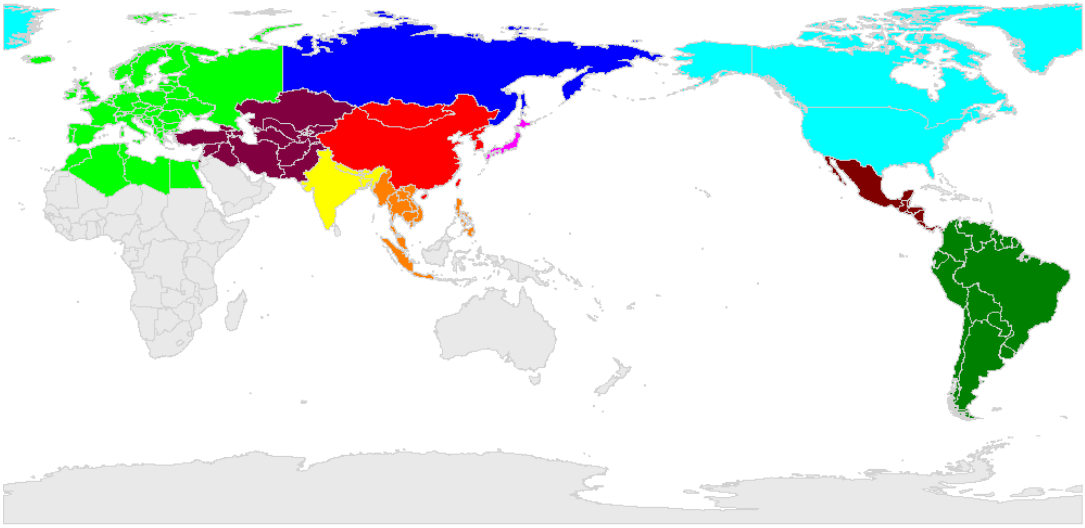
Bumblebee Specialist Group Report 2015

Edited by Paul Williams (Chair, UK) and Sarina Jepsen (Deputy Chair, USA)

BBSG IN 2015

The BBSG exists to foster the conservation of bumblebees and their habitats around the world. In this fourth report of the BBSG's activities, 2015 has been the best year so far, with accelerating progress towards our goal of evaluating the extinction risk of all ca 260 species of bumblebees worldwide using the IUCN Red List Criteria. Red List assessments have now been made for all of the European bumblebees plus 79 New World species. Congratulations to everyone on the results of all of their hard work!

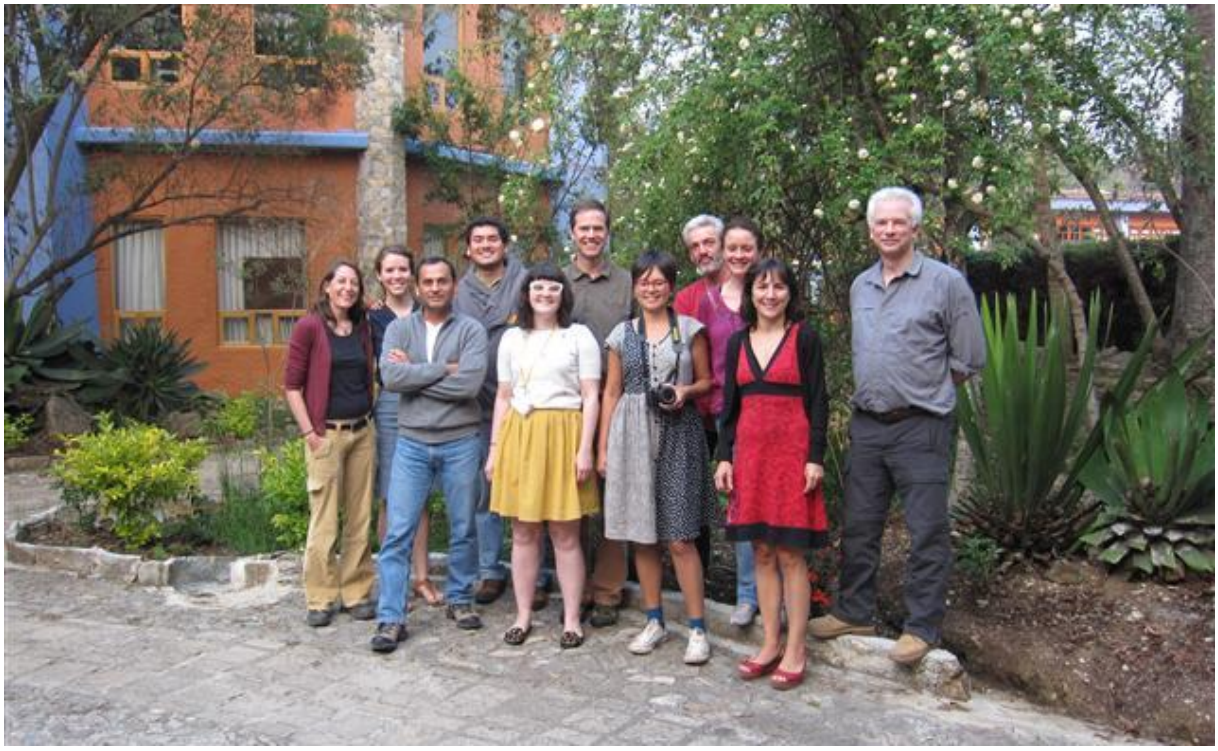
New BBSG Group for the South East Asian Region



Map of BBSG regions, with the new South East Asian Region shown in orange.

It is great news to be able to welcome the new regional group for South East Asia, led by Dr Panuwan Chantawannakul of Chiang Mai University, Thailand, and including colleagues, Dr Pham Hong Thai of the Vietnam National University of Agriculture, and Dr Jonathan Koch, working on the Philippine fauna from the University of Hawaii at Hilo, USA. Details of the progress that they are already making are given in their report below.

Mexico workshop 2015



Red Listing Workshop for Mesoamerican and South American groups of the BBSG in Chiapas, Mexico.

In the Spring of 2015, the BBSG held a workshop to help in completing Red List assessments of the threat status of the bumblebee species in Mesoamerica and South America. This was run as part of the Mesoamerican Congress on Native Bees in San Cristóbal de Las Casas, Chiapas, Mexico. We are enormously grateful to Rémy Vandame and his team at ECOSUR, who organised and hosted the workshop so comfortably and so amiably. We also very much appreciate the support of CONABIO (Mexico) and IUCN and for funding the workshop.

Seven members of the BBSG from Mesoamerica and two members of the BBSG from South America met to share knowledge of assessment methods and data. The BBSG Red List Authority and Xerces Society Conservation Biologist Rich Hatfield, BBSG Chair Paul Williams, and IUCN Species Survival Commission staff member Jennifer Luedtke led the workshop.

Since the workshop, the members of the BBSG from Mesoamerica, working in cooperation with the Xerces Society and other members of the BBSG, have published nine bumblebee Red List assessments for Mesoamerica. The remaining three species assessments have been submitted to the IUCN for final review and publication. Members of the BBSG from South America, working in cooperation with the Xerces Society staff and other BBSG members, have published one bumblebee species assessment, and the remaining 21 species assessments have now been submitted to the IUCN for final review and publication.

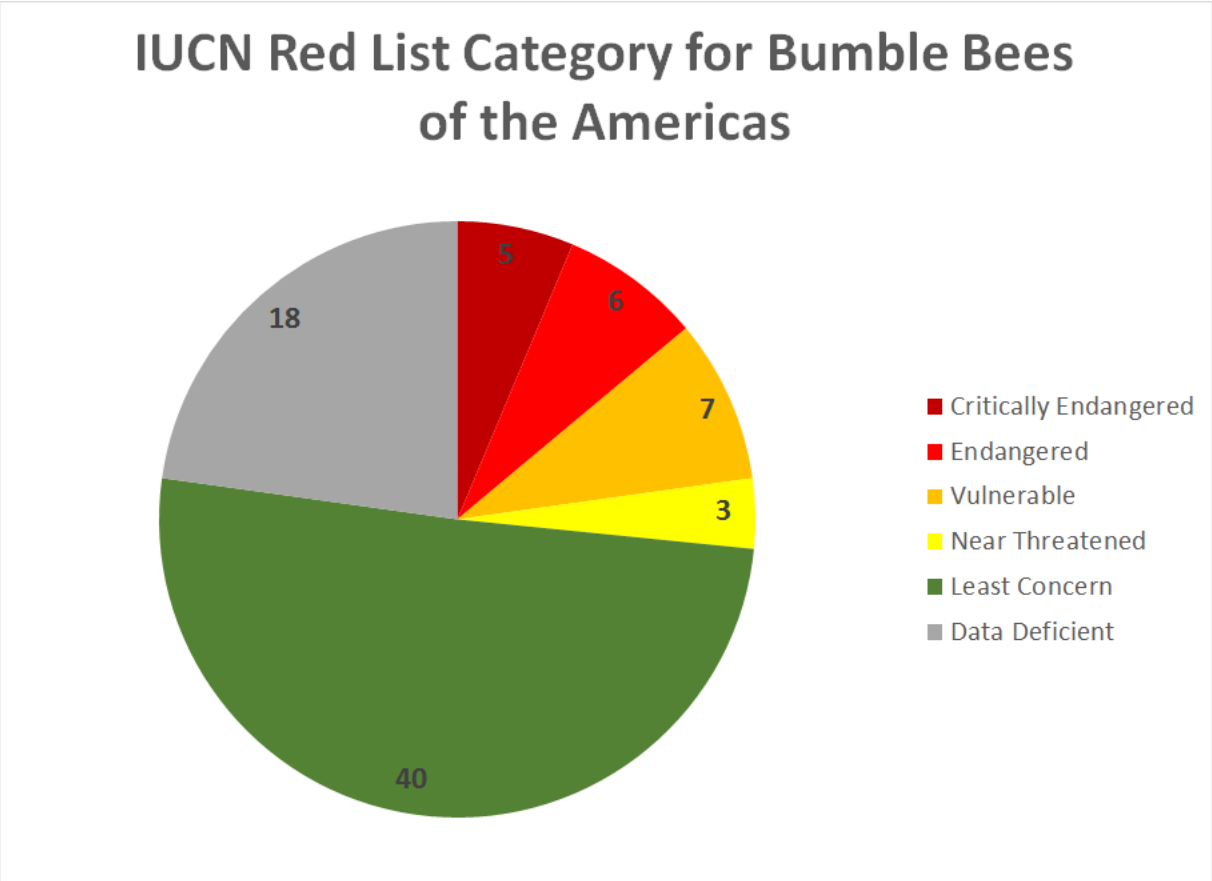
BBSG Red Listing Workshop in Mexico pushing back the frontiers.

Red Listing the bumblebees of the Americas

Rich Hatfield / Sarina Jepsen / Rémy Vandame / Carolina Morales / Sheila Colla / Robbin Thorp / Paul Williams

Bombus opifex enjoying a swim in a pink ocean of ornamental flowers at Sierras de Córdoba, Central Argentina. (Photo Carolina Morales**.)**

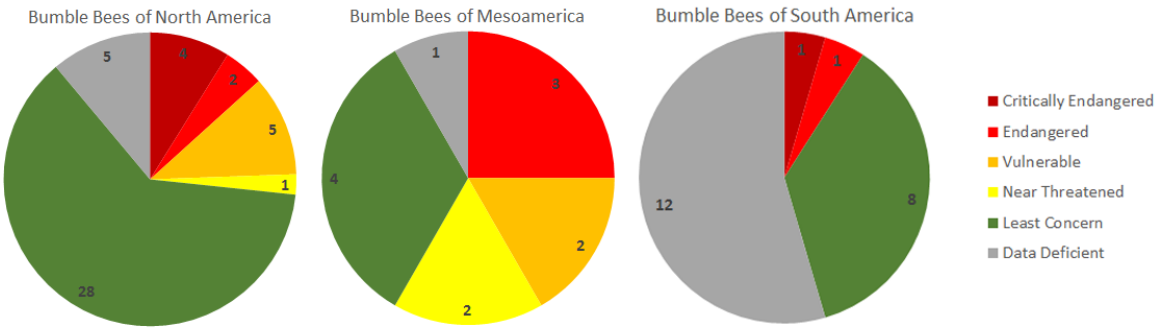
This past year was especially productive for the BBSG in the Americas. We completed the evaluation of the extinction risk of all 79 species of bumblebee from North America, Mesoamerica and South America using the Red List Criteria and completed written assessments for each species. To complete each assessment, we have produced maps of the distribution of each species and compiled information on taxonomy, distribution, population status, habitats and ecology, use and trade, threats, conservation actions, and rationale for assigning each Red List category for all 79 bumblebee species of the New World, and entered that information into IUCN's Species Information System (SIS). Forty-five species assessments from the New World have been published on the Red List to date, and the remaining 34 species assessments have been submitted to the Red List and will be published during the first update in 2016.



Pie chart showing the number of bumblebee species in each Red List Category for the New World

Taken together, around one-quarter of the bumblebees in the New World are in a Red List threatened category – from Near Threatened to Critically Endangered. In the New World five species are listed as Critically Endangered, and three of those species are cuckoo bumblebees. Although this finding is new, it is not surprising, since cuckoo bumblebees are dependent upon other bumblebees as hosts, and some of the most endangered cuckoo bees co-occur with host species that are also threatened with extinction.

Another conclusion from this work is that half of the species of bumblebees in South America have relatively poorly understood ranges – yet they are clearly experiencing continuing threats related to habitat loss and climate change. Many of these species are poorly understood and have relatively narrow historical ranges and, if patterns from North and Mesoamerica hold, may experience undocumented declines. A priority for further work will be to conduct regional surveys in South America to understand better the conservation status of these important animals.



Pie charts showing the number of bumblebee species in each Red List category for each region of the New World

In North America, we used a database of nearly 300,000 geo-referenced North American bumblebee records, assembled from approximately 150 academic, research, citizen science, and private collections (for a list of data contributors see: http://www.leifrichardson.org/bbna.html), we evaluated changes over the past decade in each species' extent of occurrence (EOO), persistence, and relative abundance. We used the results of these analyses to apply the Red List Criteria and assign Red List Categories to 46 species of North American bumblebees. We invited peer-review of the analytical methods and application of the Red List Criteria from the Chair and the 20 North American members of the BBSG and adjusted our analyses and/or interpretation of those analyses based on that feedback. We have also coordinated with bumblebee specialists in Mesoamerica (i.e.from Mexico to Panama) to obtain all available distribution information for the six species that occur in in both North and Mesoamerica. Using this information, we evaluated the entire geographic range of these species.

In Mesoamerica, the BBSG compiled a database of over 24,000 geo-referenced records of bumblebees, including an extensive survey effort undertaken by Rémy Vandame and his team at ECOSUR since 2013 to document the current range of Mesoamerican bumblebees. Historical data were provided by more than 40 individuals and institutions, and describing specimens held in at least 15 collections around the world (a list of data contributors is available at: http://www.ecosur.mx/beesofmesoamerica/). With assistance from the Xerces Society the Mesoamerican BBSG applied the methods developed for the North American assessments to conduct robust quantitative assessments on the twelve species of bumblebees endemic to that region. Ten more species of the region were Red List assessed as parts of the 45 species assessed in North America, since they occur in both regions.

In South America, the BBSG compiled the knowledge of several bumblebee experts throughout South America to assess the status of the 22 species of bumblebees endemic to that region. Despite considerable effort, little is known about many of the species, especially those with historically small, or remote ranges. It is clear that a concerted effort is needed to document the current distribution and conservation status of these important animals. This is especially true as some evidence suggest that additional species, such as *B. bellicosus*, are likely to be in peril. This species has undergone dramatic declines in the northern part of its range in Brazil, but very little is known about its distribution in the remainder of its range in Paraguay, Uruguay, and Argentina – making a global assessment of its status nearly impossible. One species from South America that is well-documented, and has experienced

dramatic declines likely due to the introduction of two non-native bumblebees, is *B. dahlbomii* (Red List Category: Endangered). This species' assessment was published in 2015.

Challenges. There has been much discussion about using the current IUCN assessment process for the assessment of invertebrates that have broad distributions and limited data. The issue with bumblebees is compounded because unlike many other Red Listed invertebrates most bumblebees are broadly distributed—not rare endemics. The lack of data on the decline for these species mandated that we take a different approach to these assessments. In North and Mesoamerica we used large databases to evaluate changes over the past decade in each species' extent of occurrence, persistence, and relative abundance. This allowed us to prepare robust, data-rich assessments. In addition, we solicited feedback from multiple bumblebee specialists. We believe that we have created a process and a product that is fully supported by the bee research community, and that will be very useful to both the scientific and bee conservation communities. In fact, this assessment methodology is being adopted to assess a large group of stingless bees in Mexico and Mesoamerica as a result of the workshop that we conducted at the Mesoamerican Congress on Native Bees.

The lack of available information for the distribution of South American bumblebees was another challenge for these assessments. To our knowledge, comprehensive recent survey work has not been conducted, and many historical records have not been digitized, or re-examined to confirm identification. Several morphologically similar species in South America have all-black color patterns, which makes identification challenging. Many of these specimens need re-examination before a clear assessment of conservation status can be conducted.

While these assessments can currently be considered complete, there are likely revisions that will be needed in the near future. In North America, Europe, and northern Asia, the primarily arctic species of the subgenus *Alpinobombus* are currently undergoing taxonomic revision and are likely to include new species (Williams et al. 2015). In Mesoamerica, there is evidence to suggest that *B. ephippiatus,* as recently accepted, actually consists of a complex of several closely similar species including undescribed species (continuing from work by Duennes et al. 2012). Further taxonomic re-assessment is currently underway for several species groups in the Mesoamerican and South American regions. Revisions are well under way, with some species newly described (Francoso et al. 2015, Santos-Junior et al. 2015) and with further progress to be published in 2016.

Relevance beyond the IUCN. The importance of pollinators for ecosystems and agriculture has recently been recognized in the first global assessment driven by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES; http://www.ipbes.net/plenary/ipbes-4). Pollinators are essential to our environment, providing the critical service of pollination to nearly 80% of the world's flowering plants, including one-third of the world's food crops. Furthermore, many of the vitamins and micronutrients essential to human nutrition—such as vitamin C—are predominately found in plants that require insect pollination. In North America, there are approximately 3,600 native bee species, but the native bumblebees are the only group that has been studied sufficiently for us to be able to understand which species are endangered and which are stable. Prior to this project, regional reports indicated that some species of North American

bumblebees had undergone recent, dramatic declines. There were also some reports of declines in native bumblebees in South America, but there had been no analysis of the conservation status of all New World bumblebees. These assessments can now form the basis for a framework of conservation measures, research direction, and policy changes to mediate the identified threats to bumblebees, and to improve the habitat necessary for species recovery.

The process of using the IUCN assessments to improve the bumblebee conservation landscape has already begun in North America. Using the results from our Red List analysis in North America, the Xerces Society has been reaching out to state departments of wildlife advocating for protection for the North American species considered threatened in the Red List. Twenty-six US states that received our status assessments and recommendations have listed at least one bumblebee species as Species of Greatest Conservation Need in their updated State Wildlife Action Plans. This status makes those bumblebees eligible for federal funding for conservation projects related to research, restoration, and management. In addition to State Wildlife Action Plans, these IUCN assessments have been used to support the listing of bumblebees as Sensitive Species on three National Forests regions – an important conservation status for imperiled animals of federal land – and for endangered species listings in the Canadian provinces of Ontario and British Columbia. These combined factors have affected bumblebee conservation at a continental scale, and will continue to do so as the status of these essential pollinators is recognized by policy-makers, scientists, and the general public.

While the publication of the South and Mesoamerican bumblebees in the IUCN Red List is too recent for us to be able to report on any consequential long-term conservation benefits, it is our hope that these assessmentswill similarly affect policy and restoration work for bumblebees in the months and years to come. To raise awareness further about the importance of this work and its conclusions, we will present the results of these assessments at the International Congress of Entomology in Orlando, Florida, and to the Meeting of the Canada/Mexico/U.S. Trilateral Committee for Wildlife and Ecosystem Conservation and Management in Ontario, Canada in 2016.

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NORTH ASIA

Alexandr Byvaltsev / Maxim Proshchalykin

Bombus fragrans worker resting on *Cirsium* near Lake Maraldy, Pavlodar Region, Kazakhstan. (Photo Alexandr Byvaltsev.)

In 2015 we made good progress towards our aim of evaluating the diversity of bumblebees in Russia. A list of the bumblebees of Khakassia has now been compiled (Byvaltsev et al., 2015), with 38 species of bumblebee known for this region. Five species, namely *B. cullumanus*, *B. cryptarum*, *B. mocsaryi*, *B. semenoviellus*, and *B. soroeensis*, are recorded from Khakassia for the first time. One species, *B. sylvarum*, is excluded from this list of bumblebees, because previous reports were based on a misidentification of *B. pascuorum* (Kupianskaya et al., 2014). Three species, *B. amurensis*, *B. filchnerae*, and *B. fragrans*, are known from Khakassia only from specimens from the end of nineteenth and the beginning of the twentieth century. It is possible that these species are extinct, but we must be careful,

because bumblebees were not collected in the region between 1930 and 2004. It is possible that these species are now very rare and should be treated as endangered, so further investigations are needed.

The core of the bumblebee assemblages on the steppes of Khakassia is formed by eight species, which can be divided into three groups: very abundant – *B. ruderarius*, *B. mocsaryi*; abundant – *B. armeniacus*, *B. humilis*, *B. pascuorum*; and common – *B. rupestris*, *B. sibiricus*, *B. sichelii*. Bumblebees are more abundant and diverse in the mountain steppes than in the lowland steppe regions of Khakassia.

In 2016 we plan to compile a list of the bumblebee species for Krasnoyarsk Krai.

At the end of July 2015 we collected bumblebees near Lake Maraldy (Pavlodar Region, Kazakhstan). We were very surprised by a very high abundance of *B. fragrans*, one of the rarest bumblebee species of the Eurasian steppes, but one of the dominant species near Maraldy. This gives hope for its conservation.

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WEST ASIA

Murat Aytekin / Alireza Monfared

In the Middle East, bumblebees are as well known as honeybees as animals beneficial for human health. Recently studies have been made in several laboratories, focussing on bumblebees as benefical insects. Two papers in particular relate to the taxonomy of bumblebees, including a study on bumblebee venom for human health research.

Some good news is that for the *Apimondia* meeting in İstanbul in 2017 we plan to organize a round table meeting on the loss of bumblebees, which will include invited specialists.

In Iran, bumblebees live in mountainous regions. During 2015, sampling has added more localities for these bees. Some of the important new localities are in the provinces of Kohgiluyeh and Boyer Ahmad (Kakan, Sisakht), Fars (Sepidan, Sarbast), Chaharmahal and Bakhtiari (Cheshmeh Shaykhalikhan, Baba Haidar, Farsan), and West Azarbaydjan (Urmia, Silvana). Most castes of the various species were collected, which are now deposited in the Iranian Pollinating Insects Museum, in the Faculty of Agriculture of Yasouj University. Confirmation of species for the new records of Iranian bumblebees were made by Pierre Rasmont in Mons, Belgium.

Species recorded for the first time for Iran were *B*. *sichelii, B*. *rupestris,* and *B*. *velox.* The first of these species, *B. sichelii*, was collected from Tehran (Dizin), Golestan (Gorgan, Shah kuh), Ardabil (Sabalan, Alvares, Sarein, Moeil), Ghazvin (Moalem kellayeh, Verk). The second species, *B. rupestris*, was collected from Ghazvin (Moalem kellayeh, Verk). In addition, specimens of *B*. *handlirschianus* were collected from Ardabil Province (Moeil, Alvares, Shirvandarrehci, and Kasra mountains and some other points). This is a rare species recorded previously only from the north of Iran by Skorikov. According to the last taxonomic revision, there are now 34 bumblebee species in 11 subgenera in Iran. The current list of these bees includes: *B. terrestris*, *B*. *lucorum* , *B*. *cryptarum, B*. *cullumanus, B*. *soroeensis*, *B*. *argillaceus*, *B*. *hortorum*, *B*. *portchinsky, B*. *incertus*, *B*. *alagesianus* (*keriensis*-complex), *B*. *sichelii* (new record), *B*. *handlirschianus*, *B*. *bohemicus*, *B*. *maxillosus*, *B*. *quadricolor*, *B*. *sylvestris*, *B*. *vestalis*, *B*. *rupestris* (new record), *B*. *haematurus*, *B*. *niveatus*, *B*. *sulfureus*, *B*. *fragrans*, *B*. *subterraneus*, *B*. *melanurus*, *B*. *humilis*, *B*. *pascuorum*, *B*. *ruderarius*, *B*. *sylvarum*, *B*. *zonatus* , *B*. *persicus*, *B*. *laesus*, *B*. *armeniacus*, *B*. *mesomelas*.

We are preparing a computerized key for the identification of Iranian bumblebees in collaboration with Paul Williams in London, UK. As part of this project, we aim to publish maps of localities in Iran from which bumblebee species have been collected over a period of 70 years of data gathering. This will help us to assess the Red List status of the species. We also plan to publish a taxonomic study of the bees of the subgenus *Psithyrus* collected in Iran.

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(Left) Sampling in central Iran around Yasouj with MSc students. (Right) Sampling near Damarvand Peak (the highest in Iran) near Tehran. (Photo Alireza Monfared.)

Sampling in the north west of Iran, Ardabil, Fandoghlu. (Photo Alireza Monfared.)

Sampling near Qazvin, Moalem kelayeh, Verk.

Lunch break.

EAST ASIA

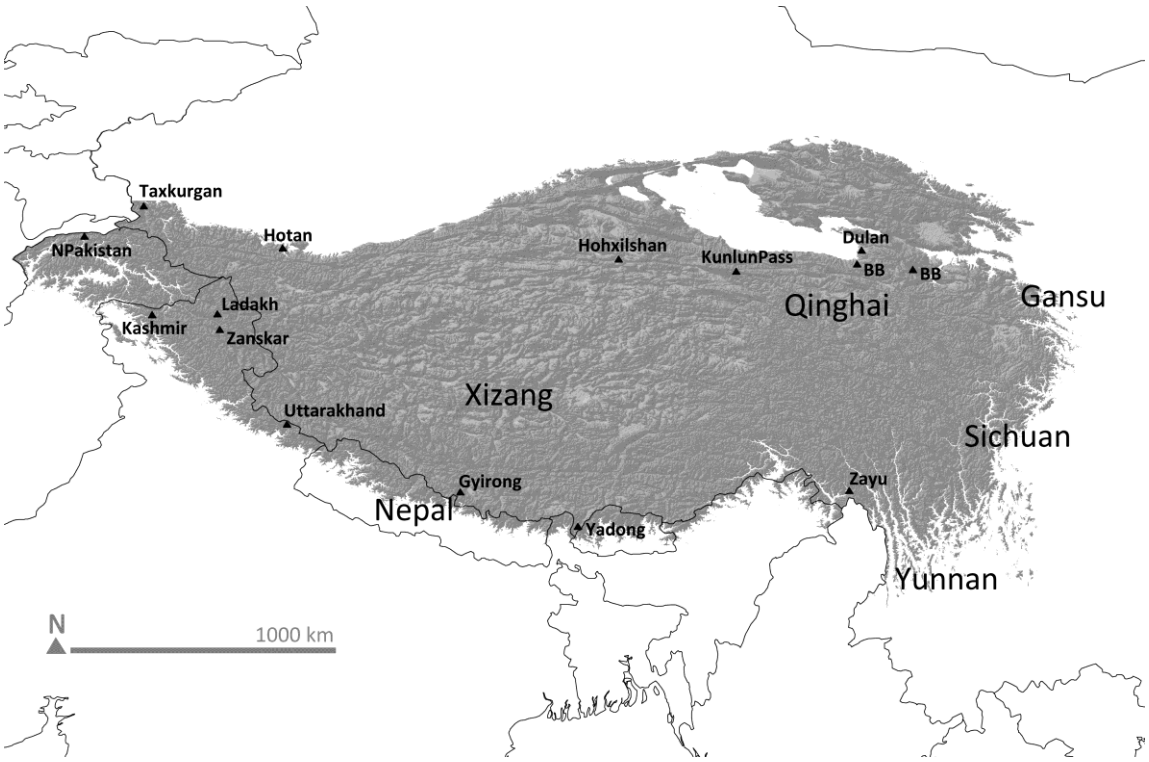
An Jiandong / Huang Jiaxing / Paul Williams

2015 has been a productive year for the East Asia group in China, as we move gradually towards being able to Red-List assess this exceptionally large fauna (currently estimated as at least 127 species). Significant progress has been made in the publication of a review of the distribution of bumblebees across the Tibetan plateau and a first study of the evolution of the long-tongued bumblebees of the subgenus *Megabombus*.

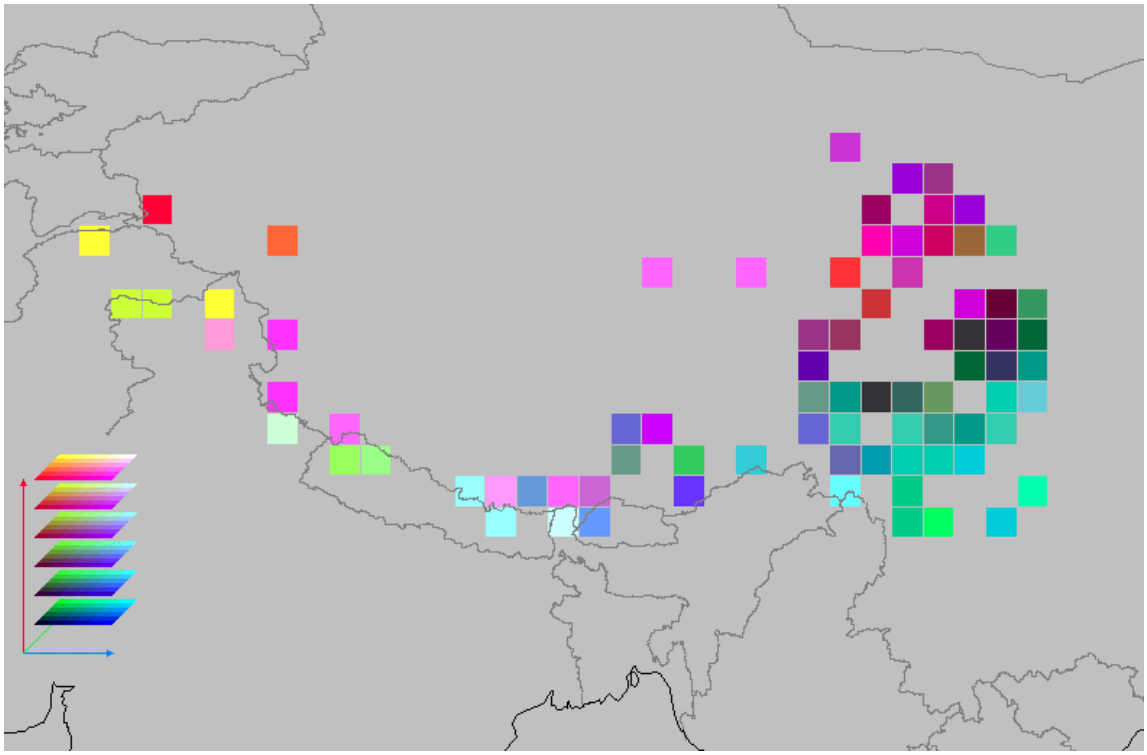
The semi-arid Nimaling Plain in Ladakh at 4800 m (viewed from ca 5100 m, opposite a peak at 6400 m), where a glacial stream waters a patch of *Caragana* on an old terminal moraine (right) that supports an isolated assemblage of nine species of bumblebees. (Photo Paul Williams.)

The Tibetan plateau, as a physical structure, is an area above 3000 m that is approximately one third of the size of the entire USA or Europe (grey map below). Although at its centre it is a cold arid desert with few plants or bees, the surrounding mountains include the greatest hotspot of diversity for bumblebees world-wide, with more non-*Psithyrus* alpine bumblebee species (44) than the whole of America north of Mexico (40). It is a complex meeting point for several regional faunas (colour map below). The eastern and southern bumblebee faunas in wetter habitats appear to be closer to equilibrium with climate factors, whereas some western faunas in more arid regions appear to be further from equilibrium with the measured climate factors. One possibility is that the western faunas depend on highly localized (unmeasured) factors for mitigating the low precipitation over much of this region, in particular on continuous summer streams with meltwater from distant permanent glaciers or from high-ridge precipitation (photo above). Consequently, conservation threats to Tibetan bumblebees may include climate change causing loss of permanent streams in the west (Williams et al. 2015), as well as the over-grazing documented previously in the

east (Xie et al. 2008), threats that have not been major concerns for bumblebee conservation elsewhere.



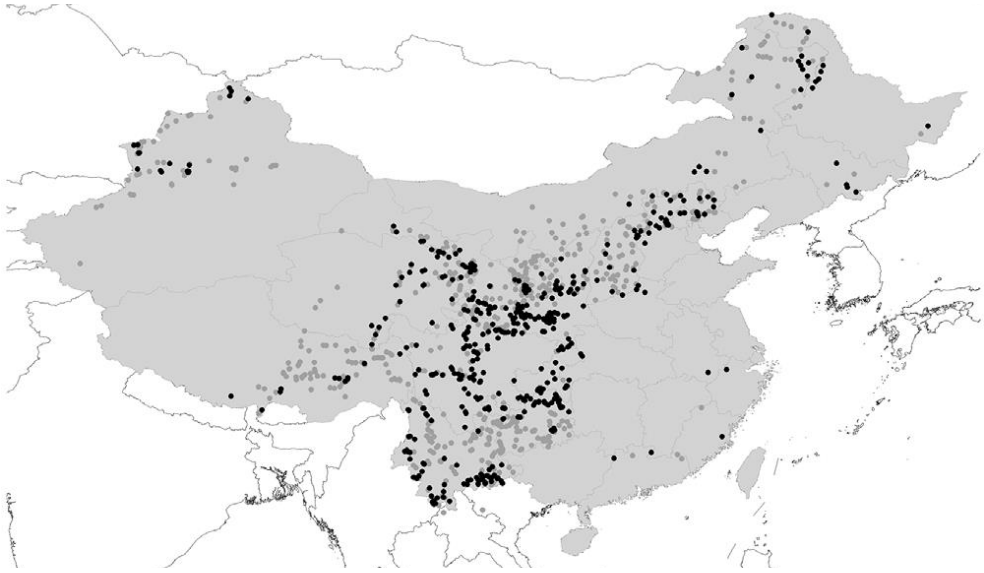
Map showing the Tibetan plateau region above 3000 m elevation in grey.



Map representing variation in the species composition of some of the richer alpine bumblebee faunas, using intensities of red (~ Central Asian fauna), green (~ Himalayan fauna), and blue (~ central plateau fauna), combined as shown in the colour scale on the left (see the paper for a detailed explanation).

Extreme long-tongued *B. consobrinus* worker visiting *Scabiosa* in Inner Mongolia. (Photo Paul Williams.)

Megabombus bumblebees have unusually long tongues and are generally more specialised than other bumblebees in their choice of food plants, which might make them more vulnerable to environmental change. The most extreme specialist species occur either in the far north (*B. consobrinus*), or at high elevations (*B. gerstaeckeri*), in situations where very long tongues coincide with the shortest nesting seasons. Species with the longest tongues but occurring further south and at lower elevations use a broader range of food plants (Huang et al., 2015). Field work is continuing to record data to investigate these patterns further and to investigate the effects of environmental change.



Map of sites sampled across China for bumblebees by the BBSG East Asia group and collaborators 2005-2013: grey spots, all bumblebee records; black spots, records for species of the subgenus *Megabombus*.

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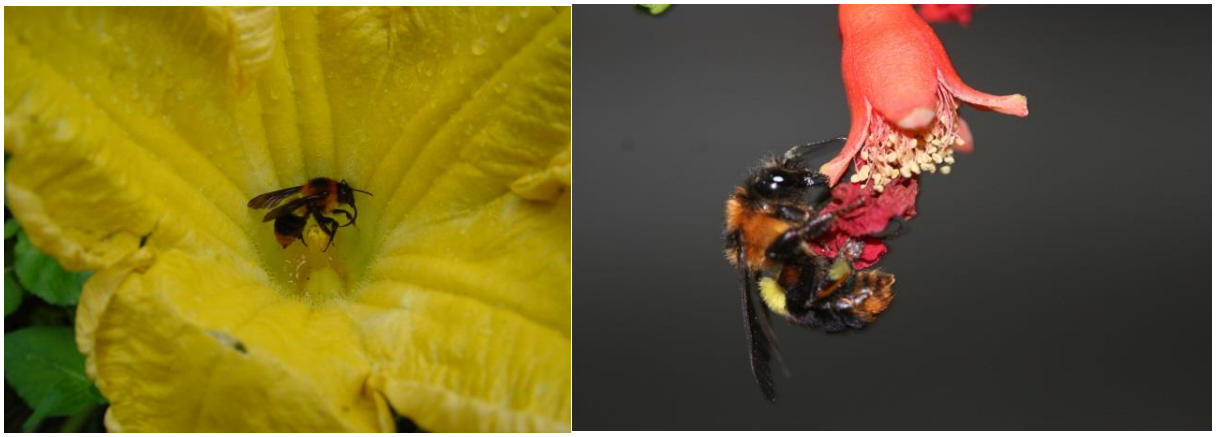
SOUTH EAST ASIA

Panuwan Chantawannakul / Pham Hong Thai / Jonathan Koch / Paul Williams

The BBSG regional group for South East Asia was established at the end of 2015. We are starting to survey and update the bumblebee species in our region. These species will be assessed for their distribution and threats. In Thailand, *B. breviceps* and *B. montivagus* were mostly present from our survey in Mae Hong Son, Chiang Rai and Chiang Mai provinces, Northern Thailand. Two species of bumblebee were also found in all of the mountains of North Vietnam at 900 m above sea level: *B. haemorrhoidalis* (= *montivolans*) and *B. breviceps.* The commercial utilization of bumblebees is already being practised to assist pollination in greenhouse tomatoes.

Bombus montivagus at 1375 m, Chiang Mai, Thailand. (Photo Chainarong Sinpoo.)



Bumblebees in Loong Luong commune, Moc Chau district, Son La province, Vietnam. (Photo Pham Hong Thai.)

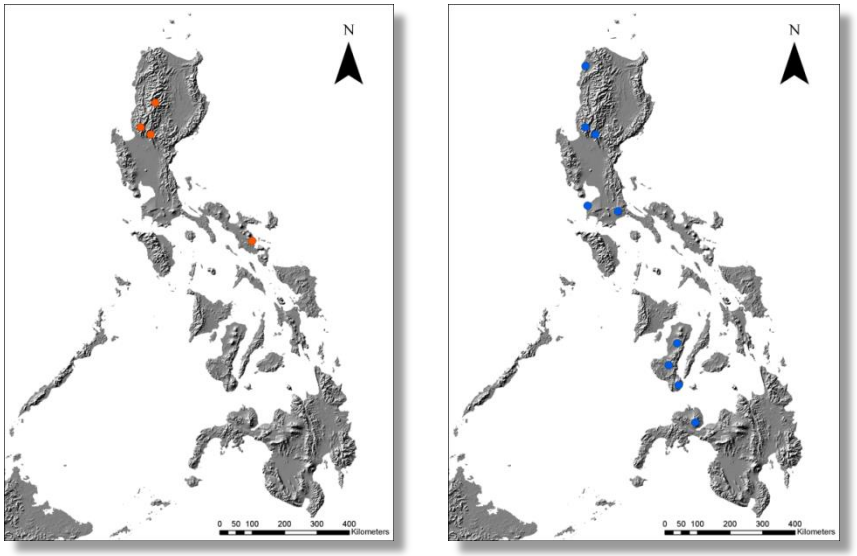
Bombus breviceps at 1304 m, Chiang Mai, Thailand. (Photo Chainarong Sinpoo.)

Rearing bumblebees in Hanoi, Vietnam. (Photo Dr. Pham Hong Thai)

In the Philippines, bumblebees or bubuyog (in the Tagalog language), are not well studied. Situated on the ring of fire, the Philippines are represented by more than 7,000 tropical islands located between latitudes 5° and 20° north. It is a biodiversity hotspot with thousands of endemic plant and animal species, many of which are threatened by intense land use and climate change. The archipelago has 29 volcanic mountains over 1500 m, from the northern island of Luzon to the southern island of Mindanao. We propose to extend research efforts to include the Philippines,.

At present there are at least two bumblebee species recognized in the Philippines, *B. irisanensis* and *B. flavescens* (in the broad sense, see http://www.nhm.ac.uk/research-curation/research/projects/bombus/pr.html#flavescens). *Bombus irisanensis* is considered to be vulnerable based on a preliminary IUCN investigation, as few specimens have been collected since the 1990s. Historically, both species were found to be distributed across the provinces of the Philippines with higher mountains (> 1500 m, maps below). *Bombus flavescens* may be part of a complex of species, and further systematic investigation is needed. The Philippine population of *B. flavescens* has a colour pattern distinct from the populations in mainland Asia. Digitized ditribution data are sorely lacking for Philippine bumblebees, and there are no substantial studies of food plants. At present there are at least 60 specimens of *B. irisanensis* housed at the University of the Philippines Los Banos Natural History Collection. In this update, we provide maps of records recently georeferenced with GoogleEarth for both *B. irisanensis* (map left) and the *B. flavescens* species complex in the Philippines (map right).

We recommend that future research initiatives include (1) digitization of available museum specimen records and (2) a new survey of bumblebees in the Philippines, as the most recent documented surveys were conducted in the 1990s. From the older investigations and available data, areas in the Philippines that should have a high priority for investigation include Baguio (16.4167° N, 120.6000° E), Mt. Isarog (13.6592° N, 123.3733° E), and Mt. Apo (6.9875° N, 125.2708° E).



Distribution maps of available records for (left) *B. irisanensis* records and (right) *B. flavescens s.l.* in the Philippines.

BBSG IN 2016

We are now making good progress with species assessments in many regions of the world. This is a good time to share experiences on how best to overcome problems in applying IUCN Red List criteria to bumblebee data. We are especially looking forward to exploring ways to combine our quantitative analyses from different regions into global Red List assessments for the widespread species. As ever, let us know what you need and we will try to find a way to help.

London 29 March 2016