Bumblebee Specialist Group Report 2017

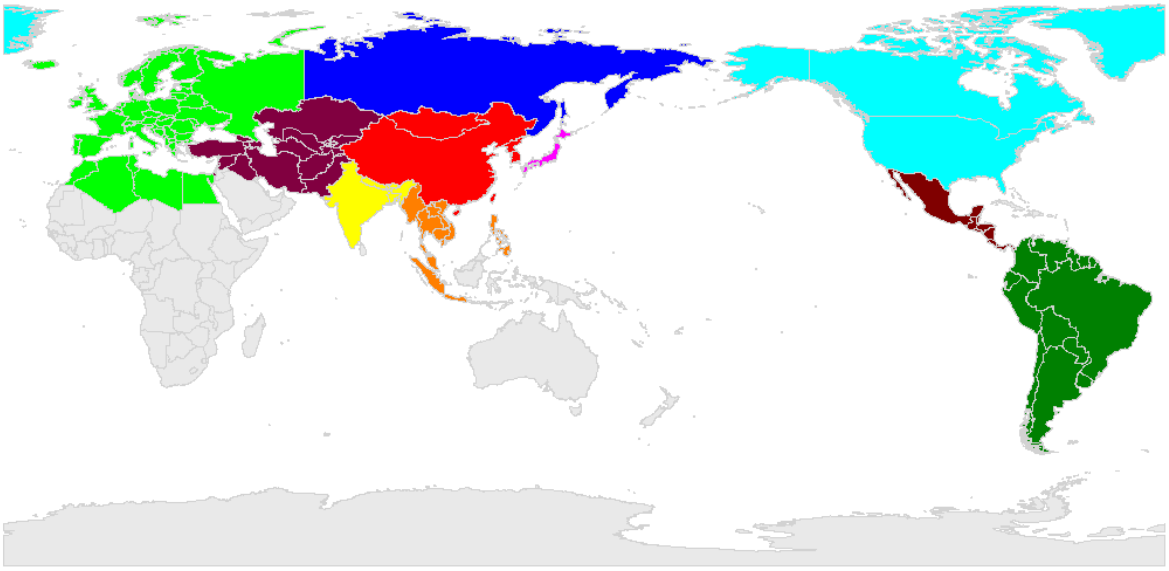
Edited by Paul Williams (Co-Chair, UK) and Sarina Jepsen (Co-Chair, USA)

BBSG IN 2017

The BBSG exists to foster the conservation of bumblebees and their habitats around the world. In this sixth report of the BBSG's activities, 2017 has been another busy year, with continuing progress towards our goal of evaluating the extinction risk of all ca 265 species of bumblebees worldwide using the IUCN Red List Criteria. Red List assessments have now contributed to advances in species protection in both North and South America.

Where are we now? – Progress with Red List assessments world-wide

In our first six years, the BBSG has made substantial progress in its mission to evaluate the extinction risk of all bumblebees according to Red List criteria and publish species profiles on the IUCN Red List, especially in Europe and in the Americas. In this report it is time to take stock and look at the situation in each BBSG region – to look at the challenges and opportunities ahead. It is important to appreciate that the situation is very different in different BBSG regions, with different levels of knowledge of the bumblebees and very different numbers of specialists available to work on the project, and with different levels of support. We are keen to look for opportunities for BBSG members to support one another across regions to help make progress towards our common goal, especially as we move from regional to global assessments of each species. We invite regional coordinators to contact us to let us know what factors limit your ability to accomplish red list assessments for the bumblebee fauna of your region, so that we may have a complete picture of the situation.



BBSG regions.

Work has begun on looking for patterns in vulnerability among bumblebee species, with phylogenetic analyses of the European fauna by Nicolas Vereecken (2017) and of the world fauna by Marina Arbetman et al. (2017).

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Vereecken NJ (2017) A phylogenetic approach to conservation prioritization for Europe's bumblebees (Hymenoptera: Apidae: *Bombus*). *Biological Conservation*, 206: 21-30.

EUROPE

Approximately 66-70 species have been recognised in Europe recently, depending on the species concept accepted. All of the species recognised prior to 2017 have been assessed for Red List status within Europe (see the BBSG Annual Report for 2013 and 2014), of which at least nine are endemic to the region, so 56 species need to be assessed beyond Europe. Within Europe, distributions are relatively well recorded and databased, so that baseline data are available (by arrangement) for comparison in the future.

Two new species were recognised from molecular studies in 2017: *B. konradini* in Italy (Martinet et al. 2018) and *B. glacialis* in Novaya Zemlya (Potapov et al. 2017). Phylogenetic patterns in vulnerability for the European fauna are described by Vereecken (2017)

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Potapov GS, Kondakov AV, Spitsyn VM, Filippov BY, Kolosova YS, Zubril NA, Bolotov IN (2017) An integrative taxonomic approach confirms the valid status of *Bombus glacialis*, an endemic bumblebee species of the High Arctic. *Polar Biology*.

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NORTH AMERICA

47 species are recognised here, including the species newly described in 2016, *B. kluanensis* from the subarctic north west. All currently recognised species have now been assessed for Red List status globally, although the species of the subgenus *Alpinobombus* are being revised and *B. kluanensis* has yet to be assessed. Assessments of species listed as Data Deficient will be improved in future years as data gaps are filled, especially from parts of species ranges beyond North America (e.g. by bringing together experts from around the world). Within North America, distributions are relatively well recorded and databased, so that baseline data are readily available for comparison in the future.

Red Listing North America's bumblebees

Rich Hatfield / Sheila Colla / Sarina Jepsen / Leif Richardson / Robbin Thorp

Here we describe the methodology used by the North American BBSG to assess the North American *Bombus* spp. fauna. We benefitted from a comprehensive database that had been digitized for the publication of *Bumble Bees of North America* by Williams et al. (2014) with good coverage throughout most species' ranges. While we recognize this is not the case for much of the rest of the world, we thought it might be helpful to detail our methods in hopes that others could use them, adapt them, or improve upon them for future bumblebee (or other) Red List assessments. If you have any questions about the specific ArcGIS tools or methods used here, please feel free to reach out to Rich Hatfield at the Xerces Society for Invertebrate Conservation (rich.hatfield@xerces.org).

Before detailing the methods, it is important to note that we attempted to apply the best methods to evaluate the extinction risk of North America's bumblebees, in a manner that is consistent with the IUCN framework. A key part of the IUCN framework is assessing changes

that have occurred within the last 10 years of the assessment (or 3 generations, whichever is longer). As such, this ten-year timeframe is integral to the methods we have applied and describe below. When applying the IUCN Red List Criteria to broadly distributed invertebrates with short lifespans, and very little population data, some interpretation and use of best professional judgment is required. Some of the challenges of applying these criteria have been noted by others, most notably Cardoso et al. (2011, 2012; but see Collen & Böhm 2012). Nevertheless, the IUCN Red List Criteria provide the international standard for evaluating extinction risk in a manner consistent among regions and taxonomic groups. The methods described here were developed in coordination with IUCN Red List Specialists and in consultation with European colleagues who have finished their regional Red List assessments. We suggest you review the key parts of the IUCN Red List Criteria noted below for more detail about the listing process, and about the categories and criteria. Please direct any questions about these methods to Rich Hatfield at the Xerces Society for Invertebrate Conservation (rich.hatfield@xerces.org).

IUCN Red List Criteria Documents:
http://www.iucnredlist.org/documents/RedListGuidelines.pdf
This is the key document for the IUCN assessments. While the entire document is worthwhile, the key sections that pertain to our analysis are highlighted below:

- 2.2: Nature of the Categories (page 7-10)
- 2.3: Nature of the criteria (page 13-15)
- 3.1: Data availability, inference and projection (page 16-17)
- 4.1 Population and population size (page 20)
- 4.5: Reduction (criterion A) (page 25-26)
- 4.9: Extent of occurrence (criteria A and B) (page 31-34)
- 5-5.1: Guidelines for Applying Criteria A (page 42-44)
- 10-10.3: Guidelines for Applying the Categories DD, NT, and NE (page 62-65)

IUCN summary one-page document:
http://www.iucnredlist.org/documents/2001CatsCrit_Summary_EN.pdf
This one page document provides a summary of the five criteria used to evaluate extinction risk.

Methods for the IUCN analysis: data set
Williams et al. (2014) assembled a database of nearly 300,000 electronic records for specimens of North American *Bombus* species (sensu Williams 2013) from academic, research, citizen science and private collections. Most contributions to the database include records of all *Bombus* held by an institution or individual, but in order to reduce bias associated with collections, in cases where only select taxa had been digitized, we dropped that entire collection from the database. We further removed all records lacking species-level determinations or other essential label data. We used GoogleEarth and ArcGIS 10.0 (ESRI 2010) to verify, correct or add georeference information for many records with insufficient or inaccurate location data. We individually dropped records that were well outside the known range of a species if the determiner could not be verified as a knowledgeable melittologist. The final dataset includes 202,198 specimen records housed in nearly 150 collections in North America and elsewhere.

Analyses

We evaluated changes in each species' spatial distribution over time using extent of occurrence (EOO) and a measure of persistence (described below). We also assess changes in each species' relative abundance, which we consider to be an 'index of abundance relevant to the taxon', as specified by the IUCN Red List Categories and Criteria (IUCN 2012). For both the EOO and persistence calculations we divided the database into historical (1805–2001, *N*= 128,572) and current (2002–2012, *N*= 73,626) records. This timeframe was chosen as IUCN criteria stipulate that species decline must have been observed over the longer of three generations or 10 years; the analyses were originally conducted in 2013.

Extent of Occurrence

Since the historical database had significantly more records, and therefore could lead to an over-estimate of range loss due to an increased chance of including more records near the edge of each species' range, we rarefied the historic data set by randomly selecting 73,626 records from the historical time period to use in the EOO measurement. Using *z*-tests for differences in proportion, we ensured that the relative abundance of each species in the subsampled historical data was not significantly different from the relative abundance of that species in the original database. To measure changes in each species' EOO, we first used a *k*-nearest neighbors approach to create local convex hulls (LCH) for each species in each time period (Getz et al. 2007). Generally we used the 'minimum spurious hole covering' rule proposed in Getz (Getz et al. 2007). However, since the ranges of most North America bumble bees are large, our 'spurious holes' frequently included large expanses of inhospitable habitat for bumblebees (e.g. The Gulf of Alaska). We used LCH instead of minimum convex polygons (MCP) to avoid including large areas of uninhabited habitat that is common with the broadly distributed North American fauna (see Figure 1). After the LCH polygons were created, we clipped the polygons to the North American continent to remove large patches of unoccupied habitat (e.g. Great Lakes). Using the areas calculated from these polygons, we compared the current area to the historical area to determine change in home range size.

Sampling Effort

Since we used presence-only records that primarily came from museum specimens for our analysis of changes in range size, sampling effort likely played a significant role in species presence or absence from a particular region. To account for varying sampling effort and to avoid overestimating range loss, we created sampling density rasters from the presence points of all bumblebee species, in both the current time period and the random sample of the historical time period (using ArcGIS 10.2) (See Figures 2–3). For each species, we calculated the relative difference in sampling density in areas where the EOO from the historic time period did not overlap with the EOO from the current time period (see Equation 1). Using the area of this non-overlapping polygon, we calculated the average sampling density for both time periods (See Figures 4–7). Species that experienced range loss in the current time period that had a lower sampling density than historically had their range loss estimates adjusted by the relative difference in average sampling density to account for the change in effort. We did not adjust the change in range estimates for species that had a higher sampling density in the current time period.

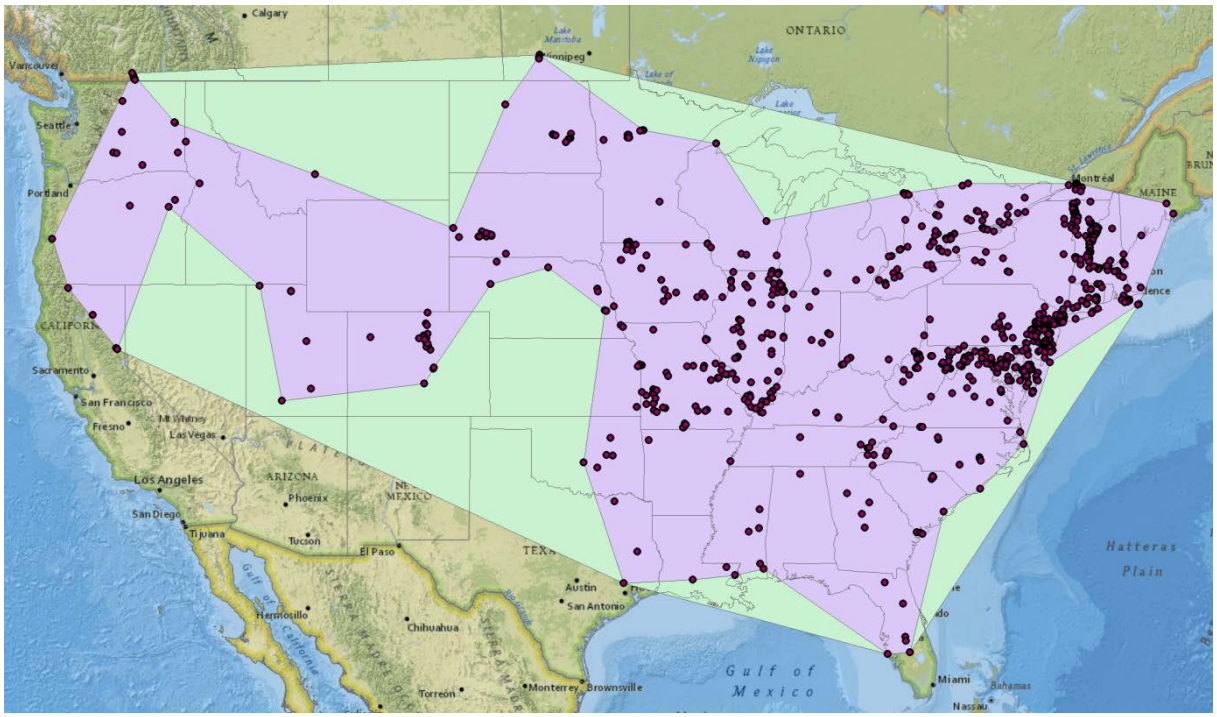
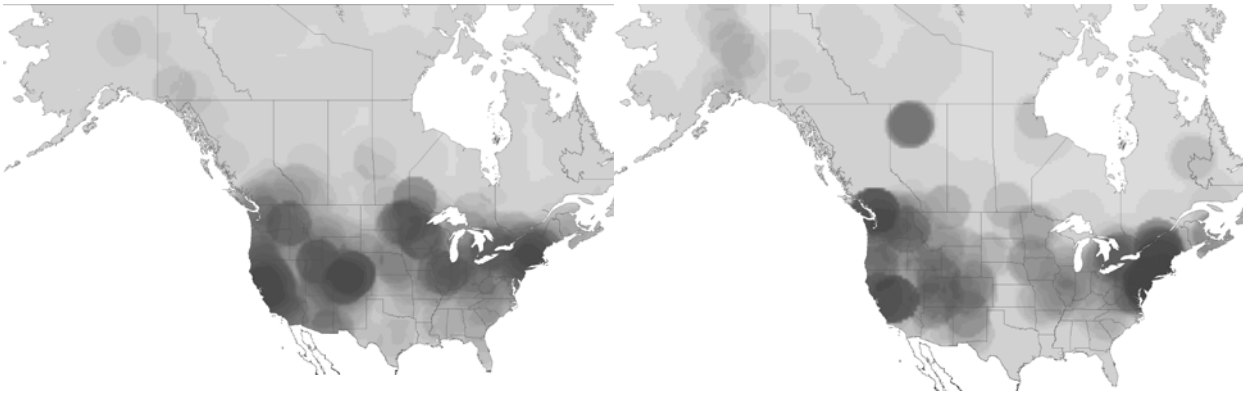
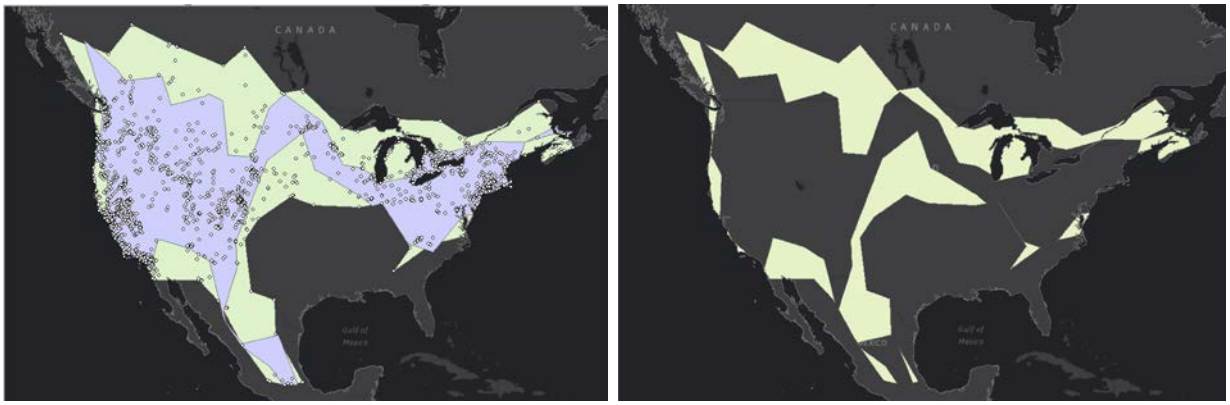


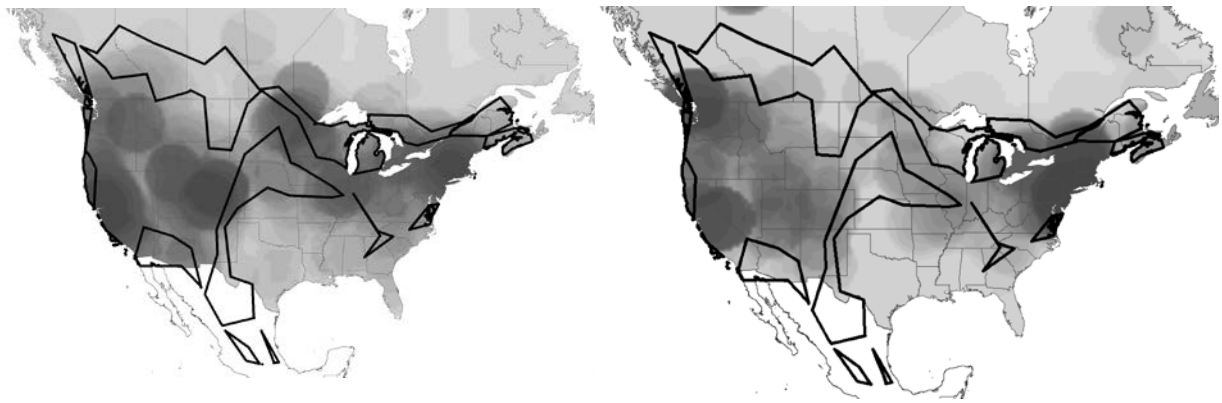
Figure 1. Difference between MCP (green) and LCH (pink). Polygons were clipped to the continent (to remove area over open ocean and large lakes) later in the process.



Figures 2–3. Sampling density rasters for the historic (left) and current (right) time periods.



Figures 4–5. Historic (green) and current (lavender) polygons for B. fervidus (left). Non-overlapping area from historic and current time periods for B. fervidus (right). These polygons represent the range loss for this species before correction for sampling effort.



Figures 6–7. Non-overlapping polygons shown on top of the sampling density rasters (see figures 2-3) from the historic (left) and current (right) time periods.

Changes to the range loss estimates due to differences in sampling density can be seen in Table 1. Because the sampling effort was so much lower in the range loss polygon for *B. fervidus* in the current time period (65.52% less) we adjusted the range loss estimate from 42.52% (RL_C) to 15.94% (RL_A) (see Equation 1, Table 1) using this formula:

$$RL_A = RL_C \left(\frac{|SD_H - SD_C|}{\frac{SD_H + SD_C}{2}} \right)$$

Equation 1. Used to adjust (A) range loss (RL) estimates based on sampling density (SD) in the historical (H) and Current (C) time periods.

Table 1. Range loss adjustment for B. fervidus based on sampling effort.

Bombus fervidus	
Historical EOO	1,370,639,244 HA
Current EOO	787,869,202.8 HA
Range Loss	42.52%
Difference in Sampling Effort	62.52%
Corrected Range Loss	15.94%

Persistence

To determine species' persistence within their home range, we divided the continent into 50 km x 50 km grid cells. We used 50 km grid cells to be consistent with previous European and North American *Bombus* spp. analyses (Williams et al. 2007; Colla et al. 2012) and because the data in the historical database was georeferenced from specimen label locality descriptions, which are sometimes inaccurate at smaller spatial scales (Wieczorek et al.

2004). For each time period we divided the number of grid cells occupied by each species by the total number of grid cells occupied by all species. Then, the value from the current time period was divided by the value from the historic time period to detect changes in persistence over time. While the metric that we report is not truly a measure of range size, it does provide a measure of each species' persistence within its home range (see Figure 8).

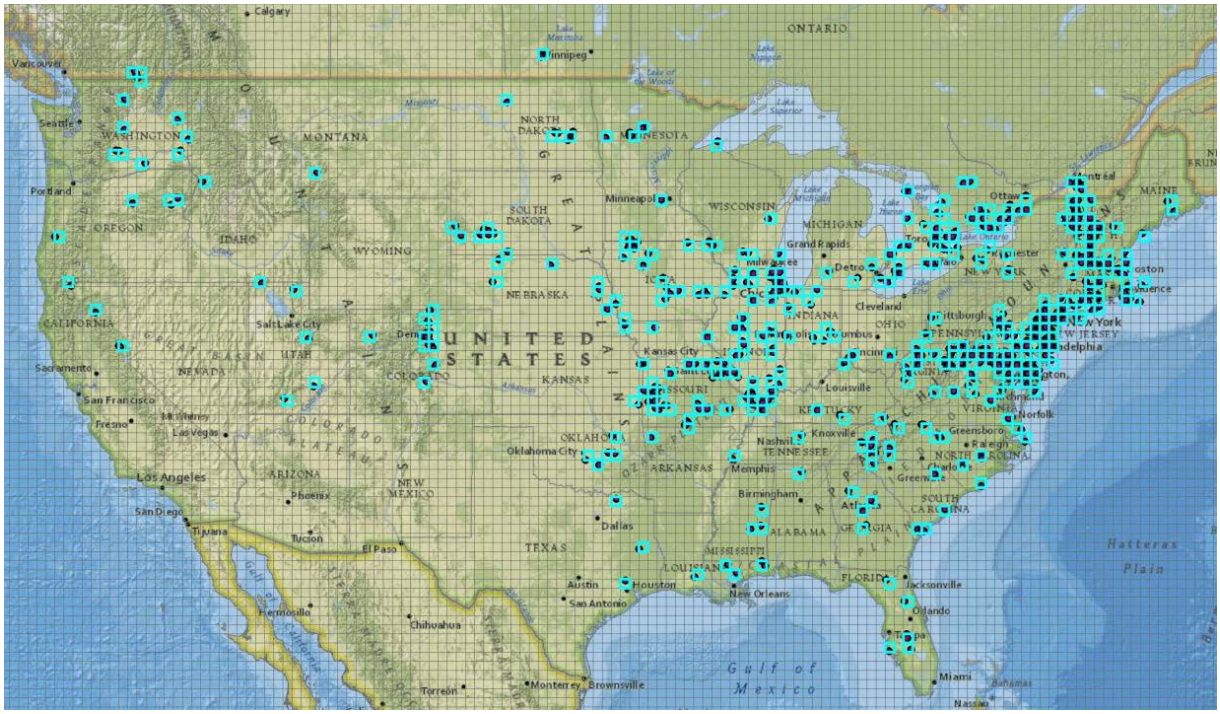


Figure 8. Map showing 50 km x 50 km grid cells used to generate persistence estimates.

Relative Abundance

To evaluate changes in the relative abundance (RA) of each species, we divided the full database into historical (1805–2001) and current (2002–2012) and calculated the RA of each species in each time period. Then, to estimate changes in RA, we divided the current RA by the historical RA. In addition to comparing the historical time period to the most recent decade, we also broke the database up into ten ten-year periods, plus one time period covering all records prior to 1913 and calculated the RA of each species in each time period (e.g. pre–1913= period 1, 1913–1922= period 2). Then, using time as the explanatory variable and RA as the independent variable, we conducted a linear regression to assess longer-term trends in each species' RA (see individual species graphs). To assess extinction risk for several species we used a linear trendline to project future declines. We used the *x*-intercept as the theoretical point of extinction.

IUCN Red List Categories and Criteria

After calculating each measure of range loss we assigned each species to a preliminary IUCN Red List Category (IUCN 2012) by looking at the quantitative measures (changes in range loss, persistence, and relative abundance) and comparing them to the quantitative thresholds of the five criteria (http://cmsdocs.s3.amazonaws.com/keydocuments/summary_sheet_en_web.pdf). When making final decisions we also considered range maps, sampling effort, recent literature, and the collective best professional judgment of the North American BBSG. Because there are limitations in evaluating extinction risk using museum specimen data (presence-only data

collected by many individuals in a non-random manner), we generally erred on the side of categorizing a species as less threatened than was justified by quantitative analysis alone. The selection of Red List Categories for each species can be greatly informed (and changed, if necessary) by the field experiences, species-specific knowledge, and collective best professional judgment of the North American bumblebee experts. Final Red List Assessments for North American bumblebees can be found here: http://www.iucnredlist.org/search/link/558c4179-6ae51a41.

IUCN Red List tools

Since we completed these analyses in 2013, several new tools have emerged to help with the Red Listing process. Many of these tools do not incorporate the methods described above (including a measure of sampling density and using the *k*-nearest neighbors approach), but they do offer guidance for those with limited GIS or spatial analysis tools. You can find some tools developed by the IUCN here: http://www.iucnredlist.org/technical-documents/red-list-training/iucnspatialresources There have also been some developments in the Program R, which are useful for these types of analyses. One example is ConR (Dauby et al. 2017).

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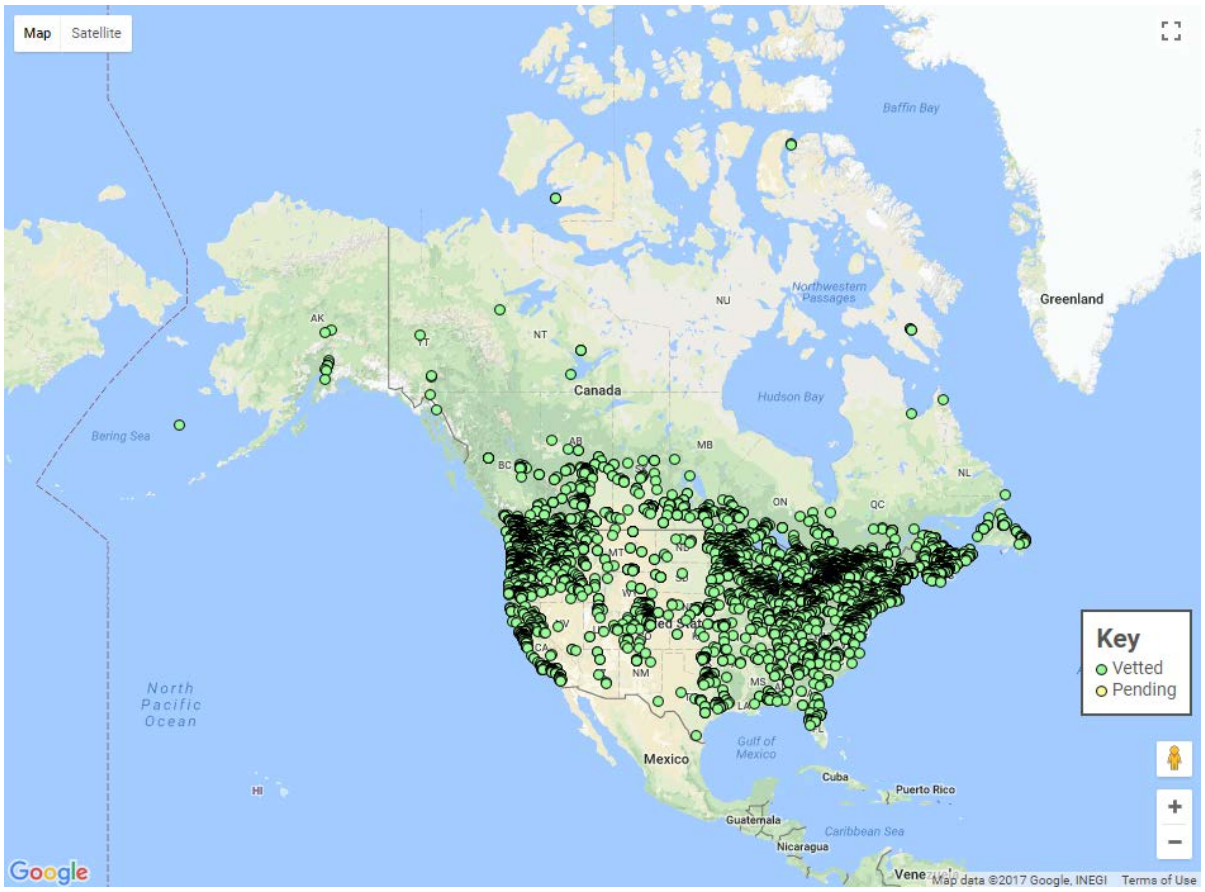
North American Region in 2017
Sheila Colla / Rich Hatfield / Robbin Thorp

Bombus terricola, from Newfoundland, Canada. (Photo by David McCorquodale submitted to *BumbleBeeWatch*)

This past year, *B. affinis* was federally listed as Endangered in the USA. It has been listed as Endangered in Canada since 2012 and is currently the only bumblebee species in both countries receiving federal protection. In Canada, *B. occidentalis, B. bohemicus* and *B. terricola* have been assessed as at-risk but are waiting to be federally listed, in some cases for a few years. *Bombus pensylvanicus* and *B. suckleyi* are in the process of being assessed in Canada. In the USA, *B. terricola*, *B. franklini*, and *B. occidentalis* are all under consideration for federal protection and are being evaluated by the US Fish and Wildlife Service. In addition to providing much needed information on distribution, ecology and decline, the IUCN Red List assessments of these and other bumblebee species have raised awareness and helped garner public support for protection of declining species in various North American jurisdictions.



Current observations submitted to BumbleBeeWatch that have been verified (as of December 2017).

Many members of the BBSG have been helping with *Bumble Bee Watch* (www.BumbleBeeWatch.org), a citizen-science project aimed to gathering information about bumblebee distribution and abundance. This project has received over 22,000 observations from over 6,000 participants. These observations have located new populations of at-risk species, expanded known ranges for some species, located *B. impatiens* well outside of its historic range (presumably due to movement for crop pollination) and has provided information about nesting and forage ecology. This growing dataset will contribute to the North American bumblebee database and be used for Red List re-assessments in future years. If you are able to help us verify species on *Bumble Bee Watch*, or would like to learn more about the project, please contact Sheila Colla (collasheila@gmail.com) or Rich Hatfield (rich@xerces.org).

MESOAMERICA

Approximately 18 species are currently recognised, although several species groups are being revised, with the promise of more species to be added soon. The Red List status for all 18 species has now been assessed globally. Within Mesoamerica, distributions are being recorded and databased, so that improved Red List assessments should be possible in the next few years.

Mesoamerican Region in 2017

Remy Vandame

Based on broad-scale sampling of more than 10,000 bumblebees in Guatemala and Mexico from 2012 to 2014, and from gathering some 12,000 data from databases in different countries, we built a database to bring together available information. In 2015 we were able to start the Red List assessment. Among the 30 species now known for the region from Panama to Mexico, we could complete the analysis for 12 species. Other species of the region were analyzed by North and South American regional groups.

From the 23 species analyzed (see the figure below), 21 had enough data to be evaluated, and from this number, 12 species were in an at risk category. This is more than 50%, which is a significant concern. It is clearly higher than the proportion of ca 25% found in North America. We wonder whether this reflects a true high risk status for the bumblebees of Mesoamerica, possibly connected with the highly diverse geography and climate, or whether it may due to biased or insufficient sampling.

For 2018, we plan to work on four topics. First, we will extend the Red List assessment to as many bee species as possible. We wonder whether knowing the proportion of species at risk for the whole group may help to resolve the concern stated above. Second, with a grant recently obtained for the Mexican fund for science and agriculture (Conacyt-Sagarpa), we want to resolve different taxonomic uncertainties present within our bumblebee fauna. Third, a post-graduate student will model the expected future distribution of bees in Mesoamerica for different climate-change scenarios. Fourth, we will complete an analysis for political ecology by studying different plans for the management of bumblebees in Mexico, from the permission to introduce exotic species, to limiting the movement of colonies within species' populations, to consider their consequences for conservation and trade.

12 species
endemic of Mesoamerica
(analyzed by BBSG Mesoamerican group)

Species	Red List category
B. brachycephalus	EN
B. digressus	VU
B. diligens	VU
B. ephippiatus	LC
B. haueri	EN
B. macgregori	LC
B. medius	VU
B. mexicanus	VU
B. pullatus	DD
B. steindachneri	EN
B. trinominatus	LC
B. weisi	LC

1 species
overlapping South and Mesoamerica
(analyzed by BBSG South American group)

Species	Red List category
B. melaleucus	DD

10 species
overlapping North and Mesoamerica
(analyzed by BBSG North American group)

Species	Red List category
B. crotchii	EN
B. fervidus	VU
B. fraternus	EN
B. huntii	LC
B. intrudens	CR
B. melanopygus	LC
B. nevadensis	LC
B. pensylvanicus	VU
B. rufocinctus	LC
B. vosnesenskii	LC

23 species analyzed
21 species evaluated
12 species threatened

SOUTH AMERICA

Approximately 26 species are currently recognised, with two species newly described in 2015 (one of these needs confirmation). The other 24 species have now been assessed for Red List status globally. Within South America, distributions are being recorded and databased, so that assessments may be updated in the next few years.

South America Region in 2017

Carolina Morales

During 2017, members of the BBSG South American Region have been strongly involved in research and outreach activities related to bumblebee conservation in the region. In August 2017, *Proceedings of the Royal Society* published a study lead by Marina Arbetman on global patterns in decline of bumblebees, and their drivers. Our global analysis shows that according to published assessments using IUCN red list categories and criteria, about one third of the bumblebee fauna with known extinction risk is declining. This pattern of decline is phylogenetically structured, with bumblebees belonging to particular lineages being more susceptible than others. Specifically, declining species were over-represented within the subgenus *Thoracobombus*, while declining species were under-represented within the subgenus *Pyrobombus*. Species with narrow geographic ranges and those with no pathogens reported are particularly susceptible to decline. Thus, the habitat of species with restricted distribution should be protected and the mechanisms to deal with pathogen infection need urgent research.

In Chile, where thousands of commercial colonies of the Eurasian *B. terrestris* are imported every year, this species has reached both latitudinal extremes of the country, from the Atacama desert in the North, to Tierra del Fuego Island in the South. According to the brief report published in July 2017 in the *Journal of Melittology* by Cárcamo and collaborators, *B. terrestris* is naturalized in Navarino Island, Cape Horn (55°S), which is the southernmost location ever recorded for this species. Another paper published in the *Journal of Insect Conservation* by Montalva and collaborators reports this species in the region of Arica (18.5° S) and Parinacota (18.2° S), in North Chile, which includes portions of the Atacama Desert, as well as very close to the borders of Peru and Bolivia. The fact that this species has become naturalized in this extremely arid region suggests that it could be a gateway for invasion to other countries in South America.

During 2017, there have been many actions to increase public awareness in Chile regarding the impact of *B. terrestris* on native biodiversity and apiculture, as reflected in the online magazine *Economia y negocios* (Economy and Business) and in the mainstream newspaper *El mercurio*. In December, the local initiative 'Moscardon revive' coordinated by undergraduate students at the University of Valdivia, held a meeting *El Moscardon nativo, una especie en peligro: Conflicto, responsabilidades y articulación ciudadana* (The native bumblebee, an endangered species: conflict, responsibilities and citizen coordination and participation) where various BBSG members were invited.

The country-wide citizen science initiative leaded by IUCN Member Jose Montalva 'Salvemos nuestro abejorro' (Save our bumblebee) have provided important new records for the invasive *B. terrestris*, as well as the endangered native species *B. dahlbomii* in Chile. As a reply to this increasing pressure to regulate *B. terrestris,* which is still being imported, the Secretary of Agriculture and Livestock (SAG, Chile) opened a process of public consultation.

However, the process was not completed and no measure or action has been implemented yet to regulate this commerce, which has led to legal complaints against the SAG for allowing the introduction of an insect considered a threat to native biodiversity and apiculture.

In 2018, we expect to share our experience on the impact of invasive bumblebees in South America at the Meeting of the International Union for the Study of Social Insects, in Guaruja, Brazil (http://www.iussi2018.com/).

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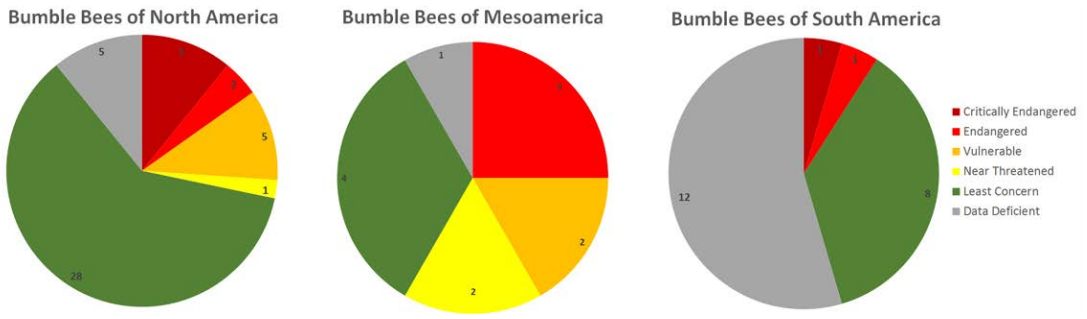
SUMMARY OF RED LIST RESULTS FOR THE NEW WORLD



NORTH ASIA

Approximately 68 species are recognised. No species have yet been assessed for Red List status within North Asia. Of the total, only two species are currently considered endemic. Low endemism may in part reflect the region's position at the crossroads among several other regions. Within North Asia, distributions are being recorded and databased, so that Red List assessments should be possible in the next few years.

North Asia Region in 2017

Alexandr Byvaltsev / Maxim Proshchalykin

We continue to evaluate the bumblebees of Russia. The first volume of the '*Annotated Catalogue of the Hymenoptera of Russia*..' has now been published. As a result of this work on museum collections, combined with an analysis of the literature and field observations from recent years, 90 species of bumblebee are now included, with the distribution data listed by administrative regions. Two species are recorded for the first time for this region– *B. gerstaeckeri* and *B. biroi* (Proshchalykin et al., 2017). New distribution data have been obtained for another 10 species (Levchenko et al., 2017).

This will not be the final tally and much more research is needed, especially in the Altai Republic. Much of the previous literature and many data labels contain only the record 'Altai', without details, so they could be from the modern territory of the Altai Krai or from the Altai Republic. For this reason the two were combined in the catalogue, where they are cited together as AL. For our preliminary results, most bumblebee material from the modern Russian Altai before twenty-first century was collected near Biisk, in the modern territory of the Altai Krai. One of our tasks for the near future is to investigate the bumblebee fauna of the Altai Republic.

We are also looking for opportunities to investigate the current status of bumblebee populations on the Russian Far East. Unfortunately most data for the continental part of this region were obtained before 1950, so it is not possible at present to make good progress with Red List assessment using IUCN criteria.

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JAPAN

Approximately 14 species are currently recognised. No species have yet been assessed for Red List status within Japan. Of the total, only one species is currently considered endemic, so 13 need to be assessed beyond Japan. There are many records in collections and in the literature that could be mobilised if funding were available, but field surveys are urgently needed.

WEST ASIA

Approximately 73 species are currently recognised. No species have yet been assessed for Red List status within West Asia. Of the total, 10 species are considered endemic, so 63 need to be assessed beyond West Asia. Within West Asia, the fauna of Turkey is already well mapped (many species shared with Europe) and good progress is being made in Iran. In Central Asia there are many records in collections and in the literature that could be mobilised if funding were available.

West Asia Region in 2017

Ahmet Murat Aytekin for Turkey

Bombus lapidarius at Eskişehir, and the new generation, Burcu and Çiğdem. (Photos by A Murat Aytekin.)

Despite a particularly difficult time in the region, which is now passing, studies of the bumblebee fauna have continued without interruption. The *45th International Apicultural Congress APIMONDIA* met in İstanbul, unfortunately with limited participation. Normally a detailed study on bumblebees would have been organized by Murat Aytekin and colleagues, but this also had to be cancelled. Despite this, several papers were published and a new thesis study was started. This situation shows that, despite everything, science on biodiversity never stops. The studies in Turkey concentrated more on bee products, medicinal and aromatic plant pollination, nest structure, and of course integrated taxonomic studies of bumblebees. There are no recent data on the decline of bumblebees in Turkey, but there is an obvious decline in taxonomists that can be noted during 2017. Nonetheless, the next generation of young scientists has now taken up the flag and has begun work as listed below.

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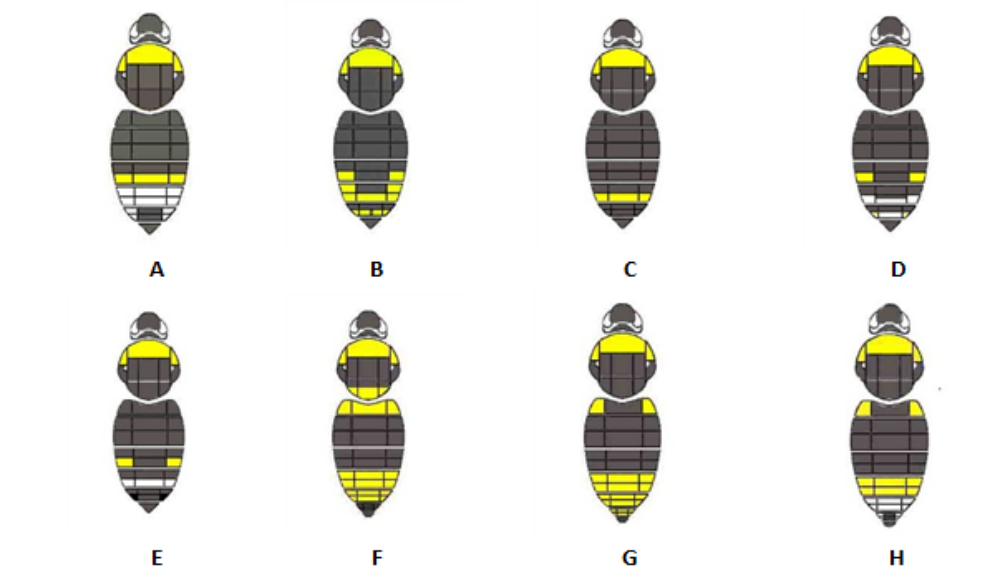
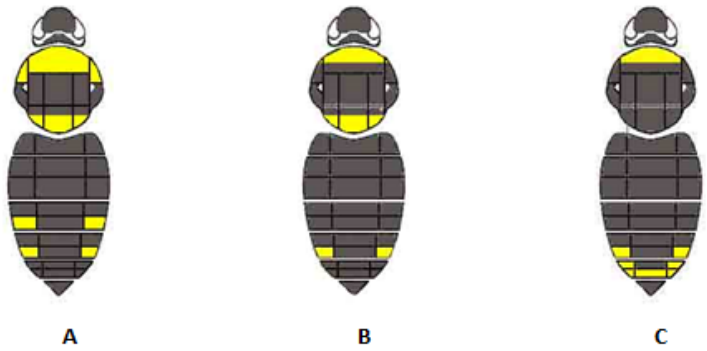
Alireza Monfared for Iran

Sampling bumblebees in Iran. Top left: camping around Isfahan. Top right: Kakan apple garden. Bottom left: collecting specimens, Chaharmahal and Bakhtiaruy Cheshmeh Dimeh. Bottom right: Cheshmeh Shaykhalikhan.

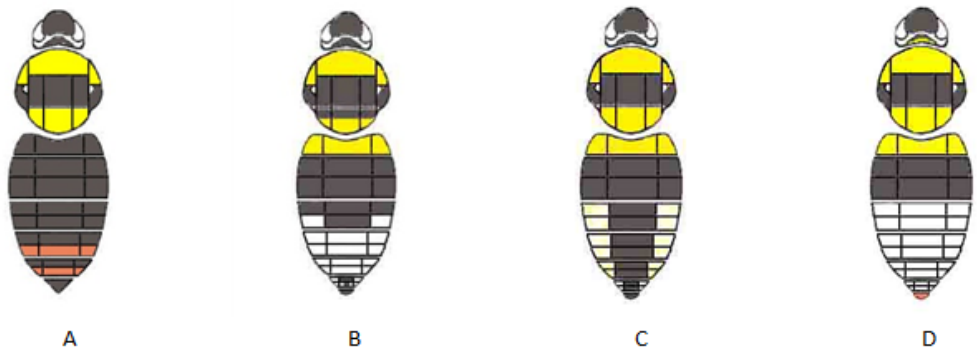
Identifying Iranian species of the subgenus *Psithyrus* - In this study we examined 64 specimens of Iranian *Psithyrus* collected between 2008 and 2015 from localities mostly in the north and north-west of Iran. In total we found five species: *B. bohemicus*, *B. maxillosus, B. quadricolor*, *B. vestalis* and *B. rupestris*. A key to their identification and species diagnoses have been provided. Complete information will be published in *Entomofauna* early in 2018.



Colour patterns of female *B. vestalis* (**A, B, C, D, E**) and male (**F, G, H**).

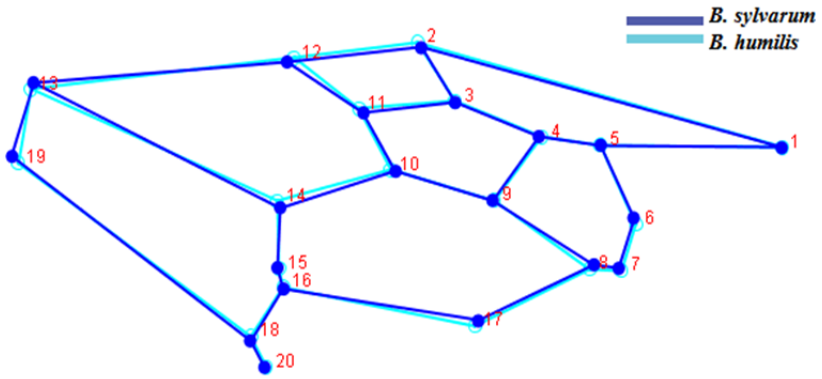


Colour patterns of female *B. maxillosus* (**A, B, C**).

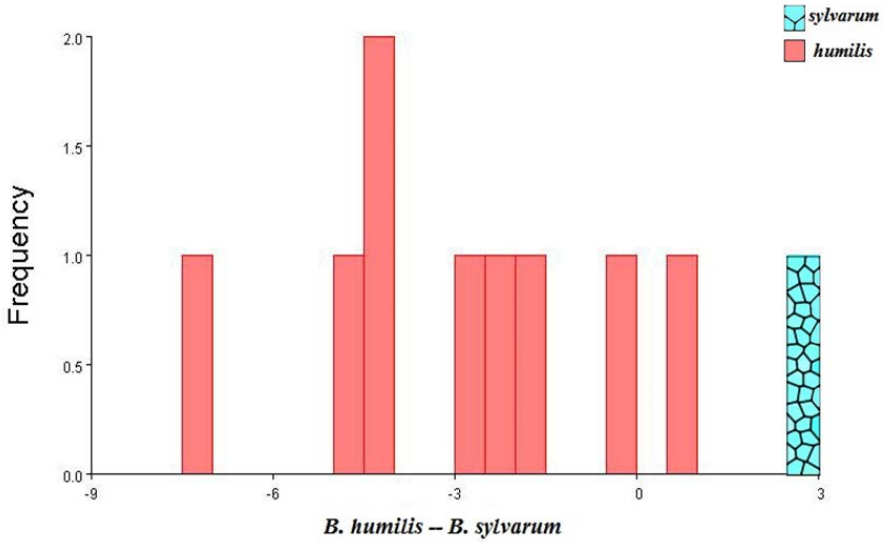


Colour patterns of female (**A**) *B. rupestris*; (**B,C**) *B. bohemicus*; (**D**) Male- *B. quadricolor.*

Separating species of the subgenus *Thoracobombus* in Iran using geometric morphometry - Morphometric methods are a useful tool to help taxonomy provide improved identification of species. Among bees, members of genus *Bombus* are very important for pollination of crops in greenhouses and for fruit. The bumblebee fauna of Iran includes species of 11 subgenera, among which *Thoracobombus* is the most diverse, with 12 known species. Although identifying species in this subgenus is usually based on colour pattern and on some morphology characters, it is still difficult for species with the same colour pattern. In this research, landmark-based methods are used for classifying species. Samples of *Thoracobombus* species that had been collected from different parts of Iran were used in the morphometric analysis. Right front wings were removed for making preparations for taking digital images. To analyse the images, we used the software tpsUtil version 1.40. Images were converted to TPS format and then imported to software tpsDig version 2.1 so that landmarks could be applied at the intersections of veins. The final stage involves the use of the software MorphoJ for landmark analysis, for discrimination of species and for determination of kinship ties and species trees. Results show that geometric morphometrics could easily distinguish the species of the subgenus and even between their castes. There is good congruence between morphological and morphometric identifications for the species studied.



Landmarks applied to the forewings of B. sylvarum and B. humilis.



Morphometric ordination comparison of wing shape between B. sylvarum and B. humilis.

EAST ASIA

Approximately 124 species are currently recognised, although several species groups are being revised, with the promise that more species will be added soon. No species have yet been assessed for Red List status within East Asia. Of the total, 23 species are considered endemic, so 101 need to be assessed beyond East Asia (some species just crossing the border into the Himalaya region or to the South East Asia region). Within East Asia, much effort has been put into recording and databasing distributions, so that Red List assessments should be possible within the next few years.

East Asia Region in 2017

Jiandong An

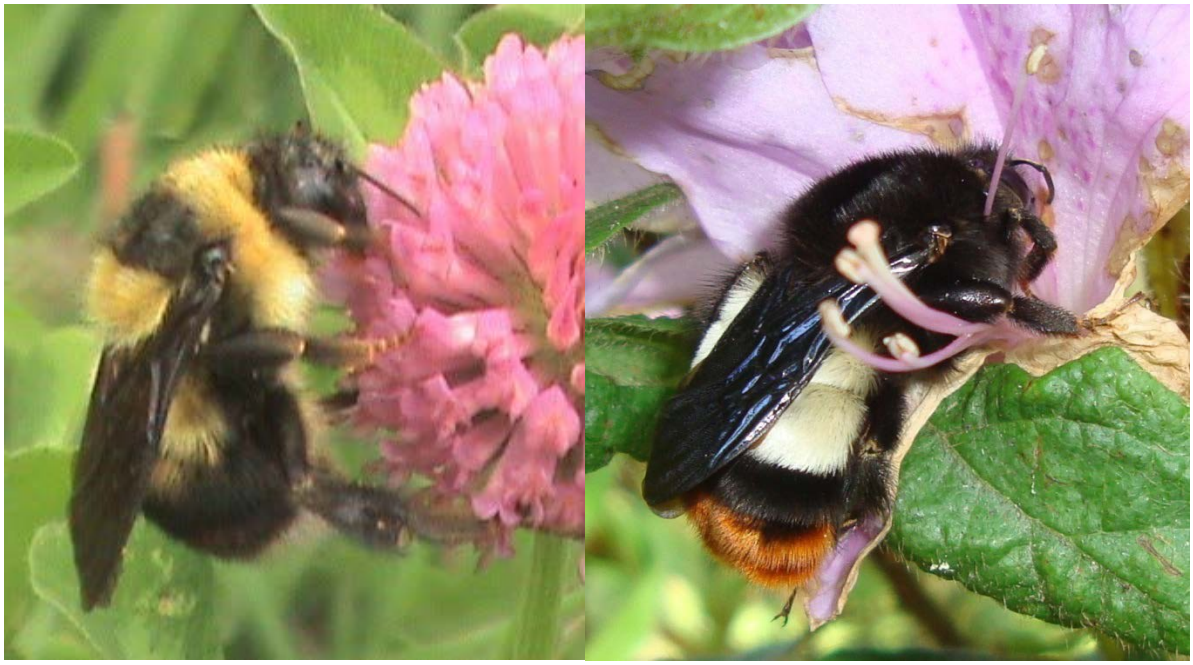
A survey of the bumblebees of China since 2005 has built up a database of over 50,000 new voucher-based records nationally, as reported in the BBSG 2016 report for the East Asia Region. That report mapped the substantial progress being made in gathering information on the distributions of Chinese bumblebee species. We are now assessing the risks of the introduced bumblebee *B. terrestris* to Chinese bumblebees, and conserve and use those native pollinators, as well as planning to move towards Red List assessments for these local species in the near future.

HIMALAYA

Approximately 52 species are currently recognised. No species have yet been assessed for Red List status within the Himalaya. Of the total, nine species are considered endemic, so 43 need to be assessed beyond the Himalaya (most in East Asia). There are many records in collections and in the literature that could be mobilised if funding were available, but field surveys are urgently needed.

Himalaya Region in 2017

Malkiat Saini



Queens of two typical Himalayan species: B. miniatus (left) and B. haemorrhoidalis (right). (Photos by Malkiat Saini.)

In search of some scarce bumblebee species, their Indian collection localities and some adjoining habitats were combed repeatedly during the last 18 years or so. Most of these species were recorded long ago from the North-Eastern states, mainly from Sikkim and Arunachal Pradesh. In view of the flowering of low lying vegetation which is spread over three and half months, from July to mid October, repeated attempts were made but all were futile. While compiling the bumblebee fauna of India (Saini et al. 2015), and after finding no other alternative, I had to procure these species or their photographs by request from the NHM, London. It appears that these species are on the verge of disappearance from India so the ZSI (Zoological Survey of India) should send a proposal to the appropriate department for their Red-List assessment as soon as possible. Absence of these species will adversely affect the pollination ecology of the high altitude Himalayas, where the environment is extremely harsh and inhospitable for other insect pollinators. It is also feared that in want of these species, some species of medicinal and other plants of substantial economic importance may also lose their hold. The only reason that can be attributed for the disappearance of these bumblebees is the extreme shift in some of the critical environmental factors. Following is the list of these endangered bumblebee species from India: *B. turneri*, *B. abnormis*, *B. luteipes*, *B. mirus*, *B. sibiricus*, *B. grahami*, *B. tanguticus*. [An update on the distribution and status of *B. tanguticus* is in Williams (2018).]

Bombus tanguticus, this queen is one of the highest bumblebees ever recorded, at ca 5640 m asl from the 1921 Everest/Sagarmatha/Qomolangma Expedition (Williams 2018). (Photo by Harry Taylor, NHM.)

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SOUTH EAST ASIA

Approximately 27 species are currently recognised. No species have yet been assessed for Red List status within South East Asia. Of the total, five species are considered endemic, so 22 need to be assessed beyond South East Asia. Many of these non-endemic species are restricted to the border regions with the East Asia region. Within South East Asia, plans are being made for recording and databasing of bumblebee distributions.

South East Asia Region in 2017

Panuwan Chantawannakul

Bombus breviceps, Thailand, Doi Inthanon 2188 m 1.viii.2017. (Photo by C Sinpoo.)

During 2017, the specialist group in South East Asia has continued to investigate both bumblebee diversity and the pathogens that affect bumblebees in this region. We now have new results on the bumblebee pathogens. In our survey, four species (*B. montivagus*, *B. breviceps*, *B. haemorrhoidalis* and *B. eximius*) were present in 11 localities across four provinces (Chiang Mai, Mae Hong Son, Chiang Rai, and Nan). We collected and screened 280

native foraging worker bumblebees for microsporidia (*Nosem*a spp.) and for trypanosomes (*Crithidia* spp.).

THE BBSG IN 2018

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 23 February 2018