Proposal to Establish an IUCN *Bombus* Specialist Group

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Summary
We propose the formation of an IUCN *Bombus* Specialist Group. As public awareness of the significance of pollinators is at an all-time high, we are excellently poised to bring this charismatic insect group into the mainstream of conservation efforts. *Bombus* face a variety of threats that are not well understood – from habitat loss and climate change to introduced diseases – and declines have been documented in Europe, North America, South America and Asia. Yet a comprehensive and detailed assessment of the global status of *Bombus* has yet to be conducted, and the priorities of this new *Bombus* Specialist Group will be to organize such a global assessment, including a major red listing effort for all species, and to promote their conservation. We will bring together scientists and conservationists from around the world to catalyze global conservation action and influence policy.

What are the key conservation issues facing the taxon or group?
There are numerous potential factors threatening this ecologically important group of pollinators, which were discussed in detail at the recent North American Bumble Bee Species Conservation Planning Workshop (St. Louis Zoo 9-12 Nov. 2010) by an international assembly of diverse stakeholders. These include severe range declines that are potentially caused by habitat loss and degradation; pathogen spillover, competition and hybridization with non-native commercial *Bombus*; pesticides; overgrazing; and climate change. Interactions between the aforementioned factors may also be threatening *Bombus* populations. Reduced genetic diversity in populations of some *Bombus* species could exacerbate the above threats as inbred *Bombus* are more vulnerable to extinction than many other animals because of their haplodiploid sex determination (with inbreeding this can lead to homozygous diploid males) and relatively low effective population sizes. *Bombus* parasites that are also in the genus *Bombus* (subgenus *Psithyrus*) are threatened by reductions in their host populations.

Habitat Loss and Fragmentation
The decline of *Bombus* in the UK has been attributed to changes in habitat due to intensification of agriculture and climate change. The impact of habitat loss on *Bombus* in other regions is probably also great, albeit less studied. In the central U.S., native tall grass prairie has been considered optimal *Bombus* habitat, yet over 99% of this prairie has been lost to land conversion. Research conducted in Europe suggests that *Bombus* populations need a minimum of six square miles of contiguous habitat to remain viable. Thus, large areas of habitat will need to be conserved or restored to protect vulnerable *Bombus* populations.

Commercial Use of Bombus
Commercial *Bombus* are used on all continents – except Antartica – in over fifteen countries, primarily for the pollination of greenhouse tomatoes. Colonies are shipped, largely without regulation, across and between continents, and the species or subspecies

used are frequently not native to the country or region in which they are used. The commercial use of *Bombus* began in the late 1980s and has expanded steadily over the past two decades. This practice presents three major risks: novel pathogens and parasites may be introduced through the global transport of commercial *Bombus*; commercial *Bombus* may establish and compete with wild native species for food or nest sites; and nonnative commercial species may mate with closely related native species, causing introgression or reduced fertility.

The spillover of the gut pathogen *Crithidia bombi* from commercial *Bombus* to wild native species has been documented in Canada, and the spread of nonnative mites from commercial species to wild species has been observed in Japan. The spread of an exotic disease from commercial to wild *Bombus* has been hypothesized as a possible cause of the dramatic decline of five species of North American *Bombus*. This hypothesis is currently under scientific investigation. Nonnative *Bombus* species have established in Argentina, Chile, Israel, Japan, Tasmania, and New Zealand. In Australia, Mexico, and western Canada, non-native commercial species have been collected from the wild. In Japan, researchers have demonstrated that commercially used non-native species will breed with closely related native species and produce hybrids. There is similar potential for this to occur in Mexico, although more study is needed. The impact of competition and hybridization on wild native *Bombus* species has yet to be quantified in any region of the globe.

Pesticides

The few studies examining the impact of pesticides on *Bombus* have consistently documented lethal and sublethal effects. For example, in eastern Canada where pesticides have been used by the timber industry to control forest insects, the disappearance of *Bombus* near sprayed areas, and the corresponding decline in local blueberry harvests has been documented. Research in the United Kingdom has recorded extensive *Bombus* poisoning in canola fields treated with insecticides. And a recent laboratory study examining the impact of low levels of a common neonicotinoid insecticide on *Bombus* showed that *Bombus* that are exposed to this chemical are not able to forage as well as other *Bombus*, which can eventually negatively impact the colony.

Overgrazing

Grazing by ungulates can significantly alter the landscape, and can negatively impact *Bombus* populations by removing floral resources, trampling above ground nest sites, and reducing populations of nesting rodents (which in turn may reduce the number of nest sites available to *Bombus*). On the Tibetan Plateau, traditionally nomadic yak herders have begun to settle near towns, which is leading to overgrazing in particular areas. Overgrazed areas in Tibet are associated with reductions in floral resources available to *Bombus* and a decrease in *Bombus* diversity.

Climate Change

More than one third of all plants and animals are predicted to go extinct as a result of climate change by 2050 if the current levels of carbon emissions continue. Climate change is already disrupting the precisely timed relationships of plants and pollinators;

researchers in alpine habitats have observed that *Bombus*' seasonal cycles have shifted in response to the changing climate. Disjunct alpine populations of northern species may be particularly vulnerable to changes in flower phenology. Since *Bombus* are most common in temperate regions, with global *Bombus* diversity peaking in the mountains of Asia, this genus may be especially vulnerable to the impacts of climate change.

Why is this taxonomic level and / or geographic scope considered to be the most appropriate level at which to address these conservation issues?
The genus *Bombus* comprises approximately 250 species throughout the world. It is therefore possible and appropriate to address the conservation of the entire genus, including parasites of *Bombus* in the subgenus *Psithyrus*. There is reason to believe that most *Bombus* species have already been described, and *Bombus* are well studied relative to most other types of bees. DNA phylogenies and identification tools are unusually well documented for this genus.

Significant conservation attention has been given to *Bombus* in the UK and North America, but a need exists to address and coordinate *Bombus* conservation on a global scale. One of multiple important potential threats to wild species is the international transport of non-native commercial *Bombus*, which will require a global partnership to adequately address. Knowledge of the effects of climate change, pesticide use and habitat degradation are all best addressed with comparative global data.

Is there a clear gap for the group to fill, and a value-added benefit that the formation of the group would deliver, rather than duplicate efforts of existing Specialist Groups or IUCN partner institutions?
There is a clear gap to fill. There are no other groups or organizations that are working globally on *Bombus* conservation. A synergy will be created by bringing subject-matter experts from all over the world together for the common purpose of *Bombus* conservation. Given that threats facing *Bombus* are global, successful efforts cannot be based on regional expertise alone.

Bombus conservation and research is well established in Europe and strong initial efforts are proceeding in North America (north of Mexico). In the UK, conservation and citizen monitoring groups such as the Bumblebee Conservation Trust, Buglife, and the Bees, Wasps & Ants Recording Society, along with a variety of researchers, have raised the profile of that country's declining *Bombus*, and are actively working toward their conservation.

In North America, researchers have documented a pattern of *Bombus* decline over the past several years – including a recent national study just completed by a research team led by Dr. Sydney Cameron. The Xerces Society has worked with dozens of researchers to gather information on *Bombus* and develop comprehensive status reviews for four of the most at-risk species. The Xerces Society petitioned the U.S. government to strengthen regulations governing commercial *Bombus* transportation and potential spread of diseases, and has engaged the Natural Resources Defense Council and Defenders of Wildlife in this effort. More than 50 stakeholders (scientists, conservation organizations,

government agency representatives and commercial *Bombus* producers) from around the world convened at the St. Louis Zoo for a North American *Bombus* conservation planning workshop – organized by Ed Spevak of the St. Louis Zoo, Sarina Jepsen of the Xerces Society, Dr. Sydney Cameron of the University of Illinois and Dr. James Strange of the USDA-ARS Pollinating Insect Research Unit. This remarkable workshop was expertly facilitated by the IUCN-CBSG (Dr. Onnie Byers), with the goal of developing a conservation strategy for North American *Bombus*. A variety of *Bombus* citizen monitoring projects have been established, including BeeSpotter (University of Illinois), a project by The Xerces Society aimed at detecting rare *Bombus* species, and Bee Hunt (Discover Life). In 2006, a white paper was published by the North American Pollinator Protection Campaign that highlighted the risks of importing non-native *Bombus* into North America.

However, large gaps remain in our knowledge of global bumblebee conservation. There is comparatively less information available publicly on the status of bumblebees in China, Russia, Mongolia, much of central Asia, Eastern Europe, and Central and South America. The recent St. Louis conservation planning workshop pointed out clearly the large gaps that remain in our knowledge of North American *Bombus* conservation, and likely in worldwide *Bombus* conservation as well.

What are the key activities / outputs that the group would undertake / deliver to better understand and address these issues, and how will these activities / outputs contribute to the SSC Strategic Plan?

At the recent St. Louis North American *Bombus* workshop, we identified many *Bombus* experts who are willing to participate in the Specialist Group and who are prepared to participate immediately in completing an IUCN red listing effort. We will work to produce a global assessment of the status of *Bombus*, and promote *Bombus* conservation worldwide.

Key Activities of the *Bombus* Specialist Group

Develop a steering committee
We will select a steering committee for the IUCN *Bombus* Specialist Group. Members will be chosen based on their location, expertise, and availability to contribute. An effort will be made to include representatives from all continents that have significant native *Bombus* faunas.

IUCN Red listing
The primary task of the IUCN *Bombus* Specialist Group will be to conduct a global assessment of the status of *Bombus*. We will work with committee members in their respective countries and query additional experts to complete this task. As part of the global assessment, *Bombus* species assessments will be submitted to the IUCN Red List. A Red List Focal Point will be appointed within the *Bombus* Species Group to focus on this effort. We will assist the IUCN Red List Office and provide feedback on IUCN Red Listing of *Bombus*.

Support critically important conservation projects
As we generate additional funding for this Specialist Group, we will provide support to projects identified as priorities by the *Bombus* Specialist Group's steering committee and Species Conservation Strategies and Action Plans. Priorities will be developed with input from multiple stakeholders. Projects may include the development of species-specific conservation strategies, threat assessments and data acquisition, assistance with direct conservation efforts, and funding for conservation related research. We will concentrate our efforts on projects that will show the greatest conservation return in a given region.

IUCN SSC Strategic Plan
The IUCN SSC Strategic Plan highlights the need to complete Red List Assessments globally for neglected invertebrate taxa in Core Program Area 1.2. The rationale for that priority includes four criteria: 1. Improved balance in taxonomic and geographic coverage; 2. Relevance to human interest and livelihoods; 3. Species of economic importance; and 4. Flagship species and species in rapid decline. The development of a *Bombus* Specialist Group would highlight each of these four criteria. First, the conservation of all bees has been neglected globally, even the charismatic *Bombus*, which this *BSG* will address through its global Red Listing efforts, development of conservation action plans, and support of research and conservation efforts. Second, *Bombus* are globally relevant to human livelihoods as key pollinators of many crops and wild plants, and thus deserve special conservation attention. Third, both wild and commercially raised species are economically significant to growers and gardeners, and serve as keystone species in many plant pollination networks. Fourth, a significant number of *Bombus* species are in decline throughout the world and require protection while many others require investigation. Core Program Area 5.1 of the Strategic Plan emphasizes the need to consider biodiversity in food production. Conserving key native pollinators, such as *Bombus*, will be important to maintaining food security, particularly as the many health problems continue to plague and threaten the economic value of the domestic honey bee. Importantly, the SSC / Invertebrate Conservation Sub-Committee recently recognized *Bombus* as a key priority.

Is there a unique / core group of relevant experts willing to dedicate energy and time towards furthering a conservation agenda around a particular taxon or group of species?
There is a core group of relevant experts. The initial specialist group will *likely* include (but is not limited to) the list of experts below. Many of these individuals have already agreed to be a part of the Specialist Group, whereas others will be contacted in the near future and invited to participate. A steering committee, which will include some of the individuals listed below, will be formed from the various regional chairs, vice-chairs and additional individuals determined by the chair. As we form this group and seek outreach, we will identify additional experts for other defined regions.

Europe
Paul Williams (Natural History Museum, London)
Pierre Rasmont (Université de Mons-Hainaut, Belgium)
Andrzej Kosior (Polish Academy of Sciences, Poland)

Dave Goulson (Stirling University, Bumblebee Conservation Trust)
Juliet Osborne (Rothamsted Centre for Soils and Ecosystem Function, United Kingdom)
Bjorn Cederberg (ArtDatabanken, Sweden)
Paul Schmidt-Hempel (Swiss Federal Institute of Technology, Zurich)
Mark Brown (University of London)
Teja Tscharntke (University of Göttingen, Germany)
Concepcion Ornosa Gallego (Universidad Complutense de Madrid)
Andrej Gogola (Slovenian Museum of Natural History, Slovenia)
Bogdan Tomozei (Museum of Natural Sciences "Ion Borcea", Romania)
Pawlikowski

Near East
Murat Aytekin (Hacettepe University, Turkey)
Hikmet Ozbek (Ataturk University, Turkey)
Alireza Monfared (Iran)

North America north of Mexico
Sydney Cameron (University of Illinois)
Sheila Colla (York University)
James Strange (USDA Agricultural Research Service)
Robbin Thorp (University of California, Davis)
Sarina Jepsen (Xerces Society for Invertebrate Conservation)
Ed Spevak (St. Louis Zoo)
Jeffrey Lozier (University of Illinois)
David Inouye (National Science Foundation)
Peter Kevan (University of Guelph)
John Ascher (AMNH)
Michael Otterstatter (Health Canada)
Elaine Evans (University of Minnesota)
Cory Sheffield (York University)
Mike Arduser (Missouri Department of Conservation)

Mexico
Ignacio Cuadriello (Universidad de Guadalajara)
Juan Carlos Salinas Navarrete (SEHUSA)
Rémy Vandame (El Colegio de la Frontera Sur)
Javier Quezada (Universidad Autónoma de Yucatán)
Ricardo Ayala (Universidad Nacional Autónoma de México)

South America
Gabriel Melo (Universidade Federal do Parana, Brazil)
Eduardo A. B. Almeida (Brazil)
Isabel Alves dos-Santos (Brazil)
A. Roig-Alsina (Museo Argentina de Ciencias Naturales, Argentina)
Alberto H. Abrahamovich (Museo de la Plata, Argentina)

Luisa Ruz (Universidad Catolica Valparaiso, Chile)
Giovanni Onore (Universidad Catolica de Ecuador)

Japan
Koichi Goka (National Institute for Environmental Studies)
Maki Inoue (University of Tokyo)
Masao Ito (Sapporo Science and Technology Vocational School)

China
Jiandong An (CAAS Institute of Apiculture)
Zhenghua Xie (Kunming Forestry Institute)

Is clear leadership available?
Dr. Paul Williams (Research Entomologist, Natural History Museum, London) will serve as the chair of this Specialist Group. He studied the distribution and decline of British *Bombus* for his PhD research at Cambridge (UK) in 1985. Since then he has continued to work on this as a Research Entomologist at the Natural History Museum, London, UK. He is looking at *Bombus* ecology and systematics world-wide, with field work especially in North America, the Himalayan region, and China (a summary is available online at www.nhm.ac.uk/bombus). He is highly regarded by researchers and conservationists around the world. Dr. Williams has the knowledge, credibility, international contacts, and organizational skills to lead the *Bombus* Specialist Group. He has established active connections with *Bombus* researchers in China, a biodiversity hotspot for *Bombus* that has lacked conservation attention.

Sarina Jepsen (Endangered Species Program Director, Xerces Society for Invertebrate Conservation) would serve as the Vice-Chair of this Specialist Group. She brings a strong background in conservation and policy and is excellent at coordinating groups. She received a Master's degree in entomology from UC Davis in 2006. She has overseen many projects aimed at conserving imperiled North American *Bombus* species, including a 2008 Status Review for three at-risk *Bombus*, a 2009 IUCN red-list assessment for the rusty-patched *Bombus* (*Bombus affinis* – still in review), a 2010 petition requesting that the U.S. government regulate the interstate movement and disease status of commercial *Bombus*, and a 2010 U.S. Endangered Species Act petition to list Franklin's *Bombus* (*Bombus franklini*) as an Endangered Species. She assisted in the organization of St. Louis Zoo IUCN-CBSG *Bombus* planning workshop to develop a conservation strategy for imperiled North American *Bombus*. She has chaired other groups focusing on the conservation of invertebrates, including the Pacific Northwest Native Freshwater Mussel Workgroup – a consortium of approximately 60 scientists and conservationists dedicated to the conservation of freshwater mussels. In each of these projects, she has coordinated extensively with scientists, other conservationists, and policy makers.

Is there an institutional source for support and coordination?
The Natural History Museum supports this effort. Paul Williams (Natural History Museum, London) will commit approximately 16 hours per month to this effort.

The Xerces Society for Invertebrate Conservation supports this effort. Sarina Jepsen (Xerces Society) will commit 25% of her time to this effort. The Xerces Society has successfully implemented projects to protect insects for four decades, and will work to raise additional funding to support Sarina Jepsen's time and additional work of the *Bombus* Specialist Group.

The St. Louis Zoo also supports this effort. Ed Spevak (St. Louis Zoo) can commit some of his time and expenses to the development of a *Bombus* Specialist Group, as well the implementation of *Bombus* conservation and research efforts. Ed Spevak has also committed to raising additional funding for this group. Ed is currently the Special Advisor to the Red List Authority for Bumble Bees in North America.