRACT. A manual that assembles standard operating procedures is an extremely valuable tool for supporting day-to-day functions of a collection. The contents of such a manual describe every procedure that is specific to an individual collection. Procedures implement collections policies which are, therefore, a pre-requisite for the development and documentation of procedures. At the United States National Herbarium, we've begun redrafting our Herbarium Procedures Manual to support a modified Smithsonian collections policy (SD-600) and the National Museum of Natural History's most recent version of a Collection Management Policy (CMP). In this latest iteration of a procedures manual, we have returned to the design phase, drawing on traditional management analysis tools in order to construct an outline into which we can plug existing and newly developed procedures. At each stage of the effort, internal staff and external advisors are playing key roles in outlining and writing draft procedures, developing and testing workflows, editing new and existing documentation, and finally stitching together the manual. A manual is not static. It must be flexible to change as collections policies inevitably change. Additionally, a procedures manual conveys a consistent message, assists in the training of new staff, and contributes to time-saving and cost-effectiveness.

INTRODUCTION & METHODS. Without written procedures, information in any type of organization can be inadequately transferred from person to person. Staff can be forced to conduct their work using trial and error (Yang 1989; Carter et.al 1999). Having a manual to support a Collections Management Policy (CMP) can minimize risk and save valuable time and personnel energy (Carter et al. 1999; Simmons 2010).
The Herbarium Procedures Manual of the U.S. National Herbarium begins with the Collections Management Policies of both the Smithsonian Institution (SD-600) and the National Museum of Natural History (CMP). The CMP defines authority and responsibility, accountability, compliance, and ethics. It includes policies for acquisition of collections, lending, borrowing and disposing of collections, access and collections care, inventory, emergency preparedness and risk management, and intellectual property rights. It includes collecting plans, that is, strategies for managing growth and use framed by the mission and scope of the collection as suggested in the "Museum Registration Methods" 5th edition (Beck 2010). Procedures provide the mechanism for implementing policies (Simmons 2010). Procedures should be specific, flexible and unambiguous.
Creating a procedures manual involves planning, designing, writing, editing, approving, installing, and communicating. The task of communicating procedures to a diverse audience can be a challenge. Testing the manual on various staff members provides valuable feedback. The feedback helps strengthen the usability and content of the manual. It is important that the manual is clear and concise, and include imagery and diagrams to assist in user comprehension.

Policy. Before a departmental policy can be created, the institution and museum collections policies (SD-600 and CMP) have been carefully reviewed. The departmental policy then informs the tasks of outlining, drafting and creating collections procedures. Once a departmental policy is drafted, it is reviewed by the department's Collections Advisory Committee (CAC). The penultimate draft of the departmental policy is sent to the department chair for review. The department chair returns the policy for final edits and departmental approval. It then goes to the director for final approval and circulation to department staff. Revision of the Museum's Collection Management Policy is on a five year cycle and is being modified this year, which made this an opportune time to address our own policies. The CMP becomes an appendix to the Herbarium Procedures Manual and is posted to the department website, http://www.botany.si.edu, which is publicly available.

Procedures. Following the creation of an amended CMP, we began to address procedures. Using multiple sources of non-traditional business operations outlines, we began to design a structure that would provide a place for every existing or newly created procedure. For new or modified procedures, designated authors were assigned the task of creating a first draft. For each procedure, both text-based and visual workflows were produced. Procedures were tested and suggestions for revisions were sent to the author. This process was iterative until the author was ready to forward the procedure for staff review. Each completed procedure became a building block for the manual, following the outline developed earlier.

RESULTS. The Herbarium Procedures Manual has created an unambiguous, shared understanding of how the collection operates in service to the staff, external scholars, and the collections themselves. It has saved time during training of new personnel. It has provided a consistent modus operandi to which everyone can subscribe.
We found that procedures require updating as time passes. Necessary change comes from multiple sources. Modifications of collections policies may dictate changes to procedures. Newly hired staff, based on previous collections experience, may offer suggestions for change. Because communication of procedures is critical, we found that by providing electronic access using our intranet and public site, as well as offering periodic meetings and workshops to inform staff, was quite effective.
Having an abridged version of our manual will prove to be valuable for providing documentation about our collection to our various permitting agencies; CITES, Drug Enforcement Agency, United States Department of Agriculture, and others.

DISCUSSION & CONCLUSIONS. Creating a procedures manual requires adequate time and planning. It also requires full engagement from various staff in the museum. The manual is constantly evolving and will need to be revised periodically. It will save time training staff, interns, and volunteers. People performing standard operations in the collection become more accountable for the accuracy and quality of their work. The value of a well prepared procedures manual cannot be overestimated.

ACKNOWLEDGEMENTS. I would like to thank the Department Chair, Larry Dorr, for his support, the Collections Advisory Committee for their input and my colleagues in the herbarium.

REFERENCES

Buck, R.A. & J.A. Gilmore. 2010. Museum registration methods 5th edition (ed. Buck, R. A., & J.A. Gilmore). The American Association of Museums Press. Washington D.C. United States.
D.J. & A. K. Walker. 1999. Policies and procedures. Pp 177-192, in: Care and conservation of natural history collections. (ed. Carter. D.J. & A. K. Walker). Butterworth-Heinemann. Oxford, England.
Simmons, J.E. 2010. Collections management policies. Pp 24-29, in: Museum registration methods 5th edition (ed. Buck, R. A., & J.A. Gilmore). The American Association of Museums Press. Washington D.C. United States.
Yang, M. 1989. Manuals for museum policy and procedures. Curator, 32: Pp 269-274
Smithsonian Institution. 2016. Department of Botany. www.botany.si.edu.

POSTER

Preventive conservation and material science

See something, say something. Using visiting researchers to help locate deteriorating avian study specimens

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ABSTRACT. The USNM Bird Collection contains many scientific study skins from the mid to late 1800s. Many of these older specimens suffer from deterioration mechanisms such as poor preparation, improper handling and chemical deterioration. They could go undetected for years or simply ignored without the help of others. Procedures were put in place to help collection staff detect these deteriorating specimens by utilizing the visiting researchers, volunteers and staff that work throughout the collection. The specimen deterioration ranges broadly and some of the most common examples will be illustrated.

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POSTER
Other topics
Brief Summary of the National Herbarium (ETH)

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ABSTRACT. Botanical research and expenditure started with the establishment of the Department of Biology in 1950s, and then the Herbarium was established in 1959, now it is called the National Herbarium (ETH). The National Herbarium is one of the biggest and oldest Herbariums in the country where all the country flora and botanical research is mainly based on. The Flora of Ethiopia project was started in 1980s through the united effort and support from Addis Ababa University and the Ethiopian Science and Technology Commission (now Ministry of Science and Technology) in Ethiopia in cooperation with the Department of Systematic Botany of Uppsala University in Sweden, financially supported from the Swedish Agency for Research Cooperation with Developing Countries (SAREC). Now it is part of the Swedish International Development Cooperation Agency (SIDA). The Flora of Ethiopia and Eritrea project was completed in 2009 and resulted in the publication of eight flora volumes with ten books. In these, about 6,027 vascular plant species with 10% endemism have been documented. These plant species are grouped into four vascular plant groups (lycopodiophytes, pteridopytes, gymnosperms and angiosperms), which comprise 243 vascular plant families (Kelbessa and Demissew, 2014). The National Herbarium contains more than 100,000 plant specimens, about 400 of which are type specimens found in the herbarium. The type specimens and the invasive species specimens were digitized in collaboration with Global Plants (GPI). Now, the National Herbarium is in the process of replacing all its old wooden cabinets by metal space-saving cabinets and is planning to digitize all specimens of the herbarium. This poster presents the Ethiopian National Herbarium activities that have been done so far and future planned activities to upgrade the herbarium to the virtual level.

REFERENCE

Kelbessa, E. & S, Demissew. 2014. Diversity of vascular plant taxa of the Flora of Ethiopia and Eritrea. Ethiop. J. Sci. 13:37-45.

ORAL PRESENTATION
Collections stewardship and policies
Access and Benefit Sharing: implementation and implications

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ABSTRACT. The Nagoya Protocol for Access and Benefit Sharing entered into force on October 12, 2014. At the same time, many Parties, i.e. countries that ratified this international agreement, had their national Access and Benefit Sharing legislation already in place, often restricting access to the genetic resources within their respective boundaries. This has wide implications for the feasibility of biodiversity research involving the collection of specimens ("access"). Since these specimens will in many cases eventually end up in museum collections for current or future research, museums must be aware of the implications of the Nagoya Protocol and are advised to develop internal policies and procedures to ensure compliance. The efforts of the Consortium of European Taxonomic Facilities and of several German Museums to deal with international and national requirements are illustrated and a mutual baseline is recommended.

POSTER
Other topics
"Zentrum für Sammlungen" – a Berlin network of museums and museum related institutions

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ABSTRACT. Due to its regional and national importance over the past 200 years, Berlin has a varied and deeply rooted museum tradition. This is reflected in an accumulation of museums, collections and museum related institutions that include tertiary education for museum professionals located in the Berlin area. The Museum für Naturkunde and the HTW Berlin (University of Applied Sciences) have initiated a network from some of these museums and institutions focusing on collection issues, especially in larger collections. The network with the working title "Zentrum für Sammlungen Berlin" is in its initial phase and intends to gather the expertise of collection professionals and those who train them both at a university level and in continuing education to form a visible center for collection related topics. These range from working groups to conservation issues, documentation and education and knowledge transfer to common projects. Besides mutual beneficial effects, the network aims at increasing recognition of the collections by decision makers and funding bodies.

ORAL PRESENTATION
Blending the educational resources of small and large collections for training the next generation of museum professionals (iDigBio Small Collections Symposium)
The Marshall University Herbarium: A model for engaging student curators in small herbarium digitization efforts

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ABSTRACT. The SERNEC (SouthEast Regional Network of Expertise and Collections) collaborative TCN (www.sernec.appstate.edu) "Key to the cabinets: Building and Sustaining a Research Database for a Global Biodiversity Hotspot" began digitizing collections more than a year ago. In this time, Marshall University herbarium (MUHW) has trained 20+ students in digitization, beginning as early as freshman year. In addition to working with student employees and research students, we successfully partnered with the Federal Work Study program. Multi-year students have permitted us to establish best practices and robust, error-reducing protocols. Our students have not only participated actively in photography and other technical aspects of the project, but they have also been instrumental in project management. Our organizational model 1) fully acknowledges the strengths and training needs of students, 2) meets the need for faculty to document their effort in the form of student benefits, 3) addresses the need to be creative in an increasingly budget-limited environment, 4) reduces the need for direct PI oversight, and 5) provides students with strong management and peer-training skills while facilitating rapid completion of this important collaborative research effort. This model demonstrates that students at all levels can and should be included as equal partners in our emerging and continuing biodiversity informatics efforts.

ORAL PRESENTION
Collections for the future – future of collections
Scientific collections and food security: their role in predicting and protecting our future food supply

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ABSTRACT. Fluctuations in food security have been felt on different timescales, from short-lived famine to prolonged declines in staple crops, livestock and wild prey. As our population has grown, we have consumed wild species, selected and cultivated them as dietary staples, altered them through selective breeding, and mitigated fluctuations in their supply with agricultural advances. An international and interdisciplinary symposium, hosted by Scientific Collections International (SciColl), explored the evidence that object-based scientific collections in a variety of disciplines may contain that could prove valuable to researchers involved in food security. Collections can reveal details about the origins and characteristics of the species we select as food sources, the ways we have and can modify them to meet our needs, and the histories and causes of their changing abundance. Through this understanding we become better able to predict and protect our future food supply.

ORAL PRESENTION
Preventive conservation and material science
Challenges of conservation treatment of historic herbaria

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ABSTRACT. Historic herbaria are complex artifacts and pose a challenge for both scientists and conservators. There are actually no data justifying conservation treatment methods as absolutely safe for the structure of botanical material. While there are many publications concerning pesticide treatment and its influence on DNA material on natural history collections, the literature on conservation treatment is not very numerable.
Analytical non-destructive methods such as MacroXRF scanning and GC/MS combined with SPME (solid microphase extraction) are very helpful to determine preliminary policy for conservators. Micro-destructive methods, such as microfading tests are good tool to investigate the artifact's vulnerability to light, what can determine the policy of exhibiting and handling of artifacts. The paper presents some of the analyses carried out on 18th and 19th century herbaria. It also announces a 3-year long project aiming at identifying a possible influence of conservation treatment methods on genetic material comprised in historic herbaria.

INTRODUCTION: HISTORICAL BACKGROUND AND TECHNIQUES. Herbaria are a valuable source of information for scientists and specialists in different domains. At the same time they are very complex artifacts that are not easy to maintain, as they consist of various materials.

The oldest examples that survived until nowadays date back in the 16th century and are attributed to the pupils of Luca Ghini, professor of botany in Bologna, assumed to create the first herbarium with dessicated plants as a scientific aid. Up to 18th century herbaria were arranged in a form of the album, until Linnaeus developed a method of attaching specimens on separate sheets, positioning one specimen on each sheet. This method is still used as it allows moving particular specimens within the collection, according to the changes in taxonomy. It also enables to correct misidentified specimens in the collection. The bound herbaria have

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Figure 1. Herbarium of Johann Friedrich Zeidler, 1732. An example for colouring of specimens in order to "preserve" the natural colour of the plant.

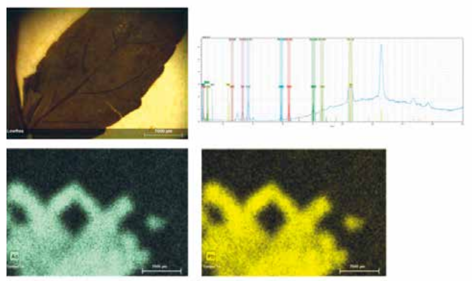

Figure 2. A fragment of Zeidler's herbarium scanned with MacroXRF. The mapping shows strong signals from arsenic (bottom left) and lead (bottom right) in the same area. The pesticide area doesn't match to the shape of the specimen.

Figure 3. Two 18th century herbaria during GC SPME analysis. The needles with the sorbent are injected in the objects wrapped in aluminum foil to concentrate the volatile organic compounds.

Figure 4. Specimen during microfading test. The diameter of the spot is 0.6mm.

a finished form and the order of specimens cannot be changed. The specimens are put often in a not intuitive order, so that may be not useful for the scientists. Nevertheless they usually still comprise a lot of historical information.

Different methods were used to create bound and loose sheet herbaria. The specimens were either sewn, attached using strips of paper, or stuck plain to the paper support. Sometimes the method of attachment was a combination of solutions. The adhesives used to attach the specimens were animal glue (first mentioned by Tournefort), isinglass (described by Linnaeus), gum Arabic, starch adhesives or mixtures (e.g. Felix Platter used a mixture of animal glue and starch adhesive).

The block of the album could be sewn and bound in leather, parchment or cardboard binding. The bindings and the block often suffered deformation because of the composition of paper, specimens and adhesives. The other aspect was conservation of plant's colour. This was achieved by different techniques, either chemical treatment in recent decades or simply by colouring the surface of selected specimens (**Fig.1**).

CONSERVATION AND PRESERVATION ISSUES. Materials used to create herbaria cause many conservation issues. Deformations and tensions between specimens and adhesives often result in cracking and crushing of plant specimens. Spaces in the deformed paper allow dust deposits and become attractive to pests. Insufficient mounting causes the loss of information. Extraordinary elements, as paint layer, can flake from the specimen, and being historical evidence they require conservator's intervention of consolidation and introduction of another material to the object.

Another big problem is the usage of pesticides in herbaria. The one that is known best and covered in literature is mercury chloride, but the list of other pesticides used is very long, e.g.: lead arsenate, naphtalene, DDT (dichlorodiphenyltrichloroethane), barium fluorosilicate, paradichlorobenzene (1,4-dichlorobenzene), phenol, LPCP- pentachlorophenyl laureate, Zyklon B (hydrogen cyanide with adsorbent), ethylene oxide, phosphine, para-chloro-meta-crezol (4-chloro-3-metylphenol), ethylene dichloride (1,2 dichloroethane), sulfuryl chloride, carbon disulfide, carbon tetrachloride, dichlorvos (DDVP, 2,2-dichlorovinyl dimethyl phosphate), methyl bromide, thymol (2-isopropyl-5-methylphenol), formalin, methyl iodide, creozote, Lindane (gamma-heksachlorocyklohexane), pyridine, aldrin, endrin and dieldrin. All these substances are not only harmful to pests but also to human health. In an unpublished report on pest management methods used in Polish herbaria (survey conducted by the author) some institutions are proved to still use phosphine, para-chloro-meta-crezol and pesticides based on dilchlorvos. The report also showed very poor documentation concerning the usage of particular methods. Awareness of the possible threats when handling herbaria is crucial for health and safety measures.

Another big issue is the wide range of profiles of institutions that have herbaria in their collection. Herbarsheets can be found the most in institutional herbaria, but they are often part of the collection in museums, libraries, national parks or independent institutes. Each institution may have different preservation and conservation policy according to their needs, habits, knowledge and budget.

PERSPECTIVES ON RESEARCH CONCERNING HISTORIC HERBARIA. Instrumental analysis of historic herbaria provides information on almost all the elements used to construct and preserve herbaria. The most promising is the usage of non-destructive techniques that can provide a lot of information on the object structure. One of the methods broadly used is X-ray fluorescence (XRF) analysis, which is suitable for identification of some of pesticides, but also inks, certain pigments and metal elements that may be possibly used in binding. However the most popular method to identify arsenic and mercury compounds is portable XRF analyser, it has limitations as it can measure one specific point during one measurement. Pesticides could be applied in different ways (onto the specimen, on the paper support, introduced in

the adhesive or applied on the interleaves), so it may be difficult sometimes to predict where it exactly should be sought. Moreover, in situations when pesticide migrates from the plant to the paper, a point measurement can be misleading. The solution is MacroXRF, an XRF scanner, which enables to map the distribution of present elements. A series of scans made on 18th century herbaria show that the distribution of pesticide can be very unintuitive and surprising (**Fig. 2**, in this case: lead arsenate).

Another technique is gas chromatography coupled with solid microphase extraction (GC SPME). In this method, a needle with a sorbent is introduced in the object (eg. a bound herbarium) and absorbs the air from inside (**Fig. 3**). The absorbed air is then analysed by the gas chromatograph, which enables to identify volatile organic compounds, such as naphthalene, formaldehyde or thymol.

Additionally, microfading may be a helpful tool to determine item's stability in regard to light exposure when exhibited or accessed in the collection. This method is micro-destructive as it uses a spot of light of very high intensity, but the colour change in the measured spot is hardly perceptible (**Fig. 4**).

Another perspective is an investigation on ethical aspect of conservation of historic herbaria. The project "Heritage preservation and ethnobotany. Analysis of the influence of conservation treatment on genetic material comprised in historic herbaria" aims at evaluation of conservation treatment and popular mending methods in regard to genetic material. This is a 3-year interdisciplinary project involving cooperation of conservators, botanists, molecular biologists and other researchers.

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POSTER

Enabling Infrastructure: Future Collections, Data & Informatics (Synthesys Symposium)

What do users want from a herbarium's web portal?

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ABSTRACT. The Botanic Garden Meise is in the process of building a new portal to access images and data of its collections. Owing to the constraints of time and money, spending resources on an analysis of user requirements can seem frivolous. Nevertheless, the success of a project is hard to evaluate if you do not know what you were trying to achieve and we felt it is important to give the users a voice in the final outcome. This will help us build a better portal, but will also engage the users from the beginning of the process; rather than imposing our vision. We decided to subcontract the user requirements analysis to an independent external company who could be more objective in their assessment. Our initial vision was a broad consultation with all stakeholders including the general public, schools, policy makers and, of course, scientists. Nevertheless, it soon became clear that such an approach would have been too expensive so we had to restrict ourselves to our core user-group of researchers. However, we divided those researchers into taxonomists, ecologists and historians. Consultations were conducted in multiple small workshops with participants recruited from inside and outside the botanic garden. Each workshop was structured to discuss the tasks and data requirements to conduct research and how an online portal can make those tasks easier. In addition, the current shortcoming and strengths of the current virtual herbarium were discussed. The results showed many areas of common interest between different user groups, everyone wanted access to as much data as possible and also comprehensive links to metadata, but there were more subtle differences. It is clear that although we can create suitable software for users it will take longest to satisfy their demand for data from specimens.

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ORAL PRESENTATION

Enabling Infrastructure: Future Collections, Data & Informatics (Synthesys Symposium)

Notes from Nature 2.0: Citizen science at scale

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ABSTRACT. Notes from Nature (http://www.notesfromnature.org; NFN) is a citizen science tool focused on public engagement and label transcription of natural history specimens. The project was developed collaboratively by biodiversity scientists, curators, and experts in citizen science, within the well-established Zooniverse platform. Notes from Nature launched in April 2013 and has been successful by any measure, with over 9190 registered participants providing 1,340,000 transcriptions. While successful, NFN has been difficult to scale up for broadest community use, both for natural history collections providers and citizen scientists. This talk introduces the newly re-launched Notes from Nature, which leverages new tools produced by both the natural history collections community and the Zooniverse to revolutionize how to bring new collections online. The key innovation are two tools, Biospex and the Zooniverse Project Builder, that together dramatically simplify and automate creation of new expeditions. The new Notes from Nature also has streamlined and enhanced transcription tools, provider dashboards, and soon to be upgraded user profile pages. Work is ongoing to build services to return "best transcripts" along with data quality assessments to our providers. We also discuss engagement efforts and overall interoperability with other biodiversity informatics tools. Such improvements help cement Notes from Nature's place as a critical component of an ecosystem of tools needed to unlock the vast legacy biodiversity data for broad public good.

ORAL PRESENTATION

Green Museum – How to practice what we preach? (General session)

Restoring the Large Tropical Conservatory (Großes Tropenhaus) in the Botanic Garden of Berlin to energy efficiency while considering aspects of monument preservation

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ABSTRACT. The Large Tropical Conservatory, built in 1906/07, is still the largest greenhouse in the Botanic Garden Berlin. The column-free steel construction, 60 m in length and almost 27 m in height, was a pioneering technical work and a proud object of representation for the imperial capital of Berlin at the time. From 2006 to 2009, this construction was fundamentally renovated under energy-saving aspects. Meeting the requirements of botany, economy and monument preservation at the same time seemed almost impossible. However, in close cooperation with engineers and producers new solutions have been developed that fulfill all demands. Now, the tropical plants enjoy the full spectrum of sunlight required for optimal growth, the energy costs have been reduced by 70% and the impressive glass dome corresponds to the original version of 1907, thus meeting the requirements of monument preservation.

ACKNOWLEDGEMENTS. The project was realized under the Umweltentlastungsprogramm II, Senatsverwaltung für Gesundheit, Umwelt und Verbraucherschutz (Berlin), project no.10876UEP/W7, 2006-2009, funded by Europäischer Fonds für die Regionale Entwicklung (EFRE) of the European Union.

Figure 1. Large Tropical Conservatory after the renovation, Victoria House in the front (Photo: Dirk Altenkirch).

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ORAL PRESENTATION

Blending the educational resources of small and large collections for training the next generation of museum professionals (iDigBio Small Collections Symposium)

Involving undergraduates in the digital community: Leveraging collections preservation, research, and outreach through a network of natural history collections clubs

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ABSTRACT. In February 2013, nine students at Arkansas State University (A-State) came together to form the Natural History Collections Curation Club (NHC3). This club was an innovative approach to resolving many issues facing the natural history collections at A-State. The students of the club made it their goal to restore the collections by dedicating their time and helping to secure funding. These efforts have resulted in funding from the Dean of the College of Sciences and Mathematics for a part-time student worker in the collections, supplies for several projects including jars and ethanol for restoring the fish collections and materials to create two large specimen mounts, and trips to visit several natural history museums. This concept has also helped other universities increase student interest and involvement in collections. To date, three other universities have active natural history collections clubs as a result of the A-State model. Beginning in the fall of 2015 these four clubs have formed a network to outreach to other universities that may benefit from this model. Our goal is to use the Natural History Collections Club Network (NHCCN) as a platform to motivate students across the globe to become interested and involved in university specimen collections.

ORAL PRESENTION

Digitization and imaging collections: new methods, ideas, and uses

Recreating a long-lost herbarium

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ABSTRACT. Between 1821 and 1864 the Horticultural Society of London [now the Royal Horticultural Society (RHS)] commissioned ten plant hunters (including Fortune and Douglas) to travel the world and between them they visited nearly every continent. As was common at that time, plants, bulbs and seeds were sent back with their herbarium specimens to be grown in the Society's gardens for assessment as to their merits in cultivation. A large proportion of all plant introductions to British gardens during this period were a result of the RHS collectors, so the herbarium specimens are of utmost importance to the history of ornamental horticulture.

The Society, facing financial difficulties, sold the herbarium specimens at auction in January 1856. Their whereabouts after auction has long been unknown, as a search in the RHS's Library and Archives proved fruitless. By chance a 'pop-up' display (January 2016) of some of their purchased collections residing at the Natural History Museum, London (herbarium code BM), acted as a catalyst to solve the mystery. We now know that other collections are held in a number of European herbaria. It is now conceivable to recreate the herbarium from digital images of the scanned specimens in these collections.

MAIN TEXT. The collections held by the Royal Horticultural Society give a unique insight into gardening, gardening design, gardening history, botanical and horticultural science, and are an important part of Britain's cultural heritage. This period following the foundation of the Horticultural Society of London in 1804 was the golden age of plant collecting for gardens and the Society's collectors were the source of a great many of the plants that are still growing in our gardens today.

Between 1821 and 1864 the Horticultural Society of London (which became the Royal Horticultural Society in 1861) commissioned ten plant hunters to bring back plants for the gardens, initially at Kensington and subsequently at Chiswick. As was normal at the time, the majority of our plant hunters also made collections of herbarium specimens (with duplicates distributed to other herbaria) which contributed to the creation of the Horticultural Society's herbarium. The herbarium collections linked to expeditions made by the collectors are not only of huge scientific significance to taxonomists (they include many type specimens and samples from places hitherto botanically unexplored), but also to garden historians, garden designers, artists and many more besides. The RHS's Lindley Library still holds journals and plant lists for many of the commissioned collectors and is actively seeking funds to help restore and digitise the records.

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Very early contributions to the Kensington garden came via different sources, including living plants (and seeds) sent by tea factors based in China, contributions from tropical botanical gardens and even plant enthusiasts employed by embassies. Many ships captains would also cooperate in this exercise, seeking advice on carrying live plants home before embarking on expeditions (Elliot 2004: 197). The Society's plant hunters (to 1856) are listed in **Table 1**.

Regrettably due to financial problems, the Horticultural Society of London sold the herbarium collection at auction in January 1856, in a sale that made c. £225 (Elliott 2004: 22) (equivalent of £21,780 today (http://inflation.stephenmorley.org). No record of where the sale items went could be found and small searches on jstor.org proved fruitless, but tantalising since it wasn't possible to say for certain where the top set of specimens were housed. For instance, a search for David Douglas types indicates herbarium specimens stored in BM, G (Conservatoire et Jardin botaniques de la Ville de Genève), G-DC (Herbier de Candolle, Conservatoire et Jardin botaniques de la Ville de Genève), GH (Harvard University), K (Royal Botanic Gardens, Kew), M (Botanische Staatssammlung München), MIN (University of Minnesota), NY (The New York Botanical Garden), US (Smithsonian Institution) and PH (Academy of Natural Sciences, Pennsylvania) to name but a few. Early in 2016, a small exhibit laid out in the herbarium of the Natural History Museum for visitors from the RHS was the key to us finding our long-lost collections. Specimens made by Douglas, MacRae and Don had been purchased by the BM for £74 10 shillings (today's equivalent £7211.60). A subsequent further search of the RHS library found more evidence. Because of obscure indexing terminology, an article written about the sale (The Gardener's Chronicle, Feb. 2nd 1856: 68) that included the names of some of the successful bidders had remained undiscovered, so until the find at the BM, we were uncertain as to where the Horticultural Society's collections were re-housed. **Table 1** shows where the Society's collections went.

Plant Hunter	Collecting Localities	Where collections are currently stored
John Potts (-1822)	China & India (mostly collecting from gardens) (1821-1822)	(no known herbarium collections)
George Don (1798-1856)	West Africa, Brazil and the West Indies (1821-1823)	BM
John Forbes (1798-1823)	Madagascar, South African, East & Southern East Africa (1822-1823)	P (Muséum National d'Histoire Naturelle, Paris) & G (Dr Planchon buying for P and Baron de Lessert for G)
John Damper Parks (c. 1791-1866)	China (1821-1824)	[CGE (Cambridge University) (Harvard University Herbaria & Libraries database 'botanist' seach)]
David Douglas (1798-1834)	North America (1823-1827, 1829-1834)	BM
James MacRae (-1830)	Brazil, Chile, Sri Lanka, Galapagos & Hawaii (1824-1826)	BM (Hawaii & Sri Lanka), P & G (Chile) (Dr Planchon buying for P and Baron de Lessert for G)
Karl Theodor Hartweg (1812-1871)	Mexico & South America (1836-1848)	LD (Lund University) (& PC (Herbier Cryptogamique, Muséum National d'Histoire Naturelle, Paris) (Prof. Agardh)
Robert Fortune (1812-1880)	China (introduced tea to India) (1843-1846)	P & G (Dr Planchon buying for P and Baron de Lessert for G)
Mateo Botteri (1808-1877)	Mexico (1854-1856)	[K (Harvard University Herbaria & Libraries database 'botanist' seach), CGE, GH (Index Herbariorum ed. 8: 517)]

Table 1. The Society's early plant hunters, their collecting localities, and herbaria where the collections are now stored

The RHS prides itself on being the definitive place to go to for advice on anything about the horticulture of plants, and this is why it is most appropriate that we create a virtual herbarium of the long-lost collections that are of such enormous significance to the horticulture of ornamental plants. This opportunity exists because so many herbarium specimens have been digitised and it is technically possible to link these dispersed collections together through the internet. This is the first time such an exercise has been attempted. Our plans are to prioritise the collectors whose specimens are more likely to be of most importance to horticulture by searching the Lindley Library archives in order to produce collecting lists and collectors itineraries. It should then be possible to find all the digitised specimens (and duplicates in other herbaria) to bring back together all the specimens that once comprised the RHS's first herbarium, hosted on the RHS website. The RHS has a herbarium (WSY) and is in the process of digitising its collections, which the virtual herbarium would complement. Follow up work is likely to include highlighting the taxa that were successfully introduced to gardens following the relevant expedition, and, as far as possible, their subsequent cultivars.

ACKNOWLEDGEMENTS. The authors would like to thank John David for his discovery of the article about the 1856 auction in The Gardener's Chronicle.

REFERENCES

Elliott, B. 2004. The Royal Horticultural Society: A History 1804-2004. Pp. 432. The Royal Horticultural Society, UK. ISBN 1 86077 272 2.

Holmgren, P.K., Holmgren, N.H. & Barnett, L.C. (Editors). 1990. Index Herbariorum. Part I: The Herbaria of the World. Eighth edition. Pp. 693. New York Botanic Garden, USA. ISSN 0080-0694.

ORAL PRESENTATION

Enabling Infrastructure: Future Collections, Data & Informatics (Synthesys Symposium)

Automating capture of metadata for natural history specimens

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ABSTRACT. The SYNTHESYS3 project is funded by the European Union through the 7th Framework Programme for Research. The aim is to produce an accessible, integrated European resource of natural history specimens for researchers. The need for the development and implementation of tools to speed up the process of data capture from natural history specimens is generally recognised, and one objective within the project focussed on automating capture of specimen metadata. The work was divided into four sections, each focussing on a different technology and process. The partners involved have collaborated to review, trial and develop tools for Optical Character Recognition (OCR), Natural Language Processing (NLP), Handwritten Text Recognition (HTR), template matching and pattern recognition. The results are summarised and presented here along with the next steps for the project.

ACKNOWLEDGEMENTS. This work was carried out with funding from SYNTHESYS3 under EU 7th Framework Programme for Research (FP7). Project reference: 312253

ORAL PRESENTION

Green Museum – How to practice what we preach? (General session)

The collection environment

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ABSTRACT. Findings from the material sciences and research in conservation technologies are changing our understanding of best practices in collection storage and exhibition environments. Consensus has shifted away from standardized criteria for all material and has instead moved towards a deeper analysis of the needs of individual media and materials. Understanding more about the impact of ranges of temperature and humidity on cultural heritage allows institutions to consider new approaches to collection care that require less energy to maintain, impose less of a burden on buildings and their systems, but still protect collections for future generations. Debate over the last few years has questioned how museums set norms for collection environments and review options for energy management, whether the latter are related to structured setbacks/ shutdowns in system operations, or to levels of enclosure to reduce reliance on mechanical systems. The research and discussions promise new flexibility in how institutions approach the resources necessary to effectively protect their collections.

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ORAL PRESENTATION
Developing a global research infrastructure framework for bio-collections (Synthesys Symposium)
Building the pan-European Natural History Collections Research Infrastructure

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ABSTRACT. The European taxonomic and natural history community has taken great steps towards integration and coordination of biological collections through developing common practices, policies and systems for virtual and physical collection access. As a result the volume and quality of collection-based research and the societal and economic relevance of these collections greatly increased. The next step for the community is to establish itself as a formally recognized European Research Infrastructure.
The European Strategy Forum on Research Infrastructures (ESFRI) sets the top-level priorities for the development of robust and sustainable RIs in Europe. Inclusion in the ESFRI Roadmap will place bio-collections at the heart of the European RIs, advancing large scale international and trans-disciplinary collaborations and opening up new opportunities for attracting funding from various public and private sources.
To secure a position on the ESFRI Roadmap in 2018, partners from 17 ESFRI member states are collaborating to form a shared vision for the future of collection-based research, policy making and economic activity in Europe and to design a sustainable infrastructure as a key instrument to realize, and go beyond, this vision. The background, structure and status of this project, called Distributed System of Scientific Collections (DiSSCo), will be presented.

ORAL PRESENTATION
Developing a global research infrastructure framework for bio-collections (Synthesys Symposium)
Challenges and Needs at the Global Scale – Sharing Resources and Expertise

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ABSTRACT. Information on the world's biodiversity is complex and scattered. Many diverse infrastructures have been established at global, regional and national scales to organize subsets of this information. These initiatives fragment effort to address key issues in biodiversity data management. Increased coordination is required in particular: 1) to promote a consistent high-level domain model for organizing biodiversity information, 2) to deliver a consistent, community-managed reference classification for all taxa, 3) to integrate data from collections and literature with molecular data management, and 4) to deliver the best possible representations of species distribution and biodiversity patterns. Addressing these issues will support the development of a comprehensive integrated knowledgebase to support taxonomic and ecological research, conservation and sustainable management.

ORAL PRESENTATION
Green Museum – How to practice what we preach? (General session)
Understanding cost management

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ABSTRACT. The cost of construction directly shapes capital projects, and understanding its process and methodologies helps stakeholders navigate a complicated and often frustrating part of a building renovation. Realizing the potential costs early and assessing the institution's capacity to raise funds makes for productive early planning, creates confidence in the project's feasibility and expedites decision-making for all involved. Folding environmental sustainability into the mix complicates the issue because, particularly in the past, going green increases the initial costs of building projects. These are critical to manage, but considering life cycle costs allows projects to study the long-term financial implications of measures that reduce energy use or increase staff efficiency and productivity, thereby contributing to institutional sustainability. This presentation will treat project costs as a risk to manage alongside other collection issues, explain the methodology for organizing (and understanding) construction estimates and suggest strategies for navigating financial concerns before, during and after a building project.

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ORAL PRESENTATION
An International Conversation on Mobilizing Natural History Collections Data and Integrating Data for Research (iDigBio Symposium)
The Art of Georeferencing: A case study at the North Carolina Museum of Natural Sciences

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ABSTRACT. Georeferencing is becoming an established practice across natural history collections worldwide, and a core component to research spanning fields as diverse as conservation and human health. However, the uncertainty surrounding historic data can span tens of thousands of meters and is rarely acknowledged in research studies. Using data from the North Carolina Museum of Natural Sciences (NCSM) as a case study, I highlight several important questions regarding georeferencing with uncertainty. The NCSM collection mirrors the historical evolution of ideas surrounding the calculation of uncertainty, beginning with the use of confidence levels based on scales of relative certainty to using the guidelines within "The Guide to Best Practices for Georeferencing". Although better matching the level of accuracy to reflect the actual uncertainties of our locality data, these practices raise several questions. Are we possibly creating a false impression of the distribution of species? How can we best provide the high-throughput required by funding agencies, yet still provide research ready data? Moreover, how can we ensure use of uncertainty by researchers? Addressing these and other open questions concerning spatial data will allow us unlock the true potential of our historic records, as they become a central component of 21st century biodiversity science.

ORAL PRESENTATION
Collections for the future – future of collections
The Leibniz Association and its eight research museums

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ABSTRACT. The Leibniz Association unites 88 institutions throughout Germany which are legally, scientifically and economically independent entities. They include both research institutes and facilities that mainly provide infrastructure for research and society. Leibniz institutions are evaluated by the Leibniz Senate every seven years at the latest. One special feature of the Leibniz Association is its eight research museums of different disciplines, ranging from cultural history to natural sciences. They define themselves as integrated research museums, as they produce collection-based research and excellent science, care for and develop its collections as part of a global scientific infrastructure, and serve as a bridge between science and society. The talk will present the concept of an integrated research museum and will show examples for the realization of this concept and it´s evaluation at the Deutsches Museum, the German Mining Museum, the German Maritime Museum, the Germanisches Nationalmuseum, the Museum für Naturkunde, the Römisch-Germanisches Zentralmuseum, the Senckenberg Museums and the Zoological Research Museum Alexander Koenig.

ORAL PRESENTATION
DemoCamp
Inselect – applying computer vision to facilitate rapid record creation and metadata capture

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ABSTRACT. *Inselect* is an open-source desktop application for Mac and Windows that greatly simplifies many of the challenges of dealing with images generated by museum mass-digitisation programmes.
Inselect produces, from a whole-drawer or similar scan, individual specimen image crops and associated metadata. The software combines image processing, barcode reading, validation of user-defined metadata and batch processing to offer a high level of automation.
Inselect has been used in the Natural History Museum, London, to process in excess of 100,000 microscope slides and is being used by several institutions on objects including pinned insects, microscope slides and paleontological specimens.
This demo will give an overview of the software and how it can be integrated into existing workflows. *Inselect* is under active development - we are very excited to engage with the wider museum community in order to increase the software's capabilities and to make it as broadly applicable as possible.

INTRODUCTION. The world's natural history collections contain an estimated two billion specimens (Ariño 2010) and constitute a large evidence base for scientific research on the natural world. These collections also have enormous cultural, historical and aesthetic value yet the vast majority of specimens are not easily accessible.
In order to simplify access to collections and to make new areas of scientific research possible, many natural history organisations are carrying out major digitisation programmes that require the bulk processing of specimens, images and unstructured metadata, while at the same time ensuring data quality (Bearman and Cellinese 2012; Blagoderov et al. 2012). The sheer scale of collections often mandates the use of 'whole-drawer imaging' in which high-resolution photographs (typically many hundreds of megabytes in size) of tens, hundreds or possibly thousands of specimens are taken (Dietrich et al. 2012; Mantle et al. 2012; Schmidt et al. 2012).

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Figure 1. The boxes view, showing a zoomable thumbnail image of a drawer of Ephemeroptera (mayflies), together with bounding boxes that can be edited using the mouse and keyboard.

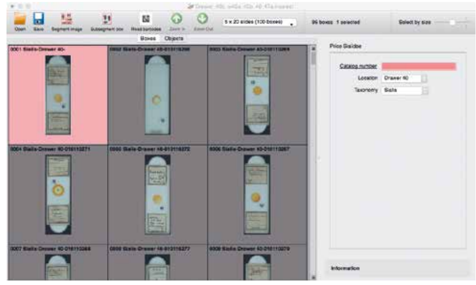

Figure 2. The objects view, showing objects (microscope slides containing Sialidae - alderflies) in a grid. The first box (selected) lacks a value for the mandatory 'Catalog number' field so both the box and the field are shown in red.

Figure 3. The objects view with a single Sialidae object expanded.

Whole-draw imaging presents two substantial challenges. First, each individual specimen, along with associated barcodes and labels, must be identified so that specimen-level images can be cropped. Second, metadata such as catalogue numbers, location within the collection and possibly transcribed information on labels, must be captured and associated with the cropped images. The lack of standard software for these activities has forced organisations to resort to laborious and potentially error-prone manual processes.

THE SOFTWARE. *Inselect* is an easy-to-use desktop application that addresses several of the needs of these large-scale mass-digitisation projects (Hudson et al. 2015). The software is open-source, hosted at https://github.com/NaturalHistoryMuseum/inselect, where installers for both Mac OS X and Windows PCs can be downloaded. Inselect offers

- automatic detection of specimens within images and the placement of a bounding boxaround each one;
- `cookie-cutter` bounding box templates, for workflows in which objects are always at the same locations within image e.g., when specimens are placed within templates;
- manual creation and editing of bounding boxes;
- barcode reading;
- association, validation and export of user-defined metadata at object-, group- and drawer-levels;
- export of full-resolution crops of individual objects.

The 'boxes' view (**Figure 1**) shows the zoomable image together with bounding boxes around individual specimens. The 'segment' command runs an algorithm that attempts to detect specimens and places a bounding box around each. The user can create, delete, move and resize boxes using the mouse and/or keyboard, making it a simple task to refine the outputs of automated segmentation.

The panel on the right contains metadata fields. The user can create metadata templates (simple structured text files; examples and documentation at https://github.com/NaturalHistoryMuseum/inselect-templates) that define the fields, their types and any associated validation. It is a simple task for the user to define field-level validation such as

- an integer greater than zero;
- a latitude in one of several formats;
- a value from a pre-defined list;
- a date in the form YYYY-MM-DD;
- a more complex scheme defined by a regular expression.

Metadata templates also specify how the filenames of exported crops will be assembled from the field values.

The 'objects' view shows individual images either in a grid (**Figure 2**) or with a single image expanded (**Figure 3**). This view allows the user to rotate images individually or in groups, making it easier to transcribe label information into metadata fields. Rotation is also applied to the cropped object images, when these are saved.

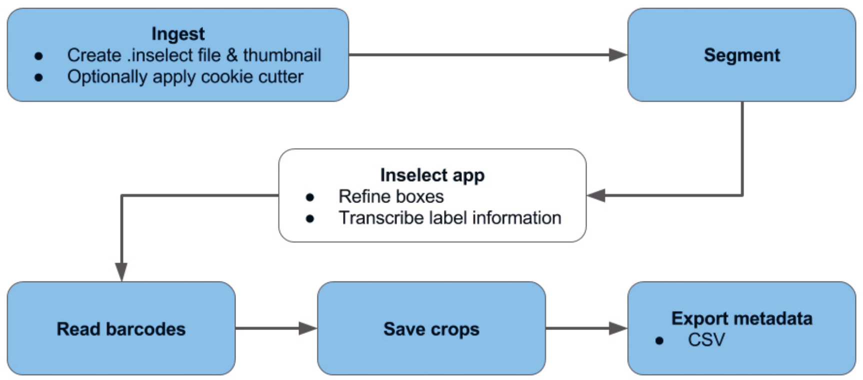

Figure 4. A typical Inselect workflow. Each of the blue boxes has a corresponding command-line tool that operates on batches of images.

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The most important and time-consuming functions on an Inselect workflow are also accessible through command-line tools that operate on batches of images and documents (**Figure 4**)

- ingest – creates the '.inselect' file (which will contain bounding boxes and metadata) and the thumbnail image that is displayed by the desktop application;
- segment – runs the automated segmentation algorithm;
- read_barcodes – reads barcodes and populates metadata fields with barcode values;
- save_crops – saves cropped images for each bounding box;
- export_metadata – writes metadata to a Comma-Separated Values (CSV) file.

Users can assemble these batch-processing tools into a pipeline that, together with the use of the desktop application, metadata templates and cookie cutter files, constitutes an efficient and highly automated workflow.

DISCUSSION. The software lacks some of the polish that users expect of software such as localization, an 'undo' feature and comprehensive documentation. *Inselect* is being actively developed - we are keen to add these features and to rapidly expand its capabilities. We would like *Inselect* to be used on as many different specimen types and within as many different workflows as possible and we are keen to assist institutions with integrating the software into their pipelines. We welcome and greatly value all comments, suggestions and bug reports, which we maintain at https://github.com/NaturalHistoryMuseum/inselect/issues/.

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REFERENCES

Ariño A.H. 2010. Approaches to estimating the universe of natural history collections data. Biodiversity Informatics. 7(2):81–92.

Beaman R.S. & N. Cellinese. 2012. Mass digitization of scientific collections: new opportunities to transform the use of biological specimens and underwrite biodiversity science. ZooKeys. 2012; 209: 7–17.

Blagoderov V., I.J. Kitching, L. Livermore, T.J. Simonsen and V.S. Smith. 2012. No specimen left behind: industrial scale digitization of natural history collections. ZooKeys 12:133–146.

Dietrich C., J. Hart, D. Raila, U. Ravaioli, N. Sohb and C. Taylor. 2012. InvertNet: a new paradigm for digital access to invertebrate collections. ZooKeys. 209:165-181

Hudson, L.N., V. Blagoderov, A. Heaton, P. Holtzhausen, L. Livermore, B.W. Price, S. van der Walt and V.S. Smith. 2015. Inselect: automating the digitization of natural history collections. PLOSONE. 10(11):e0143402.

Mantle B.L., J. La Salle and N. Fisher. 2012. Whole-drawer imaging for digital management and curation of a large entomological collection. ZooKeys.209:147-163.

Schmidt S., M. Balke and S. Lafogler. 2012. DScan – a high-performance digital scanning system for entomological collections. ZooKeys. 209:183-191

ORAL PRESENTATION

An International Conversation on Mobilizing Natural History Collections Data and Integrating Data for Research (iDigBio Symposium)

Field to database to aggregator and beyond: documenting the flora of Melanesia

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ABSTRACT. Tracking natural history specimens, from curation to distribution, along with the conversion of data from field notebook into digital format, delivery to data aggregator, and its ultimate use in research, can be a complex process. Legacy collections are expensive and time consuming to digitize, and errors are often complicated to correct. As such, developing best practices for new field collections for efficient digitization and data sharing, reproducible research and rapidly discoverable data is critical for eliminating efforts of digitization being repeated within multiple natural history collections and for avoiding the transcription errors that can result. Data sharing and use of aggregated ecological and biological data sets require knowledge of the appropriate use of identifiers, understanding data standards, and developing new skill sets in order to efficiently and accurately use biodiversity data. This presentation will highlight these concepts as they apply to research using biological collections data, with lessons learned from experiences of fieldwork and challenges and successes in using natural history data for studying the biodiversity of the tropical islands of Melanesia.

ACKNOWLEDGEMENTS. iDigBio is funded by a grant from the National Science Foundation's Advancing Digitization of Biodiversity Collections Program (Cooperative Agreement EF-1115210). This material is based in part upon work supported by the *National Science Foundation* under Grant Numbers DEB-0950207 and DBI-1057453

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POSTER

Other Topics

The preservation and display of a 'black smoker' hydrothermal vent at University Museum of Zoology Cambridge

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ABSTRACT. The University Museum of Zoology Cambridge was excited to acquire a collection of deep-sea material from the British Antarctic survey in 2015. These specimens will be an exciting addition to the new central displays within the museum, and will be an exceedingly rare display in the U.K.

The hydrothermal vent and associated barnacles, Vulcanolepas scotiaensis, were collected in 2010 in the Scotia Sea at a depth of 2394m. The collection also includes examples of the 'Hoff' crab, Kiwa tyleri, and other species that live on the vent. The preservation and display of this material is of huge interest as is contains examples of many species at differing life stages and to have it displayed together will be an exciting exhibit for the museum.

This poster will detail the preservation and display of this iconic specimen.

POSTER

Other Topics

Pigment based ink-jet printers: Use in collection management at the National Museum of Natural History, Smithsonian Institution

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ABSTRACT. Over the last 25 years, curation standards have improved for fluid and dry specimens. Increased general market demand for the production of archival documents and photographs has led to a variety of innovative inks and paper stock that meets collection management needs. Museums are benefitting from these advancements, but long term studies of these media must be established to ensure the security of our specimen data. Thermal transfer labels have been in use for two decades, allowing for longitudinal study of the product's durability in varied fluid environments. These products have performed well, but are vulnerable when exposed to certain specimen processing chemicals (e.g. surfactants). To hedge against failure of a single label product, we have been testing alternate printers and inks for back-up potential. In late 2014, the Department of Invertebrate Zoology and the Division of Fishes began testing pigment-based color inkjet printers. We replicated fluid test environments from the original thermal printer studies with the inclusion of several commonly used chemicals (e.g. DMSO, surfactants, liquid nitrogen, xylene, etc.). We present the results of the preliminary study and make recommendations for additional curation approaches using these relatively recent labelling products.

ORAL PRESENTATION

Digitization and imaging collections: new methods, ideas, and uses

Building next-generation collections: Challenges in digitizing already digitized collections

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ABSTRACT. Digitizing natural history collections has long been an idealized goal and is often an overwhelming challenge. The relevant question is how collections usability can be improved through digitization. The digitizing of vertebrate collections of the Canadian Museum of Nature (CMNVC) was initiated for collection management purposes in 1972 with the implementation of the Fish Information Retrieval System. At the same time, the National Museums Corporation of Canada advocated for a national directory based on computer technology. Digitizing CMNVC was a very slow process at that time. Various other challenges had to be overcome since then, including detecting and editing numerous errors that were introduced through successive data migrations. Today, 91% of the CMNVC are digitized, and core specimen data are retrievable on the Web for most of the collections. Digitizing, however, requires regular updates to reflect changing needs in scientific communities, and to capitalize on new opportunities that arise with the advances of computer technology. We critically reviewed European and North American digitizing initiatives to develop an innovative, systematic approach that should maximize *in situ* and remote use of both the data and physical objects. To optimize CMNVC collections usability, we advocate for interactivity of online biodiversity data portals.

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POSTER

An International Conversation on Mobilizing Natural History Collections Data and Integrating Data for Research (iDigBio Symposium)

Information Extraction from Herbarium Sheets - The StanDAP-Herb Project

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ABSTRACT. Mobilisation of specimen metadata is one of today's most pressing issues in collection management. In herbaria, this is facilitated by the fact that most specimens are largely 2-dimensional, mounted on a cardboard sheet, with labels glued alongside containing the metadata like the scientific name, collection site and date, collector, barcode, etc. Capture of digital images thus includes this information, albeit initially not in a searchable form. Data extraction itself is still done in most cases in a time consuming manual process. The StanDAP-Herb Project funded by the DFG (German Research Foundation) develops a standard process for (semi-) automatic detection of meta-data on herbarium specimens in order to replace the manual data input where possible. StanDAP-Herb evaluates existing tools and methods for automatic information extraction and attempts to integrate them into an open software architecture based on established IT standards. As a result, a standard workflow is defined to guide the extraction process. The software modules of the architecture become available for work flow processing, in order to verify data quality, facilitate data discovery and enhance the application of collection data in research.

POSTER

Green Museum – How to practice what we preach? (General session)

CollectionsEducation.org: Connecting students to citizen science and curated collections

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ABSTRACT. College-level plant diversity courses often involve a collection project, which is designed to help students learn to correctly identify, document, and preserve specimens for scientific study. While these projects are invaluable teaching tools, the specimens and associated data are often not incorporated into herbaria or online biodiversity data aggregators due to lack of quality, herbarium backlog, or both. Furthermore, students are not exposed to the emerging online citizen science initiatives and herbarium databases of our information-rich digital age. Here we present a new project and associated website (http://collectionseducation.org) designed to enhance traditional collection projects that can easily be incorporated into any plant diversity course. The project integrates traditional taxonomic practices, ongoing citizen science initiatives, and digital-age curatorial skills, with the final goal of producing archival-quality, research-ready plant observations and collections that will become part of our national biodiversity archive. Due to the importance of collections in hand and online, this project emphasizes the skills and best practices required to facilitate downstream applications of student collections and documentation of plant biodiversity. Over the past two years, we have implemented this project in 11 courses taught at four American universities. This poster will present preliminary data analysis from pre- and post-course student responses, which provides an assessment of the project's value not only to the biodiversity collections community, but to the students' learning.

ORAL PRESENTATION

An International Conversation on Mobilizing Natural History Collections Data and Integrating Data for Research (iDigBio Symposium)

Evaluating collection management systems for interdisciplinary natural history collections

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ABSTRACT. A collection management system (CMS) enables collection managers to do their jobs more efficiently and with more impactful results. In this case study, the Chicago Academy of Sciences / Peggy Notebaert Nature Museum (CAS/PNNM) shares its experience choosing between four CMS options: EMu, Specify, Arctos, and CollectionSpace. Each was evaluated on its functionality – including its ability to accurately represent our diverse collections and to enable efficient workflows – its provision for data discoverability, and its feasibility for implementation. Because the technical specificities of software inherently have a short lifespan, this case study offers evaluation through a broader framework of information science that should continue to be relevant even as the CMS options evolve.

INTRODUCTION & METHODS. Many museums have faced the task of acquiring a new collections management system (CMS) that is relational database software designed to specifically address the needs of collections. Investing in the right CMS should enable collection managers to do their jobs more efficiently and with more impactful results. The task of implementing a new CMS, however, is daunting, in large part because technology changes so rapidly and because the process requires a major commitment from the institution in terms of staff time, hardware upgrades, and software costs.

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The Chicago Academy of Sciences is the oldest science museum in Chicago, with biological and cultural collections dating back to the 1830s. A digital inventory project from 2008-2013 resulted in 61 Excel spreadsheets containing upwards of 285,000 specimen label data records. However, maintaining data in so many different spreadsheets was unsustainable. In order to provide sufficient quality control and security of the data, and to enable more effective management of the collections, CAS/PNNM decided to invest in a collections management system.

Initially, CAS/PNNM Collections staff cast as wide a net as possible in considering available collection management systems, particularly those specific to natural history collections. The available literature regarding CMS options was sparse and often the specifics of the software were found to be out of date. iDigBio and the Canadian Heritage Information Network have made available summaries about some of the CMS options, and two unpublished master's theses also produced valuable comparisons of different systems (Sully 2006 and Carpinone *et al*. 2012). Coetzer *et al*. (2012) provide details about one CMS option, Specify, while Lathrop, McDaniel, & Ritchey (2010) describe another, PastPerfect. We also requested anecdotal information from the museum community through the NHColl listserve, which responded with helpful but scattered opinions. Through this scan of existing literature and resources, we were able to narrow down our initial broad sweep of CMS options to those that would be most suitable for our collection: EMu, Specify, Arctos, or CollectionSpace. CMS options that we briefly evaluated but excluded from the remainder of this process were: Adlib, ArchivesSpace, ARGUS, Biota, CollectiveAccess, Mimsy XG, PastPerfect, Re:discovery, Symbiota, The Museum System (TMS), and Vernon CMS. We also declined to assess developing a custom database.

RESULTS

Evaluating Functionality. We examined the ability of each CMS to accurately represent collection objects and to enable efficient workflows, including (1) essential collection management transactions, (2) data cleaning and batch editing, (3) georeferencing, (4) digital asset management, and (5) content management. Our evaluations were based on thought exercises and the demo versions of software that we had access to. All four CMS options were sufficiently functional, although the specific functionality offered by each varied more than maybe expected, and no single solution has managed to incorporate every great tool (see **Figure 1**).

	Biological collection support	Paleo collection support	Geological collection support	Cultural collection support	Paper archive support	Observational collection support	Essential coll. mgmt. transactions	Data cleaning (for imports)	Batch editing	User permission levels	Digital asset management system	Content management system	Georeferencing tools	Condition tracking	IPM tracking	Pre-loaded vocab. authorities	Can import vocab. authorities	Email reminders	Annotation repatriation
EMu	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Specify	✓	✓					✓	✓		✓			✓	✓	✓		✓		
Arctos	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓			✓		✓	✓
CollectionSpace	✓			✓			✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	

Figure 1. Chart showing the presence or absence of key features between EMu, Specify, Arctos, and CollectionSpace.

Evaluating Data Discoverability. All four CMS options provide the core search and browse functionality expected of a relational database. EMu, Arctos, and CollectionSpace have the ability to search across all collection types within the CMS. Specify provides full-featured searching within a single collection, but runs into barriers trying to draw information from multiple collection types. In addition to internal searching, online data discoverability is an increasingly relevant aspect of biodiversity data discoverability. While Specify and EMu offer built-in pathways to online data publishing, and CollectionSpace can be set up to do so, Arctos makes publishing to online data aggregators as easy as possible.

Evaluating Feasibility of Implementation. It was essential to round out our evaluation of CMS options by considering both the direct costs of software licensing and support, and the indirect costs of new hardware, infrastructure, and staff time. Specific figures from our own institution's direct and indirect cost calculations are provided for reference. Our examination determined that all CMS options cost more than they appear to upfront – even "free" options such as Specify require considerable staff time for set-up and maintenance. Arctos provides perhaps the greatest indirect cost benefit to small, multi-disciplinary collections by allowing members to take advantage of essential curatorial decisions already made by the Arctos consortium body's expertise, as well as by centralizing technical support for the CMS.

DISCUSSION & CONCLUSIONS. One of our major deciding factors at CAS/PNNM was the ability for a CMS to handle all of our collections – from anthropology to ornithology to audiovisual – within a single database. Specify, although certainly a viable and affordable option for more taxon-specific collections, did not make sense for the diversity of our collections.

Additionally, staff capacity was an important concern. We were very attracted by the process-centric approach of CollectionSpace, as well as its user interface design and obviously dedicated core community, but the time investment required would be greater than feasible for us. Likewise, after considering the learning curve and design time commitment required by EMu, we felt that it too would require more staff time than we have available. Arctos would still require a significant time commitment; however, the implementation process is significantly streamlined as the interface layout and functionality have already been established. This means we would be able to progress immediately into preparing our data for migration and learning to use the new software. In addition, our IT staff wouldn't be overburdened with the installation and implementation process, nor with future CMS technical needs.

There are many solutions for museums to manage their collections data and ultimately, one size does not fit all. It is crucial for each institution to thoroughly consider the scope of their collection and what they want from a CMS. For CAS/PNNM, our collections represent a wide range of disciplines, and we wanted to maintain and expand on the connections bridging them. We determined that for our situation, Arctos would provide the easiest path to getting quality, standardized data into a relational database for all of our collections, and to making this data accessible both in-house and online.

REFERENCES

Canadian Heritage Information Network. 2012. Collections management software criteria checklist. http://www.rcip-chin.gc.ca/carrefour-du-savoir-knowledge-exchange/criteres_gestion_collections_management_checklist-eng.jsp (10 April 2015).

Carpinone, E.C. 2010. Museum collections management systems: One size does not fit all (unpublished master's thesis). Seton Hall University, South Orange, New Jersey.

Coetzer, W., O. Gon, M. Hamer, F. Parker-Allie. 2012. A new era for specimen databases and biodiversity information management in South Africa. Biodiversity Informatics (8): 1-11.

iDigBio. 2011. Biological collections databases, tools, and data publication portals. https://www.idigbio.org/content/biological-collections-databases (10 April 2015).

Lathrop, S., S.L. McDaniel, N. Richey. 2010. Exposing ourselves: A case study in collection management software implementation. *The Southeastern Librarian 58*(1): 3-8.

Sully, P. 2006. Inventory, access, interpretation: The evolution of museum collection management software (unpublished master's thesis). John F. Kennedy University, Pleasant Hill, California.

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ORAL PRESENTATION

Setting global and local digitisation priorities (GBIF Symposium)

The digitization dilemma: Setting "demand-driven" priorities and why it matters

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ABSTRACT. Worldwide, bio-collections institutions face a challenging dilemma: how to prioritize the digitization of massive amounts of data associated with millions of voucher specimens of animals, plants, fungi and other organisms that document the planet's biodiversity. Setting "demand-driven" digitization priorities is essential to having the best biodiversity data enable the best science for understanding and sustaining Earth's biological systems – and to do so in time to make a difference. But setting digitization priorities involves serving competing institutional, local, regional, national and global imperatives: individual research interests; institutional mandates; science agendas; and various environmental concerns (e.g., endangered species, invasives, disease vectors/hosts, pollinators, pests). Moreover, each imperative has its particular calculus of taxonomic groups, geographic areas, time periods, and ecosystems/habitats. Overlying these permutations are the missions of different stakeholders and funders: intergovernmental bodies (e.g., IPBES, CBD), government agencies, NGOs, private foundations, and corporations. In a resource-limited world, a digitization strategy of maximum efficacy will require all parties to collaborate on setting demand-driven, overarching priorities that, simultaneously: (1) target the most urgent environmental and biodiversity science imperatives of our time; (2) are underpinned by sophisticated gap analyses; (3) include the greatest commonality among competing interests; (4) tackle what is most pragmatic; and (5) promise the most immediate impacts.

ORAL PRESENTATION

Collections for the future – future of collections

A rock without data is just a rock: The importance of systematically integrating orphaned collections

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ABSTRACT. The Smithsonian Institution's National Museum of Natural History (NMNH) Department of Mineral Sciences' Rock & Ore Collection was offered 20,000 samples related to teaching collections and 174 graduate theses from Princeton University's Geology Department in 2009. The collections were heavily culled and 101 theses were accepted along with nine additional lots of teaching collections. In 2013, Collections Program Technicians (CPT) organized the samples within each thesis by collector's field number, and scanned the corresponding paper for reference to the sample in order to further cull the collection at the specimen level. Any rock that did not have a sample label or was not referenced in a thesis was donated to NMNH's Education and Outreach Collection or discarded. A total of 7,854 documented rocks, powders, and thin sections were accessioned, assigned a catalog number, and curated into the museum collections database, allowing for immediate research opportunities. When integrating orphaned collections, it is important to determine if a given sample has enough associated information, such as identification, precise locality, or formation name, before incorporating it into a permanent collection. If the entire collection had been kept and cataloged without systematic high-grading, there would have been a significant increase in time, storage space, and funding needed to sustain the collection with little to no gain for scientific research.

ORAL PRESENTATION

An International Conversation on Mobilizing Natural History Collections Data and Integrating Data for Research (iDigBio Symposium)

Paleontologic collection data in the broader context of paleontologic research data systems

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ABSTRACT. Paleontologic fossil occurrence information is stored in both collection and research databases. The former are mostly only accessible at institutional websites as existing (biodiversity) portals like GBIF do not adequately support the essential geologic information component of paleontologic records (geologic age and stratigraphic context). Research database projects have, by contrast, long been widely used in paleontology, and include the Paleobiology Database, the Geobiodiversity Database, NSB (Neptune), Neotoma, NOW; and other types of databases e.g. numerous clade specific taxonomic catalogs, image and phylogenetics repositories. These data are normally integrated with geoscience data for analyses, often from archives like NGDC or Pangea. Although there is substantial interest in networking collection databases to improve internal content, and in using collection databases in research, several requirements must first be met: unified data exchange standards, suited also for earth science (which require improved ontologies and vocabularies for geologic data) and methods to deal with the differences in data quality (research databases mostly contain vetted, published data, while collection databases contain a wide mixture of information, partially in need of major revision or filtering).

MAIN TEXT. Putting collection data on the internet, and providing systems that network and integrate these data are major themes in collection management. In addition to improving access to collection objects, such data can be used in their own right for analyses. GBIF, which synthesizes both collection and other (survey) data about biologic material, is a good example, being frequently used to create summary distribution information for living taxa. Other systems for distributional data have been created, such as the Ocean Biogeographic Information System (OBIS: www.iobis.org), which synthesizes (mostly published) survey data for marine organisms. Paleontology has also largely developed different data systems. Paleontologic collection data has not traditionally been widely available outside of individual institutional websites as global integrators such as GBIF (www.gbif.org) have not provided access to the geologic data (e.g. geologic age and paleoenvironmental context) that form essential parts of the information for any paleontologic object. Paleontologists have also long focussed their efforts to synthesizing published data, which is generally of higher quality, having been vetted during the publishing process. Global databases were begun in the 1970s, and several large occurrence database systems now exist, including the Paleobiology Database (PBDB: http://www.paleodb.org), Neotoma (http://www.neotomadb.org), NOW, the Geobiodiversity Database (GBDB: http://www.geobiodiversity.com) [all primarily for shallow-water marine or terrestrial fossils] and the Neptune database (current version: NSB: http://www.nsb-mfn-berlin.de) for deep-sea marine microfossils. Recently, new collection database portals that report simple geologic information for fossil records have been created as well: iDigBio for North American, and GeoCase for European collections (http://www.idigbio.org; http://www.geocase.eu). Given however the existence of well established paleontologic literature-based research occurrence database systems, a challenge is how to best integrate these emergent paleontologic collection data portals with this established, literature-based occurrence data infrastructure. A particular issue will be how to deal with the differences in data quality. Both literature and collection databases also need to be better networked to complementary information, such as the numerous community-run catalogs for taxonomic groups, plus the large volumes of paleoenvironmental data stored in online archives such as Pangea, or NGDC at NCEI (http://www.pangea.de; http://www.ngdc.noaa.gov). For this latter goal, more work is needed on ontologies and controlled vocabularies for paleontologically relevant geologic data, e.g. stratigraphy and paleoenvironment, which are mostly still standardized only at national levels. These newer concepts also needed to be added to data exchange standards, e.g. Darwin Core (v. 1.4) and the EFG extension to ABCD. Lastly, the in-between nature of the needed work means that finding resources may be difficult, as existing funding agencies mostly tend to support one or the other domain (collection management or basic research; and either biology or earth sciences). Despite these challenges, this work should be pursued as the potential contribution to science is substantial: larger scale, higher resolution, more accurate studies of fossil distributions in time and space, as well as better access to the world's repositories of fossil specimens.

POSTER

Other topics

Palms and Carl von Martius in the Botanic Garden Meise

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ABSTRACT. Palms are a family of superlatives: they claim the largest leaf, stem, inflorescence and seed. They are outstanding too in the Botanic Garden Meise, which has the privilege to possess the precious palm collection of Carl von Martius, mainly consisting of his original herbaria, as well as his fruits, seeds, fibers, waxes and resins in glass jars. He is renowned as author of the magisterial *Historia Naturalis Palmarum*, published between 1823 and 1850, being the first botanical classification of the then known 600 palm species. In 2015 all the non-herbarium material of palms, c. 550 specimens, was rehabilitated. Half of it belongs to von Martius; the other specimens mainly originate from the French colonies (dating back to 1878) and from Africa. Remarkable specimens and economically important species are i.a. betel nuts, piassava fibers, vegetable hair, coir and copra, dragon blood, sago, vegetable ivory, carnauba candles, and even a rosary and the legendary 'coco-de-mer'. This collection is not only an important historic and scientific collection but it is also an exceptional and beautiful tool to illustrate the palms for a broad public.

MAIN TEXT. In the world of plants palms are a family of superlatives: they claim the largest leaf (*Raphia regalis*), the longest unbranched stem (rattan), the largest inflorescence (*Corypha umbraculifera*) and the biggest seed (*Lodoicea maldivica*). In addition, palms are one of the three economically most important families, next to legumes and grasses. They currently represent 2522 species.

Palms are outstanding too in the herbarium collections of the Botanic Garden Meise. The Garden has the privilege to possess the precious palm material from Carl von Martius. It mainly consists of his herbaria in the original, big sized boxes. The related and more space taking fruits, seeds, fibers, waxes and resins are enclosed in glass jars, counting 300 specimens and

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forming part of the Cabinet of Botanical Curiosities. Carl von Martius is renowned as author of the magisterial *Historia Naturalis Palmarum*, published between 1823 and 1850. It is the first botanical classification of the then known 600 palm species. Many of the palm genus names take us back to contributors and contemporaries of von Martius: *Johannesteijsmannia* (named after Johannes Teijsmann, director of 's Lands Plantentuin in Buitenzorg, now Bogor, Java), *Leopoldinia* (named after Maria Leopoldina, daughter of King Maximilian I of Bavaria), *Maximiliana* (named after Prince Maximilian von Wied-Neuwied, German botanist in Brazil and North America), *Orania* (named after William of Nassau, Prince of Orange and Crown Prince of the Netherlands), *Orbignya* (named after Alcide d'Orbigny, French naturalist and collector of 10000 South American specimens) and *Verschaffeltia* (named after Ambroise Verschaffelt, Belgian horticulturist in Ghent and founder of the journal *L'Illustration Horticole*).
In 2015 all the non-herbarium material of palms in jars and in cardboard boxes was rehabilitated. The specimens were cleaned, the original labels were decoded and safeguarded, and links with manuscripts were assayed as far as possible to complete the data, which then were introduced in the database.
Unique are a number of authentic jars of thin glass of von Martius, with cork stopper and double numbering which can be traced in his *Synopsis* of the *Historia Naturalis Palmarum*! Some specimens even go back to his expedition to Brazil (1817-1820) with the zoologist Johann von Spix, commissioned by King Maximilian I of Bavaria.
Apart from the palm material from von Martius, a significant number of specimens originate from former colonies of France (19th century), i.a. French Guiana, India, Cochinchina and Reunion, and from D.R. Congo (20th century) via the Colonial Garden in Brussels or collected by Belgian botanists and co-operators in DR Congo. Globally this collection contains c. 670 specimens of palms from all over the world. A lot of specimens reflect the economic value of palms since the 19th century.
Best known from *Areca catechu* is the stimulating and red tanning masticatory called 'betel nut'. It is prepared from its seeds, cut into pieces when young and tender or boiled in water, with i.a. slaked lime and wrapped in a leaf of Piper betle. Various specimens show ruminate seeds, entire or sliced, and particles or clumps of processed material.
An important palm fiber is piassava, once used in the manufacture of cordage for anchoring vessels or tying elephants, and still used for making bristles and brushes, even for rotating sweeping vehicles. This strong fiber, appointed as from Bahia, from Pará and from Ceylon, originates from different genera, being respectively *Attalea funifera*, *Leopoldinia piassava* and *Caryota urens*. Fiber samples of the three of them are present in the collection.
Another noteworthy palm fiber is vegetable hair, which is used in upholstery. It consists in knotted, leaf sheat fibers, dyed or not, derived from *Oncosperma filamentosa* (Cochinchina) and *Chamaerops humilis* (Algeria).
From coir, the husk fiber of *Cocos nucifera* fruits, different qualities of Sri Lankan bristle fiber are shown.
A precious Arab rosary, made from seeds of *Chamaerops humilis*, belongs to the von Martius collection.
Copra, which is the endosperm of the *Cocos nucifera* seeds, yields coconut fat and oil, used in cooking, cosmetics and industry. Several specimens illustrate the innovative London Price's Patent Candle Company, who first used copra oil and refined it to stearine, obtaining candles burning bright and without smoke or smell.
Palm oil and palm kernel oil, extracted from the seeds of the West African *Elaeis guineensis*, is used in food and cosmetics. Samples come from the Colonial Garden in Brussels and from Price's Patent Candle Company, who processed it as second, overlooked, tropical product after copra oil.
Asian dragon blood is a resin appearing on immature fruits of *Daemonorops draco*. Formerly it has been used in medicine and as a dye in ancient lacquer. Appealing specimens from famous collectors, such as von Martius, the Antwerp Rigouts family and Sloane (foundation of the British Museum), show dragon blood in varying shapes, wrapped and tied with vegetable material.
Sago originates from the pith of *Metroxylon sago*. Sago is demonstrated in different forms: cake, pearls, grains and powder.
Vegetable ivory is the hard endosperm of various palm seeds, which can be treated just as ivory. Best known are the carvings from the tagua nut of the South American *Phytelephas macrocarpa*. But most interesting is a demo box of buttons made from the African mabondo nuts of *Sclerosperma mannii* and sampled by Kinds, the director of the former Colonial Garden in Brussels.

Carnauba wax is made up of particles from the dried leaves of the Brazilian *Copernicia prunifera*. The 'queen of waxes' (highest melting point) is used in the manufacture of candles, polish, cosmetics and pill coatings. Specimens of the de Macedo, who did the earliest research on it, enrich the collection.
The woody-like material of palm stems varies widely. In the case of *Borassus* species, the pattern is striking.
The legendary 'coco-de-mer' or double coconut of *Lodoicea maldivica* is not lacking. Rough seeds as well as polished ones are traded; divided into halves, they are used as plates. The genus name was chosen to honor Louis XV of France, the species epithet refers to its bizarre fruits first seen drifting ashore the beaches of the Maldives.

POSTER

Other topics

Needle felting fills: Creating fills for areas of fur loss using needle felting as a technique

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ABSTRACT. A ring tailed lemur was the subject of extreme pest damage caused by clothes webbing moths. The extent of the damage had led to the specimen suffering from areas of complete fur loss leading to large areas of exposed skin. As well as leaving the object fragile and causing instability to the rest of the fur. The fills needed to be ethical, reversible and non-invasive, causing no further damage to the already fragile specimen. The poster will provide a detailed overview of the techniques used for the treatment of the specimen as well as a guide on how to create needle felted fills using the specimens own fur.

Figure 1 / left. Before Treatment
Figure 2 / right. After Treatment with Needle Felted Fills

POSTER

An International Conversation on Mobilizing Natural History Collections Data and Integrating Data for Research (iDigBio Symposium)

Digitization Status of the East African Herbarium

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ABSTRACT. The East African herbarium established in 1902 preserves over one million collections of plants and several thousands of algae and fungi. The collection has been instrumental in support of the revision of Flora of Tropical East Africa. The FTEA in form of 263 fascicles is among the few comprehensive taxonomic revisions in the world. Digitisation of the collections started in early 1990s based on Access software and later in Botanical Research and Herbarium Management System. Although still incomplete, the database estimated to be 208000 specimens has been used to establish a National Biodiversity Atlas indicating new species hotspots. It has also been useful in modelling environmental indicator species to inform the future distribution in the face of climate change. This review gives the status of digitization at EA, database types, taxa selection criteria, data applications and challenges.

ORAL PRESENTATION

Digitization and imaging collections: new methods, ideas, and uses

Frank discussion of small herbarium digitization options for the lost, confused, weary, under-budgeted, and over-stimulated

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ABSTRACT. From experience, we realize that the overwhelm of beginning a digitization effort in a small herbarium largely stems from not knowing where to start and not clearly understanding how to sort out the litany of options available. Moreover, price of a reliable set-up may also seem like an insurmountable impediment. In many situations, herbaria have supplies that can be repurposed for digitization that will help keep start-up costs low. If nothing is available, we suggest a complete system for as low as $2500 USD. If more resources can be used, a top-of-the line computer, camera, lighting system, external hard drive, copy stand, barcode scanner, barcode labels, color separation guide, and accessories can be purchased for $10,000 USD. We recommend using image capture software that comes complimentary with the camera and free database platforms for label data. We will discuss practical aspects of image and data capture and storage including selecting the appropriate camera, lens, lighting, accessories, image processing, database, and data storage options. We will also address student worker productivity, satisfaction, and learning opportunities. Specimen digitization and data sharing are viable and necessary for small collections with limited resources.

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ORAL PRESENTATION

Collections for the future – future of collections

Small herbaria as repositories for invasive species and federal noxious weed vouchers in collaborative research

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ABSTRACT. To handle complex questions, scientific research is continuing to become increasingly collaborative. Research conducted with the Port of Savannah, Georgia, USA, intercepted propagules of non-native plant species hitchhiking on refrigerated shipping containers. We hypothesized that these shipping containers may be vectors of small-fruited invasive species entry into the USA. We sampled 331 containers transporting Peru Sweet Onions over a six-month shipping season, resulting in the capture of thousands of non-native propagules. We also conducted a preliminary survey of vascular plants in green spaces and waste areas on port property. The Arkansas State University Herbarium (STAR) serves as the primary repository for vouchers collected for this project, including plants collected from the port, ungerminated fruit/seed propagules, and plants grown under controlled conditions from the intercepted fruits. At STAR, plants are morphologically identified and made accessible on an online database. The Columbus State University Herbarium hosts duplicate specimens and DNA barcodes the vouchers. The USDA-Forest Service Research & Development leads project logistics, counts and sorts seeds, germinates propagules, and models introduction and risk. This project is a great example of interagency collaboration and the role small collections may play as leaders in global plant species identification and voucher deposition.

ORAL PRESENTATION

An International Conversation on Mobilizing Natural History Collections Data and Integrating Data for Research (iDigBio Symposium)

How digitization helped tame the Tully monster

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ABSTRACT. The Tully monster (*Tullimonstrum gregarium*) is a problematic fossil known only from the Carboniferous (Pennsylvanian, Moscovian) Francis Creek Shale Member of the Carbondale Formation of northeastern Illinois, USA. Since it was first described in 1966 scientists have assigned it to various phyla including: Mollusca, Annelida, and Chordata. In 2015 Yale University scientists, teaming up with Field Museum and Argonne National Laboratories scientists, examined over 1200 Tully monster specimens from the Field Museum's collections and used new technology to find clues from these specimens to solve this 50-year old mystery. To help locate specimens efficiently, 1305 Tully monster specimens were digitized in three weeks, creating a total of 4441 images including images of each part and counterpart in low-angle and cross-polarized light. The file naming protocol developed for this project allowed us to tag each image with the lighting used and morphological characters present in the specimen. The images along with their morphology tags were batch uploaded to our EMu database. Our specimens were now searchable by their morphology traits, which allowed researchers to quickly and efficiently locate specimens for their study.

INTRODUCTION. The Pennsylvanian (Moscovian) Francis Creek Shale Member of the Carbondale Formation is a world-renowned Lagerstätte (Baird, 1997a). The shale preserves two faunas in the Mazon Creek region (Baird, 1979). In the northern area a swampy coal forest was home to the terrestrial and freshwater Braidwood Fauna consisting of plants, insects and freshwater vertebrates and invertebrate fossils (Baird, 1997a). To the south a brackish water estuary was home to the marine Essex Fauna consisting of a variety of marine invertebrates including: scyphozoans, polychaetes, echiuroid worms, crustaceans, bivalves, holothurians, and Tully monsters (Johnson and Richardson, 1969; Baird, 1997a). Pulses of mud, perhaps generated from large storms, washed across the bay, burying these animals (Baird, 1997b). Iron and other minerals in the sediment concentrated around the buried animals, preserving them in siderite nodules.

In 1958 Francis Tully, an amateur fossil collector, brought a strange fossil to the Field Museum for identification. Dr. Eugene Richardson, a curator at the Field Museum, studied the fossil, but was unable to place it taxonomically. In 1966 he published a paper describing the fossil and named it *Tullimonstrum gregarium* - the common Tully monster - in honor of its discoverer (Richardson, 1966).

The Tully monster is found nowhere else in the world and has a unique set of traits that scientists have been unable to assign to any known group of animals. In the past the Tully has been assigned to many different animal groups including heteropod gastropods (Foster, 1979), annelids (Johnson and Richardson, 1969), and chordates (Beall, 1991).

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Yale University scientists teamed up with scientists from the Field Museum and Argonne National Laboratories to try and solve this 50-year old mystery. The scientists examined over 1300 Tully monster specimens from the Field Museum's collections and used new technology to find clues to determine what exactly is a Tully monster (McCoy et al., 2016). Tully monster fossils were examined with synchrotron X-rays at Argonne National Laboratories to look for trace elements and hidden morphologies A scanning electron microscope was used to generate elemental maps of Tully monsters to tease out any preservational features they may share with other fossils and many specimens were examined and measured to discover morphological traits to be included in a phylogenetic analysis (McCoy et al., 2016).

METHODS. A three-week project was implemented to photograph the entire 1800-specimen collection of Tully monster fossils at the Field Museum. Each part and counterpart was photographed in low-angle and cross-polarized light. Originally we had hoped to take one photograph for each specimen, including part and counterpart in the same image. Experimenting with this approach we discovered, due to differences in thickness of the parts and counterparts and size of the specimens, that individual photographs for each part and counterpart would produce better images. This decision resulted in nearly double the number of images produced for the project (not all specimens had a counterpart) and also increased the time needed to finish. This meant that only 1305 specimens out of 1873 specimens were imaged. Since few Tully monster specimens are complete a file naming protocol was developed that included morphologic characters of the specimen to help facilitate researchers locating specimens that were of interest to them. The file naming protocol used the specimen's catalog number along with two keys: one to identify cross-polarized from non-polarized images and a second key to identify which morphologic parts were preserved in each Tully monster specimen. Cross-polarized images were assigned a "_p". After the "_p" a hyphen was inserted and then one-word descriptions of Tully monster's key morphologic traits were added separated by hyphens. Key traits were: claw, stylets, proboscis, bar, eye, body, stripes, and tail (**Figure 1**). An example of an image name is PE44975B_p-body-bar-stripes.jpg.

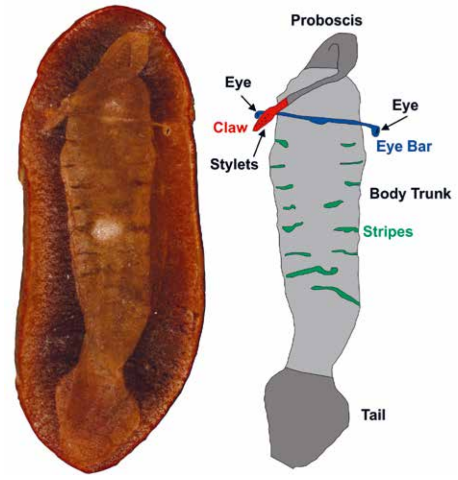

Figure 1. *Tullimonstrum gregarium* specimen (Holotype, FMNH PE 10504) with sketch illustrating morphological traits (claw, stylets, proboscis, body trunk, eye bar, eyes, stripes and tail) coded into image file name and uploaded to searchable database fields.

The name of each image was then copied into a spreadsheet and the cross-polarized key and morphology key were separated and added into their appropriate fields using find-and-replace and text-to-column commands. The spreadsheets were then used to batch upload the data to the database. The image files along with the morphology traits were added to keywords in the multimedia module allowing individual images to be searched. The images were then linked to their existing catalog entries and the morphology terms were added to the morphology field in the catalog module allowing catalog searches for morphology traits. The Tully monsters are arranged in storage by their catalog numbers making it easy to find a specific specimen from its catalog number.

	Stylets	Claw	Proboscis	Eyes	Bar	Body	Stripes	Tail
Images Tagged	52	145	463	863	1802	3116	553	965
Number of Specimens	14	45	131	241	499	856	155	291
Percentage in Collection	1.1%	3.5%	10%	18.5%	38.3%	65.6%	11.9%	22.3%

Table 1. Total number of images tagged with each morphological trait and the number of cataloged specimens that these images were assigned to in the database, and the percentage of these in the collection.database fields.

RESULTS. During the three weeks, 1305 specimens were photographed generating 4441 images. Table 1 lists the number of images tagged with the morphologic traits and the number of catalog specimens that these images were linked to in the database. All images were uploaded to our EMu database and are searchable by their morphological traits. The remaining 568 specimens are being photographed by volunteers and will be added to the database when finished. Specimens with key traits such as stylets and claws make up only 1.1% and 3.5% respectively of our collection. The ability to locate specimens with these specific morphologic

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traits allowed the researchers during the 2015 project (McCoy et al., 2016) to start work almost immediately upon arrival instead of having to spend valuable time searching through the Field Museum's collection

ACKNOWLEDGMENTS. I would like to thank N. Karpus who photographed and coded most of the specimens. I would also like to thank S. Lidgard, V. McCoy, S. Grant, K, Webbink, M. Lambruschi, E. Zeiger and W. Stanley who helped make this project possible.

REFERENCES

Baird, G. C. 1979. Lithology and Fossil Distribution, Francis Creek Shale In Northeastern Illinois, in Mazon Creek Fossils. Ed. Matthew H. Nitecki. Pages 41-67.
Baird, G. C. 1997a. Fossil distribution and fossil association, Pp.21-26. In Richardson's Guide to the Fossil Fauna of Mazon Creek (Shabica, C. W., Hay, A. A. eds.) Northeastern Illinois University, Chicago.
Baird, G.C. 1997b. Paleoenvironmental setting of the Mazon Creek biota, p.35-51. In Richardson's Guide to the Fossil Fauna of Mazon Creek (Shabica, C. W., Hay, A. A. eds.) Northeastern Illinois University, Chicago.
Beall, B.S. 1991. The Tully monster and a new approach to analyzing problematica. Pp. 271-285 In The Early Evolution of Metazoa and Significance of Problematic Taxa (A.M. Simonetta and S. C. Morris eds.) Cambridge University Press, Cambridge.
Foster, M. W. 1979. A Reappraisal of Tullimonstrum gregarium. Pp. 269-301, in: Mazon Creek Fossils (M. H. Nitecki, ed.)
Johnson, R.G. and E.S. Richardson. 1969. Pennsylvanian Invertebrates of the Mazon Creek Area, Illinois: the Morphology and Affinities of Tullimonstrum. Fieldiana: Geology 12: 119-149.
McCoy, V. E., E. E. Saupe, J. C. Lamsdell, L. G. Tarhan, S. McMahon, S. Lidgard, P. Mayer, C. D. Whalen, C. Soriano, L. Finney, S. Vogt, E. G. Clark, R. P. Anderson, H. Petermann, E. R. Locatelli & D. E. G. Briggs. 2016. The Tully Monster is a Vertebrate. Nature. in press.
Richardson, E.S., Jr. 1966. Worm-like Fossil from the Pennsylvanian of Illinois. Science 151 (3706): 75–76.

ORAL PRESENTATION

DemoCamp

Using YesWorkflow to explore the results of cleaning a dataset using a script

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ABSTRACT. Data cleaning is essential for curating datasets describing natural science collections and for preparing datasets for investigating specific research questions. Data cleaning programs variously can flag suspect records, replace fields in the original records with standardized or corrected values, and remove records that cannot be corrected automatically. In all cases a collection manager or researcher cleaning data must be able to review the results generated by the program(s). Scripts, written for example in Python, are broadly used for data cleaning tasks, and an aim of the Kurator project is to make it easier to use these scripts to clean biodiversity records. Here we demonstrate how the YesWorkflow toolkit developed by the Kurator team facilitates exploration of the results of running a data cleaning script on a biodiversity dataset. Using log files easily written by such scripts, YesWorkflow can reveal which fields in particular records were marked as suspect and why, which of these fields were corrected, and what records were removed. YesWorkflow depends on annotations made in comments in a script, and we will highlight how these annotations enable interpreting and querying log files in terms of the structure of the script itself.

MAIN TEXT. YesWorkflow (YW) is a toolkit for researchers who process scientific data using scripts written in Python, R, Bash and other languages. YW aims to provide these researchers with many of the benefits of scientific workflow management systems without requiring them to use a different programming language or to rewrite their scripts using a special-purpose framework. Instead, YesWorkflow depends on script authors embedding within the comments of their script special annotations recognized by YW. These annotations declare the scientifically meaningful operations or steps performed by different parts of the script, and the paths by which scientific data flows through these steps when the script is run.

By analyzing the YW annotations in a script, YesWorkflow can reveal the 'prospective provenance' of the results the script will produce when executed. In other words, YesWorkflow makes it easy to see what data will be produced by a script, how these outputs will depend on the inputs to the script, and what intermediate data will be produced by individual steps of the script. YesWorkflow can render prospective provenance graphically to yield visualizations of scripts similar to the typical depictions of workflows supported by Kepler, Taverna, Galaxy and other scientific workflow management systems. YesWorkflow also can answer interactive queries about a script such as "Which steps in the script are affected by the value for this parameter?"

YesWorkflow further aims to reveal the 'retrospective provenance' of data produced by a run of a script. In contrast to prospective provenance which predicts how data will be produced during a script run that has not yet occurred, retrospective provenance is the actual computational history of data produced during a script run. Scientific workflow management systems such as Kepler provide retrospective provenance capabilities by actively recording the computational events that yield a final data product. YesWorkflow provides no run-time provenance recorder. Instead, YesWorkflow reconstructs retrospective provenance using the YW annotations it finds in the script in conjunction with the data, metadata, log files, and other artifacts actually produced by a particular run of the script. YesWorkflow enables graphical renderings and interactive queries of retrospective provenance analogous to those it provides for exploring prospective provenance.

In this demonstration we show how YesWorkflow retrospective provenance reconstructions can assist authors and users of scripts for cleaning biodiversity data. We present a simple data cleaning script written in Python. This script takes as input a CSV file containing occurrence records represented using Darwin Core terms; in successive steps validates the various fields of each input record; replaces nonstandard or incorrect values for particular fields when the meanings or intents of these input values are unambiguous; and optionally discards records missing values for essential fields or containing incorrect or ambiguous values for which enhancements cannot be proposed. The cleaned data set ultimately produced by the script is written to a CSV file. Each of the data validation steps in the script write key information about their operations to simple log files that are easily produced without depending on software packages specific to Python. Because the formats of these files are declared using YW annotations in the script, the structure and content of log entries is flexible and can be chosen to maximize the readability of the log files.

We then show how YesWorkflow can answer questions about the output data set, the script run, and the data validation, field updates, and record removal events that occurred during the data cleaning process. Queries will include: How many records required corrections, how many contained problematic values that could not be corrected, and how many records were removed? What are all the fields that were updated or determined to be irreparable in any record of the input data set? For a particular field what are unique values for which corrections were proposed, and the count of each across all records? What are all the records that still have problematic values in a particular field and require further attention? What standards, data sources, or validation services were used to judge the validity of values in a particular field or that provided new values for it? Which records have been updated multiple times in a script and what were those intermediate values?

Finally, we walk through one of the queries and show how YesWorkflow uses the YW annotations in the script to interpret the log entries and so produce its answers. And we end with a summary of what script authors need to do to start using YesWorkflow to facilitate review of data cleaning tasks in their work.

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REFERENCES

McPhillips, T., Song, T., Kolisnik, T., Aulenbach, S., Belhajjame, K.,Bocinsky, R.K., Cao, Y., Cheney,J., Chirigati, F., Dey, S., Freire, J., Jones, C., Hanken, J., Kintigh, K.W., Kohler, T.A., Koop, D., Macklin, J.A, Missier, P., Schildhauer, M., Schwalm, C., Wei, Y., Bieda, M., Ludäscher 2015. YesWorkflow: A User-Oriented, Language-Independent Tool for Recovering Workflow Information from Scripts. International Journal of Digital Curation 10:298-313.
McPhillips, T., Bowers, S., Belhajjame, K., Ludäscher, B. 2015. Retrospective Provenance Without a Runtime Provenance Recorder. 7th USENIX Workshop on the Theory and Practice of Provenance (TaPP'15).

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POSTER

Preventive conservation and material science

The IPM Quarantine Facilities at the NHM

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ABSTRACT. The Natural History Museum now has two IPM quarantine areas both at the main Museum building and at the offsite store building. The design of both areas provide a variety of treatments, opportunities for research in preventive conservation and the great storage capacity allows even for commercial work. The facilities allows the delivery of Museum operations in line with the institutional ethos of sustainable framework.

POSTER

Enabling Infrastructure: Future Collections, Data & Informatics (Synthesys Symposium)

AQUiLA – a platform for biodiversity data Generic data model and full-featured text search engine – a good match?

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ABSTRACT. Documentation, monitoring, designing of workflows and navigation through several data sources - this is the application area of AQUiLA. It is the digitization instrument of the Senckenberg Collections. Several biodiversity projects were already implemented in AQUiLA. AQUiLA database uses a generic data model. The design of pre-defined fields became obsolete. Fields are individually defined in a structure of tables. With the aid of a screen mask generator it is possible to design an input mask for each single collection individually. The data can be searched with the assistance of a search engine which is Lucene/Solr in AQUiLA. This full-featured text search engine allows both free-text-search as well as facetted field search. Therefore navigation through the complete data pool is possible. With an interactive interface between database and search engine, changes in the data pool are processed immediately for the search result.
With the special architecture of AQUiLA, composed of a relational database with a generic data model and search engine, which combines free-text and facetted search, collection management systems are designable for all biodiversity needs and specifications.
Almost 100 % of AQUiLA is designed with open source products.

POSTER

Enabling Infrastructure: Future Collections, Data & Informatics (Synthesys Symposium)

Test, extend and improve initial best practice for georeferencing of specimen data and also georeference your own collection data with freely accessible IT tools

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ABSTRACT. This proposed initiative of the CETAF ISTC working group wants to test, extend and improve an initial best practice for Georeferencing of Specimen data. It plans to offer CETAF collection managers the possiblity to combine georeference best practice testing with the georeferencing of own specimen collection data using freely accessible IT tools such as Google Refine. Learning by doing, help each other / help yourself, and, share your experience will be the main working principles.

POSTER

Other topics

The Value of DNA Barcoding for Collections Management

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ABSTRACT. The use of DNA barcodes in museum collections has been widely discussed as a helpful tool in species identification and subtle patterns in differentiation, but its uses as a tool in collections management is currently undervalued. Quality control: proper identification of incoming collections, detecting errors made in the field or lab, and field sampling protocols are all areas where rapid DNA barcoding of an entire incoming collection would be useful. Creating high quality extractions also benefit as backup samples and for use in loans. We present results from a survey of ca. 1700 avian tissue samples that were barcoded from the frozen tissue collections at the National Museum of Natural History including identification of problem samples.

ORAL PRESENTATION

Blending the educational resources of small and large collections for training the next generation of museum professionals (iDigBio Small Collections Symposium)

Integrating Natural History Collections into Undergraduate Education: Creating the Resources and Growing the Community

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ABSTRACT. Natural history collection specimens and associated data provide unique physical and virtual opportunities to engage students in the practice of science in authentic, place-based lessons. We will present information on how collections, and the data associated with collections, can facilitate student learning and teach valuable skill sets necessary for the 21st century workforce. The talk will highlight ongoing efforts to engage students using museum data and provide examples of current educational opportunities and existing educational modules. We will present results from recent surveys of students working in collections, collection professionals speaking to new skill sets needed for workforce training, and the collections community's insight on future directions in the use of museums in undergraduate education. We will address challenges associated with implementing natural history collection modules into undergraduate education and introduce emerging collaborative efforts to incorporate specimens and associated data into the undergraduate curriculum.

ORAL PRESENTATION

DemoCamp

Kurator: Extensible and accessible tools for quality assessment of biodiversity data

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ABSTRACT. Data quality tools are not a one-size-fits-all proposition. In the Kurator project, we are developing a suite of biodiversity data quality tools aimed at collection management specialists with little or no programming experience, database administrators and researchers with some scripting language experience, and developers. We will demonstrate a web application that provides easy access to several sets of quality control tests of natural science collections data. Moreover, it is underlain by a framework that is accessible to informatics specialists and can be extended by programmers in either Java or Python.

MAIN TEXT. In the Kurator project, we are producing semi-automated tools to support quality management of biodiversity and natural science collections data. The first of these is FP-Akka, a command line data quality application. FP-Akka supports a small set of configurable workflows to check georeferences, scientific name and authorship strings, and collecting-event dates. Present FP-Akka with a Darwin Core archive with an occurrence core, or a flat Darwin Core csv (comma separated values) file, and it produces machine-readable output that can be post-processed into a spreadsheet of human-readable results. The FP-Akka code base is in Java and uses the Akka framework to support parallel execution in workflows. FP-Akka has proven both inflexible and difficult to use for a substantial portion of the target natural science collections management audience, so we have been developing more flexible tools that can be more easily accessed.

We will present the next iteration of work on Kurator-Akka, which can be used as either a command line or a web-based Data Quality application. Kurator-Akka is designed to be accessible to non-programmer data curators through a web interface, to more advanced users through editable configuration files, and to programmers for extending functionality or developing new modules/actors. Behind the scenes, and typically invisible to users of the

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web interface, Kurator-Akka runs workflows defined in configuration files (using YAML-Yet Another Markup Language.). Workflows can invoke actors written in Java or Python, where the Kurator-Akka framework manages the data flow aspects of the workflow, allowing programmers to focus on biodiversity data quality code. A selection of pre-defined workflows, including a unique-values reporting workflow and the workflows available in FP-Akka, will be available in the Kurator-Akka web application. One of our goals is to allow users to develop data quality workflows in a drag-and-drop user interface, which behind the scenes builds YAML configuration files that can be executed through the web interface or downloaded and edited for local execution by users with some scripting language programming experience. Another goal is to enable others to write new actors (in Java or Python) that interoperate easily with the actors we provide; we further plan to provide means for sharing these actors – along with workflows that make use of them – with the community.

We will demonstrate the web user-interface of Kurator-Akka by loading a Darwin Core archive data set, selecting a workflow to run on that data set, monitoring progress of the workflow, and downloading and presenting the results. We will demonstrate data quality actors and workflows for assessing compliance with controlled vocabularies, assessing unique values (e.g., in geographic vocabulary terms) and the actors from FP-Akka.

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ORAL PRESENTATION

Enabling Infrastructure: Future Collections, Data & Informatics (Synthesys Symposium)

Error? What Error? Expectation management in reporting data quality issues to data curators

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ABSTRACT. Tools for assessing the quality of natural science collections and other biodiversity data may report that data elements do not conform to the expectations of the tests applied to the data. It is important that data curators do not take such reports at face value, but look deeper for the causes of reported issues. A reported data quality issue may lie directly in the record in question, or it may lie deeper in the process by which the record was captured, perhaps with similar effect on many other records. Alternatively, the problem may lie in a resource (such as a taxonomic authority) that was consulted by the software. Finally, the problem may lie in the data quality software itself, requiring notice to the developers. Reporting of unique problems and rich reporting of metadata describing how a data quality conclusion was reached may help data curators better understand data quality reports, how to respond to their assertions, and how to better divide them into smaller data cleanup tasks, increasing the reliability and productivity of data quality management in natural science collections.

MAIN TEXT. Tools for assessing quality aspects of natural science data are coming into widespread use. The Global Biodiversity Information Facility (GBIF), the Atlas of Living Australia (ALA), and iDigBio all run software to set quality flags on aggregated data. VertNet reports data quality to data providers, and projects such as Kurator develop data quality assessment tools that can be run by anyone at multiple points in the data life cycle. As a consequence, curators of biodiversity datasets, including the collection management staff of natural science collections, are beginning to be presented with reports concerning the quality of their data. Naive interpretation of data quality reports are likely to focus on the immediately presenting problems, which are likely to be overwhelming in number. Deeper consideration is necessary.

Data do not inherently have quality. Instead, they have quality with regard to some use or purpose. Concerns of aggregators and other consumers of primary biodiversity data may include whether the data conform to technical expectations for preparing the data for sharing via a particular standard, such as Darwin Core. Such consumers may also express concerns about Darwin Core content related to research uses of the data for the study of which organisms (identifications) occur where (georeferences) and when (collecting event dates). Reports that describe unique problems in a dataset, or examination of the first few rows of quality reports on rows in a data set, can effectively highlight things that appear to represent individual problems shared by many records, but which actually can be solved by fixing a single error elsewhere. Examples include conceptual mismatches between the original data fields and the exchange standard or errors in a taxonomic authority table.

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When a data element in a dataset does not conform to the expectations of a data quality test, and is reported as an issue in the data, the problem may, or may not, lie in the data element in question. The issue may lie, as a report will tend to suggest, in a single data record. Alternatively, the issue may stem from a problem in the process by which the data were captured, or in the software that manages the data, in which case, this one record may indicate that similar problems exist in other records. On the other hand, a data curator may examine the record in question and see no error and thereby judge the quality control software unreliable. The issue instead might lie in mismatch between a data field and the standard field in an exchange schema (e.g. from a database into Darwin Core via the GBIF Integrated Publishing Toolkit (IPT)), or in data that conforms to a local policy (e.g. types are presented under the type name, not a subsequent identification) or in the data quality software, or in the sources (e.g. nomenclators, georeferencing tools, GIS layers) that were consulted by the data quality software.

When a data quality tool reports a defect in a data record, it is important for the data curator to step away from the issue at hand and ask whether the issue is in that record, or a defect in the data quality software, or an issue in the data sources consulted. If there is indeed an issue in the record at hand, it may be fruitful for the data curator (or an informatics specialist) to examine the provenance of the record. The root problem may lie in the data management software, in a data capture process, in training of data capture personnel, or in some previous migration of the data, and many other records may be similarly affected.

A data quality tool and a data provider may have made different assumptions about the data. For example, a near shore marine sample might have a correct locality description and a georeference (latitude, longitude, datum, coordinate uncertainty), but the name of the marine water body may not have been provided in the published data, while the name of the country, primary geopolitical division (i.e. state/province) and municipality were. A person who is aware of the taxonomic context (i.e. a marine organism) and able to interpret the locality description may interpret the data as correct. Yet, a data quality control tool may have flagged the coordinate as suspect. This assertion by software could result from the coordinate plus error radius not overlapping the municipal boundary in some terrestrial GIS layer. Data quality software might assume that that marine localities include the name of a marine water body and/or a depth. An astute data curator might be able to recognize that a set of georeferenced near shore marine localities are being flagged as having problematic coordinates, but that the issue can be resolved not by fixing the (correct) coordinates, but by providing additional structured data about marine water bodies in the publication of the data. This might be an easy task (e.g. provide in Darwin Core an additional field already populated in the database), or it may spawn a large-scale data enhancement project within the institution.

When a data quality tool reports a defect with a simple flag (e.g. transposed latitude and longitude), all problems are placed into the domain of investigation by the data curator. If the data curator does not agree with the flag, there is little means for further investigation. In this case, the risk exists that the data curator may simply regard the reporting tool as unreliable and ignore its reports. If the data quality tool is able to report rich metadata about its measurements and their context, then a consumer of data quality reports will be more have a better chance of understanding the potential range of sources behind the apparent problem. In addition, filtering a data quality report on such metadata can provide a means for dividing a large report into smaller units of work. We note that metadata structures for data quality, supporting just such rich reporting, are under investigation by a Task Group in the Biodiversity Information Standards (TDWG) Data Quality Interest Group.

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M/N

ORAL PRESENTATION

Developing a global research infrastructure framework for bio-collections (Synthesys Symposium)

Building the pan-European Natural History Collections Research Infrastructure FAIR-trading. Promoting data exchange through ELIXIR Interoperability tools and services

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ABSTRACT. ELIXIR is a unique undertaking that consolidates Europe's bioinformatics resources, services, and national centres into a single, coherent infrastructure. ELIXIR explicitly supports the FAIR Principles - Findable, Accessible, Interoperable, Reusable - for its data, software, tools, events and training resources. As a distributed research infrastructure, ELIXIR is built upon the bioinformatics resources and services provided by the national ELIXIR Nodes. Computationally exposing these resources in order to make them "findable" and discoverable represents a significant challenge and encompases areas such as common API's, identifiers, meta-data standards and ontologies. One solution to this problem currently being explored by the ELIXIR Interoperability platform in collaboration with a number of international partners (US National Institutes of Health Big Data to Knowledge (BD2K), bioCADDIE, biosharing.org) is to adopt Schema.org mark-up. Here I will present how Schema.org and mark-up extensions by Bioschemas.org, could allow content providers, with relatively little effort, to structure their data in a consistent, interoperable way, and expose their data to more semantic indexing. This benefits content providers by giving them a better profile on search engine result pages (such as Google). It also benefits the life sciences community because it makes information easier to discover, contextualise, share and disseminate (Interoperable, Reusable).

POSTER

Preventive conservation and material science

Using Laponite gel for removing papyrus backings of poor quality cardboard

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ABSTRACT. Egypt is considered the true home of "papyrus paper". In Egypt, the oldest known papyrus was found, dating back to the 1st Dynasty around 3100 B.C; from Egypt papyrus writing material spread all over the Greco-Roman world; in Egypt, thanks to its dry climate, all the evidence written on papyrus has been preserved and found, with rare exceptions. Resulting from the different methods of preservation that have been used in the nineteenth century, there are many papyrus backings made of poor quality cardboard with a high acidic component and glued inadequately (with gelatine, starch glue etc.), which further enhances degradation of the papyrus .Removal of old unsuitable backings was necessary to eliminate the causes of degradation of the valuable papyrus documents, and to prevent further damage to the papyrus. For this purpose, we decided to use Laponite RD. Laponite RD is a highly-purified, synthetic silicate colloidal clay that imparts viscosity and suspension properties to various types of formulations. Laponite RD is free of crystalline silica and low in transition metals and other impurities. The technique is comparable to other aqueous techniques for the removal of pressure-sensitive old unsuitable backings from the papyrus. Mixed with water, Laponite RD is a colloidal gel with high water retention capability, and the specific mechanical properties of this gel allows the safe removal of the cardboard water-sensitive artifacts using water-based detergent systems. The removal action is limited to the contact area, and layer-by-layer removal is possible while avoiding water spreading around and absorption within water-sensitive substrates, which could lead, for example, to ink detachment. With Laponite RD is becomes possible to remove the cardboard successfully without affecting the surface of the papyrus with humidity, thus maintaining the existing text on the surface of the papyrus and the papyrus material itself. Finally, it is important to note that the technique did also stopped the stress and pressure that was caused by the cardboard backing to the papyrus.

ORAL PRESENTATION

Blending the educational resources of small and large collections for training the next generation of museum professionals (iDigBio Small Collections Symposium)

Development of a human infrastructure: SERNEC as a case study

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ABSTRACT. The SouthEast Regional Network of Expertise and Collections (SERNEC) is comprised of 233 active herbaria in 12 states in southeastern North America. The group is of interest as a case study in development of human infrastructure to generate regional scale research and teaching capabilities. The SERNEC NSF-supported Research Coordination Network (RCN) provided support from 2005-2011 for training and idea exchange among the curators in the Southeastern US. Our more recent NSF-supported Thematic Collection Network (TCN), with funding from 2014-2018 for 94 herbaria and six Information technology entities, provides us with a technical infrastructure to capture herbarium images and transfer them to various portals, where they can be transcribed and georeferenced. This effort includes Symbiota, GEOLocate, Notes from Nature, Specify and iPlant as web and software based entities that provide our "data pipeline". Our curators are engaging students in museum curation, regional systematic and ecological studies, as well as service learning opportunities. The ultimate goal of the NSF TCN effort is to use the network to link the scientific expertise of the curators with their students, affiliate users, and with the greater public through the World Wide Web, to develop a citizen science framework to accomplish regional scale research goals.

ORAL PRESENTATION

Setting global and local digitisation priorities (GBIF Symposium)

Prioritization in digitization of natural historical collections in Asia – the cases of some Asian countries

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ABSTRACT. To understand the outline and prioritization for digitization of natural history collections in Asia, we report a result of our preliminary survey of their progress in digitization. Within Asian countries, Japan, Taiwan and China are comparatively advanced in digitization of natural history collections whereas digitization in Southeast Asian countries is less progressed. In western Asia, even a census of natural history collections (how many and where) is uncertain. Results of the global survey on digitization of natural history collections by the GBIF Task Force showed that there were only 110 responses (17.8 %) from the Asian region, most likely due to language issues. In Japan, almost all of collections (97.6%) have engaged in digitization of data of their specimens. In particular, metadata of specimens of algae (97.8%), fossils of invertebrates (88.6%), and birds (78.2%) in Japan have been mostly captured in databases. Because most areas in Southeast Asia belong to the Biodiversity Hotspots, collecting, preserving and digitizating specimens from these areas is one of the Asian priorities. In addition, populating domestic and international networks with Asian collection data is also an effective first step to increasing the amount of biodiversity information from the region.

INTRODUCTION & METHODS. Nodes in Asia Region (ASEAN Centre for Biodiversity, Chinese Academy of Science, Taiwan, India, Indonesia, International Centre for Integrated Mountain Development, Japan, South Korea, Pakistan, Philippine) in the Global Biodiversity Information Facility (GBIF) have engaged in various activities (e.g., updating species checklist at national level and building network of data holders and providers) to increase the amount of biodiversity information/data in the region.
In the context of the Task Force (TF) for Accelerating Digitization of Natural Historical Collection (ADNHC) in GBIF, we implemented a preliminary survey using questionnaires prepared by the TF. To facilitate the response within Japan, the original questionnaires in English were translated to Japanese, but the questionnaires were distributed in English to other Asian countries, leaving the treatment to them. The email responses were collected in 30 days. Because the launch of the questionnaires was delayed in some Asian countries, responses from those countries have not yet been completed.
Here, we report results of a preliminary survey, utilizing a network within Japan, and GBIF Asian Nodes, on the state of digitization of Asian natural history collections.

RESULTS. Within Asian countries, natural history collections in Japan, Taiwan and China are comparatively well digitized. On the other hand, digitization of the collections in Southeast Asian countries has not comparatively progressed. In West Asia, even a census of natural history collections is uncertain.
Results of the global survey on digitization of natural history collections by GBIF Task Force on Accelerating the Discovery of Natural Historical Collection showed that there were 110 responses (17.8 %) from Asian region, of which 85 (72.3 %) were from Japan.
Responses from Japan showed that arthropod and vascular plant collections are popular in Japan, with 40 and 33 collections, respectively, being housed within 51 museums/institutions. Concerning size of collections in Japan, there are about 4.6, 3.7 and 3.5 million specimens (or lots) of arthropods, vascular plants and fishes, respectively, while there are only ca. 18,800 and 37,000 specimens (or lots) of reptiles and amphibians, and birds, respectively. In Japan, 83 of 85 collections (97.6%) have engaged in digitization of data of their collections (i.e., metadata and digital image of physical specimen). In particular, metadata of specimens of algae (97.8%), fossils of invertebrates (88.6%), and birds (78.2%) have been mostly captured in databases. On the other hand, metadata of specimens of arthropods (27.7%), vascular plants (39.8%) and fishes (54.7%) have not been mostly captured in databases.

DISCUSSION & CONCLUSIONS. Within Asian countries, Japan, Taiwan and China are comparatively advanced in digitization of natural history collections because of considerable effort of researchers and curators, and funding to support digitization. In western Asia, even in a basic census of natural history collections by type, size and location is uncertain owing to lack of a network with the region.
The fewer responses to the English questionnaires from Asian countries (17.8%) is most likely due to language issues, i.e., it is a region with multiple languages and few English speakers. Nevertheless, the survey revealed that digitization of specimen data is one of the priorities at a number of important institutions in Asia.

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The high number of responses from Japan (72.3 % from Asia) was due to the translation of the survey into Japanese, as well as utilizing a domestic network of natural history museums, Science Museum Net that includes local and university museums.
Although most of the areas of Southeast Asia are identified as the Biodiversity Hotspots (Myers, 1988; Myers et al., 2000), digitization of natural history collections in this area has not comparatively progressed. Thus, collecting and curating specimens from this area and digitization of the data is a high priority within Asia.

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REFERENCES

Myers, N. 1988. Threatened biotas: "hot spots" in tropical forests. Environmentalist 8(3): 187-208.
Myers, N., R. A. Mittermeier, C. G. Mittermeier, G. A. B. da Fonseca, & J. Kent. 2000. Biodiversity hotspots for conservation priorities. Nature 403:853-858.

ORAL PRESENTATION

Blending the educational resources of small and large collections for training the next generation of museum professionals (iDigBio Small Collections Symposium)

Preservation of natural history collections through student engagement: the internship experience at Rancho Santa Ana Botanic Garden

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ABSTRACT. Preparing the next generation of natural history collections professionals is increasingly important as natural history collections serve expanding needs for research, education, and conservation management. Educating young people about the value of plants, biodiversity, and natural history collections is a critical component of Rancho Santa Ana Botanic Garden's (RSABG) efforts. The Herbarium at RSABG, which houses more than 1.2 million vascular plant specimens, plays major roles in education and training students at different levels in their academic career. Serving the Greater Los Angeles metropolitan area, RSABG has a long-standing and successful summer undergraduate internship program in herbarium collections management and applied plant conservation, and has provided training to more than 40 undergraduate interns over the last five years. Through hands-on experimental learning, interns acquire new skills in curation and digitization, and importantly, are exposed to career possibilities in the plant sciences and natural history collections. This presentation highlights the undergraduate internship program at RSABG, with emphases on training in herbarium curation techniques and digitization, student recruitment, and new approaches to enhance the internship experience.

MAIN TEXT. Preparing the next generation of natural history collections professionals is increasingly important as natural history collections serve expanding needs for research, education, and conservation management. Rancho Santa Ana Botanic Garden (RSABG), located in southern California, is committed to botanical education and expanding capacity to prepare, train, and educate the next generation of plant scientists and natural history collections professionals. The Herbarium at RSABG, which houses more than 1.2 million vascular plant specimens, plays a major role in education and training, with emphases on the graduate program in botany, but also extends to undergraduate courses, high school and middle school programs, and internships. RSABG has a long-standing and successful undergraduate summer internship program in herbarium curation and applied plant conservation. Providing training to over 40 interns over the last five years (50% of whom were drawn from underserved groups) RSABG's program provides hands-on training in botany, conservation, and herbarium curation techniques. In the Herbarium interns have participated in several digitization and collection improvement projects, including databasing California specimens for the Consortium of California Herbaria; digitizing the collections of Marcus E. Jones, one of the most prominent botanists of the American west; and curating one of the Herbarium's ancillary collections, the cone and fruit collection. Last year RSABG expanded the internship program to incorporate six presentation and workshop style training sessions on a diverse range of plant science topics including collections management, conservation botany, and biodiversity, with an emphasis on California's plant diversity. The program culminated with a roundtable discussion on career paths and continues education opportunities with participation from students in RSABG's graduate program in botany, among other professionals in the field.

Figure 1. Undergraduate intern learns to mount plant specimens in the Herbarium at Rancho Santa Ana Botanic Garden.

We have maintained relationships with many of our past interns and at least half (54%) of them have found employment or are continuing on with their education in fields related to plant biology, natural history, conservation, and collections management. Our recruitment efforts are in large part coordinated through established relationships with STEM program coordinators, biology professors, and career counselors at colleges and universities in southern California. As our aim is also to encourage greater diversity in professions related to collections management and plant conservation, recruitment efforts are targeted to provide opportunities for underserved youth through our long-established partnerships with Hispanic Serving Institutions in the Greater Los Angeles metropolitan area, including Citrus College; California State Polytechnic University, Pomona; and California State University, San Bernardino.

POSTER

Preventive conservation and material science

Comparison of two lid types for museum fluid collections

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ABSTRACT. Recently we discovered that formalin off-gassing in our fluids collections was well above OSHA safety levels (2.0 ppm). Nearly all our lids were of the Bakelite variety and after investigation we felt that rehousing with polypropylene lids with polyethylene liners (Kols) was the resolution. When requesting funds from our university for this purpose, we were asked for data-based evidence for our solution and found none. Several publications suggest the efficacy of Kols lids (other characteristics support their superiority over Bakelites) but no supporting published quantitative data exist. We therefore conducted an experiment to compare Bakelite and Kols lids in their ability to retain formalin fumes. We also conducted the experiment in two environmental conditions, an HVAC-controlled and a non-HVAC controlled room. We found that Kols lids are superior to Bakelite in keeping off-gassing well under OSHA safety levels, although the difference was statistically significant only in non-HVAC conditions. We believe this is due to the greater air exchange rate in the HVAC controlled room, but we discuss other possible explanations. Bakelites are inferior lids for many reasons, and our results support this concept by showing quantitatively the superiority of Kols lids.

ORAL PRESENTATION

Digitization and imaging collections: new methods, ideas, and uses

Digitization in the office of the registrar: Saving our documents for the future

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ABSTRACT. The National Museum of Natural History (NMNH) has over 96,000 accessions files (approximately 500,000 individual documents), dating from the 1960s to the present, in addition to over 800 rolls of pre-1960s accessions on microfilm. These documents are the proof of ownership for the 145 million collections specimens in NMNH. The Office of the Registrar (OR) works with the seven collecting units to maintain and provide physical access to these files and digitization of them has become a necessary tool. Digitizing the OR has brought together a variety of collaborators, all working to make the information in the accession files more accessible. The process includes scanning and transcription of transaction index cards, creating records in the collections database and the scanning of the hardcopy ownership files. Utilizing a record management company to scan the physical files, NMNH will have all of the ownership records accessible as multipage searchable PDF/As in less than one year. The availability of digitized accession records is important to the preservation of the records and contributes to sustainable workflows for our staff, Pitfalls, obstacles and successes make this a case study for other museums, as well as for tackling addressing digitization of incoming accessions and loan documentation.

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POSTER

Collections for the future – future of collections

The type collection at the National Herbarium of Mexico (MEXU): a very dynamic and active collection

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ABSTRACT. After finishing the inventory of the type collection at the National Herbarium of Mexico (TP-MEXU), it has been possible to follow up the dynamics of this collection. The TP-MEXU collection stands out for its complex dynamics. In the past five years, the collection has grown more than 13%. The TP-MEXU collection was increased by 176 Holotypes, 516 Isotypes, 424 others, including 107 families best represented by Leguminosae, Compositae and Rubiaceae. The fact that there is an active period of descriptions of Mexican plant species, which are discovered mainly by the study of the materials deposited at MEXU, highlighting the relevance for the preservation and, at the same time, active use of Natural History Collections. The Global Plants (GP) initiative, led by the Mellon Foundation, represents a milestone for the management of the collection and for plant taxonomy in general. Although the Mellon Foundation substantially reduced support for the GP project, partners need to commit for maintaining up to date the resource currently managed by JStor; it would be ideal if several herbaria could incorporate their types to JStor Global Plants, while others, like MEXU, should incorporate data and images of type specimens that are constantly added to their collections.

POSTER

Digitization and imaging collections: new methods, ideas, and uses

Historic collections going global: Digitization at the University of Iowa Museum of Natural History

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ABSTRACT. Established in 1858, the University of Iowa Museum of Natural History has served scientific education, research, and as a repository for specimens from regional surveys and global research expeditions. A comprehensive inventory at the University of Iowa Museum of Natural History in 2008 brought collections back into focus, and funding was secured for targeted storage improvements and collection digitization projects. As a result, vertebrate and arthropod collections will make their debut on the global data scene yet this year. Our digitization efforts include transcribing existing handwritten data, photographing specimens and records, and mobilizing data, transcriptions, photos, and other information into publicly accessible databases. These projects have relied heavily on student employees and interns, but have also taken advantage of new approaches, such as crowdsourcing.

INTRODUCTION. Due to a shift in research focus on campus in the 1920s, museum collections became isolated from active campus researchers and were largely overlooked or forgotten by potential users for decades. Current staff are working to reconnect campus and global researchers with these historic collections.

Arthropod Collections at the University of Iowa Museum of Natural History (UIMNH) include original collections from entomological collecting expeditions by H. F. Wickham and Dayton Stoner in the late 1800s and early 1900s, supplemented by private collection donations from J. F. Abbott, among others. Additional collections include crayfish collected by Virgil Dowell and Gary Phillips, received from the University of Northern Iowa in 2007, and insects from the UI Biology Department in 2014. Three grants from the State Historical Society of Iowa funded cabinets and supplies for rehousing insects and crayfish and the manual transcription of original handwritten insect specimen labels. Currently, an NSF ADBC PEN grant is funding photography of arthropod collections and enabling UIMNH to connect with the existing InvertNet TCN, where over 45,000 arthropod data records will be published. An undergraduate student funded through the university's Iowa Center for Research by Undergraduates (ICRU) has georeferenced the collection and produced an interactive online map.

Figure 1. Interactive map of UIMNH arthropod collection locations

Vertebrate Collections include birds, mammals, and some fish and reptiles from university expeditions led by Charles C. Nutting and Homer R. Dill in the late 1800s and early 1900s, subsequent departmental additions to the bird collection, and private collections donated by William Temple Hornaday, Daniel H. Talbot, and John B. Bowles, among others. Currently, NSF CSBR funding is providing new cabinets on compactor carriages for rehousing the ornithological collections, which were previously located in five rooms scattered around the building, into one reorganized storage space. UIMNH is currently collaborating with the VertNet project to publish vertebrate data. Over 16,000 records are in the data migration process, with more to be added as we capture data during the collection reorganization. We will also photograph important and interesting specimens.

University of Iowa Museum of Natural History Collections	
Birds	13,811
Eggs, Nests	17,220
Mammals	5,111
Insects	44,142
Aquatic Invertebrates	43,250
Fluid-preserved (crayfish, leeches, misc.)	3,356
Cultural Objects	6,125
Total	**133,015**

Student Involvement has been key in our rehousing and digitization projects. UIMNH benefits hugely from the Museum Studies Certificate Program on campus, and supports program instruction with collection tours, education, and hands-on projects. Students complete 20-hour or 42-hour projects for class credit in some Museum Studies courses, or one to three 45-hour blocks of internship credit (three blocks of internship credit are required for the certificate program, which students may complete at a variety of organizations on or off campus). These unpaid but for-credit intern positions can be used to meet in-kind match requirements for some grants. Students may also be supported by ICRU research fellowships. The museum funds 20 hours/week of paid student collections assistant time, which is supplemented with grant-funded paid student positions whenever possible. Students have rehoused pinned insects, transcribed label data, scanned egg cards, and reorganized birds, among other useful tasks, providing them with important hands-on experience with collection materials and processes.

Public Involvement has included non-student volunteers working on collections projects, as well as a crowd-sourced transcription project through the University of Iowa Libraries' DIY History initiative. In 2015, over 1800 scanned images of egg collector cards were uploaded to the DIY History site for public transcription. 372 have been transcribed to date, by visitors to https://diyhistory.lib.uiowa.edu/collections/show/17. Once transcribed, the data for egg and nest specimens will be added to our vertebrate records and published through VertNet.

ACKNOWLEDGEMENTS

Funding was received from the State Historical Society of Iowa Historic Resource Development Program, NSF Advancing Digitization of Biological Collections Partner to Existing Network Program, NSF Collections in Support of Biological Research Program, and the Iowa Center for Research by Undergraduates. We appreciate additional support from iDigBio for workshop training, the University of Iowa Libraries Digital Research and Publishing Department, and the University of Iowa Office of the Vice President for Research and Economic Development.

O/P

ORAL PRESENTATION

Setting global and local digitisation priorities (GBIF Symposium)

The new enlightenment: digital collections and the re-invention of large natural history museums

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ABSTRACT. Many of the large natural history collections trace their origins back 200 years or more to the Enlightenment, when scientific and cultural objects were presented to expert and public audiences to inspire a new scientific understanding of the world. The way in which these collections are used has changed relatively little over that period, with experts continuing to travel around the world to view key specimens or specimens being sent out on loan to trusted institutions. A combination of digital and genomic technologies, alongside mass-participation citizen science, now promises to revolutionize this intellectual business model by making natural history collections openly available to global scientific and public audiences. This talk will review how large natural history museums are responding to this opportunity and the challenges it poses with respect to prioritization, collaboration and funding. The talk will focus in particular on the role of digital technologies in driving collaboration among institutions to promote the use of natural history collections in tackling scientific and socio-economic 'grand challenges' such as biodiversity loss, environmental change, human health and sustainable agriculture.

ORAL PRESENTATION

Blending the educational resources of small and large collections for training the next generation of museum professionals (iDigBio Small Collections Symposium)

Museum and Collections Biodiversity Informatics: Meeting skills needs for creating, sharing, and using the digital relatives of museum specimens

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ABSTRACT. We see collections today keeping track of ever-growing volumes of data in software systems. Researchers, staff, and students realize they need new skills to create, share, and use these data. What biodiversity informatics skills and knowledge are needed? The EU Collections Competencies Project attempts to provide some answers. What are museums like the Natural History Museum (NHM), learning from assessing the skills needed at their institutions? Worldwide, people are seeking workforce training for data science and data management skills. Software Carpentry (SwC), Data Carpentry (DC), and Reproducible Science Curriculum, provide short courses around the world, using materials aimed at novice and intermediate-level students. Biodiversity informatics workshops at iDigBio incorporate some of their materials.

We need to harmonize the development of museum biodiversity informatics training and implementation. This includes collating needed biodiversity informatics skills and literacy and finding or developing courses. Also, we need a way to track and offer ongoing education credits. What role does SPNHC play, with collections and other organizations such as Biodiversity Information Standards (TDWG), the Global Biodiversity Information Facility (GBIF), and iDigBio, to develop these training standards to sustain and support current and future workforce training? Where and how best to manage such a program?

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REFERENCES

Biodiversity Information Standards (TDWG) http://tdwg.org/

Data Carpentry http://www.datacarpentry.org/

EU Collections Competencies Project: Testing a European Competency Framework for VET in Collections Management http://eucolcomp.myspecies.info/

Global Biodiversity Information Facility (GBIF) http://www.gbif.org/

Integrated Digitized Biocollections (iDigBio) https://www.idigbio.org/

Koureas, D. & C. Valentine. 2015. Introducing data training programmes in large natural history museums to tackle their digital challenges. Biodiversity Information Standards (TDWG), Nairobi, Kenya.

Michonneau, F. & D. Paul. 2015. Providing Computing Skills for the Next Generation of Biodiversity Scientists. Society for the Preservation of Natural History Collections, Gainesville, FL.

Paul, D., F. Michonneau & K. Seltmann. 2015. More data than we know what to do with? Biodiversity informatics skills needs in the research data pipeline. Biodiversity Information Standards (TDWG), Nairobi, Kenya.

SPNHC 2016 – Oral and poster presentations, sorted alphabetically by first author

Reproducible Science Curriculum https://github.com/Reproducible-Science-Curriculum

Society for the Preservation of Natural History Collections (SPNHC) http://www.spnhc.org/

Software Carpentry http://software-carpentry.org/

Teal, T. K., K. A. Cranston, H. Lapp, E. White, G. Wilson, G. Ram & A. Pawlik. 2015. Data Carpentry: Workshops to Increase Data Literacy for Researchers. International Journal of Digital Curation 10(1):135-143.

ORAL PRESENTATION

Setting global and local digitisation priorities (GBIF Symposium)

A global survey of natural history collections

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ABSTRACT. Natural history collection institutions (NHCs) collectively house 2.5–3 billion specimens, documenting more than 300 years of the biological exploration of the Earth. These biocollections are critical for understanding, advancing and applying biodiversity science, but remain largely underutilized with only about 10% digitized. As part of a broader global strategy for mobilizing primary biodiversity data, GBIF convened a task force (2015–2016) to address the slow pace of NHC data capture. We conducted a global survey to gauge the digital readiness of the world's biocollections and perceived benefits of and impediments to digitization. More than 600 responses, most representing the USA, western Europe, and Japan, indicate that 14% of collections lack a digitized database, and 5% report no plans to digitize their collection. The most frequently cited benefit was increased collection use. Primary impediments included funding, time, and lack of administrative buy-in. Insufficient digitally-available collection data continues to constrain biodiversity research, policy and decision-making because current digitization efforts are driven by opportunity rather than community biodiversity priorities. The task force recommends that the data-knowledge-application value-chain framework be used in order to develop compelling business cases that can attract funding to mobilize data of strategic importance for research, policy and decision-making.

ORAL PRESENTATION

Enabling Infrastructure: Future Collections, Data & Informatics (Synthesys Symposium)

A Bridge from Enabling Infrastructure to Digitization Priorities, a view from industry

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ABSTRACT. Billions of people and things are being connected globally. Digitisation is forcing organisations and even countries to reimagine business models, products and services. Every industry, government, school system, university and hospital is grappling with how to navigate this digital transformation era to deliver the best experiences and value possible. In this context natural history collections are no exception and in this presentation we will talk about how we are developing commercial links with organisations. We will use Cisco UK's relationship with the NHM London as a specific example. Cisco UK has a strong history of fostering innovation and recently collaborated with the Museum to run a "Pit Stop" event working with small or medium sized businesses interested in developing innovative approaches to digitising scientific collections. We will discuss the Pit Stop process which was co-organised by the Digital Catapult Centre (https://www.digitalcatapultcentre.org.uk/), the potential for running similar events for other museums and large-scale projects like iDigBio and SYNTHESYS, and our vision for how Cisco and other businesses can support the digital transformation ambitions of natural history collections.

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REFERENCES

Cisco Pit Stop: Digitising the Natural History Museum's collections https://www.digitalcatapultcentre.org.uk/open-calls/cisco-pit-stop/

P

POSTER

Collections for the future – future of collections

Incorporating Genetic Sampling into a Traditional Botanical Voucher Workflow

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ABSTRACT. New molecular technologies and interest in genomic research have expanded the traditional use of natural history collections. Conventionally vouchered collections are being augmented within biorepositories, banks of preserved tissues and DNA samples that provide researchers with materials to study the diversity of life on Earth. Botany, Biorepository, and IT staffs at the Smithsonian's National Museum of Natural History have developed protocols for collecting and processing vouchered and genetic material while considering long-term care needs. Using the Department of Botany's acquistion workflow as a starting point, we will outline the procedure of obtaining collection permits, accessioning specimens, managing specimen data, and curating traditional specimens and genetic samples. This workflow development is ongoing and takes into account best practices as applied to traditional vouchers and genetic samples, and regulations relating to Access and Benefits Sharing. Working together with these stakeholders is proving to be critical in managing these collections for future use.

INTRODUCTION & METHODS. Thanks to rapidly developing molecular technologies, traditional natural history collections are increasingly being turned to as rich resources for genomics research. With the formation of the National Museum of Natural History's (NMNH) Biorepository, there is a place to store genetic samples. Staff have developed best practice guidelines as laid out in Zimkus and Ford (2014). This bank is a repository in an international network, referred to as the Global Genome Biodiversity Network (GGBN), which is dedicated to improving and providing best practices for the long-term preservation of genetic samples. A driving force for this workflow was initatied by the establishment of the Smithsonian's Global Genome Initiative (GGI). GGI is a collaborative group developed to provide support for collecting and preserving genetic data for the NMNH Biorepostory in order improve our understanding of the genomic diversity of life on Earth. GGI has funded many Botany projects, thus motivating us to produce this workflow. Because of the quantity of material being collected and the large volume of data to track, it is critical to have a procedure in place for the many parties involved with curating these samples. We will discuss the details of the workflow with an image of what the Botany Best Practice manual table of contents looks like in **Figure 1**.


Botany Best Practices (US National Herbarium)
Table of Contents
About this Training Module
Voucher Specimen Collection
What is a Voucher?
Dried Voucher Specimens
Ethanol Preserved Voucher Specimens
Genetic Sample Collection
Silica Gel Tissue Collection
How to Choose and Work with Silica Gel
How to Collect Samples into Silica Gel
Liquid Nitrogen Tissue Collection
Ethanol Tissue Collection
RNA Collection and Preservation
Samples in the NMNH Biorepository
Using the NMNH FIMS
Links and References
Appendix A: Diagrams representing Parent-Child relationships and Voucher-Exemplar relationships

Figure 1. This is an example of the Table of Contents that will be found at the beginning of the manual to direct users.

Obtaining collection permits. Each researcher must comply with any regulations set by the governing body of the collection locality. With this workflow, there are steps to take to ensure that the necessary permits are in place prior to the collecting event.
Accessioning process. Researchers will work with the collection staff to ensure that all specimens are accounted for and properly accessioned into the permanent collection. At NMNH, we use EMu, a collections management software that allows us to track acquisitions.
Managing specimen data. Each researcher will be responsible for recording the collection data electronically according to the standards set by NMNH. Researchers will be trained in using the NMNH Field Information Management System (FIMS) database to collect information in the field. This data can be easily uploaded to the cataloging system of EMu once they return. The traditional vouchers and genetic samples are linked in the catalog database.
Curating traditional specimens and genetic samples. Researchers will work with staff to prepare samples for either the herbarium or the biorepository based on clear guidelines set forth by NMNH collection and Biorepository staff. The traditional plant specimens will be prepared and placed in the herbarium, while the genetic samples will be stored in the biorepository, in either a mechanical or liquid nitrogen freezer.

DISCUSSION & CONCLUSIONS. This workflow has allowed us to develop a checklist for researchers to use when planning a collecting trip. This type of guide ensures that researchers are consistently meeting the requirements of the museum relative to field collecting and post-processing of organismal and genetic material. It also helps to facilitate a smoother, less error-prone process, in what is a program with multiple stakeholders.

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REFERENCES

EMu. KE Software. Web: http://www.kesoftware.com/. Accessed 13 March 2016.
Global Genome Biodiversity Network (GGBN). Web: http://www.ggbn.org/ggbn_portal/. Accessed 13 March 2016.
Global Genome Initiative (GGI). Web: http://ggi.si.edu/. Accessed 13 March 2016.
Zimkus, B.M. and L.S. Ford. Best Practices for Genetic Resources Associated with Natural History Collections: Recommendations for Practical Implementation. Collection Forum 2014; 28(1-2):77-112.

ORAL PRESENTATION

An International Conversation on Mobilizing Natural History Collections Data and Integrating Data for Research (iDigBio Symposium)

Lessons learnt from a herbarium specimen mass digitisation pilot

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ABSTRACT. Royal Botanic Gardens, Kew (RBGK) and Natural History Museum London (NHM) collaborated together on a pilot project to test a number of digitisation models in order to determine an optimum workflow for herbarium specimen digitisation. It was decided to trial Picturae, the third party company responsible for digitising Naturalis' entire herbarium collection. Approximately 67,000 herbarium sheets of Solanum, Dioscoreaceae (RBGK & NHM) and Hypericum (NHM only) were transported by lorry to the Netherlands in January 2015, and sheets and covers imaged using the 'digistreet' method that Picturae developed. A 'digistreet' is essentially a purpose-built conveyor belt system that minimises manual handling of fragile herbarium specimens and captures high resolution images. The use of Picturae's operation also extended to Alembo, a transcription centre established in Suriname, where information was transcribed from specimen folders and labels. All imaging was completed by March 2015 and folder and specimen transcription completed by September the same year. We will discuss the problems we overcame, the lessons learnt and the resource implications for the day to day curation of these taxonomic groups now they have been digitised.

INTRODUCTION & METHODS. The main objectives for this project were to:

- Identify digitisation challenges unique to Natural History Museum London (NHM) and Royal Botanic Gardens, Kew (RBGK) herbarium material, and develop existing Picturae processes to address them.
- Trial a collaboration between institutions as a means of sharing curatorial, research and digitisation practices.
- Assess the suitability of the Picturae process as a long-term method of high throughput digitisation and determine the most cost effective tailored workflow
- Establish costings for future mass digitisation projects.

RESULTS. All specimen sheets were successfully imaged using the conveyor belt system with more than 3,000 images produced per day. These rates far exceeded those that could be achieved in-house.

Following proper training and supervision on collection handling by Kew and NHM curators, high levels of specimen care were achieved throughout the digitisation process. Condition reporting of specimens at four separate stages showed no issues with specimen damage and the collections were successfully kept in the correct folder order.

The Picturae conveyor belt operators struggled with the identification of sheets with multiple specimens and did not barcode them appropriately. Therefore it was decided after the first few weeks of imaging that all sheets would be given a single barcode only. The transcribers also found it difficult to correctly flag sheets with multiple specimens during data entry, meaning that many multiple specimens would not have been identified in the digitisation process.

Overall the quality of label transcription was good and improved significantly as the project progressed following feedback provided by Kew and NHM staff. Use of a collaborative transcription document and weekly phone conferences facilitated transmission of information between NHM/RBGK and Picturae. It was decided to empower transcribers to carry out interpretation only within a specified narrow set of criteria and this was largely successful. This very minimal level of interpretation did result in the need for some further data enhancement and cleaning prior to the import of the data into institutional catalogues.

P/Q

DISCUSSION & CONCLUSIONS. Key recommendations and lessons learnt from the pilot were:

- Avoid off-site digitisation.
  Transportation of material to the Netherlands was particularly labour-intensive in the pre- and post-digitisation work involved (e.g. condition checking, freezing, packing of boxes). As well as curatorial staff time required to complete the additional work, the project incurred direct costs such as transportation and purchase of boxes. If the quantity of specimens to be digitised were to be increased, current freezing facilities would be inadequate and additional freezing facilities would need to be set up on site. Digitising the specimens in Amsterdam also increased the amount of risk that the collections were subjected to whilst in transit.

- Barcode all herbarium sheets in-house prior to future digitisation.
  Evaluation of the costs of the different models showed that outsourcing barcoding and the capture of the filed-under name from images of the folders was at least 50% more expensive than barcoding and capturing the filed-under name of the specimen in-house. A large proportion of the extra cost related to the expense of the in-house tidy up of multi-specimen sheets which would need to be barcoded, reimaged and labels re- transcribed.

- Invest more resource in quality assurance (QA) at the start the project.
  The interaction required between NHM/Kew as users and Picturae/Alembo as digitisers/transcribers was particularly resource intensive at the beginning of the pilot. Getting to know the nuances of each collection took time; questions inevitably reduced as the project continued and Picturae/Alembo became better acquainted with our material and our rules for transcription. It is recommended that QA is concentrated on high priority fields e.g. country, collection date, collector and collector number. Transcription QA should be more intensive at the beginning of the project when feedback will have the most impact and can be reduced as the project progresses.

- Continue to work collaboratively on digitisation projects with other institutions.
  Working together allowed testing of more variables and workflows than one institution alone could have tested. Having a single project manager who was the main contact point with Picturae gave clarity and ensured the pilot stayed on track.

- Outsource imaging due to higher achievable rates if image quality criteria are met.

- Explore a hybrid approach to label transcription, likely split between outsourcing, crowdsourcing, working with partners from other countries and in-house transcription.

Overall the pilot was deemed a success with the complete holdings of Solanum and Dioscoraceae specimens now digitised at Kew and the NHM. However this now presents new challenges for the staff curating these taxonomic groups. Kew alone accessions around 30,000 herbarium specimens a year, a proportion of which will be species of Dioscoreaceae and Solanum. It is important that all new accessions for these two taxonomic groups are digitised before they are incorporated into the collectionas as it wouldbe extremely resource intensive to look through the cupboards of digitised specimens to select them for imaging at a later point in time. Another issue to be considered is the need to keep the digital specimen record up to date, particularly when specimens are physically moved within the collection and filed under a different taxonomic name. If the digital record is not kept up to date then it will make the job of physically retrieving the specimen from the collection much harder and in some cases extremely unlikely. Keeping these digital records up to date requires additional staff resource, and this requirement will only increase as more of the 7 million specimens at Kew and the 6 millionspecimens at NHM are digitised. It is recommended that further work is completed to evaluate the impact of mass digitisation on curation staff, build on current guidelines, improve collection management systems and streamline workflows for curation of the digital assets created.

ORAL PRESENTATION

Blending the educational resources of small and large collections for training the next generation of museum professionals (iDigBio Small Collections Symposium)

Engaging student awareness of museum collections

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ABSTRACT. The Alabama Museum of Natural History, founded in 1831, has gone through many changes since its inception. Rooted in the Geological Survey of Alabama, it became its own entity in 1961 with early collections of rocks, minerals, fossils, mollusks, birds, beetles, herps, and more recent zoological specimens from the mid-20th century. These later collections were largely built on specimens collected by professors and their graduate students, and were only curated during the professors' tenure. Student participation in collections care has been minimal, largely because of a disjunction between the biology department and the museum, which fall under different heads.

Over the past 40 years, the museum has sponsored grade/high school "expeditions" to sites throughout the state at nominal cost. These expeditions expose students to the rigors and etiquette of collecting, while training them to become stewards of the environment. Some specimens collected become part of the museum's holdings and students often become supporters of the museum, its collections and its community involvement. Though typically focused on paleontology or archeology, the museum hopes to expand its expeditions using iNaturalist observations as a platform to engage students in Alabama biodiversity, amplified by Natural Science expeditions in zoology.

ORAL PRESENTATION

DemoCamp

Rapid filtering application design and implementation

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ABSTRACT. An increasing number of preserved specimens have been digitally imaged and have subsequently been made available over the web. There is currently an international drive to capture information contained on preserved specimen labels through use of these digital images. To date these efforts have primarily focused on the transcription of label data either through OCR (Optical Character Recognition) and NLP (Natural Language Processing) or via direct human transcription of the label and parsing and entering label data into appropriate data base fields. This type of activity is both laborious and error prone. This application is intended to provide an alternative approach to image based data capture, eliminating the need for manual key board input and allowing rapid progress through the source material by focusing on answering simple yes/no questions. The focus shifts away from the capture of the entirety of the data available on each specimen label and onto rapid capture of a single data facet across an entire collection.

ACKNOWLEDGEMENTS. This software has been developed with funding from SYNTHESYS3 under EU 7th Framework Programme for Research (FP7). Project reference: 312253

ORAL PRESENTATION

Collections stewardship and policies

Wind of change – Collections stewardship at the Museum für Naturkunde Berlin between tradition and cultural change

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ABSTRACT. The development of natural history collections is not a one-way process but a complex of dynamic and interrelated components under demanding and ever-changing conditions.
The Museum für Naturkunde Berlin provides a good example for this. Founded as part of the Humboldt-University in 1810, it became independent and member of the Leibniz Association in 2009. The 30 million zoological, paleontological and mineralogical objects are housed either in a state-of-the-art building or in a historic building that has hardly changed over the last 100 years. Research and collections management are interwoven in an integrated model of custodians. About ten years ago the Department of Collections was established to centralize the day-to-day business and to standardize policies and procedures. Later, collections development became part of the institution's research program.
As others, the institution is facing new scientific technologies that lead to new types of collections. New media and citizen science ask for new ways of opening up and using collections that were originally built up as research infrastructure for fields like taxonomy and systematics. In a world of changing financial resources and new political and societal priorities, the collections have to prove their relevance for new uses and users.
Collections development has the main aim of strengthening the collections, broadening access and increasing their relevance. In the setting of the Berlin museum, this affects and changes each of the major components: collections space, management, personnel, and strategy, and is a turbulent process of decision-taking to find a balance between core business and answering new challenges, tradition and cultural changes.

Q/R

ORAL PRESENTATION

Preventive conservation and material science

Integrated Pest Management in Austrian Natural History Museums – A sustainable approach

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ABSTRACT. Integrated Pest Management (IPM) is an important part for natural history collections like dry insects, herbaria, skins or mounted birds. In the past, many pesticides were used to treat active infestations or to prevent attacks by different insect pests. Today, most museums try to reduce the application of toxic chemicals and use an IPM program to prevent damage and the spread of insect pests in the collection or museum. In the presentation the situation of the natural history collections in Austria was analysed with interviews and personal visits to the collections. Each of the nine federal states has a natural history collection in the regional museum and freezing is the preferred treatment method. But freezing time and temperatures vary between museums and don't always follow up to date standards. The Natural History Museum in Vienna uses also Nitrogen for treatment and a cooled storage (10°C) in the basement. Some museums were found that still regularly use pesticides like toxic gases. Few of the museum staff responsible for the collections has specific training in IPM. In 2013 an IPM working group was formed and is annually meeting since then. This will help to find sustainable solutions.

ORAL PRESENTATION

Digitization and imaging collections: new methods, ideas, and uses

Using specimen portals for floristics research

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ABSTRACT. Using examples drawn from preparing treatments of the Caryophyllaceae for two American state flora projects, I will demonstrate how the availability of herbarium specimen data has modified the traditional work flow used in writing floristic treatments.

MAIN TEXT. Written floras of an area have traditionally been based on knowledge acquired in large part from examination of herbarium specimens stored in one or more herbaria from that region. The species distribution that is reported often reflects the specimens that were physically available to the author, either at their home institution or seen via visits to, and/or loans from, other herbaria known to house collections from that area. One example of two different interpretations of the floristic composition of the same region can be seen by comparing the range statements for some introduced Caryophyllaceae in the *Gray's Manual of Botany* (Fernald 1950; prepared at the Gray Herbarium) with those for the same species in *The New Britton and Brown Illustrated Flora of the Northeastern United States and Adjacent Canada* (Gleason 1952; prepared at the New York Botanical Garden); the distribution statements bear a striking resemblance to the specimen holdings of the respective herbaria. The increasing number and diversity of internet portals displaying data and often images of herbarium specimens can have a profound impact on preparation of a floristic treatment. It is now possible for one to discover and examine specimens in collections that one did not even know existed, sometimes adding significant records to the knowledge base that is being compiled.

I will use examples drawn from my work on preparing treatments of the Caryophyllaceae (Pink Family) for floristic projects in the American states of Oregon (Meyers et al., in prep.), using the Consortium of Pacific Northwest Herbaria portal (CPNWH – http://www.pnwherbaria.org/data/search.php), and New Mexico (K. Heil et al., in prep.), using the SEINet Symbiota portal (http://swbiodiversity.org/seinet/index.php) to demonstrate how this knowledge influenced my work. These examples include the following:

- The broader specimen base allowed seeing more specimens, adding distribution records, and correcting misidentifications; the "negative" side – where does one draw the line at how many specimens to examine?
- I could generate lists of taxa and herbaria housing specimens filed under those names directly from the portals, allowing one to see if there were any unexpected names to investigate.

The power of specimen portals could be enhanced by increased efforts to image all specimens (some herbaria currently display only data), making it easier for a researcher to send corrections to curators, and uniting currently disconnected portals (see Table 1) so that the sets of available tools and specimens are both more comprehensive and easier to use for projects that may include areas covered by separate portals.

ACKNOWLEDGEMENTS. I thank Stephen Meyers for providing a dataset of Oregon Caryophyllaceae at OSC, Ben Legler and Marcus Hooker for providing images of selected specimens at WTU and WS herbaria respectively, and Ben Legler (CPNWH) and Ed Gilbert and Ben Brandt (SEINet) for logistical support.

REFERENCES

Fernald, M.L. 1950. *Gray's Manual of Botany*. American Book Co., New York.

Gleason, H.A. 1952. *The New Britton and Brown Illustrated Flora of the Northeastern United States and Adjacent Canada. 3 vols.* New York Botanical Garden, New York.

Table 1. Major North American Vascular Plant Specimen Portals

A. Symbiota Vascular Plant Portals – connected to same (SEINet) database

SEINet
Consortium of Midwest Herbaria
Intermountain Region Herbaria Network (IRHN)
SouthEast Regional Network of Expertise and Collections (SERNEC)
New Mexico Biodiversity Portal
North American Network of Small Herbaria
Northern Great Plains Herbaria

B. Other Symbiota Vascular Plant Portals – not connected to SEINet

Consortium of Northeastern Herbaria (CNH)
Monarch (California Academy of Sciences)
The Lundell Plant Diversity Portal
University of Colorado Herbarium
Virtual Flora of Wisconsin

C. Major non-Symbiota Portals

Canadensys
Consortium of California Herbaria
Consortium of Pacific Northwest Herbaria

POSTER

An International Conversation on Mobilizing Natural History Collections Data and Integrating Data for Research (iDigBio Symposium)

Extant Brazilian mammals in scientific collections of Europe: an update

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ABSTRACT. Biological scientific collections are an important source of information about the organisms deposited, and testimonies of biodiversity. Organization, study and data recovery of biological collections is of invaluable importance in Brazil, where the estimated biodiversity is the largest in the world and is still far from completely known. The development of research and the training of human resources in taxonomy, systematics, and curatorial management are imperative for efficient conservation and understanding biodiversity. For historical reasons, Brazilian researchers in ecology are more numerous than taxonomists, and often lack knowledge on the importance, existence, and taxonomic and geographic magnitude about many scientific collections that house extant Brazilian mammalian species. I have upgraded my prior database containing scientific collections in the Europe, focusing on those with important series or type specimens. This list includes the history of each institution, the number of Brazilian/South American specimens deposited there, and the number of mammalian type specimens of Brazil, when the data is available. Among these, some are quite famous, such the Natural History Museum, Museum für Naturkunde, and the Zoologisk Museum, Universitets København, while others with important holdings are less well known, such the Zoologischen Sammlunge from Martin-Luther-Universität, and the Muséum d'Histoire Naturelle de Genève.

INTRODUCTION & METHODS. The aim of this study is publish an upgrade of the European scientific collections that house specimens of fundamental importance for the study of Brazilian mammalian fauna.

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Historic. Hershkovitz (1987) and Baker (1991) have discourse about the first expeditions in Neotropical region, including institutions, researchers, and naturalists who carried out those exploratory expeditions.

The collections of Neotropical material by European institutions began to be systematically gathered during the 18th century, and in Brazil specifically in 1783, with expeditions of Alexandre Rodrigues Ferreira, the first Brazilian naturalist. In the 19th century, new contributions followed the arrival of the Portuguese royal family to Brazil and the engagement between the Crown Prince Dom Pedro with the Archduchess Leopoldina, Franz II's daughter, the last Holy Roman Empire Emperor. Prominent naturalists arrived in Brazil: Friedrich Sellow (Germany, from 1814 until his death in 1831), Johann Baptist Ritter von Spix (Germany, 1817-1820), Alexander Phillip Maximilian zu Wied-Neuwied (Germany, 1815-1817), Johann Natterer (Luxembourg-Austria, 1817-1835), Alcide d'Orbigny (France, in South America 1826-1833), Peter Wilhelm Lund (Denmark, 1833 until his death in 1880), Francis Laporte de Castelnau (United Kingdom, 1842-1847), François Jules Pictet de la Rive (Switzerland, 1843-1844), and Karl Hermann K. Burmeister (Germany, 1850-1852). Between the late 19th and early 20th century, many naturalists from United Kingdom (e.g., C. Darwin, P.R. Perrens, P.O. Simons, and M.R.O. Thomas) undertook expeditions in South America.

Methods. A list of scientific collections of Europe was compiled focusing on those more important mainly by number of nomenclatural types from extant mammalian fauna of Brazil. The account was modified from Bezerra (2015) and updated by consult the official homepages or/and by correspondence with curators.

RESULTS. Surveyed collections – Number of specimens and nomenclatural types are in **Table 1**.

1) Forschungsinstitut und Naturmuseum Senckenberg (SMF), Frankfurt, Germany: Founded by suggestion of Johann Wolfgang von Goethe in 1817. The mammal collection includes material collected by Wied-Neuwied (Hershkovitz 1987).
2) Martin-Luther-Universität (MLU), Zoologische Sammlungen, Halle-Wittenberg, Germany: Founded in 1769 by Johan Friedrich Gottlieb Goldhagen. Mammal collection, structured mainly by efforts of Burmeister during 1837-1861, is composed in part by mounted specimens for exhibition, including some type specimens. Neotropical material comes mainly from Argentina, and also Brazil. Includes material described by Lichtenstein and Hoffmannsegg.
3) Muséum d'Histoire Naturelle de la Ville de Genève (MHNG), Switzerland: The collection was initiated in 1820 as Museé académique and later in 1907 as the current institution. Includes important series from South America, including rodents and bats studied by Pictet.
4) Muséum National d'Histoire Naturelle (MNHN), Paris, France: The largest and oldest natural history museum in Europe. Created in 1635 and emerged as a major research institution due to Count Buffon (from 1739-1788). There is part of the material collected by A.R. Ferreira (pillaged from Lisbon in 1808 by Napoleonic troops), and studied by Étienne Geoffroy St. Hilaire. Includes material collected by Wied-Neuwied, Castelnau, d'Orbigny, and Gervais.
5) Museum für Naturkunde, Zoologisches Museum Berlin (ZMB), Berlin, Germany: Founded in the early 19th century. The mammal collection has grown significantly during the 19th and early 20th century, after efforts of Lichtenstein, Peters, Matschie, and Nehring who described until the 1920s many species deposited there. Includes also material collected by Wied-Neuwied.
6) Natural History Museum (NHM), London, UK: The collections of natural history were started in the 17th century by Sir Hans Sloane. He died in 1753 and his personal collection given to King George II. In same year, the British Museum was founded, where the natural history collections were housed until 1883, when they were transferred to the building of the current NHM in South Kensington. The mammal collection is the second largest collection in the world and is the largest in numbers of nominal types. Oldfield Thomas described 2,900 of these types during 1876-1929, of which hundreds of species occur in Brazil. George R. Waterhouse described species of mammals from material provided by Darwin's "Beagle Voyage" in 1836.

7) Naturalis Biodiversity Center (Nationaal Natuurhistorisch Museum) (RMNH), Leiden, Netherlands: The mammal collection began in the 19th century, and the museum officially established in 1820. Coenraad J. Temminck administered the museum until his death in 1831 and had described several Neotropical mammal species. Includes material collected by Spix and Johann Andreas Wagner.
8) Naturhistorisches Museum Wien (NMW), Vienna, Austria: Founded in 1889, the collections were systematically assembled from 1806. The mammal collection has an annual increase of 500 specimens, being one of the few European scientific natural history collections not stagnant. Include material collected by Natterer and described by Johann Andreas Wagner.
9) Zoologische Staatssammlung München (ZSM), Munich, Germany: Founded in 1811 by Johann Baptist von Spix, houses ~25 million specimens. The Neotropical mammalian fauna is represented mainly by Brazil and Argentina. There are many types described by Spix and Johann Andreas Wagner.
10) Zoologisk Museum, Universitets København (ZMUC), Copenhagen, Denmark: The current collection consists of material from various collections that date back to 1650. There is a valuable collection of the Quaternary gathered by Peter W. Lund during 1830-1840 in Lagoa Santa, Minas Gerais state, Brazil, and described by him and Winge.

Institution	**Total number of specimens (1)**	**Number of nomenclatural types (2)**	**Observation**
1. Forschungsinstitut und Naturmuseum Senckenberg	95,000 (2,259 SA, 878 BR)	640 (18 SA, 15 BR)	
2. Martin-Luther-Universität, Zoologische Sammlungen	852 SA	19 SA (probable +11 BR, being 3 lost)	F. Steinheimer pers. com.
3. Muséum d'Histoire Naturelle de la Ville de Genève	~45;000 (542 BR)	17 BR	Manuel Ruedi pers. com.
4. Muséum National d'Histoire Naturelle	130,000	1,100	
5. Museum für Naturkunde	~150,000	>2,000 (160 SA, 89 BR)	C. Funk; 5th largest mammal collection of the world
6. Natural History Museum	359,000 (~2900 BR)	>11,000 (>300 BR)	2nd largest mammal collection of the world
7. Naturalis Biodiversity Center	8,905 (4,607 SA)		
8. Naturhistorisches Museum Wien	70,000 (1,827 SA./1,300 BR)	135 BR	F. Zachos and A. Blibl pers. com.
9. Zoologische Staatssammlung München	~40,000	-	
10. Zoologisk Museum, Universitets København	~40,000	80	

Table 1. Recent mammal specimens in European scientific collections. (1) Number of specimens and (2) number of nomenclatural types from South America –SA and Brazil –BR, when the data are available. Data taken in collection official homepages.

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DISCUSSION & CONCLUSIONS. Many scientific natural history collections in Europe have suffered continuous losses in funding from their governments, which directly affects the management, infrastructure, training and recruitment of staff as well as the growth and maintenance these collections. Many are stagnant, some with few local researchers or students studying their collections, while others are in imminent danger of closing the doors or even losing their collections (e.g., Andreone et al. 2014). Support for expeditions with the aim of expanding these collections and perform timescale large inventories are also becoming less frequent. The importance of most of these scientific collections also lies in the historical-cultural content – several collections in Europe house objects that compose part of evolution of the human knowledge about the natural history.
Historical series, with good numerical and geographic representation, and temporal consistency enables us a clear picture of how human impacts and climate change influenced the biological communities over the past decades or even centuries, providing the base for the prediction of future scenarios.

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REFERENCES

Andreone, F., L. Bartolozzi, G. Boano, F. Boero, M. Bologna, M. Bon, N. Bressi, M. Capula, A. Casale, M. Casiraghi, G. Chiozzi, M. Delfino, G. Doria, A. Durante, M. Ferrari, S. Gippoliti, M. Lanzinger, L. Latella, N. Maio, C. Marangoni, S. Mazzotti, A. Minelli, G. Muscio, P. Nicolosi, T. Pievani, E. Razzetti, G. Sabella, M. Valle, V. Vomero, A. Zilli. 2014. Italian natural history museums on the verge of collapse? Zookeys 456:139-146.
Baker, RH. 1991. Part 1, Historical background. Pp. 7-33, in: The classification of Neotropical mammals – a historical résumé (M.A. Mares, D.J. Schmidly, eds.), Latin American Mammalogy: History, Biodiversity, and Conservation. University of Oklahoma Press, Norman, OK.
Bezerra, A. M. R. 2015. Coleções científicas de mamíferos do Brasil: II-Europa. Boletim da SBMz 71:11-16.
Hershkovitz, P. 1987. A history of recent mammalogy of the Neotropical region from 1492 and 1850. Pp. 11-98, in: Studies in Neotropical mammalogy: essays in honor of Philip Hershkovitz (B.D. Patterson, R.M. Timm, eds.), Fieldiana: Zoology, New Series, No. 39. Chicago, IL.

POSTER
An International Conversation on Mobilizing Natural History Collections Data and Integrating Data for Research (iDigBio Symposium)
Digitizing eocene fossil collections for global change research

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ABSTRACT. Fossils reveal the responses of organisms to climatic events in the Earth's past and provide valuable insights into how global changes today might influence evolutionary patterns of organisms in the future. A thorough understanding of the link between climate and evolution, however, can only be addressed with the mobilization of large quantities of detailed paleontological data. With funding from the Institute of Museum and Library Services, we are focusing on a rich collection of fossils from the early Eocene of Wyoming (roughly 55 to 50 million years ago). A concentrated field program by the University of California Museum of Paleontology resulted in an estimated 60 000 fossils from 225 localities spanning this warm interval. Notably, fossiliferous sediments were collected in small batches, often single shovel scoops, with each sample encoded with an individual number. This approach provides remarkable stratigraphic and geographic control, and permits the re-association of specimens disarticulated during processing. Yet, the information associated with these samples, including hand-written notes on acidic paper and polaroid photographs, was rapidly deteriorating. Using a team-oriented approach, we are rapidly digitizing these data to insure their long-term security. These newly mobilized data will yield important information on the effects of climate changes on organisms.

POSTER
An International Conversation on Mobilizing Natural History Collections Data and Integrating Data for Research (iDigBio Symposium)
Mobilizing biodiversity data in a megadiverse country: the online collections of Colombia's Instituto de Ciencias Naturales

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ABSTRACT. The Instituto de Ciencias Naturales (ICN) is Colombia's largest repository of biological collections, representing most of the country's plant, vertebrate and arthropod diversity, with over one million specimens, including 11,147 types (1,974 holotypes). To date, 619,412 specimens have been databased using Specify® software and 41% of all localities (184,224) have been georeferenced using the point-radius method. The National Colombian Herbarium (COL) leads the digitization process with 431,383 records (74% databased), of which 76% have associated images, followed by the amphibian collection with 52,247 records (80% databased). Since 2004, the ICN, a GBIF provider, has made its collections data and images available online at www.biovirtual.unal.edu.co, with continual updates to both content and web architecture. In mid-2016 we will be launching a new version of our portal "Colecciones Científicas en Línea" including images for all type collections and improvements in speed, functionality and robustness. These upgrades were undertaken to improve overall user experience and to facilitate integration, via web services, with other institutional and governmental platforms. The new portal was developed using the RDBMS MariaDB®, Loris IIIF Image Server, and the server backend written in Python™, using libraries such as Flask and SQLAlchemy; the web client uses HTML5, JavaScript, jQuery and OpenSeadragon.

ORAL PRESENTATION
Enabling Infrastructure: Future Collections, Data & Informatics (Synthesys Symposium)
Digitization Infrastructure in the US

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ABSTRACT. This presentation will give an overview of the state of the Advancing Digitization of Biological Collections initiative in the USA. Topics will include the iDigBio infrastructure, the state of the Thematic Collections Networks (TCNs), and other digitization activities. The iDigBio progress in the past year includes working groups, digitization tools, informatics training, public participation, data portal, and data processing. An update on TCN progress will focus on accomplishments of these groups and their digitization practices. Other digitization activities are active in small collections and field stations. Of particular interest is the extension of digitization into related documents (field notebooks, accession books, etc.) and the incorporation of various annotations on images and specimens.

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ORAL PRESENTATION
Digitization and imaging collections: new methods, ideas, and uses
COPIS: Prototyping a computer operated photogrammetric imaging system

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ABSTRACT. Technological advancements over the past two decades have made information about types and other specimens housed in natural history collections available online in digital form, primarily for research purposes. In the past few years more attention has been placed on digital imaging of specimens, in effect bringing the specimens out of their cabinets and increasingly into public view globally via the World Wide Web. This presentation will introduce photogrammetry as a means for 3-dimensional scanning of specimens and describe an architecture for a Computer Operated Photogrammetric Imaging System known as COPIS. The goal of the COPIS project is to develop hardware and software for rapid multi-camera, multi-view image acquisition of natural history specimens. The resulting images can then be used for accurate 3-dimensional reconstruction of the specimen surfaces.

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ORAL PRESENTATION

Preventive conservation and material science

Performing a condition survey of historic mammalian taxidermy

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ABSTRACT. The Mammalogy Department at the American Museum of Natural History is one of the oldest in the Museum, holding specimens dating to the founding collections of 1869. Mounted skins and taxidermy have become important historic objects, especially examples of extinct or endangered animals, or those mounted by important figures in the development of taxidermy. In an effort to better understand the history and technology of the collection, as well as its condition, Natural Scien ce conservators conducted an inventory and condition survey of Mammalogy taxidermy holdings. Conservators worked for four months, opening every cabinet to locate and examine 632 mounted specimens. Individual mounts were photographed and assessed using a custom-built FileMakerPro database. Background data, overall condition, detailed component condition, and treatment recommendations were recorded. The process required conservators to define the limits of materials qualifying as taxidermy; establish an understanding of taxidermist materials and methods; and streamline survey procedures in tight spaces. The project identified dominant influences on the condition of taxidermy in the Mammalogy collection, and provides collections staff with a basis for decisions related to future conservation, loans and exhibits. The surveying procedures developed can be applied to other collections to help preserve similar pieces for the next generation.

ACKNOWLEDGEMENTS. Work was carried out under the guidance of project leaders Lisa Kronthal Elkin (Chief Registrar and Director of Natural Science Conservation) and Judith Levinson (Director of Anthropology Conservation). The survey was supported by the Mammalogy Department: Neil Duncan (Collection Manager), Eileen Westwig (Senior Scientific Assistant), Eleanor Hoeger (Scientific Assistant), and Brian O'Toole (Scientific Assistant). Funding was provided by an Institute for Museum and Library Services National (IMLS) Leadership Grant.

REFERENCES

Quinn, S. C. 2006. Windows on Nature: The Great Habitat Dioramas of the American Museum of Natural History. Harry N. Abrams: New York, NY.

POSTER

Preventive conservation and material science

Filling feather loss: Tricks & tips

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ABSTRACT. Preserved bird skins are notoriously thin and delicious to pests, making taxidermy bird mounts particularly vulnerable to feather loss. With few established techniques for replacing lost feathers, there is ample room for creative problem solving by conservators working in this area. Treatments of two pieces of bird taxidermy will be presented. One, a historic emperor penguin that had suffered a probable pencil stab to the chest; the other, a bald eagle that lost its iconic white head feathers after a botched "restoration." The case studies will illustrate two fill techniques – one involving the use of real, purchased feathers, and the other the fabrication of "conservation feathers." Although there were pros and cons to both techniques, one resulted in a more successful treatment for both birds. These methods for making feather fills may be useful for those charged with caring for natural science collections as well as ethnographic and historic collections that include feather clothing, ceremonial blankets, and other feathered objects.

ORAL PRESENTATION

Digitization and imaging collections: new methods, ideas, and uses

Assessing the initial implementation of Arctos in interdisciplinary natural history collections

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ABSTRACT. A collection management system (CMS) – relational database software specifically designed for the needs of collections – provides collection managers with a tool for streamlining workflows and maintaining access to specimen data. However, the challenges of adapting to a CMS can be daunting. In this case study, we relate our experience in the first six months of transitioning to the Arctos collection management system, including an assessment of the implementation process, functionality in use, and data discoverability both internal and external.

INTRODUCTION & METHODS. The Chicago Academy of Sciences / Peggy Notebaert Nature Museum (CAS/PNNM) is the oldest science museum in Chicago, and its collections reflect an exciting era of naturalist explorations throughout the latter half of the 1800s and into the 20th century. Beginning in 2008, CAS/PNNM received a series of grant funding to digitally inventory portions of its diverse natural history collections, which include biological, geological, and cultural objects, as well as archives and audiovisual materials (see **Figure 1**). Collectively, these items document the historic biodiversity of North America, in particular the Midwest/Western

Great Lakes region. Five years later, the inventory and specimen label data capture of the object-based collections was complete and had resulted in 61 Excel spreadsheets containing upwards of 285,000 records. Processing of the archives and audiovisual collections continues.

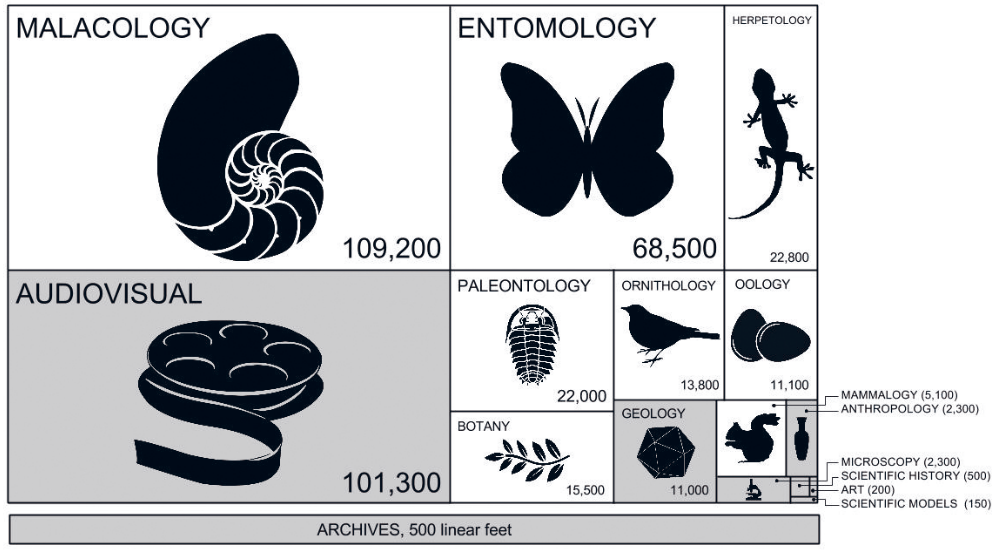

Figure 1. Visual overview of CAS/PNNM collection holdings with object or material counts specified in each discipline. Gray background on a discipline indicates that it is non

Although the inventory was a huge success, maintaining data in so many different spreadsheets is unstable and was hindering the full potential of our collections. In light of this, CAS/PNNM committed to invest in a collection management system (CMS). After a considerable decision-making process, it was determined that Arctos would provide the easiest path to getting quality, standardized data into a relational database for all of our collections, and to making this data accessible both in-house and online (see Krimmels & Roberts, 2016, this issue).

Arctos (http://arctosdb.org) is a cloud-based CMS, providing online accessibility to collection data. It is a consortium, and its current list of 20 institutions represent a diverse array of collections. With leaders such as the University of California at Berkeley's Museum of Vertebrate Zoology and the University of Alaska Museum, Arctos is a stable option optimized across many disciplines of natural and cultural history. Institutions using Arctos share the costs of maintaining, hosting, and developing the software. Although each institution retains intellectual control over its data and has a virtual private database for their collections, physical data storage is shared offsite, and certain information is shared globally amongst Arctos collaborators (e.g. if the same collector deposited specimens in two institutions, there would only be one record for this collector within all of Arctos).

RESULTS. In the initial period since beginning the transition to Arctos, we have been pleased with the ease of implementation, responsiveness of the Arctos technical support, and burgeoning integration that Arctos enables between our transaction workflows and our specimen records. The transition to Arctos is also resolving two of our challenges: 1) providing a secure, offsite backup for our collections data, and 2) offsite access for our collections data.

The infrastructure set-up process for Arctos is non-existent, allowing us to immediately dive into the migration process. Arctos is hosted by the Texas Advanced Computing Center, which provides a cloud computing environment, unlimited online media storage, and preservation-quality data backup. Because Arctos was designed as a web-based application from the beginning, it has a high capacity to enable rapid data mobilization. As it operates in any browser, there is no software to be installed, enabling work to be conducted at multiple locations and facilitating exploration of the data by others.

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Managing a collection involves applying transactions, such as accessions or loans, to a diverse range of objects. By bringing transaction handling into a common space with specimen records, Arctos allows us to avoid a “fragmented information flow,” as described by Forbes (2012) in her assertion that a CMS should “serve as a core resource, used to manage every aspect of a collection.” Our experiences with the transaction options in Arctos have been positive and straight forward, and include accessioning, and creating labels and other forms. Attaching citations, publications, videos, and images to records has likewise been smooth and adds further multi-dimensionality to our data.

Online data publishing is a fairly new aspect to collection management, but one growing in relevance as biodiversity data consortiums such as iDigBio and the Global Biodiversity Information Facility (GBIF) become better known. CAS/PNNM views publishing its collections data online as an important goal that improves the accessibility of our specimens and better enables our data to contribute to the broader conversations involving natural history collections. The current pace of research, though, tends not to include data that isn’t easy to access – an idea expanded on by Robertson et al. (2014) in a paper on GBIF’s role in the biodiversity data community. This creates a situation where it is critical for us to make our data as accessible as possible. Prior to beginning the Arctos migration, we published four collection datasets on VertNet. Having experienced the formatting process for our specimen data from Excel for VertNet, we are pleased that with Arctos, specimen data will automatically be pushed to GBIF and other aggregators.

DISCUSSION & CONCLUSIONS. We have thus far imported data for our accession records, mammalogy, and oology collections. Data were cleaned and normalized, and follow the DarwinCore Standards. Staff addressed specimens requiring further research into catalogue or accession files as much as possible prior to their upload into Arctos, as this made the transition smoother. The Collections Department incorporated its strong volunteer base into the data cleaning and preparation process. Many of these volunteers work with Excel files until the data are ready for upload, while others have been trained to enter data directly into Arctos, such as for newly prepared specimens. Additionally, the data preparation process sparked other projects with the collections that proved to be necessary and beneficial to our end result, such as research into records that fed into accession paperwork and the subsequent reorganization of those records.

Arctos has allowed us to standardize our collections data across disciplines and improve the quality of data as it relates to physical collections. With the cloud-based system, Arctos provides us with new pathways through which to share our collections, enabling specimen information to be shared much easier both internally and externally. Transitioning to a new CMS requires significant planning and preparation. Maintaining flexibility to our project workflows while we migrated data into Arctos allowed us to address aspects of data management that ultimately resulted in stronger collection management.

REFERENCES

Forbes, M. 2012. CollectionSpace: A story of open-source software development and user-centered design. *Bulletin of the American Society of Information Science and Technology 38*(3): 22-26.

Krimmel, E., D. Roberts 2016. Evaluating collection management systems for interdisciplinary natural history collections. This volume.

Robertson, T., M. Doring, R. Guralnick, D. Bloom, J. Wieczorek, et al. 2014. The GBIF integrated publishing toolkit: Facilitating the efficient publishing of biodiversity data on the internet. *PLoS ONE* 9(8): e102623. doi:10.1371/journal.pone.0102623

SPNHC 2016 – Oral and poster presentations, sorted alphabetically by first author

ORAL PRESENTATION

Preventive conservation and material science

Preserving iron sulfate bearing papers

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ABSTRACT. When paper is impregnated with iron sulfate solutions, it progressively becomes brown and fragile. The most well-known case of these degradations corresponds to “iron gall ink corrosion” that has motivated numerous studies dealing with chemical pathways and possible remediation strategies. Although most fundamental aspects of the degradation are still unanswered, the definition of conservation strategies has been largely improved in the last two decades.
The present communication aims to review the most relevant of these aspects from fundamental considerations to practical applications in the context of natural History collections.

ARE NATURAL HISTORY COLLECTIONS CONCERNED WITH IRON SULFATE BEARING PAPERS? Iron gall inks are composed of a mixture of iron(II) sulfate, gallic acid and gum Arabic. In western countries they have been largely used since the middle ages, and very possibly even since antiquity. From the nineteenth century onwards, with the industrial revolution and development of chemistry, ink-makers progressively mixed these inks with other types of inks and with synthetic dyes [Champour and Maleyre 1895] in order to gather in one product the benefit of each ink. Examination of ink-making recipes also shows that iron sulfate was a common ingredient of nib writing inks until the 1960s. Therefore many of the manuscripts written in the 19th and 20th century contain iron sulfate bearing inks. They are acidic and relatively rich in iron.
Iron sulfate bearing inks evidently concerns book notes, logbooks, labels and archival material related to natural History collections (**Figure 1**, left). Labels damaged by iron sulfates may also be found in paleontological and mineralogical collections. When a label is placed in contact with a damaged specimen containing iron sulfides or iron sulfates, spectacular degradation of the paper may be observed (**Figure 1**, middle and right).

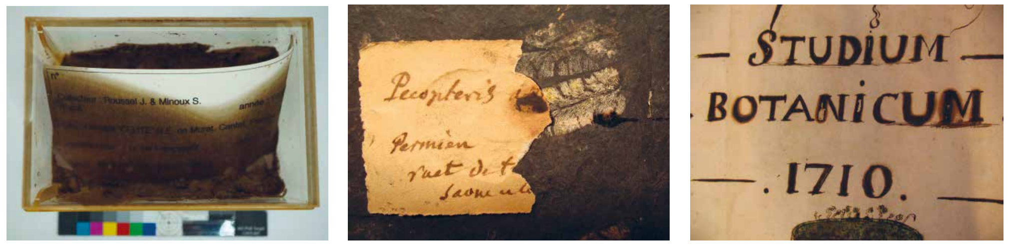

Figure 1. Iron sulfate bearing papers
Left: Herbarium front page (Herbier de Foucques, 1710, MNHN); middle : label glued on a fossiliferous shale damaged with sulfate efflorescence (rozenite) (MNHN.F.6890); right : label in contact with a damaged pyritized fossil.

WHAT IS THE DOMINANT DEGRADATION PATHWAY? The presence of iron sulfate in the ink does not inevitably lead to the destruction of the carrier but it may, in certain conditions, have a detrimental impact. The first step of degradation corresponds to migration of ink ingredients in the carrier. This is usually achieved when the document is exposed to high humidity conditions (above 80-85% RH) [Rouchon et al 2009, 2013, Belhadj et al 2014]: condensation of water in the paper leads to dissolution of water soluble compounds, which migrate in the paper.
When ink components, such as iron and sulfates ions are present in the inner part of the sheet, chemical degradation takes place. It is usually attributed to superimposition of acid-catalyzed hydrolysis and oxidation pathways. Which pathway is the dominant one remains a controversial question, but there is a consensus on the fact that this degradation leads to browning and loss of mechanical properties. Near the ink line, the paper becomes fragile, but far from the ink line, it is still strong. Damaged documents are often handled without specific care because people are not aware that the paper is locally brittle. Yet turning pages, even carefully, implies bending sheets. This action may induce locally an unbearable mechanical solicitation, provoking cracks and finally holes in the fragile area.

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CONSERVATION STRATEGIES. Preventive conservation guidelines for storage of written documents are relatively simple: they should be kept in dry and cold environments. Conservation treatments appear more problematic as water is the preferred solvent of paper conservators (for instance, most adhesives are water based). During treatments, papers are often exposed for differing durations to high humidity conditions, which might be enough to provoke ink migrations. These are often hardly perceptible by the naked eye but may be detrimental in the long run. In order to limit the risk of ink migration while using water based treatments, several tests have been designed. The first one, the bathophenanthroline indicator paper [Neevel and Reissland 2005] was designed to identify the presence of iron and is also a reliable solubility test. The second one, the Dutch mending test [Belhadj et al 2014], can be used for artefact loans to check the quality of climate during transport and exhibition. It is also a powerful tool to define safe protocols such as local mending with water based adhesives [Van Veltzen 2011, Phan Taan Luu and Jacobi 2011].
A large effort of research has been dedicated to remediation treatments which aim to stop the chemical decay with addition of alkaline and anti-oxidant compounds. One of the most efficient is the phytate treatment [Rouchon et al 2011] that can be used with specific care on highly damaged documents [Desroches et al 2012]. It however remains time consuming and thus expensive.

CONCLUSION. There is currently no "universal" protocol to deal with conservation of paper artefacts damaged by iron and acidity. Regarding highly damaged artefacts, a great piece of work remains to be done to apprehend the chemistry underlying the degradation in order to propose targeted chemical treatments. It remains however that the greatest part of our written heritage is relatively well preserved and mainly needs preventive measures. The priority is to avoid excessive handling and uncontrolled exposure to high humidity conditions of the artefacts thus reducing the occurrence of further damages. If humidification is needed (for whatever reasons), simple colorimetric tools can be used to safely monitor the treatments.

REFERENCES

Belhadj, O., C. Phan Tan Luu, E. Jacobi, S. Meslet-Struyve, S. Vez, B. Reissland & V. Rouchon, 2014. The Dutch Fe-Migration Mending Test : Exploring Further Areas of Use. Journal of Paper Conservation 15: 9-15.

Desroches, M., V. Duplat & V. Rouchon. 2012. An Aqueous Treatment for Highly Damaged Manuscripts : Minimising the Risk of Mechanical Damage. Journal of Paper Conservation 13:36-37.

Champour, M., 1895. Nouveau manuel complet de la fabrication des encres. Encyclopédie Roret, Paris.

Neevel, J.G. & B. Reissland. 2005. Bathophenanthroline Indicator Paper. PapierRestaurierung 6:28-36.

Phan Tan Luu, C. & E. Jacobi. 2011. Repair on Iron Gall Ink with Remoistable Tissue. Journal of Paper Conservation 12: 37.

Rouchon, V., B. Durocher. E. Pellizzi & J. Stordiau-Pallot. 2009. The Water Sensitivity of Iron Gall Ink and its Risk Assessment. Studies in Conservation 54, 236-254.

Rouchon, V., E. Pellizzi, M. Duranton, F. Vanmeert & K. Janssens,. 2011. Combining Xanes, ICP-AES and SEM/EDS for the study of phytate chelating treatments used on iron gall ink damages manuscripts. Journal of Analytical Atomic Spectrometry 26:2434-2441.

Rouchon, V., M. Duranton., O. Belhadj, M. Bastier Desroches, V. Duplat, C. Walbert, B. Vinther Hansen. 2013. The use of halide charged interleaves for treatment of iron gall ink damaged papers. Polymer Degradation and Stability 98:1339-1347.

Van Velzen, B., 2011. Remoistable Tissue. Journal of Paper Conservation 12:36.

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ORAL PRESENTATION

Digitization and imaging collections: new methods, ideas, and uses

Digital transcription improves access to egg collections and mobilizes phenological data

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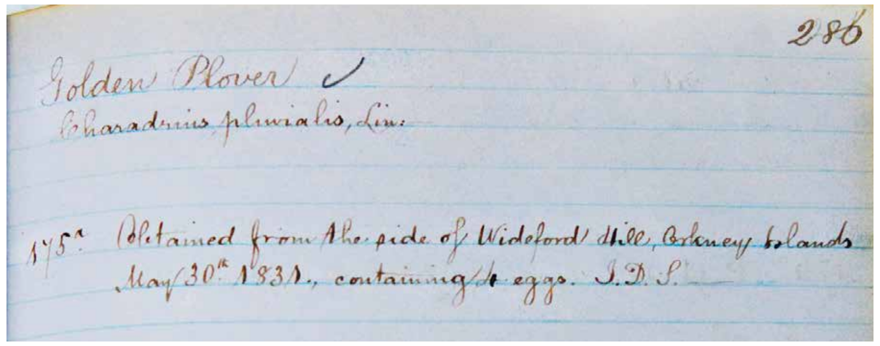
ABSTRACT. The Natural History Museum in the United Kingdom (NHMUK) holds the most comprehensive birds' egg collection available for research and one of the two largest in the world. As it is impracticable to attach data as a label to eggs, collection information is often kept separately and cross-referenced via annotations on the eggshell. These manuscripts embody the rich scientific, historical and cultural background to the specimens but are often fragile and inaccessible. Here we describe the motivation for our efforts to create a digital image archive and to transcribe these important records to improve access. We review the opportunity of using more than 150 years of mobilized data on collecting dates and localities of eggs to estimate changes in laying dates over time (breeding phenology) and consider whether, by relating this data to changes in temperature and precipitation, we may be able to use digitisation projects to assess the long-term climate change impacts on breeding phenology. We conclude that digital transcription of manuscripts accompanying collections improves collection management, research access and may expand a collection's international impact.

MAIN TEXT. The Natural History Museum in the United Kingdom (NHMUK) has embarked on various projects within its Digital Collections Programme to 'mobilise the data (and where useful images) to solve major scientific and societal challenges'. Sharing collections and data digitally has become a key priority of museums and fundamental to ensuring our collections remain relevant, accessible resources which provide answers to key questions in ecology and evolution. It is impractical to tie labels to eggs to record their data, so information has traditionally been written directly on the eggshell surface or more commonly cross-referenced via annotations on the eggshell ('set' marks) to manuscripts (labels, catalogues & index cards). Early egg specimens were often crudely prepared with relatively little, if any, basic data written on the eggshell but by the mid-1800s prominent oologists like Professor Alfred Newton (1829-1907) were promoting standardised approaches to data recording which ensured eggs always had 'a reference to the journal or note-book of the collector, wherein fuller details may be given' (Newton 1860).

Some early Victorian naturalists, e.g. John Drew Salmon (1802 – 1859), recorded egg collection data in handwritten manuscript catalogues, from which secondary index cards could later be transcribed and in the latter half of the 19th century the use of (often pre-printed) index cards to record primary data became common oological practice either supplementing, or replacing hand-written catalogues. In the United Kingdom this culminated with the widespread use of standard 5"x3" index cards by the early 20th century. **Figure 1** shows two such 19th and 20th century sample data sources for eggs of Eurasian Golden Plover (*Pluvialis apricaria*), a species whose breeding phenology is related to temperature and synchronised with the emergence of Crane fly (Tipulidae) as a food source.

The potential availability of often unexploited long-term bird breeding data in the egg collection of the NHMUK has increasingly interested international researchers (Russell, 2010), but much of the primary data for the NHMUK egg collection is inaccessible online because it is held on ca. 130,000 index cards and associated manuscripts, and hundreds of handwritten manuscript catalogues. Our reasons for digitising and transcribing these manuscripts are


286
Golden Plover
Charadrius pluvialis, Lin.
175a Obtained from the side of Wideford Hill, Orkney Islands May 30th 1831, containing 4 eggs. J.D.S.

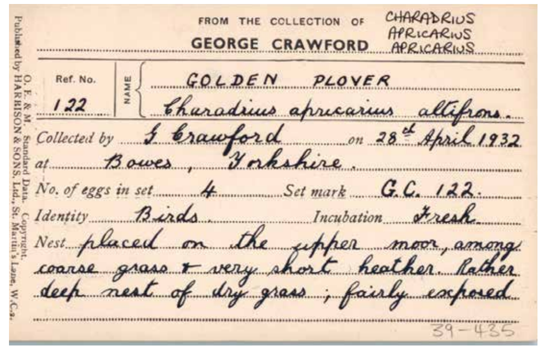

FROM THE COLLECTION OF GEORGE CRAWFORD
CHARADRIUS APRICARIUS APRICARIUS
Ref. No. 122
NAME GOLDEN PLOVER
Charadrius apricarius altifrons.
Collected by J. Crawford on 28th April 1932
at Bowes, Yorkshire.
No. of eggs in set 4 Set mark G.C. 122.
Identity Birds. Incubation Fresh.
Nest placed on the upper moor, among coarse grass & very short heather. Rather deep nest of dry grass; fairly exposed

Figure 1. Example data sources for Golden Plover (Pluvialis apricaria):
a) Detail from Catalogue of the Salmon Collection for a c/4 [175a] collected on 30th May 1831 from Wideford Hill, Orkney;
b) Index card from the Crawford Collection for C/4 [G.C. 122] collected on 28th April 1932 at Bowes, County Durham

R/S

therefore to: 1) guarantee the long-term security of the data; 2) facilitate transcription and databasing as a precursor to specimen digitisation; 3) improve collection management; 4) increase research access to our bird breeding data; and 5) increase international impact of the NHMUK oological collection.

Many of the NHMUK index cards are envelopes (**Figure 2**) containing original fragile labels, maps, photographs, even feathers, some already show significant signs of deterioration. Repeat consultation puts manuscripts at risk, so a digital access alternative was a priority. Our workflow involves every card / envelope being hand numbered with a unique identifier, and cards sorted into pre-defined categories to speed up the digitisation process. We use two different scanners depending on the form and condition of the object. 'Standard' manuscripts and index cards, and simple data cards (single or double-sided cards in good condition with no attachments, folds or inserts) can be scanned in batches of ca. 25 at a time using an automatic document feeding scanner (e.g. Fujitsu Flatbed A4 scanner), producing consistent images efficiently with pre-assigned and customizable settings. Envelopes with contents and fragile material are scanned manually using a flatbed scanner (e.g. Epson flatbed A3 business scanner), which can be time consuming process as contents must be laid out in a uniform manner and Information on the reverse of any item requires a second scan. Care has to be taken to ensure contents remain together with their envelope and that no damage occurs.

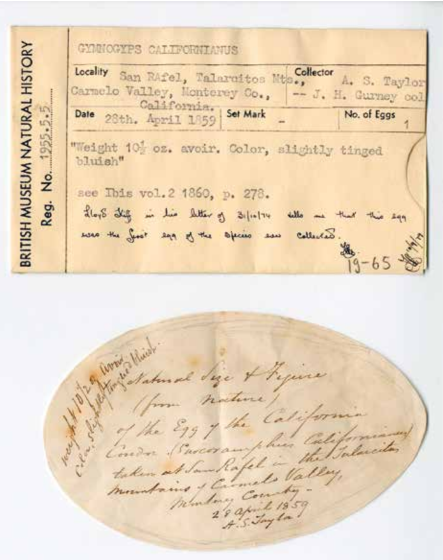


Figure 2. NHMUK Index card envelope containing the original handwritten label for the 1859 California Condor (Gymnogyps californianus) egg acquired by A. S. Taylor – the first egg of the species collected & preserved for science.

All images are generated as high quality TIFF files then compressed for uploading to the NHMUK long-term deep storage facility. For day-to-day use within the museum by curators and researchers JPEG files are created. A Microsoft Access database data-entry form was produced, allowing core data from each card to be transcribed from the images. Data and images are then transferred to the Electronic Museum management system (KE Software) used in the NHMUK. This assists in all aspects of collections management, audit and enquiries and, in the longer term, facilitates universal primary data access via the online NHMUK data portal http://data.nhm.ac.uk .

At risk, fragile material is highlighted in the database and prioritised for attention by a paper conservator. Various low-cost and quick steps can also be employed, e.g. custom-made Archival Polyester pockets to minimise handling and archival card support to ensure static does not cause tearing of fragile materials.

Research on the collections was one of our five motivators. Anthropogenic climate change has widespread impacts on biological systems, as evidenced by changes in avian phenology, e.g. timing of egg laying and arrival of migrant birds, both used as indicators of climate change by the UK Government, e.g. UK Spring Index. As these shifts in timing occur at differential rates across taxa, changes have the potential to severely disrupt trophic links with negative consequences for populations. Ornithology has provided 'some of the best examples of the impacts of recent climate change on wildlife from around the world but we have only begun to scratch the surface' (Crick 2004). To predict future impacts of climatic change on bird populations, it is essential to develop a detailed understanding of the mechanisms underlying observed relationships between meteorological conditions and phenology based on long-term data to capture sufficient variation in weather conditions. However, long-term phenological datasets are often restricted to individual species or localities. Egg collections are demonstrably major stores of long-term data for phenological analysis (Scharlemann 2001). In their conclusions about long-term time series of ornithological data, Møller & Fiedler (2010) illustrated the need for online access to such large data sets and, alongside more recent complementary data from nest record schemes, museum data facilitate analyses over more than 150 years. There is good evidence that climate change has changed the seasonal patterns of avian life cycles (Pearce-Higgins & Green 2014). We believe that transcribing egg manuscripts will contribute to research on the long-term consequences of climate change and that we here outline a cost-effective digitisation project with substantial benefits to museums, researchers and society.

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REFERENCES

Crick, H. 2004. The Impact of Climate Change on Birds. *Ibis.* 146 (suppl. 1) 48-56.

Møller, A. P. & W. Fiedler. 2010. Long-term time series of ornithological data. In A. P. Møller (Ed.), *Effects of Climate Change on Birds.* pp. 33-38. Oxford: Oxford University Press

Newton, A. 1860. Suggestions for Forming Collections of Birds' Eggs. Edward Newman. London. Pp. 1-15 (Reprinted, with additions, from the Circular of the Smithsonian Institution of Washington)

Russell, D. G. D., J. White, G. Maurer & P. Cassey 2010. Data-poor egg collections: cracking an important resource. In: Louette, M., G. Cael. & W. Tavernier. (Eds). 2010. Proceedings of the Sixth European Bird Curators Meeting. Journal of Afrotropical Zoology, Special Issue.pp.77- 82

Scharlemann, J. P. W. 2001. Museum egg collections as stores of long-term phenological data. International Journal of Biometeorology, 45: 208-211.

Pearce-Higgins, J. W. & R. E. Green. 2014. *Birds and climate change: impacts and conservation responses.* Cambridge University Press, Cambridge.

ORAL PRESENTATION

Enabling Infrastructure: Future Collections, Data & Informatics (Synthesys Symposium)

Global Plants: A Model of International Collaboration

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ABSTRACT. Global Plants (http://plants.jstor.org) is a community-contributed database that features more than two million high resolution plant type specimen images and other foundational materials from the collections of more than 300 herbaria in 70 countries. Complementing the high resolution specimen images are extensive flora and other reference materials, collectors' correspondence and diaries, and tens of thousands of paintings, photographs, drawings, and other images. Global Plants strives to be a comprehensive resource for aggregating and exploring the world's botanical resources, thereby dramatically improving access for students, scholars, and scientists around the globe.

Global Plants is the outcome of the Global Plants Initiative (GPI). The Andrew W. Mellon Foundation, along with leading experts in the field, had developed the idea of creating a digital library of type specimen images and related material and as a result funded the initial digitization activities in the Global Plants Initiative. Over 10 years, GPI has grown into an international partnership wherein herbaria work together to create a shared database of information and images of plants worldwide.

POSTER

Other topics

Low-quality images to manage scientific collections of fossils: the case of Paleobotany and fossil invertebrate collection of the MNCN-CSIC

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ABSTRACT. Priority objectives of the Museo Nacional de Ciencias Naturales (MNCN-CSIC) include conservation and management of systematic collections in order to make them available for scientific and cultural purposes. Low-quality images are being used in the Paleobotany and fossil invertebrates collection as a tool of collections management. This paper shows a protocol for taking these digital images. Between 2008 and 2014, 24,109 images were taken (10,505 records in the databases). In this context, low-quality images are being used as a tool to make collection management easier, and as a technical solution to compensate the lack of resources, especially the human ones. Eight years after the beginning, total activity of the collection has been increased. We consider digital images are a powerful tool to manage palaeontology collections, because fossils' digital versions reduce their manual handling. In the middle term, time for management has been saved, and responses to collection users are been made quicker and easier. Risks associated to handling (dissociation, breakage, health and safety risk to staff, etc.) have been avoided or reduced.

INTRODUCTION. Managing a Natural History Collection means it must be preserved and improved to enhance its accessibility for scientific and educational purposes that is the reason why it was created. To develop this work properly, a documentation system is needed, which controls associated data with the fossils since the admission's moment and ensures that we know what they are, where they are, and how they are used.

Databases and digital images are part of the documentation system in the Paleobotany and Fossil Invertebrates Collection of the MNCN-CSIC of Madrid, Spain. This collection houses around one million fossils of plants and invertebrates. Handling fossils is a hard task due to their rocky nature and high weight, and especially in Fossil Collections of MNCN-CSIC due to the storage system with stacked boxes. Health and safety guidelines must be followed to avoid risks to the staff. Handling fossils is a risk to the fossils too, and should be carried out with care. As a result, this task is time-consuming.

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During the last eight years, human and material resources at the MNCN-CSIC have decreased dramatically because of the economic crisis. Because of human resources constraints, response to users could be affected. To face the problem, in 2008, a protocol to take low-quality digital images of specimens and their labels began to be tested and implemented, to gradually reduce specimen's handling. The final goal is to speed up the process of collections' management, easily and low cost, and gradually restrict handling fossils to the moments of scientific stays, departure and entrance of loans, preservation tasks, and security reviews in order to speed up responses to users.

MATERIAL AND METHODS. When fossils are going to be used or potentially used in exhibitions, for scientific purposes or others, they must be handled. At this point, every lot is photographed as a whole (labels included), if it has not been done yet.
Digitising is expensive and international digitisation projects do not fund it (Berendsohn *et al.*, 2010; Vollmar *et al.*, 2010), so it has to be carried out with the available resources, although there is no funded project behind, and the lack of human resources is often the weakest point in the MNCN. **Figure 1** shows the human resources available during these years to develop this task. **Figure 2** shows the technical resources needed: digital camera of general use, simple hardware (Desktop, 21'' screen, external hard disk, and external server) and software licensed to CSIC.
The Imaging Protocol consists of placing a scale bar as reference, at the top; a white surface as background, the MNCN label, as brand, in the left, the rest of the labels, around the fossil or fossils. At least two images are taken per lot: two positions of the pieces which depend on the fossil group, one goes with front part of the labels and the other with the back one. An extra image with higher detail is taken if there is any label attached on fossils or to depict important details. The image format is JPEG. The workflow follows with validation, naming, processing and secure storing of the images. With the licensed software, the colour balance of the images is automatically corrected. The aim is to obtain a combined image of fossils and labels in an easiest and fastest way, to avoid the need to access to them if they are not going to be used. So, we do not invest time in obtaining high-quality images, nor details with scientific purposes. The name of each image always includes the catalogue number.

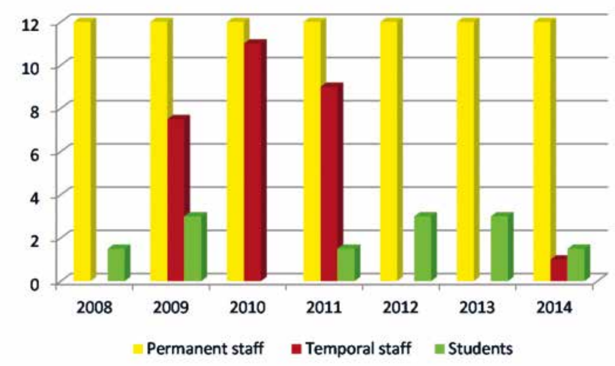

Figure 1. Total time per year, in number of months, available between 2008 and 2014 by each group of collaborators.

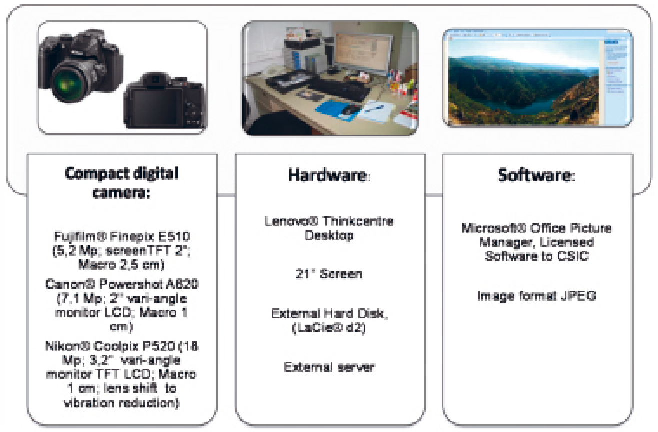

Figure 2. Available technical resources: compact digital cameras, hardware and software.

RESULTS. The imaging protocol is fully implemented in the collection and has led to an image store that is accessed during normal management tasks. Between 2008 and 2014, 24,109 images were taken (10,505 records in the databases). These quantities have been broken down by collections in **Table 1**, and by collections and year in **Figures 3 and 4**.
These images are being used to:

- Develop digital inventories for new or legacy items: all data are incorporated into the database using the pictures.
- Be included in the lists of pieces preselected for an exhibition. These lists are sent by mail to the institutions in order to they can select what they need.

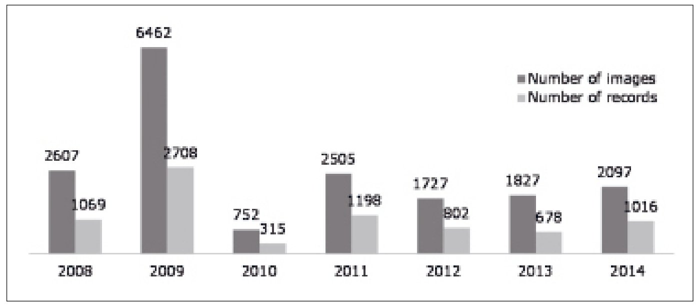

Figure 3. Number of images of MNCN fossil invertebrates collection, and number of records of the database, by year.

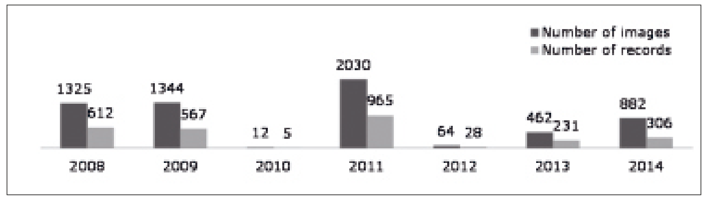

Figure 4. Number of images of the MNCN Paleobotany collection, and number of records of the database, by year.

- Be attached to the package for exhibition loans, and be used as loan indicator.
- Assess their physical condition (before and after loans to exhibitions, and restoration).
- Data retrieving from figured specimens (when data has been lost).
- Retrieve relation between fossils and labels if an accident occurs and something has been mixed.
- Labels' digital version allows us to check and improve data associated to the fossils (Chapman, 2005).
- Be sent by mail to researchers when they need data in advance.

(2008-2014)	Images	Records
Fossil Invertebrates	17984	7789
Paleobotany	6125	2716
Total	**24109**	**10505**

Table 1. Number of images of Paleobotany and fossil invertebrates MNCN Collection, and number of records of each database.

CONCLUSIONS. In this context, low-quality images are being used as a tool to make collections management easier, and as a technical solution to the lack of resources, especially the human ones.
Eight years after the beginning, we consider digital images are a powerful tool to manage palaeontology collections, because the fossils' digital versions reduce their manual handling:

- in the middle term, time is being saved, and responses to collection users are being quicker and easier, so the total activity of the collection has been increased.
- risks associated to handling (dissociation, breakage, health and safety risks to staff) are being avoided or reduced.

ACKNOWLEDGMENTS. These results wouldn't have been possible without the work of the Museum staff and the students who have collaborated with us, in one way or another, during the last nine years.

REFERENCES

Chapman, A. D. 2005. *Principles of Data Quality*, version 1.0. Report for the Global Biodiversity Information Facility, (GBIF). Copenhagen. http://www.gbif.org/resources/2829.

Berendsohn, W. G., G. Chavan, & J. A. Macklin. 2010. Recommendations of the GBIF task group on the global strategy and action plan for the mobilization of natural history collections data. Biodiversity Informatics, 7:67–71.

Vollmar, A., Macklin, J. A. & Ford, L. S. 2010. Natural history specimen digitization: challenges and concerns. Biodiversity Informatics 7: 93-12.

POSTER

Collections for the future – future of collections

Data-basing of the mineral and rock/ore collection at Museum für Naturkunde Berlin – looking backward and forward

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ABSTRACT. The Mineral and Rock/Ore Collection at Museum für Naturkunde Berlin was founded in the 18th century and comprises at present approximately 250,000 objects. Due to a missing card file system containing single object data the data-basing of the collection was started already in 1995 using a clear data entry strategy. At the end of 2015 193,163 from the ~250,000 collection objects were data-based, and a completion could be achieved in 12-15 years. The data entry rates are clearly depending on the conditions of the collection regarding historical or actual processing. Major problems during data-basing comprises i) historical labels which are difficult sometimes even impossible to transcribe and/or have an unknown handwriting, ii) fast classification of rock samples, and iii) nomenclature of collection distant objects. A major goal for the future is the connection of all of the available data for each individual object, which includes the information of the collection database in combination with associated, but separately internal as well as external stored data. This strategy will provide an optimal prepared collection for the future.

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INTRODUCTION. The Mineral and Rock/Ore Collection at Museum für Naturkunde Berlin was founded originally as a Royal Mineral Cabinet in 1781 by the Prussian king Friedrich II with Carl Abraham Gerhard as its first director. Together with other precursors of this collection, the Royal Mineral Cabinet was subsequently integrated into the University of Berlin, which was founded 1810 by the Prussian king Friedrich Wilhelm III, renamed to Mineralogisches Museum, and stored together with other natural science collections in the university's main building at the boulevard "Under den Linden". Nevertheless, the rapidly growing collections lead to the decision to build a dedicated collection and museum building, the Museum für Naturkunde, which was opened in 1889, and integrated most of the university natural science collections. Since that time the Mineral and Rock/Ore Collection is stored within this building, and retained in many cases in their original place and inventory.
Originally, the collection was only subdivided into a systematic mineral and a regional rock collection. Due to the establishment of new research areas (e.g., ores, impactites), the set-up of a systematic rock collection for teaching and the takeover of a crystalline erratic rock collection, the structure of the collection is nowadays more complex and can be subdivided into ten subdivisions (see **Table 1**). Although the collection comprises approximately 250,000 objects, the access to the collection objects was limited in the past due to a missing card file system containing single object data. An access to collection objects was only possible using the object array either in systematic or regional order as the basis for searching for objects.

Type of collection	Estimated objects in total	Data-based objects (2015)
Mineral Collection		
Systematic mineral collection	175,000	161,163
Technical product collection	2,500	60
Crystallographic model collection	2,500	0
Rock/Ore Collection		
Regional rock collection	17,000	7,651
Systematic rock collection	8,500	8,540
Ore collection	21,000	10,431
Impactite collection	5,000	4,800
Crystalline erratic rock collection	10,000	417
Natural building stone collection	1,000	101
Thin and thick section collection	7,500	0
Total	250,000	193,163

Table 1. Structure of the Mineral and Rock/Ore Collection at Museum für Naturkunde Berlin displaying the estimated number of objects and the status of data entry for the collection subdivisions.

DATA-BASING OF THE COLLECTION. Due to an increasing number of inquiries the access to the collection had to be improved and therefore a database was set-up already in the year 1995. First, a Paradox database was established, which was later moved to MS Access. At present, the Mineral and Rock/Ore Collection uses a server hosted, multi user MS Access 2010 database in combination with a Cumulus multimedia database. The text-based contents are stored in the MS Access database whereas multimedia contents (e.g., images, PDF) are deposited in the multimedia database and were automatically linked with the MS Access database. For acceleration of data entry pick-up lists for classification, location and acquirer were implemented.
Since the beginning of the data-basing a clear strategy for data entry was implemented. The importance and frequency of usage was used to arrange an order for data entry between and within the different collection subunits.

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First, between 1995 and 2008, the major part of the systematic mineral collection was data-based in several working packages. This collection subdivision was already in good conditions regarding modern label information on classification, location and accessioning. Therefore, the data-basing was fast and could be carried out predominantly by technical staff members.
Since 2009 the data-basing takes place in the Rock/Ore Collection. Here the impactite collection was the first collection subdivision selected for data-basing as this part of the collection is most frequently used for actual research projects. Afterwards the systematic rock collection was data-based to collect experience with the existing rock nomenclatures and to establish a clear classification system for rocks within the database. Currently, the data-basing is conducted within the regional rock and ore collections. Generally, due to the lack of a modern reprocessing, the conditions of the samples within the Rock/Ore Collection regarding classification are much poorer in comparison to the Mineral Collection. Additionally, many of these samples have only labels from the 18th and 19th centuries with old handwritings, which must be transcribed in a time consuming process. Therefore, the data-basing in the Rock/Ore Collection is much more time consuming in comparison to the Mineral Collection, and needs for many objects also the input of an experienced scientists.
The progress of data-basing is shown in **Figure 1**. At the end of 2015 193,163 from the ~250,000 collection objects were already in the database. An extrapolation of the data entry rates based on the currently available personal capacity indicates that a completion could be achieved in 12-15 years.

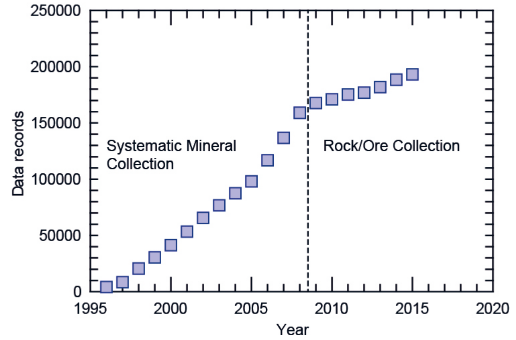

Figure 1. Development of the database for the Mineral and Rock/Ore Collection at Museum für Naturkunde Berlin. Note the distinctly different data entry rates in the two collection subdivisions.

PROBLEMS. The experience with data-basing of the collection objects reveals the following major problems:
i) Historical labels contain important data about the objects as well as through their handwriting information about the investigators and/or collectors of these objects. Unfortunately, many of these old labels are difficult sometimes even impossible to transcribe and/or have an unknown handwriting. Both items reduce the available information about the objects. These gaps were partially compensated by linking scanned labels to the data records allowing a fast investigation of unknown handwritings.
ii) Classification of rocks is in many cases missing or out of date for historical samples. Scientific rock classification needs normally time consuming and destructive investigations, e.g. thin section microscopy and chemical analyses, which is normally not possible during routine rock data-basing. Therefore, in many cases a primary rock classification has been applied based on literature data, geological map information or curators knowledge. Nevertheless, the development of fast and non-destructive rock classification methods in the future would be desirable.
iii) Classification of collection distant objects is problematic. For example, technical products could by classified using mineralogical or chemical classification systems, or crystallographic models made of wood or porcelain can be named by their crystal form and habit or by assignment to a mineral, but the latter is problematic due to isomorphism and additionally not possible in all cases. For such objects it is useful to define classification standards.

OUTLOOK. A major goal for the future is the connection of all of the available data for each individual collection object. The information for an individual object available through the collection database should be enriched by linking to associated, but separately internal as well as external stored data including collection and inventory lists or catalogues, archival documents, analytical data and publications. This task is time consuming, but will distinctly raise the scientific value of the collection, and therefore will provide an optimal prepared collection for the future.

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ORAL PRESENTATION

Green museum – How to practice what we preach? (General session)

New uses for old collections: rediscovering and redefining economic botany

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ABSTRACT. In the 19th century the power of objects to preserve and communicate ethnobotanical data was well-understood. Plant-based raw materials and artefacts were shown in dedicated museums of economic botany, such as those at Kew (founded 1847) and Adelaide (1864), in botanical museums (Berlin, 1878, Harvard 1958), and in colonial museums (Amsterdam 1864, Kolkata, 1901). These had a strong commercial aspect, using science to assist exporters and importers of plant materials, and were also popular educational resources. However, by the 1950s many displays seemed old-fashioned, oil-based products were the future, and most such collections were placed in storage or divided among other museums.

Since the 1990s a combination of factors has revived interest: widespread enthusiasm for sustainable materials; large-scale rehousing and digitization of collections and, crucially, the emergence of new user groups including indigenous communities, historians of medicine, science and empire, and analytical chemists working in art history and archaeology. Using recent case studies from economic botany collections at the Royal Botanical Gardens, Kew, and Naturalis, Leiden, we explain how we have rediscovered collections at our own and other museums, and explore the transition from a narrow 'economic' view of their use to one that values both scientific and cultural components.

POSTER

Green Museum – How to practice what we preach? (General session)

Greenovations! Benefits and drawbacks to the LEED Silver Certification Renovations of Pod 3

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ABSTRACT. Using principals and standards of the United States Green Building Council (USGBC), and Leadership in Energy and Environmental Design (LEED), The Museum Support Center's Pod 3 was renovated in 2007-2009 as a high-performance green building that is a healthy, productive place to work, learn and preserve the nation's heritage. Our poster will outline the benefits and drawbacks of these green renovations after 7 years of using this space for laboratories, offices, and collections storage.

ORAL PRESENTATION

Collections for the future – future of collections

Museums, keys, recording schemes and amateur naturalists. Why museums underpin the recording movement and why its crucial they continue

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ABSTRACT. Regular biological recording underpins our knowledge of the local fauna, is crucial to our understanding of ecological change especially climatic change, increases the taxonomic knowledge in groups, flags issues as they arise and keeps taxonomic experts in touch with the general public keeping us, as national institutions, relevant.
Museum collections and Museum experts when working in association with biological recording groups and with organizations such as the FSC in the UK willing to print and produce accessible taxonomic keys can make a huge impact to our knowledge of certain taxa, increase public knowledge and lead to taxonomic discoveries. Museums must continue to invest in this quest.

SPNHC 2016 – Oral and poster presentations, sorted alphabetically by first author

ORAL PRESENTATION

Enabling Infrastructure: Future Collections, Data & Informatics (Synthesys Symposium)

Witikon: nationwide mass 3D digitization

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ABSTRACT. Slovakia has become a leader in 3D digitization of cultural heritage artefacts, implementing the national project 'Digital Museum' between 2012-2015. Over 180,000 collection items from 33 of the largest museums, across 55 locations were scanned. The leading technology was the automated 3D digitization solution Witikon, which was developed based on curator's requirements.

Due to the high throughput of Witikon, a large variety of collection items ranging from 5cm to 2m including glass, dark and glossy objects were scanned within 6 minutes per item in high resolution using Phase One cameras.

The output of the scanning, per collection item, were hundreds of high resolution photographs, a highly precise 360° photography/object panorama (with accurate textures and colours) and a high quality 3D model was generated with limited post processing within a few hours. Thus, setting a new benchmark for speed and quality of 3D digitization. Providing one complete solution which meets the all the needs of conservation, research and presentation.

We discuss the underlying technology, its application for the 3D digitization of natural history specimens and provide examples across different types of natural history collections.

REFERENCES

http://www.witikon.eu/
http://images.cemuz.sk/hotspots/02_kanvica_F-2346.html
https://www.youtube.com/watch?v=2OIQ31Bt_g8

ORAL PRESENTATION

Green Museum – How to practice what we preach? (General session)

Sustainable conservation on the way to the green museum

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ABSTRACT. The diagnosis of global climate change is by now 25 years old. The melting of the large glaciers and the increase of sea levels are no more a distant vision of the future, but became a phenomenon of our daily reality. The hurricanes Katrina (2005) in New Orleans, or Ike (2008), who brought destruction and prolonged shortage of electricity to the Caribbean and parts of Texas, more and more such storms with increasing damage potential seem to origin along the Atlantic-Caribbean axis. Also other regions are concerned by this development.

Climate change over the next 100 years will likely have a range of direct and indirect effects on the natural and material environment, including the historic built environment. Important changes will include alterations in temperature, precipitation, extreme climatic events, soil conditions, groundwater and sea level. Iron corrosion attacks trains in Spitzbergen, and museum pests spread to new regions. Even if these prognoses are not fully certain, they indicate clearly that we should prepare for a negative development and a severe degradation of the conditions for our collections and monuments as well as for soaring invoices on energy costs in high-tech HVAC devices. Climatization in humid and tropical regions is a critical issue for museums world-wide. Climate change, linked to the increasing demand of our society for energy and resources, has forced sustainable development to the top of the global political agenda.

How can we preserve our collections and monuments in a sustainable way for future generations? Here we deal with three closely interwoven challenges: On the one hand, the conservation and preservation, the possibly longest extension of the lifespan for our cultural heritage, on the other hand the financial and infrastructural ramifications for this endeavor, and finally, the question of energy and resources (energy efficiency, carbon footprint). Priorities can always be set in different ways, but it terms of sustainability, the three aspects have to be dealt with simultaneously: A green museum is a museum which incorporated and implements the concept of sustainability in its program, its activities and its physical setting.

Museums do more than storing knowledge and materials. They are also mediators and multipliers in the important cultural, social and scientific dialogues of our time. Museums face the large societal challenges on a daily base. Experience continuously shows, that disaster is a mostly a social construct. Also for this reason, museums need to embrace the "green museum" debate on all levels, from the staff to the visitors.

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Preventive conservation, an integral part in the "green museum" concept, is not a protocol, it is a process, in constant development. All stakeholders in culture heritage preservation have to collaborate systematically to identify, understand and mitigate risks, respecting all three columns of sustainability including the financial and the ecological impact. In this process, we are all together on our way to the green museum.
Museum collections and Museum experts when working in association with biological recording groups and with organizations such as the FSC in the UK willing to print and produce accessible taxonomic keys can make a huge impact to our knowledge of certain taxa, increase public knowledge and lead to taxonomic discoveries. Museums must continue to invest in this quest.

ORAL PRESENTATION

Blending the educational resources of small and large collections for training the next generation of museum professionals (iDigBio Small Collections Symposium)

Small collections can make big waves in education and outreach

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ABSTRACT. Natural History Collections have always been storehouses for curiosities and centers for biodiversity research. Collections, be they 2 million specimens or 200, have the unique opportunity to have a large impact on the intellectual and educational development of the public. In having a large storehouse of natural history specimens, data and expert scientists they can be a focal point for learning about biodiversity and the scientific process. In the past, outreach activities have largely been restricted to tours and "show and tell" style activities. These activities, while still great for engaging collection visitors, do not fully utilize the resources available in a museum collection. Through the use of specimens and their data, collections can provide the non-scientific community with engaging education and outreach opportunities. In addition, collection curation activities, telepresence outreach, georeferencing, molecular phylogenetics and fieldwork associated with these collections provide educational experiences that are arguably unmatched in any other field of science. Given that large collections are tasked with numerous scientific visitors, loans and an ever growing collection they find themselves with less time and resources for dynamic outreach. Small collections provide a unique and intimate atmosphere for enriching education and outreach activities and fill a niche left by larger collections.

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ORAL PRESENTATION

Enabling Infrastructure: Future Collections, Data & Informatics (Synthesys Symposium)

Data Portal and the Graph of Life

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ABSTRACT. The Natural History Museum, London's (NHM) Data Portal (http://data.nhm.ac.uk) provides a sustainable and publicly accessible online repository of our digital collections and research data (currently circa 3.5m records and 900k images). It allows museum scientists to deposit research datasets that can be cited in publications, as well as tools to integrate, visualise and analyse these data. The next stage of Data Portal activity involves connecting our data with other major data sources. Traditionally this has been viewed as a major challenge, requiring agreement on vocabularies around which our data can be organised. By using GBIF's aggregation activities we have sidestepped this problem, to implement a scalable and reusable graph-building mechanism. This allows us to connect the products of the NHM's digitisation programme to a wider data ecosystem, including WikiData, Encyclopedia of Life, Catalogue of Life and a variety of other data providers. In this presentation we will give an overview of the current portal functionality, technologies and processes associated with the system, in addition to demonstrating potential phenotypic, phylogenetic, genetic and environmental applications that demonstrate the value of connecting NHM data with other data sources.

ORAL PRESENTATION

Preventive conservation and material science

Seeing is believing, a fourteen year study on efficacy and economics of visual inspections to protect a large mammal collection.

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ABSTRACT. In response to the loss of in-cabinet fumigants, the National Museum of Natural History, Smithsonian Institution's Division of Mammals applied a consistent voluntary visual inspection protocol over fourteen years. Per cabinet, inspections required about 7 minutes. Cases categorized as clean, dirty, signs of life, and live insects neatly compartmentalized levels of uncertainty, and drove cabinet specific treatment and cleaning actions. Persistent re-infestation led to cabinet renovation or replacement.
For IPM to be successful it must demonstrate predatory efficacy better than the replacement rates of pests. With a maximum 1.5% of staff time devoted to IPM, cabinet infestations of *Thylodrias contractus* and *Necrobia rufipes* were near zero within three years. Rebound after a forced three year hiatus of inspections was similarly supressed by a following round of inspections. The investment of time was found comparable with that of previous cabinet repellant or fumigation regimes, but without the aggregated loss of access to collections during enclosure and out-gassing of fumigant. This allowed longer and safer access to collections over the year. The study also includes an economic comparison to historical methods of cabinet level pest suppression with fumigants against two other comparably large collections documented within the last half century.

POSTER

Other topics

Natural history education using marine debris: A hands-on beachcombing museum display

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ABSTRACT. By examining objects that have washed up on the seashore, we can find evidence of marine animals as well as changes in the marine environment. The interface between the land and sea is the frontline for observations of changes that are taking place in the ocean. Beachcombing along sandy beaches is well suited to natural history education, as the activity is safe for beginners. In addition, exhibits dealing with marine debris in natural history museums confront students and naturalists with another unique way to learn about the natural history of the ocean.

MAIN TEXT. The source of marine debris – the ocean – which transports this debris to beaches all around the Japanese archipelago, faces dangers posed by global warming and marine pollution. Facing the open sea, sandy beaches are well suited for beachcombing, and a rich variety of marine debris can be discovered. Surveys of marine debris that has drifted ashore can be conducted by instructors or teachers using field guides to natural history. In addition, items of interest can be collected (e.g., shells and stones for beginners), and non-collectable items can be recorded using a digital camera.

Marine debris	Example
Natural objects from the sea	Seashells, Crabs, Fishes, Marine mammals Tropical seeds and fruits
Natural objects from the land	Driftwood, Walnuts, Terrestrial mammals
Artificial objects from the sea	Glass floats, Plastic floats, Fishery gear
Artificial objects from the land	Toys, Balls, Litter

Table 1. Classification of marine debris that has washed up on seashores.

Marine debris can generally be divided into four categories based on the origin and characteristics of the object (**Table 1**). Natural objects include seashells, crabs, fishes, marine mammals, tropical seeds and fruits, and artificial objects include items such as glass and plastic floats, fishery gear and items produced overseas. Some marine debris is terrestrial in origin and might include items such as driftwood and walnuts, while artificial objects could include things like plastic toys, balls and litter. Of these items, the natural examples of marine debris, such as seashells, marine mammals, tropical seeds and fruits, are very important for natural history education.
The warm Kuroshio Current flows northeastward along the southern part of the Japanese archipelago, and a branch of the Kuroshio Current, known as the Tsushima Current, flows into the Japan Sea to the west of the country. From the north, the cold Oyashio Current flows southward along Japan's east coast, and a branch of the Oyashio Current, called the Liman Current, enters the Japan Sea from the north. The mixing of these warm and cold currents produces the abundant marine life found in Japanese waters.

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Figure 1. Diorama in the Hokkaido Museum showing a porpoise that has become stranded on a sandy beach.

The unique marine conditions in the Japan Sea support a wide diversity of marine organisms. Changes in the sea surface temperatures of the Japan Sea appear to be related to the inflow of the Tsushima Warm Current, which transports warm-water taxa northward. During autumn-winter, the paper nautilus, Argonauta argo, is frequently stranded on the beach. After 2005, mass strandings of paper nautiluses have been recorded repeatedly on the Japan Sea-side of Hokkaido, and it is considered that this may be due to higher than average sea-surface temperatures. Since sea surface temperatures in the Japan Sea are expected to increase due to global warming in the 21st century, it is possible that the frequency of such strandings may increase.

In addition to natural history, exhibits in natural history museums often present rare or important material. For example, whale and dolphin agroundings are often subject of displays in the marine exhibits of museums (**Figure 1**), and other examples of marine debris are also sought after for museum exhibits. For example, planktonic and deep-sea organisms are valuable because they are rare and are typically only washed ashore during severe storms and typhoons. Since these organisms are usually dead, marine biodiversity is not affected.

Consequently, beachcombing of sandy beaches is an effective learning tool for natural history education as the activity is safe for beginners. The most interesting aspect of beachcombing is that participants can contemplate the histories of the objects that they find. Similarly, exhibits in natural history museums that deal with marine debris are unique learning tools for students and naturalists.

ORAL PRESENTATION

Enabling Infrastructure: Future Collections, Data & Informatics (Synthesys Symposium)

Automating the insect digitization – speed and costs

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ABSTRACT. Digitization of natural history collections can be enhanced by automation. We tested the performance of an automatic imaging line with two common groups of insects. Our two operators digitized an entire Coleoptera collection of 14,000 specimens in 28 working days, which translates on average to 80 specimens /hour. The workflow applied included use of two cameras, one imaging the specimen from the top and one imaging the labels from the side. For Macrolepidoptera, one operator imaged 70 specimens /hour at maximum speed. Here one camera was in use, and labels were spread on the pallet customized for specimen transportation. For Microlepidoptera, similar performance was achieved. Based on these benchmarks, progress and costs of digitization can be estimated. For example, at Digitarium, outsourcing digitization of Macrolepidoptera as a service costs around 108,000 € for imaging of 100,000 specimens during ten months. As an option, museums can purchase an imaging line for insects (around 30,000 €) and develop their in-house digitization. Both approaches can be applied in the mass digitization of individual insect specimens.

INTRODUCTION & METHODS. Entomological collections in natural history museums are often extensive, and digitizing them by the individual specimens can be daunting task. However, automation can speed up the imaging process and decrease expenses. World's first automated, conveyor belt driven digitization line for pinned insects was developed by Digitarium in 2014 (Tegelberg et al. 2014). A replica was delivered to the Finnish Museum of Natural History LUOMUS in 2015, where it is currently being used for a wholesale imaging of Lepidoptera specimens.

We tested the performance of the digitization process using the imaging line for pinned insects with two major groups of insects, Coleoptera and Lepidopera. During digitization of Coleoptera, the imaging line employed workflow involving use of two cameras, one imaging the specimen from the top, and another from the side. The side image captured the labels intact in pins, and also from below using a mirror. During the digitization of Lepidopera, only one camera was used. Labels were removed from the pins and placed next to the specimen on a custom-made pallet. Each pallet was photographed twice: once for the specimen and once for the labels. Each sample was assigned a unique ID, printed on a label in both human- and machine-readable forms. Basic specimen data, including the scientific name, were transcribed before the imaging. A single operator is enough to operate the semiautomatic system at the speeds presented below. Adding a second person allows for simultaneous database entry of basic collecting data (localities, dates and collector names). Quality of the images was verified regularly. With both collections, the hourly and daily production of imaged specimens was recorded, and workflows were adjusted based on specimen type to speed up the process. Finally, all the costs were summed and the price of digitization of large amounts of specimens could be calculated.

RESULTS. At Digitarium, two operators digitized an entire Coleoptera collection of 14,000 specimens in 28 working days, which translates on average to 80 specimens /hour. In a Macrolepidoptera benchmark, one operator imaged 70 specimens/hour at maximum speed. At LUOMUS, two persons processing assorted museum specimens of Microlepidoptera (Depressariinae and Oecophoridae) averaged a speed of 57 samples/hour over two months, including the transcriptions of basic collecting data. Maximum speeds of ~120 samples/hour were reached when processing material with only one label per specimen.

The cost of imaging 100,000 specimens of Macrolepidopera as a service, including salaries, overheads, IT help, rents, transport and logistics, is around 162,000 € during a ten month period. For Coleoptera, costs of imaging 100,000 specimens as a service reach 108,000 €. We also calculated the overall price of the delivery of insect imaging line, built by Digitarium. The present price is around 30,000 € including installation, testing, and training.

DISCUSSION & CONCLUSIONS. The imaging line was proven to be configurable for different insect collection types, as needed. The aim of the line is to image individual specimens and the pinned labels. Imaging without removing labels from pins worked well for beetles of variable sizes, speeding up the imaging process and reducing the need to handle fragile specimens. On the other hand, the large wings of Macrolepidoptera hindered the imaging of the labels in the pins. Thus, the labels were spread on the pallet. It slowed down the imaging but compared with earlier, man-made imaging, production of images was still several times faster when using the line. Benchmarks for flies and wasps are underway at this writing.

Digitization consumes resources that can be decreased by automation. With efficiency, costs per specimen go down. However, not all museums have human resources, space and IT systems to start large-scale digitization. Services for insect digitization have now been developed and available in Joensuu, Finland. During our digitization projects, budgets were followed and analyzed. The calculated costs of digitization of beetles and butterflies are direct costs without any profit, and reflect co-operational project costs. They also reflect use of one imaging line, by trained operators with long experience on handling insect specimens.

Another option to museums in managing mass-digitization is to acquire their own imaging line (cost around 30,000 € as turn-key solution with the delivery of the necessary hardware and software services) and develop their in-house digitization workflows. This will be the most economical solution for large collections and in the long term. Imaging and transcription of labels of one million pinned insects would cost, as an in-house, long term project, about 50 cents per specimen. We conclude that mass-digitization of entire insect collections is now available.

REFERENCES

Tegelberg, R., T, Mononen & H. Saarenmaa. 2014. High-performance digitization of natural history collections: Automated imaging lines for herbarium and insect specimens. Taxon 63(6):1307-1313.

SPNHC 2016 – Oral and poster presentations, sorted alphabetically by first author

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ORAL PRESENTATION
Preventive conservation and material science
Moving of the geological and botanical collections at NHMD

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ABSTRACT. As part of the preparation for the building of a new natural history museum for Denmark, all of the geological and botanical collections which are currently held within the building site of the new museum are in the process of being moved to a temporary storage. Altogether approximately 3,5 million specimens are being moved and meta-registered in the process.
The move has been complicated in several respects as the different collections have been housed in many smaller rooms in various buildings – from subbasements to addicts and usually without access to an elevator. Further more the geological collections were infected by fungi and therefore required special cleaning for fungi spores in connection with the move.
The talk will concentrate on the preparations for the move, the complications, the solutions and the future plans for storage of the NHMD collections.

BACKGROUND. Denmark is building a new natural history museum in the midst of the Botanical Garden in Copenhagen. If everything goes as planned, it will be finished in 2020. As part of the preparation for the building of the new museum, the geological and botanical collections, which are currently held within the building site of the new museum, are in the process of being moved to a new temporary storage.
Altogether approximately 3,5 million specimens are being moved and meta-registered in the process. The collections are being moved by a team of 15-17 persons, which has been hired by the Collections section to do the packing, the unpacking and the meta-registration of the collections. The actual move is done by a professional moving company.
The temporary storage is a rented 3000 m2 warehouse situated 20 minutes outside of Copenhagen. The temperature fluctuates in regard to the outside temperature while dehumidifiers control the relative humidity (50% +/-5%). As we strongly expect getting new state of the art collections halls in the new museum including new furniture, a lot of the old collections furniture is reused in the temporary storage in order to save money.
The aim is to have all the collections fully accessible for research and curating in the time between this move and the final move into the new museum.

Figure 1. Tray with geological material is packed and stored in specialmade transportation wagons.

Figure 2. Cleansing box in dirty part of the cleansing container

THE GEOLOGICAL COLLECTIONS. The move of the geological collections (approx. 1 million specimens) started in August 2015 and is expected to be finished by the end of June 2016.
The move of these collections has been complicated by a lot of things. First of all, most of the geological specimens were housed in the basement or subbasement of the old Geological Museum, with no access to an elevator. This has led to the construction of special transportation wagons which can house most of our standard trays. The trays are packed in the wagons which are then plastic wrapped and hoisted through a latch to the outside yard.
As we did not have the proper procedures in place for dealing with naturally occurring radon, asbestos and toxic minerals, we first had to map the occurrence of problematic specimens and create procedures for handling them, so that it was safe for the moving team to work with the collections.
Finally, most of the geological collections were infected by fungi as a result of a flooding in 2011 and therefore required special cleaning for fungi spores in connection with the move. For that we constructed a special cleansing container, where all specimens were cleansed by compressed air in order to get rid of the fungi spores. For the greater part, the cleansed boxes with specimens were moved into new clean drawers, but for the most heavily infected collections, all boxes were replaced with new ones and placed into newly bought compactors. All work with contaminated collections was done in full protective gear (suits, gloves and turbo masks).
When all the collections have been cleansed and set up in the new facility, the collections will be meta-registered.

THE BOTANICAL COLLECTIONS. The work with the botanical collections started in January 2016 and will be finished by the 1st of September, when the future building site must be vacated of all collections.

As the botanical collections are much more homogenous than the geological collections, this big challenge is not its complexity, but the amount of objects to be moved – more than 2,5 mill. herbaria sheets and some other smaller collections (alcohol, wood, seeds etc.).
As it is impossible to secure the botanical material from pests in the new temporary storage, it was decided to pack the contents of each pigeonhole into a plastic bag, which is then meta-registered. By means of a vacuum machine, the air pressure within the bag is slightly reduced before it is sealed. Besides acting as a pest barrier, the plastic bag fixates the content which minimizes the negative effects of handling. The plastic bags are then packed into standard cardboard boxes which are frozen for 4 days at minus 30 degrees Celsius to kill any active pest infestations. All the botanical material goes through the freezer before being transported to the storage facility and this part of the process is taken care of by the moving company.

SUMMATION. Even though it is potentially very damaging to the collections to move them, some very good things can come out of such a move as it is an excellent possibility to clean up in the collections and to get a lot of basic curatorial work done.
For our part, especially the geological collections were in a bad state, but now all the specimens have been cleansed, a lot of the specimen boxes have been replaced by new ones and the collections are in a better order than ever before. Further more we now have procedures for handling potentially problematic specimens and all of the collections will be meta-registered. The latter is also true for the botanical collections which in addition are pest free as they have been through the freezer.
All in all, the move has been a big gain for the collections.

ORAL PRESENTATION
Setting global and local digitisation priorities (GBIF Symposium)
Principles for setting digitization priorities for herbaria

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ABSTRACT. Herbaria hold specimens of plants (including flowering plants, ferns, bryophytes and algae) and fungi (including lichens). Herbarium specimens were among the first natural history collections to be digitized. Databasing of specimen labels began in the 1980s, and specimen imaging in the late 1990s. Collaboration on digitization projects began early and remains a hallmark of the herbarium community. The willingness to join digitization collaborations suggests that digitization priorities align strongly among collections. Herbaria have generally favored digitization projects that allow entire blocks of their collection to be digitized, because selection for specimens for such projects is easiest. More than 200 herbaria have digitized type specimens for the Global Plants Initiative, and geographically-based collaborations are also well established, for example in Australia, Brazil, and within the U.S. Taxonomic collaborations are somewhat less common, but exist in the U.S. for algae, bryophytes and fungi, for example. Less common so far are collaborations based on biology or ecology, conservation status or collection date (or date ranges). Specimen selection for such projects is far more time-consuming, although demands for more customized digitization will probably increase with the number of research projects that require species occurrence data to analyze broad patterns of plant distribution.

ORAL PRESENTATION
Digitization and imaging collections: new methods, ideas, and uses
Bringing dark data to light – how do we keep the lights on?

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ABSTRACT. SEMC (Snow Entomological Museum Collection), like many other natural history museums and herbaria, is currently serving over a million specimen records to multiple data aggregators including GBIF, iDigBio, Discover Life, Bison, CRIA, and others. These records are queried, viewed, and downloaded every day from countries across the globe. Where are the publications that cite these specimen records? Are these digitized specimens being utilized for environmental impact statements, Department of Defense projects, conservation, or land management projects? What improvements or corrections have been made to the data? How can we incorporate these emendations and updates back into the source databases? What policies, regulations, or other actions have communities and governments taken based on these records? Currently all the data, research, publication, and associated funding is pouring outward with little return to the source museums that house and care for physical specimens and their digital counterparts. We need to complete the feedback loop to drive improvements to the source databases, to increase knowledge about data usage, and to funnel funding back to the collections again to grow an increasingly accurate, relevant, useful, sustainable future for our Natural History collections.

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ORAL PRESENTATION
Green Museum – How to practice what we preach? (General session)
Collection planning

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ABSTRACT. Collection planning is emerging as a best practice and for good reason. In an environment of reduced financial resources coupled with goals for greening our museums, collection planning is the cornerstone for both institutional and environmental sustainability. Collection planning forces us to think critically about what should be in our collections and is guided by an intellectual framework that aligns the content of collections with the larger goals and mission of the institution. The Denver Museum of Nature & Science authored its first Long-Term Collection & Research Plan in 2008 in preparation for the design and construction of the recently completed Avenir Collections Center. In this context, the Plan documented our collecting goals, identified targeted deaccession opportunities, and served as the basis for collection growth estimates for the future. It gave staff, Trustees, and funders the confidence that the Museum was prepared to build a right-sized, sustainable Center. This presentation will present with highlight the collection planning process utilized at the Denver Museum of Nature & Science.

ORAL PRESENTATION
Preventive conservation and material science
A Smithsonian Institution case study: Managing the movement of bulky collections

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ABSTRACT. Within every museum there are distinctive collections that present a challenge when they need to be re-housed. The bulky bamboo collection at the United States National Herbarium is such example. The collection came to the Smithsonian in the 1940s and developed through the late 1980s. It contains 1,419 specimens ranging in size and shape. This collection has been stored in handmade wooden cases crafted in-house in 1950. The basic material used in the construction of these cases consists of toxic material that affects the health and safety of the staff and the collection. To move these specimens three specific phases of movement were required; Phase 1 – location and space for new cases, Phase II – staging of the swing space for the bulky specimens and Phase III – movement of the bulky specimens from the old cases into the new cases. Each phase required a significant amount of planning and coordination between multiple events within each phase. Lessons were learned and since many museums have distinctive and bulky collections, our experiences can be used by others who may share the same legacy housing and re-housing bulky irregular items.

INTRODUCTION. Every museum collection has a particular set of idiosyncratic re-housing issues. The U.S. National Herbarium has recently faced these issues in the form of the bulky bamboo collection. Dr. McClure started collecting bulky bamboo in the 1940s and the collection continued to develop and grow through the next forty years. Since the late 1980s this collection of 1,419 specimens has become static but still holds important information on the structure of bamboo stems and rhizomes that are too large to press and mount onto the typical herbarium sheets.

These specimens were stored in substandard wooden cases constructed in the 1940s through the late 1960s. By their very nature, these cases contain hazardous materials. The modern consensus is to use metal cases since they are superior in design and security (Hatchfield, 1995; Moore and William, 1995). Thanks to a generous grant from the Smithsonian's Collections Care and Preservation Funds, we were able to replace the wooden cases with metal ones, which present a safer and greener work environment for both the specimens and the staff.

There were numerous steps in planning, but the broader shift consisted of three distinct phases:
1). The creation of space for the new cases
2). The staging of swing space
3). The movement of specimens to the new cases

Project management and flexibility were important components throughout these three phases. Without the help of all staff in the Department of Botany and coordination of additional Smithsonian building and facilities support staff, the move would not have been possible. All of these different components came together in an organized and timely manner to re-house this irreplaceable collection.

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METHODS
Phase 1 – Location Creation. The integration of the new cases into the flow of the herbarium range required reconfiguration of two spaces. To accomplish this task, a series of very specific shifts of both specimens and cases had to occur. Planning of this domino effect required detailed location data and maps of the collection. Other museums faced with a collection move had the same data needs (Benson, 2001). One tool to create and display this type of information is ArcGIS which has been used to map collection for research and conservation (Molineux et al., 2012). The U.S. National Herbarium has detailed information as to the location of each case, the composition of the case and the content. Maps are regularly created from this data using ArcGIS. Using these maps, each event in sequence was coordinated and completed in an organized manner.

Phase 2 – Staging of Swing Space. For any move, large or small, swing space is critical (Schoenholz, 2001). The majority of the cases is designed for pressed herbarium sheets and is not compatible with storing large bulky specimens. Rather, we were forced to move the wooden bulky cases to a holding space and use these cases to stage the specimens. To insure the safety of the specimens, the drawers were removed; placed on countertops with a plastic covering while the empty cases were carefully moved.

A number of willing staff and volunteers were essential for the careful movement of these drawers since no one person could safely carry a drawer. Online software such as Doodle polls was the best option we discovered in organizing staff for tasks, assignments and coordination of their time commitment. To help motivate the staff, the project was broken down into easy goals. This way at the end of each shift, staff had the feeling of accomplishment. Utilizing these different tools this phase happened within the appropriate timeline.

Phase 3 – The individual movement of specimens to new cases. There is little published information detailing movement of specimens on the individual scale. Most documentation that exists is for large-scale shifts of museum collections. In organizing people who are not familiar with moving specimens, a protocol was established.

In this protocol location description within the museum is critical. There was a size difference between the wooden and metal cases. Specimens that fit in the wooden cases many not fit fully into the metal cases. To help solve this problem extra cases were purchased. The main issue was that the specimens were inventoried with their storage location. If they were moved, their new location was recorded. As the collection was moved the protocol was used to update the location of the specimens.

RESULTS. The primary result from this move is a better storage of the collection in their new metal cases. As with all moves there are unexpected issues with the timing of project and the availability of staff. We were able to move 35 wooden cases to the new metal cases and create a protocol that will be used in the future. As we moved specimens, we were able to check on their conservation status. Having the large variety of stems and rhizomes on display provided a teaching opportunity for the department. Many of the staff and the volunteers did not realize this collection existed and it provided a way to view the amazing diversity of bamboo species. Finally, with a finite goal in mind people we were able to move specimens and drawers at a faster rate then predicted.

DISCUSSION & CONCLUSIONS. As with any movement of collections, project planning is the key to avoiding large issues. Even with a plan there is a level of flexibility needed (Benson, 2001). By having the series of events laid out combined with maps for phase 1 and 2, and the protocol for phase 3, these processes worked in concert to facilitate the move. The protocols provided a blue print for future moves as well as documenting to future staff at what we did. Each step of the process was documented and if there are any questions about our methods, staff will be able to review and learn from them. Finally, this collection is now housed in better equipment that will be able to last the next 100 years.

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ACKNOWLEDGEMENTS. I would like to thank Carol Butler and Smithsonian's Collections Care and Preservation Funds for support and funds during this move and Carol Butler for her support for travel to this meeting. Also the Staff of the Department of Botany and The Building Support Staff for their tireless work in helping with this process.

REFERENCES

Benson, L. 2001. Chapter 2: Moving the Collections- Stage 1: Planning. Pp. 14-18, in: Moving the Mountain: Science Museum of Minnesota guide to moving collections. Collection Management and Conservation Department. Science Museum of Minnesota. St Paul Minnesota.

Hatchfield, P. 1995. Wood and wood Products. Pp. 283 -289, in: Storage of Natural History Collections: A preventive conservation approach (C.L. Rose, C.A. Hawks, and H.H. Genoways, eds.), Society for the Preservation of Natural History Collections, Iowa City, IA.

Molineux, A., Zachos, L., Criswell, K.E., & Risien, T. 2012. GIS, The Key To Collection Management of A Large Research Archive. Collection Forum 26(1-2):60-69.

Moore, B.P. and Williams, S.L. 1995. Storage Equipment . Pp. 255 -267, in: Storage of Natural History Collections: A preventive conservation approach (C.L. Rose, C.A. Hawks, and H.H. Genoways, eds.), Society for the Preservation of Natural History Collections, Iowa City, IA.

Schoenholz, D. 2001. Chapter 2: Moving the Collections- Stage 3: Packing. Pp. 26-45, in: Moving the Mountain: Science Museum of Minnesota guide to moving collections. Collection Management and Conservation Department. Science Museum of Minnesota. St Paul Minnesota.

ORAL PRESENTATION

Preventive conservation and material science

Combining digitisation and sustainable conservation: The Airless Project

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ABSTRACT. The Airless Project at the Natural History Museum (NHM) London (UK), has been devised to increase the preservation potential of the earth science specimens at highest risk from pyrite oxidation. Specimens are identified through surveys and then placed in anoxic microenvironments created using barrier film and oxygen scavengers. Microenvironments were chosen as a far more sustainable and cost-effective option than building and maintaining a humidity- or oxygen-controlled storage facility. Since each specimen will be photographed as part of the condition reporting process, the addition of digitisation to the conservation workflow was included to increase accessibility and project impact.

The project now incorporates barcoding each specimen and recording its barcoded location and digital images in the museum's collection management system KE EMu. The images will also be used as part of the condition report data, which will be imported from Microsoft Excel. Digital association of both condition and treatment data will be accelerated by the use of the specimen barcodes.

INTRODUCTION & METHODS

Pyrite Oxidation. Pyrite, or 'fool's gold' (iron disulphide), is a common mineral of varying crystal structure that can often be found in or around fossils. It can occur as a compact, crystallized and stable form or as a porous, microcrystalline and unstable form. Pyrite oxidation, or 'decay', can occur when the mineral reacts with atmospheric oxygen when relative humidity (RH) exceeds 60%.

$$4FeS_2 + 13O_2 + 2H_2O > 4\ FeSO_4 + 2H_2SO_4 + 2SO_2$$

The resulting by-products of this oxidation often comprise sulphuric acid and hydrated ferrous sulphates which can be very harmful to specimens, labels and storage media. Once pyrite has begun to oxidise, mineral hydrates will form at as low as 30% RH. Signs that pyrite oxidation is occurring include expansion cracks, white/yellowish acicular crystal formations and a sulphurous odour.

Pyrite oxidation is a significant issue at the NHM. Treatments to stabilise the decay products include ethanolamine thioglycollate immersion and paste, and ammonia vapour (Newman 1998). The prevention of further oxidation is only possible, however, with the use of humidity- or oxygen-controlled environments (Fellowes and Hagan 2003).

Anoxic Microenvironments. Pyritic specimens that are affected by oxidation are photographed and condition reported, followed by any necessary remedial treatment.

The fossil is then re-stored within an inert foam inlay inside an acid-free tray, ensuring expansion of re-storage is minimal. To prevent further decay, the specimens are re-stored in an anoxic microenvironment. A bag is made out of Escal™ Neo, a transparent oxygen barrier film consisting of seven layers, including a protective outer layer of polypropylene, a gas-barrier layer of ceramic-deposited polyethylene terephthalate and an inner layer of heat-sealable polyester (McPhail et al. 2003). Perspex templates, corresponding to each storage tray size, are used to cut out the desired size. The edges are then heat-sealed to form a gift-style bag. The specimen within its storage tray is then placed inside the bag along with its labels, a new barcode and the appropriate number of oxygen scavenging sachets. The bag is then heat-sealed at the top, leaving enough additional material so that it can be cut open and re-used. Once a specimen has been accessed, it is returned to conservation staff so that they can replace the oxygen-scavenging sachets and re-seal the bag. The specimen labels are placed in a polyester sleeve, which are attached to the outside of the storage boxes before being sealed so that the specimen data is visible within the new anoxic microenvironment (**Figure 1**).

RESULTS

Anoxic Microenvironments. Although transparent and simple to open, anoxic environments reduce accessibility due to financial reasons: once the bag has been opened the oxygen scavenger must be replaced. This discourages frequent access to specimens. The addition of barcodes and the naming of images so that they are suitable for processing with a web-based application, however, adds little to the conservation workflow and both increases digital access and decreases the need for physical access. Photographing the specimens before bagging not only aids condition reporting, but creates a digital surrogate. This reduces the need to access the specimen through opening the bag, particularly in exploratory investigations.

Figure 1. A pyritic ammonite, acid-burned labels, a completed anoxic microenvironment (with barcode inside) and a handheld barcode scanner.

Digitisation of Data. The digitisation aspect of the project was made possible by working in collaboration with the NHM digitisation project eMesozoic and utilising web-based applications which had already been developed.

Each specimen is given a unique barcode which is photographed with the specimen and its original labels. The image(s) are then named, using Syrup software and a barcode scanner, with the specimen and location barcodes. The images are then ingested into the museum's data management system (KE EMu) using a web-based application which creates a stub record with the unique specimen barcode, location and image(s). A second application is then used to associate the barcode stub with the correct catalogue record, by manually typing the catalogue number visible in the image.

The conservation data is recorded in Microsoft Excel spreadsheets using the new specimen barcode, scanned directly and so saving time and preventing typing errors. The spreadsheets are then imported into KE EMu, uploading the conservation data and associated images.

DISCUSSION & CONCLUSIONS

Problems Encountered. Problems encountered during the project include digitisation of morphological parts or groups as individuals; duplicate registration numbers already in existence; and expansion of space when locations have already been digitised. When the specimens are re-stored increased footprint is often inevitable: specimens which have been crowded together in a tray become more spaced out when provided with inert foam cushions. Tray sizes are kept to a minimum and complex tiered systems are being constructed, but some expansion is unavoidable. This poses a problem because the original location barcode has been used to name the specimen image and create the database record. This issue has been resolved by recording the specimen data and new location, which can be subsequently imported into KE EMu. The collection of the data is very rapid because it only requires a scan of the specimen and the new location barcodes.

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CONCLUSION. This project successfully exemplifies how digitisation can be incorporated into cross-department projects. At the end of 3 years Airless aims to have placed over 10,000 high-risk specimens into anoxic microenvironments, each with a digital image, location, condition report and treatment record, all linked to its unique barcode.

ACKNOWLEDGEMENTS. The authors would like to thank David Smith, Pip Brewer and Lil Stevens, at the NHM, for invaluable help with the development of the digital side of the project. Thanks also go to the other members of the Airless team: Matthew Porter, Kieran Miles, Richard Devany, Zoë Hughes, Consuelo Sendino, Gill Comerford and Julie Gray.

REFERENCES

Fellowes, D. & P. Hagan. 2003. Pyrite oxidation: The conservation of historic shipwrecks and geological and palaeontological specimens. Reviews in Conservation 4(Supplement 1): 26-38.

Newman, A. 1998. Pyrite oxidation and museum collections: A review of theory and conservation treatments. The Geological Curator 6(10): 363-371.

McPhail, D., E. Lam, & A. Doyle. 2003. The heat sealing of Escal® barrier films. The Conservator 27(1): 107-116.

POSTER

Collections for the future – future of collections
Building systems and capacity to monitor and conserve the flora of the British Virgin Islands

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ABSTRACT. A collaborative project lead by Kew's UK Overseas Territories Team, with the National Parks Trust of the Virgin Islands, the University of Puerto Rico- MAPR Herbarium, the Puerto Rico Department of Natural & Environmental Resources- SJ Herbarium and the US Fish and Wildlife Service-Caribbean Ecological Service Field Office, is going on since April 2015. The main objective of this project is to increase botanical capacity in the British Virgin Islands (BVI), to help conserve the BVI's native flora.

The inclusion of the MAPR and SJ Herbaria from PR has been key, as they hold important botanical collections from the Puerto Rican Bank and the Caribbean region. MAPR has facilitated initial training in herbarium techniques and database management. Visits from collaborators had been made to PR and the BVI's to study the regional flora, observe good management of protected areas and see restoration projects for threatened plant species. Digitalization efforts of the SJ herbarium are also in place to make the BVI's collections deposited there available to the scientific community.

With international and regional expertise, this project is strengthening local capacity and the development of the botanical collections, resources and data systems in BVI to enable long-term plant conservation and habitat management.

INTRODUCTION & METHODS. Currently in BVI, threatened species and their habitats are not adequately monitored and existing botanical collections are not representative of wild plant diversity. Due to recent staff/role changes, the National Parks Trust of the Virgin Islands (NPTVI) lacks training in maintaining/monitoring threatened species and their habitats, and does not have access to botanical data systems and monitoring data. A collaborative project is in place in the British Virgin Islands (BVI) thanks to the Darwin Plus funding (DPLUSS030) to increase botanical capacity in BVI, in order to help conserve their native flora. Objectives of this project include: (1) provide training to young personnel at NPTVI in plant collecting, preservation and data gathering, (2) strengthen regional and international partnerships to secure regional biodiversity into long-term plant conservation and habitat management, (3) make accessible online the specimens collections data from the Caribbean UK Overseas Territories and restricted range taxa from the Puerto Rican Bank .

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The project started in April 2015 and is being led by Kew's UK Overseas Territories (UKOTs) Team, together with the National Parks Trust of the Virgin Islands (NPTVI), the MAPR University of Puerto Rico, Mayaguez Campus Herbarium (MAPR), Puerto Rico Department of Natural and Environmental Resources Herbarium (SJ) and the US Fish and Wildlife Service (USFWS)-Caribbean Ecological Service Field Office.

The project first year got off during May 2015, with a visit to Puerto Rico of the UKOTs Team to start working collaborations with the PR partners. This initial visit combined project meetings, the training of Ms. Natasha Harrigan from NPTVI in database management and herbarium best practices for the curation of specimens, and field visits to monitor rare and endangered plant populations. After that visit, the team and partners moved to BVI for the continuation of the training of the personnel from NPTVI and to visit protected areas in BVI, to discuss best management practices of protected areas, and to monitor plant species of conservation concern. Ms. Harrigan visited Kew Gardens for more training on data-basing of herbarium specimens.

During January 2016, the project focused on the digitalization of the SJ Herbarium collections data from the UKOTs and priority species from PR deposited there. A week visit to that herbarium was made to database and photograph relevant collections. MAPR provided a dataset of around 1000 records from the BVI's and from species of importance to the project. Field work training was also made at PR and BVI's on field data collecting.

RESULTS. Project is halfway through with much of the training done in the how to's on database and digitalization. Data input and digitalization of the target species from the SJ Herbaria is on their way, and will continue during April 2016, with the collaboration of SJ and MAPR personnel. Some important not databased collections were found at SJ: *Ilex urbaniana* collections from PR, *Zanthoxyllum thomasianum* collections from PR, *Bastadiopsis eggersii* from Guana and the holotype of *Pitcairnia jareckii* from Guana. We re-discovered the BVI endemic and critically endangered *Calyptranthes kiaerskovii* on the island of Tortola within the Sage Mountain National Park. This small tree species was first reported as being found in Tortola in 1895; however, it had not been seen there again until the project team has found it in June 2015. This extends the species' known distribution range from the Gorda Peak National Park, on the island of Virgin Gorda, to the island of Tortola. The project team also discovered a new population of *Calyptranthes thomasiana* (Thomas' Lidflower), a Virgin Islands endemic shrub that is also threatened with extinction.

DISCUSSION & CONCLUSIONS. The progress that we have had so far on this project emphasizes the importance of good data-based herbarium collections for the management and conservation of native and endangered flora. Also, being able to stress the importance of data cleaning, good botanical collections and photo catalogues to young botanists will assure that the quality of the data improves and helps to create best practices for the management and monitoring the endangered flora. New collaborations are under way to create a seed bank facility in the University of PR at Mayagüez, and to continue other collaborations on the management of particular endangered species.

ACKNOWLEDGEMENTS. The authors thank the NPTVI and PR partners (SJ-DRNA, USFWS & MAPR-UPR) for their continued support and assistance and for providing necessary research permits and letters to other government departments to facilitate the work. We also want to acknowledge the Darwin Plus Initiative for their financial support to this project.

REFERENCES

Hamilton, M.A. (2015). Puerto Rican Bank (British Virgin Islands & Puerto Rico) June 2015, Fieldwork report and photographic supplement. Overseas Fieldwork Committee (OFC) registration number 559-8. Unpublished report. Royal Botanic Gardens, Kew, 61pp.

W

ORAL PRESENTATION

Green Museum – How to practice what we preach? (General session)

Collection Risk Assessment

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ABSTRACT. A collection risk assessment identifies risks, calculates their magnitude, identifies and prioritizes sustainable risk reduction strategies. At the Denver Museum of Nature & Science, a risk assessment was a key planning exercise to inform the design specifications for the Avenir Collections Center as well as custom collection storage equipment, and preservation resource allocations. Risk assessment rests on the established collection significance and quantifies risk of loss over time. At DMNS, collection significance was documented in its Long-Term Collection & Research Plan and significance categories were defined in the risk assessment process. Sustainable mitigation actions for those quantified risks can be achieved by some combination of avoiding, blocking, detecting, or responding to a risk. This presentation will discuss collection risk assessment method based on the Cultural Property Risk Analysis Model (CPRAM), and point to design specifications utilized as a result in the design of the Avenir Collections Center.

ORAL PRESENTATION

Preventive conservation and material science

From body bags to boxes of bones; Herpetology and ichthyology skeletal preparation at Yale Peabody Museum of Natural History

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ABSTRACT. Properly prepared osteological specimens are useful in a variety of scientific research projects as well as educational programs and exhibition. Many different end-users of a specimen have different requirements and needs, including special preparation of specific anatomical features, tissue collection and standard morphometric data that must be collected prior to, or during, specimen preparation. Herpetological and ichthyological specimen preparation at the Yale Peabody Museum of Natural History includes a variety of methods and procedures to ensure maximum use of the resultant specimen, while safeguarding against risks associated with skeletal specimen preparation, including dissociation of data and damage from dermestids. The standard procedures for skeletal preparation of amphibians, fishes and reptiles at Yale Peabody Museum of Natural History will be discussed.

ORAL PRESENTATION

Green Museum – How to practice what we preach? (General session)

Collection space planning

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ABSTRACT. A comprehensive understanding of the space and volume requirements to rehouse a collection and plan for its future is a central factor in designing an efficient and sustainable collection facility. Undertaking the relatively complex exercise of translating how collections are originally housed, usually in overcrowded and unsustainable conditions, into their requirements for a new facility is critical to informing today's fast-paced building design process. A Collection Space Plan ideally rests on an institution's collection planning that guides the collection's specific content and informs how it will grow. Exploring the implications of different collection furniture choices, developing methods for calculating collection uncrowding and understanding the interrelationship of collection spaces with other museum activities are all important components of the Collection Space Plan. This presentation will focus on the collection space planning process implemented for the design of the Avenir Collections Center at the Denver Museum of Nature and Science and collection facilities for other institutions.

ORAL PRESENTATION

An International Conversation on Mobilizing Natural History Collections Data and Integrating Data for Research (iDigBio Symposium)

Data librarianship and small collections support

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ABSTRACT. For many academic libraries, involvement in data curation is a relatively new endeavor. Some aspects of data curation mirror long-established library practices (describing, organizing, and providing access to materials) but some libraries are grappling with the form their services might take, and the extent of their engagement with researches and collection managers in these areas. Collection managers and researchers may also have questions about what the library might bring to the table.

At the University of Oregon, we've begun a few exploratory collaborations between the data librarians and research groups in support of data preservation and access for their collections. These initiatives extend beyond natural history collections, and have been limited in scope but they have the potential to achieve improvements in curation-friendly practices that can facilitate data sharing. This session will describe successes and challenges from these small projects, and the bridges that could be formed between these communities.

MAIN TEXT. As research funding organizations have begun to stress the importance of research data access and preservation, academic libraries, in partnership with other stakeholders, have responded with services and staffing to help faculty meet these requirements. Given the funding environment in higher education, and the ambiguity and changing nature of technology, research practices, and funder requirements, the scope of these efforts at most institutions has been fairly limited to date.

Libraries have provided training for researchers on best practices for research data management, and offered consultations and training on data management planning for research funding proposals. In some cases they also provide institutional data repositories which can preserve and register datasets to create durable identifiers, present metadata for discovery, and provide open access.

Collection managers, curators, museum administrators, and researchers may be interested in taking advantage of some or all of these services, but perhaps especially integrations between their collection management systems and data repositories. These offer the potential for archival preservation of data such as image files via the repository, while taking advantage of metadata capture and editing in the collection management system. Implementing collections software is a precursor to this. At the University of Oregon we are exploring these two types of collaborations.

I will detail some of the challenges and opportunities we have encountered, outcomes, and lessons learned. There will be an opportunity to discuss these topics, and some of the questions that are yet to be answered.

POSTER

Other topics

Crowdsourcing specimen labels – the Crab Shack experience

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ABSTRACT. CA "Wet collections" are particularly difficult to digitize: labels are intermixed with specimens inside capped, fluid-filled containers. In most cases, reading the label requires removing it from the jar, then reassembling the specimen storage lot. As an experiment in collection digitization, the Marine Biodiversity Center at the Natural History Museum of Los Angeles County launched a project to capture the complex label data from our collection of marine crabs in the family Cancridae (approximately 1,000 lots). Most of these jars contain multiple labels, reflecting generations of collections and research attention to the specimens. High-resolution imaging of the labels was deemed essential, since label type, size, handwriting, and other subtle features are valuable metadata fo this collection. To help transcribe the data from the label images, we partnered with Notes From Nature (Florida State University & Zooniverse) to test the effectiveness of using Internet crowdsourcing. By also partnering with the WeDigBio project, we promoted in-house digitization events. With this project, we explored the efficiency of the crowd transcription vs. using trained in-house staff to do the data entry as well as the costs and benefits of public involvement.

POSTER

An International Conversation on Mobilizing Natural History Collections Data and Integrating Data for Research (iDigBio Symposium)

Digitization of Dearness Fungal Type Collection

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ABSTRACT. The Dearness Fungal Herbarium is curated by the National Mycological Herbarium (DAOM) in Ottawa Canada. John Dearness [JD] was an educator and collector who died at the age of 102 in London Ontario in 1954. An important historical figure in the history of Canadian mycology, he was the sixth president of the Mycological Society of America. His collection covered 9200 different species of fungi and held 503 type specimens he named. In 2014 all located type specimens were digitally photographed and their collection information databased, 5400 images from the general collection were also captured. Previously his filing cards were photocopied and these photocopies were subsequently scanned as images. Dearness did not assign collection numbers. He used numbers for species, which were used for his filing system, which have been confused for collection numbers. Posthumously JD accession numbers are being assigned. More recently barcodes were included in the high-resolution pictures taken in a light box. This effort is part of a larger herbarium digitization project aimed at preserving records of collections and increasing the accessibility in the long term both within our institution and to the broader community. Sample images of Dearness type specimens and his filing system are detailed.

W

POSTER

Green Museum – How to practice what we preach? (General session)

Butterflies in bags: saving time, space and money

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ABSTRACT. In terms of amateurs and professionals studying and collecting insects, Lepidoptera (butterflies and moths) represent one of the most popular groups. It is their popularity, in combination with wings being routinely spread during mounting, that result in Lepidoptera often taking up the largest number of boxes and amount of space in insect collections. As space, time and money are commodities museums want to use as efficiently as possible, any process that results in saving either one forms a welcome and timely addition to collection management. Here we describe a workflow that can be applied to unmounted air-dried specimens of Lepidoptera (both recently collected and backlogs) to register (data and images) and store them (unmounted) in glassine bags. An important aspect is that the entire workflow can be carried out by non-specialist volunteers. Compared to current common practice, the workflow described here reduces the number of specimens for which mounting is required by using a new storage system for Lepidoptera (glassine bags), while still providing optimal accessibility of the data. By disclosing digitized data via internet, specialists worldwide are able to assist with identifications and to easily access the data for research purposes.

ORAL PRESENTATION

Preventive conservation and material science

Permanent storage of Lepidoptera in glassine envelopes: reducing resources while optimizing accessibility

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ABSTRACT. In terms of amateurs and professionals studying and collecting insects, Lepidoptera (butterflies and moths) represent one of the most popular groups. It is their popularity, in combination with wings being routinely spread during mounting, that results in Lepidoptera often taking up the largest number of boxes and amount of space in entomological collections. As space, time and money are commodities museums want to use as efficiently as possible, any process that results in saving either one forms a welcome and timely addition to collection management. Here we propose a means to permanently store unmounted air-dried Lepidoptera in glassine envelopes. The described workflow entails registration and graphic documentation of the specimens to ensure accessibility of the data, and limits mounting to those specimens for which mounting is considered essential. The entire workflow can be carried out by non-specialist volunteers. Additionally, by disclosing data and images via internet, specialists worldwide may assist with identifications. Although only tested for Papilionidae, results suggest that the workflow and permanent storage in glassine envelopes described here can be applied to most groups of Lepidoptera.

INTRODUCTION. In 2015 an inventory was carried out in the collection of Naturalis Biodiversity Center, Leiden, The Netherlands, to estimate the number of papered[1] Lepidoptera. The inventory revealed a backlog of some 500,000 specimens, some being as old as 80 years. A substantial part of the backlog (> 200,000) consisted of Lepidoptera collected by J.M.A. Van Groenendael, a Dutch physician working in the former Dutch East Indies between 1931 and 1954 (Boer 1998). While this collection potentially provides a wealth of information for research, processing this amount of Lepidoptera following current practice (i.e. spreading and pinning the specimens) would take up roughly 7.500 drawers. Therefore a pilot project was launched, funded by the Van Groenendael-Krijger Foundation, to develop an alternative for handling unmounted Lepidoptera that is more time- and space efficient while still providing accessibility. The pilot project centers on the use of glassine envelopes. Because they are transparent and easy to use (Gibb 2015; Winter 2000) glassine envelopes are widely used to temporarily store unmounted Lepidoptera. In the current project a workflow has been developed that digitally discloses unmounted Lepidoptera (data and images) while the specimens are placed in glassine envelopes that can be used as permanent storage. The workflow, once in place, can be carried out by non-specialist volunteers.

Figure 1. The handling step of the proposed workflow. It shows the original paper folds, the camera setup, the computer showing the camera's Live View and the permanent storage of unmounted Lepidoptera in glassine envelopes.

1 Papering consists of placing specimens with the wings folded together dorsally (upper sides together) in folded triangles or in small rectangular envelopes of glassine paper (Gibb 2015).

MATERIAL & METHODS. Some 6000 envelopes that contain unmounted Papilionidae collected by Van Groenendael in Java, Indonesia were used to test the workflow. Papilionidae were chosen because they are large and relatively easy to identify up to the species level. The specimens had been papered in triangular folds of contemporary newspapers and book pages, and were stored away roughly sorted by geography in large envelopes and insect drawers. Although geographical information usually was available, taxonomic information never went below the family level. The following workflow, divided into two steps, describes the process undertaken to disclose and store the Papilionidae as carried out by non-specialist volunteers:

Step 1: Preparation

- An inventory of a drawer is made, registering the amount of envelopes and any additional information available on storage unit level – such as collecting date and location – while grouping the envelopes according to date and locality.
- For each specimen a unique record is assigned in the Collection Registration System[2] (further: CRS), registering the aforementioned information.
- Labels are printed on thick, 100% cotton, acid free ledger paper to ensure sustainable storage. Each label is provided with a unique Data Matrix.
- Labels are subsequently cut to fill out the glassine envelopes. This provides support for the specimen as soon as it goes into the glassine envelope.

Step 2: Handling (see Figure 1)

- The individual Lepidoptera are photographed together with their old paper fold and the newly printed information label, using a DSLR camera.
- The information on the paper fold (mainly locality and date) is manually registered into the CRS-database.
- The label is inserted into the glassine envelope, after which the specimen is carefully inserted[3]. Any loose legs or antennae are photographed and stored as well.
- The envelopes are subsequently housed in numerical order in small cardboard boxes that sit within tailor made drawers. Reordering the envelopes taxonomically is a planned future endeavor.

Once the specimens are digitized, a specialist uses the photographs to identify them and manually adds the taxonomic information in an external file. This file is later imported into the CRS-database. While identifying specimens, the specialist also indicated which specimens should be mounted or sampled for DNA either because the identification remains uncertain or because it belongs to a rare or interesting species.

RESULTS. The workflow applied here resulted in 6000 unmounted specimens of Papilionidae being fully digitized and transferred, still unmounted, to glassine envelopes containing sustainable, acid free information labels. Only for a very small percentage was mounting deemed necessary by the specialist. **Table 1** summarizes the estimated differences in resources required to mount 6000 specimens of Papilionidae in the traditional way and using the workflow described here (scenario 1). Hypothetical scenario's 2 and 3 are added to illustrate the efficiency of the workflow in case larger percentages require mounting.

For 6.000 Papilionidae	New workflow scenario 1	New workflow scenario 2	New workflow scenario 3	Traditional practice
% mounted	5	25	75	100
# boxes required a. for mounting (50 ex.) b. for envelopes (400 ex.)	total: 21 a. 6 b. 15	total: 21 a. 6 b. 15	total: 21 a. 6 b. 15	total: 120 a. 120 b. 0
Handling time in days* a. for mounting (40 ex./day) b. for envelopes (80 ex./day)	total: 83 a. 8 b. 75	total: 113 a. 38 b. 75	total: 188 a. 113 b. 75	total: 150 a. 150 b. 0
Material costs involved** (€)	1900	2950	5550	6000

Table 1. Resources required to handle and digitize 6000 unmounted specimens of Papilionidae.
*includes mounting, labeling and digitizing, excludes relaxing time required for mounting
**includes boxes, glassine envelopes and acid free ledger paper

2 CRS or Collection Registration System is a web based database based on UTF-8 and developed by the company DeventIT. It was used in the past five years to digitize the entire Naturalis collection, and now holds records of 8 million specimen on object-level and 30 million specimen on storage unit-level.
3 A representative selection of the paper folds is collected for its historical value, as well as any paper folds relevant for collection history and management. The rest of the paper folds along with the emptied and scanned envelopes are being disposed of.

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DISCUSSION. For Papilionidae, due to their size and ease of identification, saving resources when applying the new workflow is evident. Whether or not the amount of space saved is less for groups of smaller sized Lepidoptera has not been tested thoroughly yet. Based on table 1 the reduction of resources becomes less significant when circa 50% or more of the set of specimens require mounting after papering. Being able to pre-estimate this percentage will assist in deciding whether or not the workflow should be applied. Importantly, even if a large percentage requires mounting, the entire set of unmounted Lepidoptera will have been made digitally accessible. This in turn facilitates research, improved selection of specimens to be mounted and online dissemination to approach specialists for aid in identification. Future automated identification tools for unmounted Lepidoptera that recognize shape and color patterns of the wings would perfectly match the workflow presented here, allowing for a rapid first identification. Even if identification of unmounted material is only possible to a higher taxonomic level (i.e. family or subfamily), this allows photographs to be grouped, which reduces the manual work required from specialists. The workflow presented here demonstrates a promising way for disclosing and permanently storing unmounted Lepidoptera. It even holds the potential to be further developed and tailored to facilitate in-field registering and papering, resulting in specimens that upon arrival can be stored directly in the collection.

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REFERENCES

Boer, A.J. de, 1998. J.M.A. van Groenendael. A life between Medicine and Entomology in Indonesia. Van Groenendael-Krijger Foundation and Institute for Systematics and Population Biology, Amsterdam.

Gibb, T.J. 2015. Contemporary Insect Diagnostics: The Art and Science of Practical Entomology. Oxford: Academic Press.

Winter, W.D. 2000. Basic Techniques for Observing and Studying Moths and Butterflies. Los Angeles: The Lepidopterists' Society.

POSTER

Green Museum – How to practice what we preach? (General session)

How green thinking is practiced when shipping specimens

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ABSTRACT. The Smithsonian Institution's Museum Support Center is a Leadership in Energy and Environmental Design (LEED) building. Many other Smithsonian facilities are also LEED-certified which demonstrates our commitment to sustainability in design and function. This presentation highlights how one unit, the Division of Amphibians and Reptiles, practices what is preached. Discussion is about how work on the front lines of collection management helps to support these goals. In particular, how conservation practices are employed during the critical task of transporting collection material between scientific institutions. A cost-benefit analysis will also be discussed.

ORAL PRESENTATION

Enabling Infrastructure: Future Collections, Data & Informatics (Synthesys Symposium)

The Great Migration: Negotiating the path from physical object to digital surrogate

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ABSTRACT. Digitising a collection object requires making a plethora of decisions at many successive points in the process. These choices dictate the quality, accessibility and digitisation cost of the digital surrogate. However, for the large scale digitisation of thousands to millions of objects, these processes must be streamlined and integrated with multiple systems. This requires a set of practical policies and standards based on a pragmatic design to deliver a digitisation process that achieve the ideal balance of quality, utility and open access versus security, research competitiveness and cost.

Beyond the policies and standards are the complexities of the people, systems and controls required to make them work in real world digitisation scenarios. This presentation will track the path of an example collection object through this process, from planning to publication, and describe the NHM's approach to streamlining the process using digitisation policies and standards.

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