



**SKY
ISLAND
ALLIANCE**

Protecting our Mountain Islands
and Desert Seas

Restoring Connections

Vol. 15 Issue 1 Spring 2012

Newsletter of Sky Island Alliance

Sky Island Biodiversity

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Rainbow hedgehog cactus (*Echinocereus rigidissimus*).
Courtesy Tom Van Devender.



Through the Director's Lens

by Melanie Emerson, Executive Director

This coming May 1-5, 2012, hundreds of scientists and conservationists will come together from across the US, Mexico and the world to report out on the state of Madrean Archipelago biodiversity. During that week Tucson becomes the hub of the most important dialogue on Sky Island conservation in a decade. The Madrean Conference will include highlights from the last three years of SIA's Madrean Archipelago Biodiversity Assessment (MABA) effort and outcomes, along with the exceptional work of numerous partners and colleagues all working toward the same goal: to better understand and protect this magnificent region. I hope you can join us!

As the executive director of Sky Island Alliance, I am frequently asked about what we do. Certainly I deliver our rousing 'elevator speech'—that 30-second spiel on our mission and approach to conservation. The 30 seconds that only whets one's appetite, piques one's interest enough, hopefully, to ask more. And people almost always do. They hear "biodiversity" in our mission

statement and curiously ask, "Why is biodiversity so important?" How do we effectively answer this question...as an organization, as scientists, and a conservation movement? What resonates with the man on the plane sitting next to me? What is compelling to the woman at the market, the gym, the coffee shop, the feed store? What is understandable to children at the Tucson Festival of Books? These are all places and circumstances where we interact with the broader public—how do we answer, "Why biodiversity" in a way that permeates individuals' experiences in the world?

We can talk about the known: The moth to grizzly connection at Yellowstone talus slopes or the documentation of over 19,000 new species (from 2009 compilations)¹.

We can talk about the unknown: What percentage of life-saving medicines come from newly-discovered vascular plants, animals, fungi and bacteria?

We can talk about the ethereal: It's important to know that all these amazing living things are out there and that we're doing everything to keep them alive and well, thriving in their environments.

We can talk policy: We document because in order to protect, we must know what species are

out there and where they are. We cannot protect critical habitat for jaguar unless we know where they roam and reside.

We can talk in analogies: Components in a smartphone are (or should be!) there for a particular purpose. To the non-technical they interact and create a functioning system capable of amazing things. I know what some of the parts are there for, such as the battery and the memory chip. I don't know what most of the component parts are though, and I can see that through numerous interactions they comprise a complex system with important outputs that support my life (not so much in the physiological sense as the be-at-work-on-time sense). The engineers and designers who develop these devices know why all the parts are there, how they fit together and interact. They can diagnose what's missing, wrong, firing incorrectly. They know that every piece is critical to the device's ability to perform all its functions. And that is a system that human ingenuity has created. The natural world is akin, but with millions of 'component parts'—species, ecosystems, natural processes—and interactions that no engineer, designer, mechanic or scientist has yet named or discovered the countless complex relationships.

We should ALL be talking about biodiversity, in whatever way seems most accessible. In order to ensure our own safety net, to provide natural flexibility in a changing climate, to be literally and figuratively closer to the place we call home, we should be protecting the diversity of life that helps protect us. Please join us for five days in May at the Madrean Conference to further the critical conversation about Sky Island biodiversity.

It is through knowledge of the unique attributes of species that we illuminate the origin and evolutionary history of life on our planet. As we find out where species live and how they interact, we increase our ability to understand the function of ecosystems and make effective, fact-based decisions regarding conservation.

— Quentin Wheeler, professor, School of Sustainability and Senior Sustainability Scientist at the Global Institute of Sustainability, Arizona State University

Melanie Emerson

¹2011 State of Observed Species (SOS) report released Jan. 18 by the International Institute for Species Exploration at Arizona State University

Photo courtesy Chris Marzonia.

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PO Box 41165, Tucson, AZ 85717

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Staff

Melanie Emerson *Executive Director*

emerson@skyislandalliance.org

Acasia Berry *Associate Director*

acasia@skyislandalliance.org

Jenny Neeley *Conservation Policy Director*

jenny@skyislandalliance.org

Keri Dixon *Development Director*

keri@skyislandalliance.org

Jessica Lamberton *Wildlife Linkages Program*

Coordinator jessica@skyislandalliance.org

Julie St. John *Newsletter Editor & Designer*

julie@skyislandalliance.org

Louise Misztal *Conservation Policy Program*

Coordinator louise@skyislandalliance.org

Maggie Trinkle *Finance & Operations Associate*

maggie@skyislandalliance.org

Nick Deyo *MABA Project Coordinator*

nick@skyislandalliance.org

Rod Mondt *Protected Lands Program Coordinator*

rod@skyislandalliance.org

Sarah Williams *Volunteer & Outreach Coordinator*

sarah@skyislandalliance.org

Sergio Avila *Northern Mexico Conservation Program*

Manager sergio@skyislandalliance.org

Tom Van Devender *MABA Project Manager*

vandevender@skyislandalliance.org

Trevor Hare *Landscape Restoration Program Manager*

trevor@skyislandalliance.org

Using Science for Conservation: How Sky Island Alliance Gets it Done

by Jessica Lamberton, Wildlife Linkages Program Coordinator

Building New Bridges for Wildlife

This year, the Wildlife Linkages Program not only celebrated its tenth year (look for the report this spring!), but the funding approval for three wildlife crossing structures — including the second wildlife overpass to be constructed in Arizona (see rendering below) — as part of a needed expansion of State Route (SR) 77 / Oracle Road in Oro Valley. These projects were supported by the data and recommendations Sky Island Alliance contributed to the Arizona Wildlife Linkages Assessment and SIA continued to watchdog the process, assuring funding agreements met deadlines and the project was fully approved though the design phase. Working with residents, we encouraged local volunteers in Sun City and Rancho Vistoso to monitor wildlife in the backyards and in the footprint the proposed wildlife crossings, providing baseline monitoring before construction; documenting black bear tracks in golf course sand traps; photographing badgers and bobcat kittens on remote cameras; and, effectively engaging neighbors in the process. This success was confirmed when, in December 2011, a new project proposed by the Tohono O’odham Nation that cited scientific data from the Arizona Wildlife Linkages Assessment gained final approval for RTA funding on SR 86 near Kitt Peak. This project will consist of another two wildlife underpasses and a vegetated wildlife overpass, and is the first indication that the SR 77 wildlife crossing project, scheduled to break ground in 2013, is serving as a model for similar projects in the rest of the region.



Sky Island Alliance serves on the Pima County Regional Transportation Authority (RTA) Wildlife Connectivity Workgroup, helping to direct dedicated funds to priority linkage projects in the county. *Rendering courtesy Coalition for Sonoran Desert Protection.*

Wilderness and Protected Lands

The ultimate achievement of using science for conservation is the permanent protection of habitats, and therefore the permanent protection of ecosystem processes and species. In addition to the protection of lands through the Sonoran Desert Conservation Plan and other initiatives, we also seek to protect critical blocks of core habitat that comprise a functional wildlife linkage network and provide a stronghold for many species. In the United States, the highest level of land protection

wildlands can acquire is the designation of Wilderness. Wildlife linkages between the Sky Island mountain ranges strengthen the value of Wilderness, for without secure wildlife linkages the ecological health of a designated Wilderness is compromised, just as a wildlife linkage becomes moot without the protected wildland blocks it connects. Wildlife monitoring data and volunteer advocacy have been instrumental in documenting Wilderness-quality lands, building public support, and giving momentum in our effort to introduce legislation to permanently protect the Tumacacori Highlands and the Land of Legends (northern Chiricahua, Dragoon and

Whetstone Mountains) as designated Wilderness.

As part of this long-term effort, we have built relationships with local residents, landowners and agency personnel, and provided further support of Wilderness designation by continuing to conduct vegetation surveys, riparian restoration, road closures and wildlife monitoring within these areas.

In addition to this direct application of science, our wildlife monitoring data has also been integral to providing strong, accurate responses for emerging issues in ecosystem defense. Our detailed recommendations on scoping comments for proposed Arizona Department of Transportation and Federal Highway Administration projects has led to many recommendations being implemented where wildlife movement could be facilitated by culvert improvements and other wildlife friendly practices. In addition, we have remained actively informed and engaged on transportation infrastructure, mining and new energy development projects, working to oppose the proposed Rosemont and Patagonia mines that would devastate a key wildlife block and adversely affect its associated wildlife linkages, inform decision making for the proposed SunZia transmission line routes, and mitigate and increase knowledge on the impacts to wildlife and habitats from border infrastructure and border related activities.

Protecting Our Mountain Islands and Desert Seas...

Sky Island Alliance's dedicated staff advance the organization's goals every day — in the field with volunteers, around the map table planning strategies, in the office, at community meetings, reaching out to Sky Island residents... you name it. If it's important to the Sky Island region, we are there. We hope you're inspired — let us know!

Madrean Archipelago Biodiversity Assessment (MABA) *by Nick Deyo*

The winter months find many of the Sky Island flora and fauna in a dormant state — reptiles hibernate in their burrows and most perennial plants are not flowering, making them difficult to identify. MABA expeditions typically take advantage of the abundance of species found during the rains of late summer, so for now the field season has ended. Yet MABA staff remain hard at work, adding species records to MABA's online database, promoting the MABA project in Mexico, and preparing for the upcoming Madrean Conference (see below) in May.

The MABA online database (www.madrean.org) is the most comprehensive source of biodiversity information for the Sky Island region — an invaluable resource for researchers and conservationists. This virtual *Flora* and *Fauna* houses species records collected on MABA expeditions to Mexican Sky Islands, as well as hundreds of thousands of other plant and animal records compiled from herbaria, museum collections, and scientific literature. Aside from storing species records, the MABA database offers dynamic tools, which can automatically generate species lists and taxonomic keys. The database is always growing — since this past September 1,794 animal records and 45,806 plant records were added. The majority of new plant records came from Turner, Bowers, and Burgess's *Sonoran Desert Plants: An Ecological Atlas* — an important ecological text, previously unavailable as a web database.

In November, MABA staff gave two presentations entitled "*Documentación de la Biodiversidad del Archipiélago Madreño*" as well as hands-on workshops using MABA's online database at two biology conferences held in Hermosillo, Sonora — the *VI Congreso Universitario de Biología* at the University of Sonora and the *II Congreso de Ecología* at the *Centro de Estudios Superiores del Estado de Sonora* (CESUES). The talks and workshops reached several hundred students and researchers, and elicited a great deal of excitement about the MABA database and expeditions. Participation in these two conferences will build an even larger network of bi-national collaborators studying and conserving the biodiversity of the Mexican Sky Islands.

The third *Biodiversity & Management of the Madrean Archipelago* conference will be held in Tucson, May 1–5, 2012, marking a significant milestone for the MABA project. Previous Madrean

Conferences were held in 1994 and 2004, each concluded there was a lack of data about biodiversity which is necessary to support the management and conservation of this spectacular region, particularly in Mexico. MABA was created by Sky Island Alliance with support from the Veolia Environment Foundation to fill this data gap. If conference participation is used to gauge MABA's success, the program has succeeded greatly. Conference organizers Dr. Tom Van Devender and former SIA Board member Dale Turner have received 22 abstracts for papers and presentations from MABA staff and volunteers. MABA project manager Dr. Tom Van Devender will be presenting a keynote speech on the evolution of the MABA project. Other topics include John Palting's "Moths of Rincón de Guadalupe, Sonora: The Dresden-Bacadéhuachi connection" (see related article page 8) and Robert Villa's "Comparison of the herpetofauna of the Sierras de la Madera and Bacadéhuachi with the Yécora fauna." This conference will be an exciting event for MABA, for Sky Island Alliance, and for science in the region.

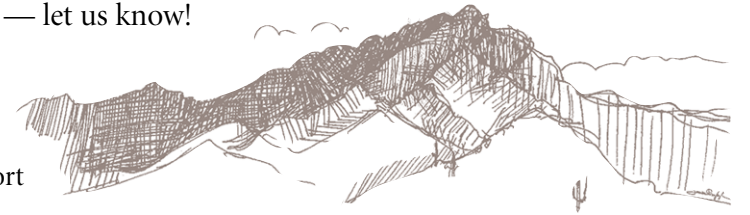
Conservation Policy Program

by Jenny Neeley

Sky Island Alliance continues to be a leader in the fight against the Rosemont Mine which threatens to devastate the Santa Rita Mountains. The mine would trash thousands of acres of wildlife habitat, obliterate over 1,300 acres of riparian areas including the headwaters of Davidson Canyon, and draw down and pollute the Santa Cruz aquifer, increase regional air pollution and destroy numerous cultural resources. In October 2011, the Coronado National Forest released the Draft Environmental Impact Statement (DEIS) for the project and accepted public comments through January 31, 2012. In addition to submitting robust, science-based comments opposing the project, SIA staff and volunteers attended public meetings, held a public comment-writing workshop, and encouraged our members to submit their own comments through regular enews updates and action alerts.

And the fight is not over yet! The DEIS is only one of many local, state, and federal regulatory approvals that Rosemont Copper must receive before it can move forward. SIA continues to engage in every one of these battles to ensure this harmful proposal never becomes reality.

As part of Sky Island Alliance's ambitious climate change adaptation project, we continue to work



with land management agencies to implement projects identified during our ongoing series of workshops and designed to increase the ability of agencies to address landscape-level changes resulting from a warming climate. With funding from the Desert Landscape Conservation Cooperative, Sky Island Alliance initiated a project to inventory and assess springs and seeps in the Sky Island region. These resources are critical to supporting wildlife and biological diversity in the region and are becoming increasingly important refugia as the climate warms. Working with trained volunteers and a variety of agency, county, non-governmental organizations and other partners, we will develop a better understanding of the location and importance of springs and seeps, and will restore these waters so they can best support the plant and animal species that depend on them.

Northern Mexico Conservation Program

by Sergio Avila

The final weeks of 2011 were of heightened excitement when jaguar and ocelot sightings in southern Arizona were reported — the news even made it to the *New York Times!* (December 4, 2011). First, a jaguar sighting in Cochise County was reported by a hunter; then a months-old report of an aerial sighting of a jaguar in the Santa Rita Mountains by a helicopter pilot, was deemed 'credible' by the Arizona Game and Fish Department (AZGFD). Finally, in early December AZGFD officials reported an ocelot sighting, releasing the photo of a spotted cat. During these reports, SIA staff received calls, offered feedback, talked to the media and shared opinions regarding the three reports. The jaguar in Cochise County was proven by photos and video; the second sighting was only a description of a "large spotted cat." The third turned out to be a misidentification on the part of AZGFD.

Each of these reports, accompanied or not by supporting evidence, is typical of those we receive at SIA. Each time we remind ourselves that, even with trained eyes, adequate descriptions and good intentions, not all reports turn out to be credible, provable or real. The need for evidence that can support our observations is fundamental for a science-based organization: a photo, a track, scat or kill, a detailed observation of behavior, and other

Sky Island Alliance is a non-profit membership organization dedicated to the protection and restoration of the rich natural heritage of native species and habitats in the Sky Island region of the southwestern United States and northwestern Mexico. Sky Island Alliance works with volunteers, scientists, land owners, public officials and government agencies to establish protected areas, restore healthy landscapes and promote public appreciation of the region's unique biological diversity.

useful information such as location, habitat type, or time of the day. A combination of observations and corroborating evidence is desired. We do appreciate people taking the time and effort to let us know what they've seen; so thank *you* for that.

Back at the office, we have been sharing our biological information for very urgent, pressing threats such as mining projects, specifically in the Santa Rita and the Patagonia Mountains. In addition to public comment-writing workshops, numerous meetings and other work, SIA staff has spent considerable time going over the 1,100 pages of the Draft Environmental Impact Statement for proposed Rosemont Copper project in the Santa Rita Mountains. Additionally, we have also written comments in response to a Biological Assessment for the Hardshell Exploration Drilling project in the Patagonia Mountains. Staving off both mining projects presents an opportunity to utilize and share the wealth of biological information staff and volunteers have gathered throughout the years. We see it as our responsibility to inform the corresponding agencies and other organizations, and make sure we protect, maintain and restore the plants and animals that call our Sky Islands home. These mining projects are NOT a done deal; the fight continues.

Similarly, several staff members submitted abstracts for the Third Madrean Conference to be held in Tucson on May 2012. I will be presenting results from our remote camera surveys in northern Mexico, and from our border mapping project. We are excited to present the results of our projects at this conference, shedding light on the species that live in the region.

Protected Lands Program

by Rod Mondt

It's the start of a New Year and Wilderness, as a major component in the protection of regional biological diversity, remains integral to the Sky Island Alliance agenda. Our areas of interest feature outstanding Wilderness attributes and clearly qualify for designation: Protecting these areas serves to provide core habitat and overall biodiversity. With that in mind, our goal continues to be the establishment of Wilderness in Cochise and Southern Pima County.

While the Tumacacori Highlands Campaign remains on hold, the Land of Legends Wilderness

Campaign gathers increasing support among Cochise County business leaders and user groups. One piece of good news is the Forest Service has recommended the Northern Chiricahua Mountains for Wilderness in the new Forest Plan. While they jump from one completion date to the next, we are going all-out to convince them to include the Whetstones and the Dragoons. We continue to engage our public officials and local residents by making presentations and building support with our partner conservation organizations.

This remains an important opportunity to protect the most biologically and culturally diverse pieces of Arizona as it was and as it remains to this day.

Wildlife Linkages Program

by Jessica Lambertson

A new year means bigger and better things from the Wildlife Linkages Program!

In conclusion of the program's 10th anniversary, the long-awaited 2001-2011 Wildlife Linkages Program Report was released, beautifully designed by our very own Julie St. John, and includes contributions from some of the program's founders: Janice Przybyl, Roseann Hanson and Susan Morse. The 2012 survey schedule was also released with changes to improve our study design so that surveys occur on the same weekends every year. Tracking volunteers can look forward to learning more about these and other new improvements during our February Tracking refresher training to be held at the Amerind Museum in Dripping Springs, AZ.

Outreach at the Bisbee 1000 Stair Climb, and at the Saguaro National Park BioBlitz was successful, as well as fun! At the 2011 Saguaro National Park BioBlitz, we participated with remote camera monitoring and wildlife track surveys with middle school groups, conducted our own track count survey with a team of exceptional volunteer trackers, ran a table at the event, provided "Biodiversity University" learning activities and gave a talk on wild cats of the region. Sky Island Alliance was listed as one of the event sponsors because we were so involved in making the event successful.

Thanks to the stellar efforts of volunteers in Sun City, we have an amazing amount of tracking data and remote camera photos of backyard bobcats and other species moving between the Catalina and Tortolita Mountains. Their data is being analyzed with nearby track count information by Jonathan Reed, a University of Arizona student and intern with Sky Island Alliance. Student intern Meagan Bethel has also been busy in the office, analyzing wildlife response to fire using remote camera data.

We continue to build on the small tasks and successes that make up everything we do for wildlife connectivity in the region... and there is good reason to celebrate! Three wildlife crossing structures including another wildlife overpass along State Route 86 near Kitt Peak have been approved for funding by the Pima County Regional Transportation Authority. This project was proposed by the Tohono O'odham Nation and supported by data from the Arizona Wildlife Linkages Assessment. As we hoped, the Oracle Road

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Founders Fund is a Success – Thank you!

Thanks to your membership support, we far exceeded Sky Island Alliance's fundraising goal for the 20th Anniversary Founders Fund! Our sincere appreciation goes out to our Founders and challenge donors for speaking out and asking the community to help make more of our great work possible. And many thanks to those of you who contributed or invited a friend or colleague to participate. Through donations over the past year and attendance at our benefit concert with R. Carlos Nakai and Gabriel Ayala, over 200 members made gifts from \$10 to \$10,000. All of you are helping launch our next decade by supporting this fund. In total, you helped us raise over \$106,000, exceeding our goal and making sure we finished our 20th anniversary year strong. Your support will keep SIA initiatives thriving and growing. We are grateful for your help so that we may keep working to deepen and broaden support for our work and community engagement in conservation.

Madrean Archipelago Biodiversity Assessment: Amazing Results its First Three Years

by Tom Van Devender, MABA Project Manager.

On the second United States-Mexico Boundary Survey in 1892-93, Lieutenant David Gaillard took detailed notes on the natural history of the borderlands including the Sierra San Luis and Cajón Bonito in northeastern Sonora. He described the region as “bare, jagged mountains rising out of the plains like islands from the sea”. The genus of the blanket flowers (*Gaillardia*) is named in his honor. In 1951 in *Natural History* magazine, Weldon Heald, a resident of the Chiricahua Mountains, named these ranges “sky islands,” evoking the image of continental islands emergent from inland seas of desert grassland or desertscrub. Fred Gehlbach’s 1981 book *Mountain Islands and Desert Seas. A Natural History of the U.S.-Mexican Borderlands* stimulated interest in the southwestern United States. His use of “desert seas” was rhetorical and included lowland grasslands and Chihuahuan desertscrub. In 1992, University of Arizona herpetologist and ecologist Charles Lowe coined the term “Madrean Archipelago” for the isolated ranges between the Sierra Madre Occidental in Sonora and the Mogollon Rim in central Arizona. Today both Madrean Archipelago and Sky Island region are used to describe this important area.

In 1995, Peter Warshall and Steve McLaughlin estimated that there were about 40 Sky Island ranges in the Madrean Archipelago. Based on the criteria of an isolated mountainous area with crowns of oak woodland or pine-oak forest, I identified 52 Sky Island ranges and complexes on Brown and Lowe’s 1982 map of the biotic communities of the Southwest. In Sonora, there are 36 Sky Island ranges or complexes of ranges connected by oak woodland above about 1,100 m (3,600 ft) elevation. Our current view of the Sky Island region extends west to the Sierra El Humo south of Sásabe and south to the Sierra Mazatán and Sierra San Javier east of Hermosillo. In this area the ‘desert seas’ surrounding the Sky Islands are desert grassland and Chihuahuan and Sonoran desertscrub in the north, foothills thornscrub farther south, and tropical deciduous forest around the Sierra San Javier.

The Madrean Archipelago is one of the greatest biotic convergence zones in the world. Species characteristic of temperate woodlands and forests of the Sierra Madre Occidental and Rocky Mountains, tropical deciduous forest and thornscrub from the south, Great Plains grasslands and Chihuahuan desertscrub from the east, and Sonoran desertscrub from the west come together in northeastern Sonora. The



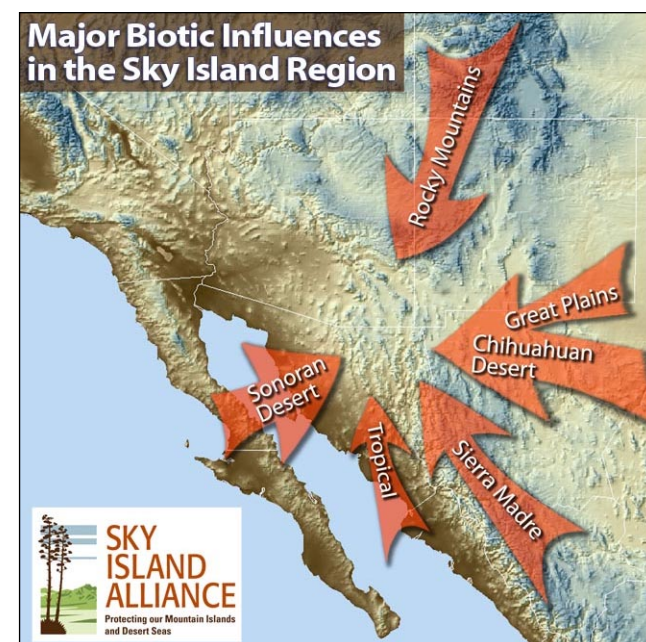
above View to Sierra San José, Sonora, and the Huachuca Mountains, Arizona. The US/Mexico border passes between them. *Courtesy the author.*

below Map of the biotic affinities of the Madrean Archipelago. *Courtesy Sky Jacobs.*

transition from the New World tropics to northern temperate zone is in eastern Sonora at about 29°N to 30°N latitude. Foothills thornscrub extends farther north in finger-like tributaries of the Río Bavispe (Yaqui) drainage, where some tropical plants and animals reach their northern range limits in southeastern Arizona and southwestern New Mexico.

The 1994 symposium *Biodiversity and Management of the Madrean Archipelago. The Sky Islands of Southwestern United States and Northwestern Mexico* and its sequel in 2004, brought together lots of information on the biota, land management, conservation, etc. for the Sky Island region, but mostly north of the border. The 2010 *Diversidad Biológica de Sonora* edited by myself and Francisco Molina-Freaner and sponsored by Sky Island Alliance, summarized the current knowledge for Sonora of all plants and animals, geology, land use, conservation, and much more. More important, the book is a starting point for future ecological research in the state.

The Madrean Archipelago Biodiversity Assessment (MABA) program at Sky Island Alliance began in April 2009 with funding from the French-based, Veolia Environment Foundation, US National Park Service, and the Turner Foundation. This is a visionary project to



document the distributions of all plants and animals in the Sky Island region of northeastern Sonora and adjacent Chihuahua. The first three years of MABA have been a resounding success. I was hired as Manager in May 2009. The skills and initiative of past Project Coordinators Mark Trinks and Caroline Patrick, and current coordinator Nick Deyo and the support of SIA



left View to the north from the Sierra de los Ajos, 1992. *Courtesy Dale Turner.* right MABA Expedition group in Rincón de Guadalupe, August 2011. *Courtesy Chris Marzonie.*

staff Sergio Avila, Melanie Emerson, Acasia Berry, Sky Jacobs, and Trevor Hare have moved the project along at coachwhip escape speed. Ed Gilbert, our database guru, has programmed, massaged, tweaked, and badgered the MABA database into an incredibly useful regional resource.

Expeditions to gather new biological observations in the Madrean Archipelago in Sonora are not new. Barry Campbell and Stephen S. White of the University of Michigan explored the Río Bavispe Region in northeastern Sonora in search of amphibians, reptiles, and plants from 1935 to 1941. Joe Marshall studied birds and vegetation in the Sky Islands of Arizona, Sonora, and Chihuahua from 1952 to 1961.

Beginning in the early 1990s, about the same time that Sky Island Alliance advocated its way into existence, future Sky Islanders were already going on expeditions. Founders Mark Fishbein, Richard Felger, and Dale Turner, along with Jim Malusa, inventoried plants in the Sierra de los Ajos in 1992. Turner, Cecil Schwalbe, and Carl Olson returned to document animals in 1998. Ana Lilia Reina-Guerrero and I began studying the Sierra Madre Occidental baseline flora of the Municipio de Yécora in the eastern Sonora in 1995. Bob Minckley began to collect bees and plants on Rancho San Bernardino east of Agua Prieta in 2000. Aaron Flesch and Sky Jacobs have been documenting the birds on Sky Island mountaintops since the early 2000s. Turner, Erik Enderson, and Steve Hale went to the Sierra de la Madera (Oposura) to observe herpetofauna in 2003.

Plant and animal observations were made on MABA Expeditions to the Sierra San Luis (September 2009), Sierra el Tigre (March 2010), Sierra de la Madera (August 2010), Ciénega de Saracachi-Sierra San Antonio (May 2011), and Sierra Bacadéhuachi (August 2011). These expeditions were remarkable

international events with 25-45 participants, including MABA scientists, agency biologists, university professors and students, photographers, journalists, and volunteers.

The increase in knowledge about the Sonoran part of the Madrean Archipelago has been dramatic. The MABA database (Madrean.org) is still developing, but is already a powerful analytical tool. There are currently 37,705 plant observations from the Sky Island region in northeastern Sonora in about 2,700 taxa — a whopping 73% of the state flora! There are 32,130 animal observations from the Sky Island region in the database, but the number of taxa is difficult to say because insect names are poorly covered in the Integrated Taxonomic Information System. There are 38 taxa of freshwater fishes in the Sky Island region, 13 (34.2%) of them non-native. Arthropods are very numerous and poorly collected in Sonora, with ca. 4,000 observations in the Sky Island region in ca. 1,380 taxa. Better-known groups are Lepidoptera (moths and butterflies, ca. 620 taxa), Odonata (damselflies and dragon flies, 65 taxa), and Formicidae (ants, 53 taxa). Jim Rorabaugh lists 143 species of amphibians in the entire Madrean Archipelago. My tally for the Sonoran portion is 106 taxa, with another 26 Sierra Madre Occidental in eastern Sonora. There are 553 species of birds in Sonora in the database with 358 species (61.1%) of them in the Sky Island region. For mammals, there are 73 taxa recorded from the Sonoran Madrean Archipelago, although the dataset is not as complete as with other vertebrates. The Third Madrean Archipelago Conference in May 2012 will, in part, be a celebration of these activities, successes, and advances.



above from left Selected species inventoried in the Sierra Bacadéhuachi: Adelaide jewel beetle (*Chrysina Adelaide*), Chihuahua earth snake (*Geophis dugesi*), and clearwing moth (*Pseudohemihyalea edwardsii*). *Courtesy Tom Van Devender and George Ferguson.*

Cosponsors Ajos-Bavispe CONANP Reserve, Universidad de Sonora, Universidad de la Sierra, and Comisión de Ecología y Desarrollo Sustentable del Estado de Sonora

Field scientists Ana Lilia Reina-G., Jesús Sánchez-E., Socorro González, Gertrudis Yanes-A., María de la Paz Montañez-A., George Ferguson, George Yatskievych, John Anderson, Barbara Phillips, Laura Moser, and Ed Gilbert (plants); John Palting, Justin Schmidt, Nico Franz, Kim Franklin, and Robert Johnson (insects); Wayne, Amy, and Martha Van Devender (land snails); Alejandro Varela (fish); Dale Turner, Martín Villa, and Steve Hale (herps); Eric Wallace, Trevor Hare, and Van Clothier (frogs, aquatic habitats, restoration); Sky Jacobs and Carl Tomoff (birds); and Horacio Cabrera, Sandy Doumas, Maggie Fusari, and Roseann and Jonathan Hanson (mammals)

Scientists who helped with identification after trips Richard Bailowitz and Jim Brock (butterflies, odonates), Carl Olson (general 'bugs'), and Robert Behrstock (grasshoppers)

Volunteers Cynthia Wolf, David Bygott, Graciela Robinson, Tim Cook, Dick Kreuger, Terry Gustafson, and many more

Photographers Chip Hedgcock and Frank Rose

Robert Villa wowed us with his solo violin inside colonial churches in Bacadéhuachi and Granados

Enrique Yescas (*SonoraEs*), Chris Marzonie (*Overland Journal*), and Roseann and Jonathan Hanson (*Terra*) wrote stirring accounts of the expeditions in their publications

Thanks to ALL of you and of course to the Veolia Environment Foundation for their continued support





above *Eupackardia caletta* (Calleta Silkmoth) specimens collected in El Rincón de Guadalupe in August (left) and September (right). Courtesy Tom Van Devender.

Biodiversity Assessment of the Moths of El Rincón de Guadalupe, Sierra Bacadéhuachi, Sonora, Mexico *by John Palting*

With the human population eclipsing the 7 billion mark, the need to identify, bioinventory, and preserve the last wild places on the planet is becoming increasingly urgent. This is exactly the mission of MABA, right here in the Sky Islands of the southwest US and Mexico. The Sierra Bacadéhuachi, near Moctezuma, Sonora was identified by MABA director Tom Van Devender as an area with few biological records and potential high diversity, separate but near the main Sierra Madre. In the midst of this relatively unexplored range, the Catholic Diocese of Sonora had built a retreat to escape political persecution earlier in the century and still owns the 7000 acre property today. El Rincón de Guadalupe is one of those special places where humans have touched the land lightly and created a wonderful compound of shelter in the midst of unspoiled natural beauty — the perfect venue for both spiritual and scientific investigation. Built and rebuilt between 1920-1940, the hand-hewn stone buildings were clearly made with great love and the whole compound blends in beautifully with the surroundings, many of the stones now sporting a lovely veneer of lichens, mosses and ferns that only comes with time. The history of the compound is in itself quite interesting and the buildings have a wonderful and comforting presence, from the library to the small chapel to the *panadería*, where the daily bread was baked in a wood-fired oven. The primitive road into El Rincón is just difficult enough to limit visitation, but not too difficult with 4 wheel drive vehicles to pass. The road climbs rather abruptly, going from desert scrub to oaks and finally pines in about 10 miles.

I had the privilege of visiting El Rincón twice in 2011 as part of Sky Island Alliance's MABA initiative, first in early August and a second time

in early September. The moth fauna encountered was dramatically different on each trip, with the August visit being particularly rich in members of the moth families Saturniidae (silk moths), Sphingidae (hawk moths) and Arctiidae (tiger moths). The second visit a month later was particularly rich in Noctuidae (cutworm moths), particularly those families and genera that feed on flowers. In fact, botanical sampling of plants in the flowering stages was the goal of the second expedition for Tom Van Devender, who felt many important botanical records were missed on the first trip because the plants weren't far enough along in their development. On this second trip the moths told us we were there at the right time.

The first visit was an official MABA expedition, actually the largest MABA expedition to date, with over 40 participants. Logistically, I'm sure it was a challenge, but the facility seemed to accommodate the large group comfortably, and the participants owe a debt of gratitude to Tom and Enrique Yescas, editor of *Sonora Es* magazine, for arranging the wonderful accommodation. I chose the *panadería* as my base of operations for collecting and curating moths, as it offered some overhead protection from afternoon thunderstorms. Making a biological inventory of moths is a challenge, as most moths are strictly nocturnal, and often exhibit temporal phenology throughout the night, with different species flying at different times. Thus, one must spend nearly the whole night checking the lights in order to assemble a relatively complete picture of what is there. This is followed by spreading and drying many of the specimens, a critical step which also helps one recognize subtle differences in species that might otherwise be overlooked while they are flying about the lights. I usually spend all night collecting and all day pinning the material,

followed by another all night of collecting and another day of pinning...eventually, most of the faces around the lights start to look familiar, at which point one feels exhausted but confident they have done a pretty good job making a bioinventory.

Identified taxa from the first trip to El Rincón stands around 205 species, which are all observations in the MABA database. Collecting several specimens is ideal for unknown species, as moths are so diverse that one must often mail specimens to various experts around the world for determination, and some require genitalic dissection in order to make a definite determination. One of the great surprises of the August 2011 expedition was the number of tropical taxa more typically associated with tropical deciduous forests that were flying among the pines of El Rincón. These included the extremely large, tailed Saturniid moth *Dysdaemonia boreas*, a common monsoon species around Álamos where the larval foodplants in the family Bombacaceae occur, but certainly not expected in the pines so far north. Another totally unexpected saturniid moth was *Copaxa rufinans*, which was previously thought to be restricted to extreme southeast Sonora, where the caterpillars feed on plants in the family Lauraceae. Like Bombacaceae, plants in this family were seemingly absent, yet the moth was there — evidently coming from somewhere nearby that held a pocket of tropical vegetation. Also recorded were tropical Sphingids *Xylophanes ceratomoides* and *X. tersa*, and one of the largest tropical Sphinx moths, the *Forestiera*-feeding *Sphinx leucophaeta*. A single specimen of the metallic, tropical wasp-mimic tiger moth, *Phoenicoprocta lydia*, was also an unexpected record. Northern range extensions for several

species more typical of the Yécora plateau, 120 kilometers farther south, were also a surprise: *Copaxa muellerana*, *Coloradia prchali* (both saturniids, the latter named in honor of Steve Prchal, founder of Sonoran Arthropod Studies Institute), *Epicrisias eschara*, *Ammalo* nr. *paranomom*, two species of *Amastus* (all arctiidae, Tiger Moths) show the association of this area with the main Sierra Madre Occidental. A noteworthy southern record of the large silkmoth *Hyalophora gloveri* was also obtained — center of distribution for this moth is the Rocky Mountains, with only a handful of Sonoran records.

While noctuids (cutworm moths) were not particularly abundant in August, some of those that were collected were important records and several are thought to represent new, undescribed species. A new species of *Richia* nr. *cofrensis* was collected, along with possibly new *Licnoptera* nr. *illudens*, a new *Bryolymnia* nr. *biformata* and two possibly new *Zale* sp. (one nr. *obsita*, another nr. *sabina*). All of these moths are currently with Don Lafontaine, a noctuid expert at the Canadian National Collection in Ottawa, being barcoded for DNA. Specimens of *Paraceliptera guerreronis* and the beautiful shiny white *Chasmina mexicana* collected on the August trip also proved to be very exciting. Both of these moths were described earlier in the 1900s from much farther south in Mexico by the German lepidopterist M. Draudt and figured in the famous German lithograph series on Lepidoptera by A. Seitz. The original type specimens, the only actual specimens of these moths known, were destroyed in WWII when Dresden, Germany was bombed by the Allies in February of 1945. **The specimens collected at El Rincón represent the first specimens collected since the types.** In addition to noctuids, two undescribed species of limacodid moths (slug moths) were collected at El Rincón. Specimens of these moths have been sent to Dr. Marc Epstein in Sacramento, CA, a world expert on this family. For just a few nights of sampling at El Rincón, **there were as many as 12 moths that are new to science** and many incredible records, demonstrating what a special place this is. The convergence of Rocky Mountain species, Sierra Madre Occidental specialty species, and tropical species at the northern edge of their range was striking. A very exciting non-moth record from El Rincón was the metallic green and copper *Chrysina adelaida*, a scarab beetle more associated with the mesic pine forests of Chihuahua, with just a few Sonora records near Yécora — yet another species indicating how unusual the site of El Rincón is.

The September 2011 “return to El Rincón” was a much smaller group of 3 vehicles. The tranquility of the place was more evident this time, and the moths were just as exciting. Virtually all of the



from left John spent countless hours in *la panaderia* and at the three collection sheets collecting, preserving, and routinely calling out new species. Courtesy Chip Hedgcock.



“giant moths” seen a month earlier were absent, as were most of the tropical species. Instead, there was an explosion of smaller moths, with the number of identified taxa this time coming to 214. The most amazing assemblage of species belong to the noctuid subfamily Acontiinae, which are best known as the “bird dropping moths”. Many species in this group are mottled black and white and spend the day perched on the upper surface of leaves, looking like dry bird droppings. A whopping 37 species in several closely related genera of acotiines were recorded at El Rincón, the most I had encountered anywhere. Other exceptional diversity was noted in the noctuid family Steriinae, with these feeding as caterpillar in the flower heads of composites. Particularly abundant was the bright orange “Goldenrod moth”, *Cirrhophanus dyari*, a moth never encountered in large number is Arizona, but here well over 100 showed up at the lights. Another undescribed noctuid was collected on this second trip, this one in the genus *Charadra* nr. *moneta*. Specimens of this moth were sent to Chris Schmidt in Canada, who just last year revised the genus north of Mexico, who **confirmed the moth as a new species.** An additional specimen of the rare *Chasmina mexicana* and additional records of *Chrysina adelaida* were also obtained.

As the fall season had arrived by our September trip, caterpillars from the previous month’s burst of moth activity were especially evident. The *Ceanothus buxifolius* bushes around the compound were virtually denuded by the gaudy caterpillars of the Notodontid (Prominent moth) *Crinotes beidermani*, black with bright red legs, false “eyespot” and a spiderweb network of bright yellow. When frightened, the caterpillars arch their bodies in a menacing way, exposing the false eyespots and red prolegs like the mouth of a monster — if this fails to deter harassment, they regurgitate a translucent blue “goo” all over themselves (that really looks like AIM toothpaste). If left alone, they eat the goo and resume feeding. Another caterpillar delight was

the Christmas-colored larvae of the silkmoth *Eupackardia caletta*, collected for us by a local cowboy on *Rhusaromatica*, a previously unrecorded food plant for this moth. While in Arizona, desert populations of this moth feed on ocotillo, this mountain population exploits a very different plant. These and other photogenic caterpillars rounded out another extraordinarily productive MABA trip to El Rincón.

With over 400 taxa of moths recorded from two brief expeditions to El Rincón de Guadalupe, one can safely extrapolate that **the species diversity exceeds even that of the richest localities in the US**, the Huachucas Mountains of southeastern Arizona being one such site, with 1,500 moth taxa recorded. The wonderful biodiversity of this locality, including an unusual number of undescribed taxa, combined with the natural beauty and historic value, makes this a standout for protection for future generations. In part, this sort of recognition was the goal of Enrique Yescas, who arranged with the Catholic Diocese of Sonora to allow us to visit the site, and who is advocating that the area be offered permanent protection. Participants from both sides of the border came away with a deep appreciation of what a special biological refugium the Sierra de Bacadéhuachi and El Rincón represents.

Much more than just an exercise in documenting biodiversity of the Sky Island region, MABA has created a wonderful venue for collaboration between scientists, students, teachers and concerned individuals on both sides of the border. More than half of the participants on the August El Rincón expedition were from Mexico, including students and teachers from UNAM and UNISIERRA. Friendships forged on MABA expeditions will undoubtedly help future conservation efforts, lead to collaborations and help ensure unique Sky Island localities like El Rincón remain for future generations to enjoy. Documenting what is there is just the first step.



Documenting Diversity

by Charles "Chip" Hedgcock

I was incredibly fortunate to be invited to participate in the very first MABA expedition in September of 2009. My assigned role would be to use my skills as a biological photographer to produce photo vouchers of reptiles, amphibians and invertebrates discovered during the trip. Along with documenting animals in the field, I would also photograph animals brought back to camp by other members of the expedition. These animals were photographed with temporary studio setups and then returned to the place of capture for release unharmed.

Photo vouchers are photographic documentation of the various species found. They work around the need for special permits that are typically required — and increasingly difficult to obtain — for collecting and transporting specimens between countries. Permits for rare, threatened, or sensitive species are especially difficult to procure. To be used in this fashion, photo vouchers must therefore show diagnostic characteristics of each specimen with enough detail for positive identification.

Instead of collecting a physical specimen from the field and storing it, pickled in a jar on a shelf somewhere, careful photographic documentation of animals is now accepted. In fact, photographs are often preferred by curators since digital files take up such a small amount of space and have relatively little maintenance.

As well as taking photo vouchers, I decided that I would also try to document the entire event — the biologist working in the field, various habitat types encountered, and pretty much everything and anything that I felt was relevant to the project and might be useful for helping Sky Island Alliance tell this amazing story. It must have worked, they kept inviting me back.

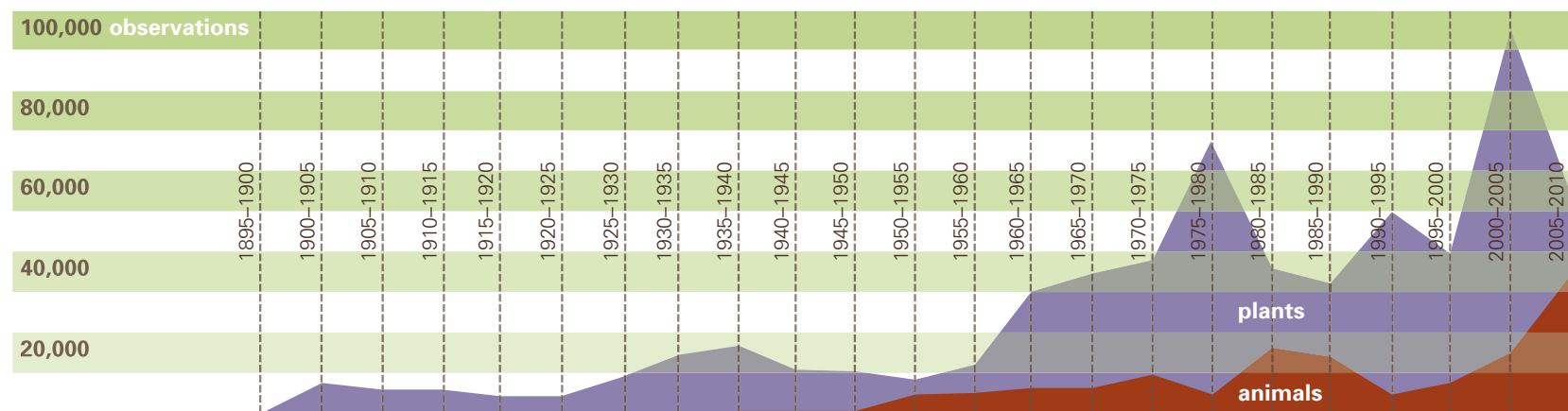


Voucher photographs of many animals were taken immediately upon capture, before the animal might have an opportunity to escape (see Striped plateau lizard above). While not the most aesthetically pleasing, images like these provide enough information to positively identify the animal to species. Some animals were retained over night, returned to the point of capture in the cooler morning hours. There, with the animals more subdued, "Beauty shots" were attempted that captured the animal *in situ* during their release (see Green rat snake next page). Some animals, like the Mountain skink (next page) were brought in by other members of the MABA field team. Captured animals were photographed in an impromptu studio. After being documented, they were returned to the point of capture and released back into their environment. Data collected for each animal were transferred to voucher sheets. These individual Voucher sheets were saved as a Word document and, along with the voucher image files, placed in a folder. Each animal then had its own folder and the whole set were burned to a DVD and delivered to both the University of Arizona's herpetology collection and Sky Island Alliance.

This page, clockwise from top left: Dorsal, ventral and lateral views of Striped plateau lizard (*Sceloporus virgatus*), Eyed silkmoth (*Automeris randa*), Sonoran Lyersnake (*Trimorphodon lambda*), Green-bordered fighting beetle (*Pasimachus viridans*), and Lowland leopard frog (*Rana yavapaiensis*).



This page, clockwise from top: Ciénega de Saracachi, Mountain skink (*Eumeces callicephalus*), Wolf spider (*Rabidosa santrita*), Millipede (*Hiltonius* sp.), and Green rat snake (*Senticolis triaspis*).



The earliest plant record within the MABA database was collected in 1805; the earliest animal record in 1855.

The MABA Database: Shining a Light on Sky Island Biodiversity

Text and analysis by Nick Deyo, MABA Project Coordinator, cartography and GIS analysis by Alex Smith and Nick Deyo

Imagine trying to conserve important habitats and species in a region you know little about; it is like describing a landscape after only visiting it in the dark. Since 2009, the Madrean Archipelago Biodiversity Assessment has been shining light on the state of biodiversity of the Sky Islands, especially in Mexico, with the aim of supporting conservation. Cataloging the biodiversity of the Sky Island region is no easy task considering the area contains over 40 mountain ranges, hundreds of rare and endemic species. It includes numerous habitats ranging from the Rocky Mountains to the north, the Sierra Madre Occidental to the south, and the Sonoran and Chihuahuan deserts in between. Faced with this daunting task, Sky Island Alliance worked with programmer Ed Gilbert to create the MABA online database. Since its creation, the database has grown to become the leading source of information

for many groups of species in the Sky Island region. This special biodiversity issue of *Restoring Connections* gives us the opportunity to pause and reflect on the state of the MABA database, discussing its history, the nature of online databases, profiling the status of species records, and why it's important to support conservation in the region. If you are not familiar with the database, this is also a good chance to learn about its uses.

The MABA project is a direct result of the Madrean Conferences held in 1994 and 2004. These conferences were hosted by the U.S. Forest Service and convened scientists and natural resource managers from the US and Mexico to discuss the biodiversity and natural resources management of the Sky Island region (DeBano et al 1994 and Gottfried et al 2005). One resounding conclusion

from both of these conferences was the lack of biodiversity data to support the management and conservation of this spectacular region, particularly in Mexico. MABA was created by Sky Island Alliance in partnership with the Veolia Environment Foundation to fill this data gap. The MABA database is the primary means for managing, querying, and sharing the fruits of countless hours of SIA staff, collaborator, and volunteer labor — a wealth of plant and animal data.

The MABA online database is considered a “virtual flora and fauna” — a digital resource revolutionizing the way biodiversity information is documented and shared. *Floras* and *faunas* refer to both the species of plants and animals that inhabit a region as well as publications that describe them (Heidorn 2004). Historically floras and faunas have taken the form of print media and contain information such as scientific classifications (taxonomy), species descriptions, illustrations, photos, distribution maps, and identification keys. You may be familiar with the University of California Press's *Arizona Flora*, or Hoffmeister's *Mammals of Arizona* — these are important paper-based resources for our region. However, there are limitations to printed materials when it comes to documenting biodiversity, not least of which is the sheer number of organisms in some taxonomic groups — given that there are an estimated 5,300 species of flowering plants in Madrean Pine-Oak Woodlands alone (Conservation International 2011), you would need a small forklift to carry this field guide around, not to mention that the cost and labor associated with publishing regional floras and faunas. In 2003 the estimated cost of producing a flora with 2,104 species was \$1,579,946 (Mori 2003). Web-based virtual floras like MABA's database overcome many of these problems: they are relatively inexpensive, allow for unlimited images, support millions of species records, allow for complex queries of the data, and can be corrected and updated continually (Conversation with programmer Ed Gilbert 2011). In addition,

One of the finest features of the MABA database is that it is available to anyone who wants to learn more about the incredible biodiversity of the Sky Island region. See for yourself! Create your account today at www.madrean.org and begin your own virtual expedition.

web-based flora and fauna provide a medium for collaboration between researchers and citizen scientists — increasing the speed with which biodiversity data is collected and made available. Time is critical considering how quickly species and habitats are being lost to development and other human activities (Heidorn 2004).

The MABA database is an extremely powerful tool for researchers, conservationists, and anyone else interested in the natural history of the Sky Islands. The database does not just house hundreds of thousands of plant and animal records; it offers some very useful tools for learning about these species and their distributions. With MABA you can search for species using detailed taxonomic and geographic criteria. For example, it is possible to search for all records of the genus *Crotalus* (rattlesnakes) within Pima County. It is also possible to generate lists of species by clicking on Google Maps and using the “Build a Checklist” tool. Or, by simply clicking on Tucson and specifying the family *Cactaceae*, it is possible to generate a list of all the database records for cactus species in the Tucson area. Once you have your list, you can use it like a taxonomic key — clicking on plant characteristics to narrow your choices to a few species. Once species have been selected, it is possible to learn more about them by generating distribution maps, reading species’ descriptions, and searching for photos in the Image Library. These are just a few of the tools available for searching for and learning about the species of the Sky Islands.

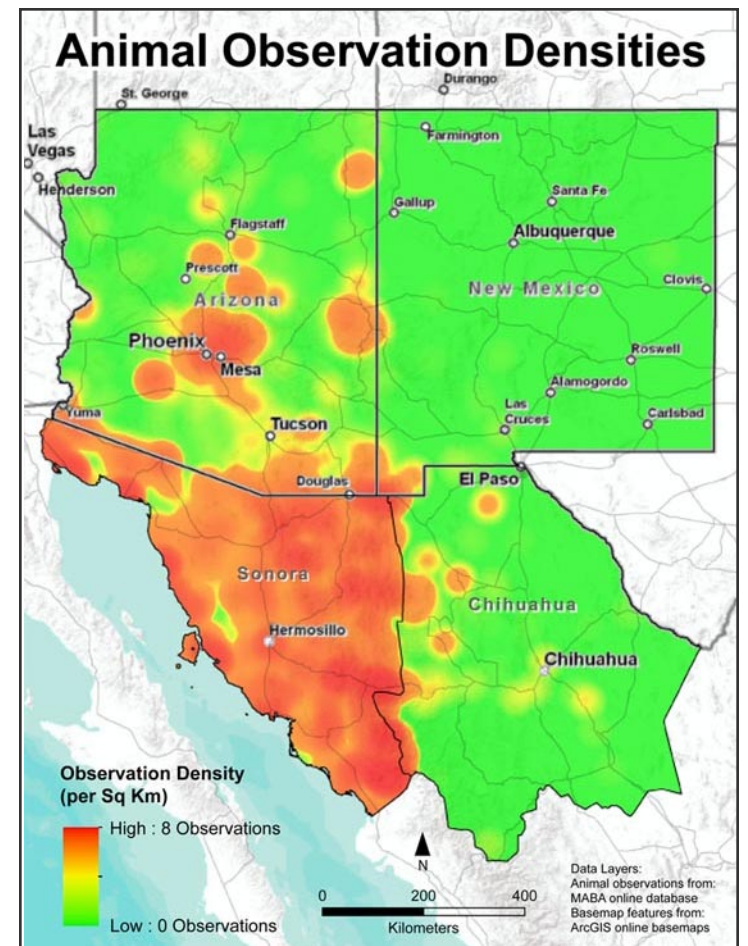
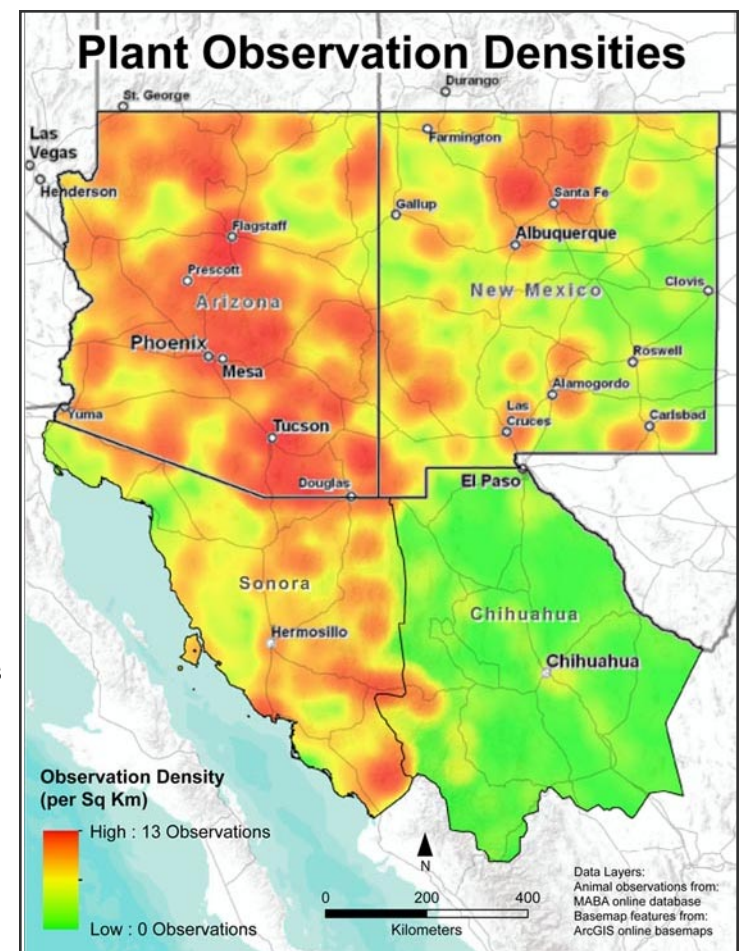
No matter how sophisticated a virtual flora or fauna is, it is only as good as the data it contains; describing the biodiversity of a region as completely as possible is the ultimate goal of any flora or fauna. Adding records to the database has been an ongoing task for MABA staff and volunteers since the project’s inception in 2009. Preparation for the third Madrean Conference in May of 2012 has given MABA staff an opportunity to pause and reflect on the status of the database. It is important to note that not all of the records have been gathered by MABA; in fact most records in the database come from collaborating with other organization, such as herbaria and natural history museums which have their own species databases. The MABA database takes advantage of technology developed for the SEINet online flora, which shares much of the same data. The figures to the right show the number of records within the states of Arizona, New Mexico, Sonora, and Chihuahua. (Note: any records without geographic coordinates were not included in this analysis.) Currently, the MABA database contains 592,192 plant records distributed among 25 different collections. The MABA fauna database contains 132,235 animal records from seven different collections. Another way to examine the database is to see which years were the most productive for record collection (see table on

previous page). The earliest plant record within the MABA database was collected in 1805; the earliest animal record is from 1855. The obvious trend is that more plant and animal data has been collected in recent years. It is also possible to view the geographic distribution of the databases. The adjacent maps were created using a geographic information system and show the density of observation per square kilometer. Arizona noticeably contains the greatest number of plant records, while Sonora currently has the most animal observations within the database. One obvious finding from these maps is that most data is located around cities, some select mountain ranges, and roads — indicating that the distribution of records reflects travel routes, human population centers, and specific research interests rather than the abundance of species. Looking at the data sets in these ways allows the MABA staff to focus their efforts on areas that are not well represented, helping to provide a more complete picture of biodiversity in the region.

The MABA project has come a long way since it started in 2009, and the MABA online database is one of the many contributions of this project. After three years of intensive data collection and compilation, we are just starting to get a sense of what species are well recorded and which taxonomic and geographic areas need more attention. Without a tool like MABA’s virtual flora and fauna, this task would be impossible. Documenting the biodiversity of a region as diverse as the Sky Islands is a tremendous task, but one that is essential for preserving the unique species we all care about.

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Currently, the MABA flora database contains 592,192 plant records distributed among 25 different collections. The MABA fauna database contains 132,235 animal records from seven different collections. Arizona noticeably contains the greatest number of plant records, while Sonora currently has the most animal observations within the database.



from left *Melampodium moctezumum* — one of 39 species commonly known as blackfoots (sunflower family) — found 20.5 km SSE of Moctezuma, Sonora, August 2011. *Acer grandidentatum* (Bigtooth maple). *Matelea caudata* — one of about 200 species commonly known as milkvine (dogbane family) — found north of Mazocahui, Sonora, August 2011.

Flora of the Madrean Archipelago in Sonora, Mexico

by Thomas R. Van Devender, MABA Project Manager. Photos courtesy the author.

In 1998, the World Wildlife Fund identified 'Mexican Pine-Oak Forests — Mexico, United States' as a global biodiversity hotspot. It has also widely been stated that the Sierra Madre is a hotspot. This is actually a vast area within the Sierra Madre Oriental on the east and the Sierra Madre Occidental bounding the Mexican Plateau in the double rain shadow between them. The Sierra Madre Occidental extends up western Mexico from Zacatecas and Jalisco north to Chihuahua and Sonora, Mexico. While Jerzy Rzedowski in his 1978 *Vegetación de México* stated that the highest diversity of plants in Mexico was in the pine-oak forest of the Sierra Madres, for the purposes of this article we are interested in the diversity in the northernmost Sierra Madre Occidental ranges in Sonora and Chihuahua and the isolated Sky Island ranges in the Madrean Archipelago northward into Arizona and New Mexico.

The international border between the United States and Mexico was established by the Treaty of Guadalupe Hidalgo at the end of the Mexican-American War in 1848 and the Gadsen Purchase in 1853. The U.S. government sent expeditions to survey the new border led by soldier-scientist William H. Emory. The border is an east-west transect across the Continental Divide that intercepts all of the major biotic communities of greater Southwest. These expeditions were the first biological inventories in the Sky Island region, much of it done by military physicians, who had more free time than others in the expedition.

The botanists associated with the first U.S.–Mexican boundary survey (1848) were John M. Bigelow, Charles C. Parry, Arthur C. V. Schott, Edmund K. Smith, George Thurber, and Charles Wright. Their specimens collected along the Arizona-Sonora border were sent to eminent

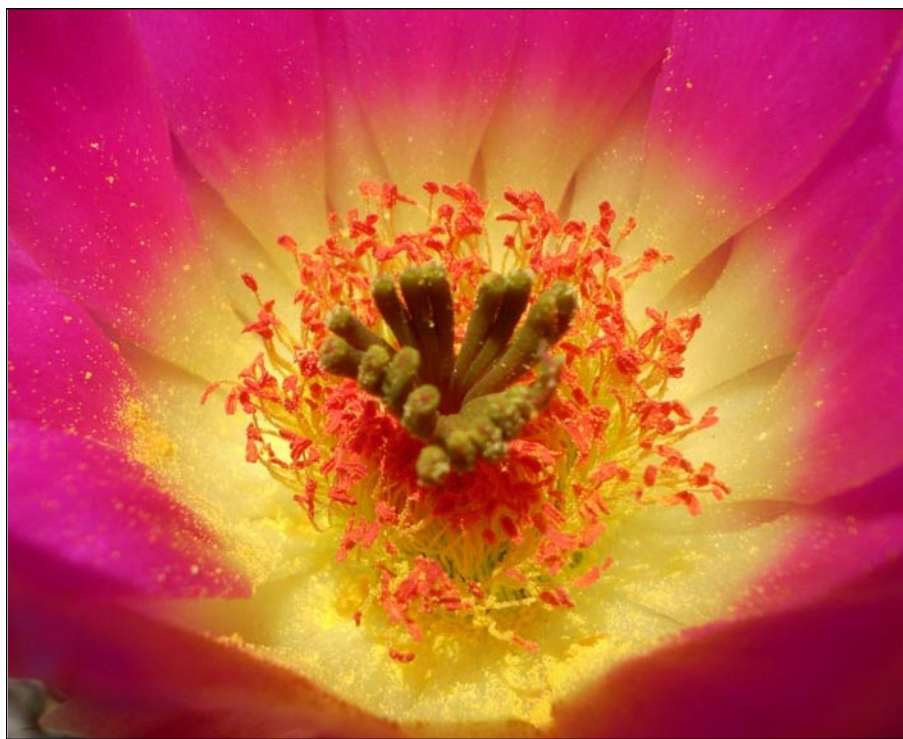
botanists such as Asa Gray at Harvard University, German-born St. Louis physician Georg Engelmann, and New York state botanist John Torrey. Botanists Carl V. Hartman and Francis E. Lloyd accompanied the Norwegian explorer Carl S. Lumholtz on his 1890-1893 Mexican anthropological and geographic expedition from Bisbee, Arizona, south and east into the Sierra Madre Occidental. Edgar A. Mearns, a surgeon and naturalist on the second U.S.–Mexican boundary survey (1907), collected animals and plants, and described general aspects of the vegetation in the Arizona-Sonora borderlands. Numerous plants bear the names of these explorers, collectors, and systematists; for example *Quercus emoryi*, *Nolina bigelovii*, *Penstemon parryi*, *Lophocereus schottii*, *Rhamnus smithii*, *Anisacanthus thurberi*, *Garrya wrightii*, *Krameria grayi*, *Opuntia engelmannii*, *Anthericum torreyi*, *Esenbeckia hartmanii*, and *Solanum lumholtzianum*.

The 1994 symposium, *Biodiversity and Management of the Madrean Archipelago: The Sky Islands of Southwestern United States and Northwestern Mexico*, and its sequel in 2004, brought together information on the biota, land management and conservation of the Sky Island region, but mostly north of the border. Floras on the Mexican side of the border were forgotten for most of the 20th century. U.S. botanists went farther south, lured by botanical treasures in the tropical deciduous forests of the Río Mayo region, pine-oak forests in the Sierra Madre Occidental in eastern and southeastern Sonora, and Sonoran desertscrub in the scenic Pinacate Region of northwestern Sonora, and the boojum tree (*Fouquieria columnaris*) landscapes on the Baja California Peninsula. Botanists from Mexico City rarely visit *la frontera*, more than 1,500 kilometers away. An important exception was the

botanical expeditions (1938–1941) led by Stephen S. White of the University of Michigan to explore the Río Bavispe region in northeastern Sonora.

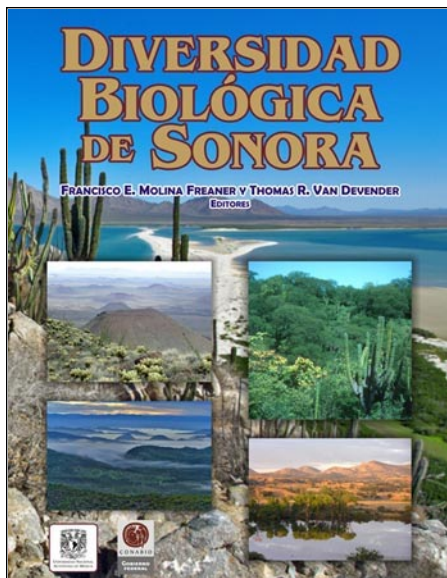
Modern botanical forays into the Sky Island region began in the early 1990s, about the same time that Sky Island Alliance advocated its way into existence. Paul S. Martin at The University of Arizona led a team of botanists, including Mark Fishbein (SIA founder) and me, to collect in the Río Mayo region in tropical southern Sonora, resulting in the 1998 book *Gentry's Río Mayo Plants*. Ana Lilia Reina-Guerrero and I began studying the flora of the Municipio de Yécora in the northern Río Mayo region in 1995. This area in the Sierra Madre Occidental in eastern Sonora has a very rich flora (1,774 taxa), and serves as a baseline to compare with Sky Island floras. In the 1994 Madrean Archipelago Symposium, Fishbein and fellow SIA founder Richard Felger presented their preliminary flora of the Sierra de los Ajos, one of the highest and most temperate Sonoran Sky Islands. A comparison of the floras of the Huachuca Mountains in Arizona with the Yécora area by Reina-G. and me in 2004 showed the Sierra Madre to be about 30% more diverse.

By far the most ambitious project to learn more about the plants of the Sky Island region in Sonora is the Madrean Archipelago Biodiversity (MABA) project at SIA begun in 2009. Plant and animal observations were made on MABA Expeditions to the Sierra San Luis (September 2009), Sierra el Tigre (March 2010), Sierra de la Madera (August 2010), Ciénega de Saracachi-Sierra San Antonio (May 2011), and Sierra de Bacadéhuachi (August 2011). Jesús Sánchez, Curator of the Universidad de Sonora Herbarium (USON) has been collecting plants in Rancho El Aribabi and other borderlands areas under support of a series of Comisión Nacional para el Conocimiento y Uso de la Biodiversidad



Bloom of *Echinocereus rigidissimus* (Rainbow hedgehog cactus), P. Blanca, May 2008.

(CONABIO) projects. With the expertise of Ed Gilbert, MABA developed a database to make all historical records from museum collections, literature, field notes, and new observations easily accessible for conservation, research, and education. The MABA: FLORA database is an extension of the Southwest Environmental Information Network (SEINet) plant database and MABA: FAUNA is a new resource for the region.



In the 2010 book *Diversidad Biológica de Sonora* (above) edited by myself and Francisco Molina-Freaner and Van Devender, a chapter on vascular plants by Van Devender, Felger, Fishbein, Sánchez-E. and Reina-G. summarized the flora of Sonora, which included 3,653 taxa (now ca. 3,700) documented by herbarium specimens in 1,103 genera and 188 families in an area of 184,934 km². Preliminary analyses using the MABA-SEINet database yielded 37,705 observations from the Sky Island region in northeastern Sonora in about 2700 taxa! The whopping 73% of the state flora in the Sky Island region reflects its very high biodiversity. The Madrean Archipelago is one of the greatest biotic convergence zones in the world. The New World tropics reaches its northernmost limit in North America in eastern Sonora at about 29°N to 30°N latitude. Species characteristic of temperate woodlands and forests of the Sierra Madre Occidental and Rocky Mountains, tropical deciduous forest and thornscrub from the south, Great Plains grasslands and Chihuahuan desertscrub from the east, and Sonoran desertscrub from the west come together in northeastern Sonora. Foothills thornscrub extends to 30°30'N in the Río Bavispe (Yaqui) drainage, with some tropical plants and animals following northern tributaries into southeastern Arizona. Very little floristic work has been done in the high, montane forests of the northernmost Sierra Madre Occidental ranges near Mesa de Tres Río or the near by Sierra Huachinera, which likely have the highest plant diversity in Sonora.

That's the good news! There is always more to learn, new areas to explore, plants to find.

Sky Island Alliance and Allies Challenge Proposed Open-pit Mine in Patagonia Mountains

by Jenny Neeley, Conservation Policy Director

Harshaw Creek, nestled in the Patagonia Mountains southeast of Tucson, is a rare riparian gem in the Sky Island region. Widely considered a premiere international birding destination, this area provides essential habitat for numerous imperiled species. It also provides the town of Patagonia with a portion of its water supply, as well as numerous recreation and ecotourism opportunities.

Unfortunately, if the Wildcat Silver Corporation has its way, this peaceful refuge for wildlife and humans alike will be transformed into a 600-foot deep open-pit mine and processing plant, with almost 3,000 acres of national forest lands buried under mining waste. Sky Island Alliance is putting to work our extensive knowledge of this area's importance as a critical wildlife linkage in order to make sure this does not happen.

Extending south into Mexico as the Sierra San Antonio, the Patagonia Mountains serve as one of the region's most important wildlife linkages, one of only three remaining cross-border corridors in southeast Arizona where human development and border infrastructure do not impede wildlife migration. Information gathered through on-the-ground surveys and wildlife monitoring shows that this linkage is essential to the recovery of the ocelot and jaguar, with both species documented repeatedly in the mountain ranges encircling the Patagonia Mountains and 55 percent of all jaguar sightings in the 20th century occurring in this area. From 2001 to 2007, biologists monitored at least two jaguars thirty to sixty miles west of the Patagonia Mountains, and SIA has repeatedly documented two different jaguars thirty miles south of the Patagonia Mountains in Sonora's Sierra Azul.

In 2009, SIA documented the first live ocelot in Arizona in forty years, only about thirty miles from the Patagonia Mountains, and we also have extensive documentation of a known breeding population only thirty miles south in Sonora. Recently, the Arizona Game and Fish Department documented ocelots on two different occasions in the nearby Huachuca Mountains.

Last year, the Wildcat Silver Corporation submitted a plan with the Coronado National Forest to expand mining activities in the Harshaw Creek Watershed. The Forest approved the plan after exempting the project from the National Environmental Policy Act and waiving the need for an environmental assessment, wrongly concluding that no natural resources or municipal watersheds would be affected.

Sky Island Alliance, the Patagonia Area Resource Alliance, and Defenders of Wildlife are challenging this dubious and ill-informed decision, and have asked the courts to put this project on hold until the Forest undertakes a thorough environmental review of the project's impacts. SIA is translating science into action and utilizing the hard work and dedication of our volunteers and staff in order to conserve this important Sky Island linkage for the jaguar, ocelot, and all other plant, wildlife and human communities that call this extraordinary place home.

Amphibians and Reptiles of the Sky Island Region

by Jim Rorabaugh

You've managed to get your four-wheel drive vehicle all the way up the road in Cañon Evans to the Ajos-Bavispe Reserve's cabin. Now comes the hard part — negotiating the old, unmaintained logging roads into the high country of the Sierra Los Ajos. But you persevere, maneuvering your vehicle over boulders and around washouts that threaten to roll your jeep down steep, rocky ravines to what would no doubt be an unpleasant end. But the voyage is worth the risk, as you travel ever higher through lush mixed conifer forest and aspen groves toward the highest point in Sonora. The last kilometer is on foot, and all uphill. But the vista from the 2,625-meter peak is spectacular, and as you gaze around the 360-degree view, you realize just how much of a crossroads you're at. On this clear May day, before the moisture and clouds of summer obscure the view, the Sierra El Tigre is clearly visible to the southeast, around which the Río Bavispe flows, dipping to the south where it joins with the Río Aros to become the Río Yaqui, which drains much of eastern Sonora. To the south and west, the Río Sonora flows towards the sea through valleys of semi-desert grasslands, which turn to foothills thornscrub, and then to the Sonoran Desert. To the north, the Río San Pedro arises in the mountains and flows through short grass prairie, then through Chihuahuan and Sonoran desertscrub to the Gila River. Surrounding these rivers, and providing much of the water for them, are the Sky Island mountain ranges with their patchworks of montane flora and fauna that are remnants of wetter and cooler times.

The herpetofauna — amphibians and reptiles — are also at a crossroads in this region, with more or less distinct assemblages that insert their influence from the Chihuahuan Desert and Great Plains to the northeast, the Sonoran Desert mostly to the west, the forests of the Mogollon Rim and Rocky Mountains to the north, the Sierra Madre Occidental to the southeast, and have a tropical presence that scurries and slithers its way northward through tendrils of thornscrub, and farther south, in the tropical deciduous forests that carpet the base of the southernmost Sky Islands.

Within view of the top of the Sierra Los Ajos, boa constrictors, spiny-tailed iguanas, and neotropical whipsnakes — denizens of tropical America — inhabit the lowlands and foothills to the south, while temperate species — prairie rattlesnakes, Great Plains toads, and greater short-horned lizards — penetrate the Sky Island region from the north and east. Many species are restricted to the cooler, wetter montane forests and woodlands, such as twin-spotted and ridge-nosed rattlesnakes, the Chihuahuan black-headed snake, mountain horned lizard, and Yarrow's spiny lizard. It is now hotter and drier than any time since the late Cretaceous, but during the last five million years, episodes of climatic oscillation, from cool and wet to warm and dry, caused corresponding contraction and expansion of biotic communities. For instance, several lines of evidence suggest that during the latter half of the Wisconsin glacial period (45,000-11,000 years ago) pinyon-juniper-oak woodlands occupied many of the Sky Island valleys. Spruce-fir forests were also much more widely distributed than they are today. Fauna associated with these woodlands and forests moved up and down in elevation with warming and cooling periods. As they did, some differentiation among montane herpetofaunal populations developed, as evidenced by genetic differentiation among populations of Yarrow's spiny lizard in mountain ranges of southeastern Arizona. Ridge-nosed rattlesnakes are represented by three subspecies in



***Craugastor tarahumaraensis* (Tarahumara barking frog), Rincón de Guadalupe, August 2011. Courtesy George Ferguson.**

the Sky Island region that are likely also products of the contraction and expansion of the montane woodlands.

In total — from the Santa Teresa and Pinaleno Mountains in the north, south to the Sierra de San Javier, west to the Baboquivari Mountains, and east to the Animas Mountains and Sierra San Luis — the Sky Island region is known to be home to about 143 species of amphibians and reptiles, including two salamanders, 26 frogs, toads, and spadefoots, 11 turtles and tortoises, 48 lizards, and 56 snakes. This is a remarkable diversity owing to the crossroad influences of temperate and tropical biotic communities. These numbers compare favorably with published state totals for Sonora (187), Chihuahua (169), and Arizona (148), each of which are much larger areas than the Sky Island region. Northeastern Sonora, in particular, is poorly studied in terms of amphibian and reptile distributions, and additional species are certain to be detected there.



***Lampropeltis pyromelana* (Madrean mountain kingsnake), Rincón de Guadalupe, September 2011. Courtesy Tom Van Devender.**



from left **Species like rodents are marked when they are caught so that researchers can have a rough idea of how many rodents are in the study area — if 100 rodents are captured the first time and 100 the next, but only 60 of the second group have been marked, it can be deduced that there are at least 140 rodents.** Allie Gaither-Banchoff at the study site.

BioBlitz: Bats, Rodents, and New Perspectives

by Allie Gaither-Banchoff, 8th grade, Paulo Freire Freedom School. Photos courtesy the author.

In November, I participated in the 2011 Saguaro BioBlitz. During BioBlitz I backpacked up the Rincon Mountains with ten other people from my school, five scientists, and a paramedic to the Grass Shack campground where we stayed for four days and three nights. Our goal was to help identify and record plants and animals in Saguaro National Park. Two of the scientists studied bats and small rodents. We helped them trap rodents such as pack rats and pocket mice, recording things such as their weight, their gender, and where we caught them. With these same two scientists we also caught bats in mist nets and recorded their wing span, what type of bat they were, and much more.

Working with the bat scientists was my favorite part because I love bats and I am interested in protecting and studying them. While we were helping we got to set up mist nets in the evening — large nets that are made of such thin material that the bats can't sense them until they are caught. Once we caught the bats we recorded things such as their wing span, their weight, and what type of bat. There were also two bug scientists staying with us at the campground whom we assisted by spending many hours catching bugs such as toe biters so that they could take them back and collect info on them. There was only one bird and plant scientist with us. We took multiple small hikes with him and talked about the native and exotic plants and recorded where they were on a GPS. He also taught us many new plant names such as *Carnegiea gigantea* which is a saguaro's scientific name. We also learned many of the native bird calls and got to hear a Great-horned owl. On many of the nights we looked at the stars and were amazed at how

many there are. This was especially fun because in the city you only see a small portion of the stars even if you may not realize it.

During our stay at Grass Shack, we also talked about sound and light pollution and why it is important to stop or minimize it. Sound and light pollution are artificial light and sound that affect the natural world in ways that mess up the food chain. For example: Many animals rely on hearing their predators sneaking up on them but if there is extra noise going on, they cannot hear them coming. To demonstrate sound and light pollution we played a game. This game involved two people; the prey and the predator. The prey put earplugs in and the predator tried to sneak up on the prey. After we tried it with the earplugs we tried it a second time without the earplugs. The earplugs demonstrated sound pollution, and we found that an animal is more likely to be caught by a predator if there is sound pollution because

it stops the animal from hearing the predator, just like we discussed. Light pollution is also part of why we can only see so many stars in the city because excess light blocks out the stars.

After going on BioBlitz, I have many new perspectives about the environment and the Sky Islands of southern Arizona. I learned lots and I saw many things that I might have never gotten the opportunity to see if I hadn't gone. It was a fantastic trip and I would highly recommend that residents and visitors to Tucson take the opportunity to enjoy our Sky Islands.

Allie is an eighth grade student at Paulo Freire Freedom School. She likes to hike, read, and spend time with her chickens. While she is not doing any of these things she likes to dance on the trapeze. Every year Allie also spends one month in the White Mountains on the Blue River.

Give Creatively!

SIA is already planning this year's awards banquet (May 24: Save the Date!) and are looking for donations to make the silent auction a great success.

Do you work for a business that could donate a gift basket?

Have a favorite restaurant that might donate a gift certificate?

Are you an artist who can support the event
and SIA with a unique creation?

Please send your ideas and offers to Keri@skyislandalliance.org.

Conserving Bird Diversity in the Madrean Archipelago

by Jennie Duberstein, Education and Outreach Coordinator, Sonoran Joint Venture

From coastlines and rivers to desert grasslands to mountaintops clad in spruce and fir, the southwestern United States and northwestern Mexico are home to an amazing diversity of wildlife and habitats. The character of the region is one of ending points, meeting places, and overlap among desert, temperate, and tropical habitats. Throughout the region, one finds a rich mixture of species and habitats that would normally be separated by considerable distances. The Rocky Mountains from the north meet the Sierra Madre Occidental from the south. The Chihuahuan Desert from the east blends with the Sonoran Desert from the west. The varied topography and distinctive climate of the region translate into an array of desert, grassland, scrubland, riparian, spruce-fir, forested, and wetland habitats. This variety, in turn, supports extremely diverse bird life.

If you are a birder, you already know that southeastern Arizona is world famous for the amazing diversity of bird life. People arrive from

all corners of the globe to see species that can be found nowhere else in the United States. From hummingbirds, tanagers, and trogons in the spring and summer to sparrows, raptors, and tens of thousands of Sandhill Cranes in the fall and winter, every season in this region is full of bird spectacles.

When you add northwestern Mexico to the equation, the diversity only increases. In the southwestern U.S. and northwestern Mexico together, researchers have documented nearly 650 species of birds migrating through, breeding, or wintering. This represents approximately two-thirds of all bird species that occur in northern Mexico, the United States, and Canada.

There are over twenty endemic or near endemic resident or breeding species, including birds such as, Gray Thrasher, Abert's Towhee, and Rufous-winged Sparrow. Additionally, there are several endemic subspecies such as "Arizona"

Grasshopper Sparrow and "Large-billed" Savannah Sparrow. Remnants of old-growth pine-oak forest support important species such as Golden Eagle, Military Macaw, Thick-billed Parrot, and Eared Quetzal. Other priority landbirds are Sinaloa Martin, Spotted Owl, Red-faced Warbler, Aztec Thrush, Five-striped Sparrow, and Montezuma Quail. Riparian areas support many in-transit migrants as well as breeding Thick-billed Kingbird, "Western" Yellow-billed Cuckoo, and "Southwestern" Willow Flycatcher. Unfortunately, there are also species that are presumed extinct, such as the Imperial Woodpecker from the Sierra Madre Occidental.

Many of the birds in the region are Neotropical migrants: birds that breed in the temperate zone of North America and migrate to more tropical regions in the south to spend the winter. Some species breed in the southwestern U.S. and northwestern Mexico and



Euptilotis neoxenus (Eared Quetzal). Courtesy Dominic Sherony.

migrate to Central America for the winter. Others breed in Canada and the western U.S. and come to southern Arizona and northwestern Mexico to spend the winter, while others may stop in the Sky Island region to refuel before continuing their southward (or northward, depending on the season) journey.

Because of the migratory nature of so many of the birds in the region, land use practices in one area can have far-reaching effects on bird populations. Threats to the area's ecology are as diverse as the bird species found here. Development, unsustainable grazing and logging practices, mining, conversion to agriculture ground water pumping and surface water diversion, non-native plant invasions, recreational pressures, drought, and climate change all present real and serious threats to the birds of the region.

Fortunately, if the challenges to bird conservation in the region are varied, so are the opportunities to meet them. From collecting basic data to document presence and distribution of birds in the region to undertaking habitat restoration and protection projects to community outreach and involvement efforts, partners in the Sky Island region are working to help ensure a healthy future for bird populations. Although the threats are serious, collaborative partnerships and innovative projects provide hope for a future where thriving populations of native bird species, as well as people, are supported by healthy landscapes.

Support SIA!

Join or renew here OR through our secure website:
www.skyislandalliance.org

We rely on membership support for our work to protect the natural treasures of our Sky Island region. *Contributions are tax-deductible; we are a 501(c)(3) non-profit organization.*

Basic membership for one year is \$35, but if you add to that, here's a sampling of what your dollars can do:

\$50 will help us survey 30 miles of roads and riparian areas...

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Protecting Our Mountain Islands and Desert Seas *continued from page 5*

wildlife crossing project, scheduled to break ground in 2013, is providing a model for similar projects elsewhere. In Cochise County, we have begun actively working to increase wildlife corridor awareness by conducting a connectivity planning assessment with the goal of bringing projects like these to other parts of the region. As human population and transportation needs increase, these critical wildlife connections will become more and more necessary. This new wildlife crossing project will be exciting to follow.

Recently, I was very happy to join trackers Dana, Dagmar, Karen and Tom during their North Canyon transect survey in Las Cienegas where we followed the trail of a striped skunk in addition to seeing sign from deer, coyote, fox, and a roadrunner. We shared lunch under a juniper tree, and on the way home, were graced with the sight a herd of Sonoran pronghorn against the backdrop of the Santa Rita and Whetstone mountains, reminding us why we do all this hard work in the first place.

Landscape Restoration Program

by Trevor Hare

We had a very busy fall here continuing our work in the field — chasing non-native frogs around the Pajaritos, stacking rocks on Ciénega Creek to halt erosion, planting riparian vegetation along Aravaipa Creek and its tributaries, and walking Sonoran creeks and wetlands. But our work doesn't stop there. Before we can get out there and restore the landscape, we plan, we meet with the agencies, we drink coffee and *plática* with Mexican landowners and their vaqueros, we share discoveries at conferences and write proposals and reports, and of course we submit comments on some of the disastrous proposals people, corporations and agencies concoct for our beautiful Sky Islands.

Of course even the meetings, the writing, the phone calls and emails — while not as fun as chasing critters around — are generally fulfilling and worth it. For example, in September I traveled to Palm Desert, California, in the shadow of the Santa Rosa and San Jacinto Mountains National Monument to attend the Conservation Lands Foundation Annual Rendezvous where we learned about how other groups around the west work with the Bureau of Land Management to protect National Conservation Areas and Monuments. Then, in October we spent two days on the San Pedro River with the National Riparian Service Team learning about and planning protective and restorative actions for that mighty river. Also, in October we attended, presented at, and led a field trip for the Arizona-New Mexico Travel Management and ORV Conference. Finally, in November the heavy lifting began.

One of the most nefarious and injurious proposals to come across our desks in a long time (we didn't get a chance at the border wall) is the proposed Rosemont Copper Mine in the northern Santa Rita Mountains, home to endemic, rare and threatened species of animals and plants, and recently visited by a jaguar. This mine will undo years of riparian and upland restoration that has occurred on Las Ciénegas National Conservation Area, and kill Ciénega Creek, so we have poured our hearts and souls into reading the thousands of pages of documents and the Draft Environmental Impact Statement (DEIS) — we have found that it is totally inadequate, that the public cannot make informed comments, and that the Forest Service cannot make an informed decision. Stay tuned for what promise to be an exciting year both in the field and behind the desk!



Join the Tradition... Volunteer!

Sky Island Alliance formed in 1991 by a group of concerned scientists, conservationists and activists who wanted to keep our public lands intact and wild so that future generations would have an opportunity to enjoy the quiet solitude of a mountain meadow and experience a landscape where native species still roamed. Today, Sky Island Alliance gathers people together to protect our rich natural heritage and restore native species and habitats. New volunteers come out all the time, whether they are seasoned backpackers or have never looked at, much less know what a topographic map is. We welcome you to join us!

There are Always Volunteer Opportunities to Rejoice in and Restore our Sky Islands!

Check www.skyislandalliance.org for the latest calendar!

Join our Landscape Restoration Field Weekends

Habitat Restoration Weekends: These trips can be physically demanding but have a wide variety of tasks to suit different skills and fitness levels. Current program work focuses largely on riparian restoration. Volunteers learn hands-on restoration techniques such as building one-rock dams and other water harvesting structures that control erosion, trap sediment, stabilize stream banks and retain water on the landscape. These structures, combined with the planting of young , — increase quality wildlife habitat along vital riparian corridors.

Riparian and Recreational Impact Surveys: Volunteers gather at a base camp and are matched with three to four other volunteers. We provide a map, GPS unit, digital camera, and data sheets. The teams are sent out to walk a riparian area or road transect. Each team collects photo and geospatial points to document their findings. Depending on the distance to the site, volunteers drive out for the day or camp out.

Contact Sarah at 520.624.7080 x23 or sarah@skyislandalliance.org

Adopt a Transect

Monitoring the presence of mammal species in important intermountain corridors: This volunteer program involves the largest time commitment. After an extensive training in identification and documentation of wildlife sign, volunteers are teamed up with other trained trackers to monitor a transect (tracking route) every six weeks. Check www.skyislandalliance.org or join our eNews list for information on our next tracking workshops!

Contact Jessica at 520.624.7080 x21 or jessica@skyislandalliance.org

Represent SIA at Outreach Events

Volunteer to spread the mission of Sky Island Alliance! SIA is regularly invited to participate in community events within the Sky Island region, but have limited staff resources to ensure our participation. We are seeking committed volunteers to represent SIA at public events, give presentations to the public and help at SIA outreach events and workshops. If you enjoy interacting with new people, sharing your knowledge of the region, and furthering the mission of SIA, this is the job for you!

Contact Sarah at 520.624.7080 x23 or sarah@skyislandalliance.org

Make a Difference

Data entry, analysis and office needs: Enter and analyze data collected in the field so that Sky Island can put that hard-earned information to work.

Contact Sarah at 520.624.7080 x23 or sarah@skyislandalliance.org

We're looking for a few members who have expertise in planned or legacy giving: If you feel well-versed from your experience, whether on the finance or legal side, to participate in the conversation to help us develop and launch a more formal program, please contact keri@skyislandalliance.org



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Protecting our Mountain Islands and Desert Seas

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Bill Radke *US Fish & Wildlife Service*
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José A. Sarukhán-Kermez
*Comisión Nacional para el Conocimiento y
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