THE XERCES SOCIETY

FOR INVERTEBRATE CONSERVATION

4828 Southeast Hawthorne Boulevard, Portland, Oregon 97215, USA

Telephone 503-232-6639 Fax 503-233-6794 www.xerces.org

Dedicated to protecting the diversity of life through the conservation of invertebrates - the little things that run the world

January 18, 2007

California Department of Food and Agriculture
ATTN: Mr. Jim Rains
1220 N Street, Room A-316
Sacramento, CA 95814

Bumble bee (*Bombus impatiens*) pollination of field crops in the state of California. California Environmental Quality Act Initial Study and Mitigated Negative Declaration

Dear Mr. Rains;

The Xerces Society for Invertebrate Conservation et al. hereby submits comments to the California Department of Food and Agriculture (CDFA) regarding the Notice of intent to adopt a negative declaration for a proposal to introduce a non-native bumble bee, *Bombus impatiens*, into California for open field crop pollination. The non-native bumble bee *Bombus impatiens* is classified as a pest in California and requires a state permit for importation into the state. State permits are issued to California residents or businesses by CDFA; Division of Plant Health and Pest Prevention Services. These comments are in response to the analysis and tentative conclusions as presented in the CEQA document, "California Environmental Quality Act Initial Study and Mitigated Negative Declaration" (September 2006).

In brief, The Xerces Society opposes importation of *Bombus impatiens*, due to the many ecological risks and unknown outcomes of importing this bee. We strongly disagree with the finding that the prescribed risk mitigation measures adequately address the significant ecological risks associated with importation of *Bombus impatiens*. The proposed mitigation measures are fraught with vulnerabilities and should not be relied upon as a basis for allowing the importation of *Bombus impatiens*. The Xerces Society urges the CDFA Division of Plant Health and Pest Prevention Services not to approve the requested permit for importing *Bombus impatiens*.

We believe that there should instead be a focus on the ongoing effort to identify and commercialize bee species that are native to California.

These comments are submitted by **Scott Hoffman Black**, Executive Director and **Matthew Shepherd**, Pollinator Conservation Director, The Xerces Society for Invertebrate Conservation; **Robbin Thorp**, **Ph.D**., Professor Emeritus, University of California, Davis; **Claire Kremen**, **Ph.D**, Asst. Prof of Arthropod Biodiversity, University of California, Berkeley;

Sarah S. Greenleaf, Ph.D., postdoctoral scientist, Department of Plant Pathology, University of California-Davis; **Jim Lyon**, Senior Vice-President, National Wildlife Federation, Washington D.C.; **Gabriela Chavarria, Ph.D**., Director, Science Center, Natural Resources Defense Council, Washington, DC; **Kim Delfino,** California Program Director, Defenders of Wildlife, Sacramento, CA; **Cory S. Sheffield**, **Ph.D**, Department of Biology, York University, Toronto, CN; **Gordon Frankie**, **Ph.D**, University of California, Berkeley; **Peter F. Brussard**, **Ph.D.,** Department of Biology, University of Nevada Reno; **John Losey, Ph.D.,** Professor of Entomology, Cornell University, Ithaca, NY; **Boris C. Kondratieff**, **Ph.D.,** Professor of Entomology, Colorado State University, Fort Collins, CO; **Vance Russell**, Landowner Stewardship Program, Audubon California, Winters, CA; **Amanda Jorgenson**, Executive Director, California Native Plant Society, Sacramento; **Kieran Suckling**, Executive Director, Center For Biological Diversity, Tucson; **Dan Silver**, Executive Director, Endangered Habitats League, Los Angeles, CA; **Emily B. Roberson**, Native Plant Conservation Campaign, San Francisco, CA; **Michael Klein**, Entomologist, Klein-Edwards Professional Services; **Scott Thomas**, Conservation Director, Sea and Sage Audubon, Irvine, CA; **Jess Morton**, Treasurer, Palos Verdes/South Bay Audubon Society, Palos Verdes Peninsula, CA; **Daniel R. Patterson**, ecologist, Tucson AZ; **Dave Werntz**, Science and Conservation Director, Conservation Northwest, Bellingham, WA; **Robert S. Jacobson**, M.S., Entomologist, Lenoir, NC, San Diego, CA; **Erin Robertson**, Senior Staff Biologist, Center for Native Ecosystems, Denver, CO.

The Xerces Society for Invertebrate Conservation
The Xerces Society is an international nonprofit organization dedicated to protecting biological diversity through the conservation of invertebrates. We have over 5000 members throughout the United States including over 1000 members in California. The Society was formed in 1971 and has been working to protect endangered invertebrates and to advance pollinator conservation for decades. We have been working for the last four years in California to educate farmers about the importance of native pollinators and how they can protect and restore this resource.

Other non-profit organizations
The non-profit organizations signed on to this letter represent many thousands of people in California and hundreds of thousands of people nationwide. These non-profit organizations include: National Wildlife Federation, Natural Resources Defense Council, Audubon California's Landowner Stewardship Program, California Native Plant Society, Center for Biological Diversity, Endangered Habitats League, Native Plant Conservation Campaign, Sea and Sage Audubon, Palos Verdes/South Bay Audubon Society, Conservation Northwest, Bellingham, and the Center for Native Ecosystems.

These comments were developed by Xerces Society Pollinator Conservation Director, Matthew Shepherd and Executive Director, Scott Hoffman Black. Xerces Society staff consulted with Robbin Thorp, Claire Kremen, Sarah Greenleaf, Cory Sheffield, Liz Day, Jim Cane, and Peter Kevan to develop these comments.

EXPERTISE

CV's have been attached for Scott Hoffman Black, Robbin Thorp, Claire Kremen and Sarah Greenleaf.

Robbin Thorp Ph.D. Professor Thorp's academic career includes BS and MS degrees in Zoology from University of Michigan, Ann Arbor, and PhD degree in Entomology from University of California, Berkeley. He joined faculty in Entomology at UC Davis in 1964 where he taught courses in General Entomology, Natural History of Insects, Insect Classification, Field Entomology, California Insect Diversity, and Pollination Ecology. He served as Major Professor for 9 MS and 11 PhD students. He served on numerous other thesis committees at UC Davis and other institutions. He took two sabbatical leaves in Australia. He was elected a Fellow of the California Academy of Sciences, San Francisco in 1986. Thorp retired in 1994, but still serves on graduate student thesis committees and is currently on recall to co-teach Natural History of Insects. He is also involved with management of Jepson Prairie Reserve, a vernal pool ecosystem, and is Chair of its Advisory Committee for the UC Natural Reserve System. He continues his research on ecology, systematics, biodiversity, and conservation of bees and is especially concerned with declines in bumble bee populations.

Claire Kremen Ph.D. is an Assistant Professor at the University of California, Berkeley, and an Associate Conservationist with the Wildlife Conservation Society. She received her Ph.D. in Zoology from Duke University in 1987 as a National Science Foundation and James B. Duke Fellow. Her current research examines the links between the spatial distribution of wildlands, the composition of wild bee communities, farm management practices, and the delivery of pollination services to agriculture in California and New Jersey. She is a member of a National Academy of Sciences panel examining the status of pollinators in North America.

Sarah Greenleaf Ph.D. is a postdoctoral fellow at University of California Davis. She has a Ph.D. in Ecology and Evolutionary Biology, from Princeton University. Much of her research experience centers on the role of pollinators in agricultural systems. She is a Collaborator on the Natural Capital Project, a multi-institution partnership, 2006-present "*Mapping pollination services"* and a working group member at the National Center for Ecological Analysis and Synthesis, working on a project called *Restoring pollination services,"* led by Claire Kremen and Neal Williams to develop conceptual model, plan meta-analyses, and synthesize and analyze data from diverse studies and databases.

Scott Hoffman Black M.S. is Executive Director of the Xerces Society. He has degrees in ecology, horticultural plant science and entomology from Colorado State University. He has extensive experience in endangered species conservation, pollinator conservation, macroinvertebrate monitoring and forest and range management issues. Scott has authored and co-authored many publications on pollinator conservation. He has presented to universities across the U.S. as well as to international meetings and the National Academy of Sciences. Scott is co-author of such pollinator related publications as: *The Red List of Pollinator Insects of North America*, The *Pollinator Conservation*

Handbook, Protecting Northwest Prairies and Their Butterflies, Endangered Invertebrates: the case for greater attention to invertebrate conservation, and *Endangered Insects,* (a chapter in the Encyclopedia of Insects by Academic Press).

Matthew Shepherd M.S. is Pollinator Conservation Program Director, Xerces Society. Matthew has worked for the Xerces Society on pollinator conservation issues for over seven years. During this time, he has written numerous articles and other publications, including the *Pollinator Conservation Handbook*, *Farming for Bees,* and *Pollinator-Friendly Parks, The Red List of Pollinator Insects of North America,* and *The Pollinator Conservation Handbook*.

ECOLOGICAL RISK OF INTRODUCING A NON-NATIVE POLLINATOR INTO CALIFORNIA

An Ecological Risk Analysis for the Use of Bombus impatiens for Pollination of Field Crops in California (Appendix B of the CEQA Initial Study) underestimates, and/or avoids the direct, indirect, and cumulative risks afforded to native bumble bees and other pollinators through the introduction of disease. The document also failed to discuss in detail the ecological competition between introduced *Bombus impatiens* and native California bee species.

LIKELY ESTABLISHMENT OF *BOMBUS IMPATIENS* IN CALIFORNIA

It is likely that *B. impatiens* would become established in California if mitigation did not prevent their escape. Claimed mitigation success for queen excluders pertains only to greenhouses where the packaging is not exposed to outdoor environmental conditions and vents are often covered to prevent workers and males from exiting the greenhouses.

Queen excluders will not prevent males from leaving the QUADs. These devices can be easily defaulted by humans. Individual hives, including the plastic inner box, can be penetrated by rats. Other rodents or birds may also penetrate the hives. Birds such as corvids, frequently found in agricultural systems and especially orchards, would likely be capable of damaging the hives, thus allowing the release of *B. impatiens* into the wild.

In 2003, locally reared native bumble bees were placed in fields across Yolo County, CA, as part of a research project at the University of California at Davis. The colonies were housed in very sturdy wooden boxes that were made to exclude rodents, bears, and raccoons. Vandalism occurred repeatedly over a period of several weeks. A small number of boxes were so badly destroyed that the colonies had to be removed (Sarah Greenleaf, pers. comm.). The Koppert QUADs are less robust than the boxes used and would therefore be even more susceptible to vandalism. If the boxes housing *B. impatiens* colonies are vandalized, then it is highly likely that queens would escape into the environment.

TRANSMISSION OF PESTS AND DISEASES

Diseases and pathogens affecting bees are usually specific to bee genera. It is much more likely that diseases will spread from bumble bees to bumble bees or from honey bees to honey bees than that diseases will move between honey bees and bumble bees or vice

versa. Thus the claim that the "effect of potential bumble bee introductions, therefore, as it relates to the risk of pest and disease spread is deemed as not significant as compared to the current situation of introduction of honey bees in agro-ecosystems" (page 11) is not valid because there were no pre-existing native honeybee species in North America at the time that honeybees were introduced. This is not the case for bumble bees; there are presently many native species of *Bombus* in California.

There is a high likelihood that the major declines in North American bumble bees, such as *B. affinis, B. franklini*, and *B. occidentalis*, have resulted from movement of *B. impatiens* and *B. occidentalis* for the greenhouse pollination industry (Thorp and Shepherd 2005). It appears likely that *B. impatiens*, native to Eastern North America, and *B. occidentalis*, native to Western North America, but transhipped to Europe for commercial rearing and propagation, became infected with protozoan pathogens from the European *B. terrestris* that was being maintained in the same facilities at the same time. The pathogens may be different species, or strains, to which the North American species had little or no resistance. Those pathogens appear to have spread to other native species of *Bombus*, as listed above, that are now in serious decline throughout their ranges. The consequence of the loss of these species to ecosystem function remains unknown, but is not likely positive.

The risks of disease spread between *B. impatiens* and native bumble bees are much higher than the risk of disease spreading from honey bees to native bumble bees because the latter have fewer diseases in common. Additionally, the question raised in this risk assessment of diseases spreading from imported honey bees to native bumble bees is spurious because honey bees have been naturalized in California for more than 150 years.

In addition, the potential risk of transfer of disease from commercial bumble bees to native bumble bees will be exacerbated by the artificially high concentrations of bumble bee colonies in agricultural ecosystems.

Although referred to as a single species, *Nosema bombi* is known to express differences in virulence when inoculated in different species of bumble bees. It is likely that *Nosema* and other microorganisms that exist in eastern bumble bees may be different from and potentially more virulent than those that exist in western bumble bees.

On page 11 of the CEQA Initial Study, it states that one mitigation measure to prevent the spread of pests and diseases will be the "Commercial use of *Bombus impatiens*, which has proven to posses superior disease resistance properties." The fact that *B. impatiens* has disease resistance does not mean that it is not a carrier of disease. This may indicate that it is able to tolerate a disease strain without exhibiting symptoms of infection and thus is able to carry and transmit diseases to more susceptible species. Recent research in Ontario has demonstrated that the pathogens *Crithidia bombi* and *Nosema bombi* will spread from commercially reared bumble bee colonies used in greenhouses to native bumble bee colonies in the surrounding area (Colla et al, 2006).

The risk analysis submitted by Koppert also did not thoroughly discuss Deformed Wing Virus (Genersch et al. 2006), internal parasites, or other microorganisms that have been introduced in other areas of the world and cause diseases and parasitism in native bumble bees (Macfarlane et al. 1995; Goka et al. 2000, 2001).

HABITAT COMPETITION

Koppert also failed to discuss in detail the ecological competition between introduced *B. impatiens* and native California species such as *B. vosnesenskii*, *B. bifarius*, and *B. huntii*, which all share a close genetic relationship (see Thorp et al. 1983) and in some instances have similar nest site requirements. Augmenting ecosystems with a new pollinator may cause reduced population, localized extirpation, or range-wide extirpation/extinction of native species (see Pyke 1982).

There is evidence that *B. impatiens* has the capacity to live in degraded and changed habitats within its natural range and that it can rapidly spread into new areas. In the eastern United States, *B. impatiens* appears to be the bumble bee that survives the longest in changing/degraded habitats (Liz Day, pers. comm.). In addition, *B. impatiens* was not recorded in Nova Scotia prior to the 1990s (Sheffield et al. 2003), and yet is now the most abundant bumble bee in the province; meanwhile the province's native species, particularly *B. terricola*, have declined (Cory Sheffield, pers. comm.).

This is a strong indication that *B. impatiens* has the capacity to adapt to changed habitats and can establish itself in new areas, even when facing the same threats as native bees. This is of great significance when considering the release of *B. impatiens* in California.

The time span when *B. impatiens* would be in the field (potentially from mid-January through early-July) is the prime period of winter/spring bloom of flowering plants in California. Since the period of activity for native bee fauna is associated with the blooming of flowering plants, there is likelihood that *B. impatiens* will forage on non-crop flowers, especially where the colonies are close to natural areas. This period is also the time when the greatest diversity of native California bees are active.

The CEQA ecological risk analysis fails to consider competition for nest sites with closely related species, which may be more critical than competition for food. *Bombus impatiens* and its native California relatives nest in abandoned rodent burrows, and the number of these can be limiting (Heinrich 2004). The more aggressive queens will occupy the resource and reduce available nests for other species. Should *B. impatiens* become established in California, there would be direct competition for nesting habitat with *B. crotchii*, *B. californicus*, *B. sonorus*, *B. occidentalis* and *B. rufocinctus*. Both *B. crotchii* and *B. sonorus* occur primarily in the Central Valley in California and the latter has shown declining populations, especially in the southern Sacramento Valley in recent years.

A parallel case has been demonstrated with cavity nesting leaf-cutting bees, in which the non-native bee, *Megachile apicalis*, has spread throughout much of California and Oregon, and into parts of Washington. In the process it has reduced populations of native

cavity nesting bees and even a prior invading close relative, *Megachile rotundata,* the alfalfa leaf-cutting bee (Stephen 2003, Barthell et al. 1989).

Even without establishment there can be competition. The artificially large concentrations of non-native bumble bee colonies in agricultural crops can put more competitive pressure on scattered nests of native bumble bees. The contention that "Bumblebees, after placement, forage in the general area in which they are placed" is not supported by the literature on bumble bee foraging (Goulson 2003). In addition, most literature on bee foraging ranges shows that there is a direct correlation between body size and flight range; smaller species forage 3 km away from the nest while larger bumble bees forage up to 10 km from the nest (Darvill et al 2004, Knight et al 2005, Greenleaf et al 2007). Thus, bumble bees are capable of foraging over considerable distances.

OVERLAP BETWEEN NATIVE BUMBLE BEES AND *BOMBUS IMPATIENS*

The contention that "In a natural setting mating takes place in fall" is absolutely wrong for the Mediterranean climate of California. The proposed mitigation of releasing *B. impatiens* colonies only between weeks 3 and 22 (mid-January to early-June), with up to five additional weeks for pollination in the field (as late as mid-July), will not prevent interaction between males and queens in California. In California, colonies of *B. vosnesenskii* , *B. melanopygus* (= *B. edwardsii*), and other species in the subgenus *Pyrobombus* are often initiated in January or February (Thorp et al. 1983). This is especially true in the southern, coastal, and lower elevation parts of their ranges. Males are often produced by May and June (Linsley 1944). Thus the proposed usage of *B. impatiens* is not in a timeframe that is different from the natural life cycle of native bumble bees, especially *B. vosnesenskii* and *B. melanopygus* (= *B. edwardsii*), in California. This proposed timeframe for introduction will not serve as a useful mitigation for California conditions. In addition, bumble bees are highly adaptable seasonally as illustrated by the successful introductions and establishments of four species from Great Britain to New Zealand in the 1860s where seasonal cycles are six months different!

Table 1: Flight periods of California native bumble bee species.

The nine species listed below have been recorded in the Central Valley (Thorp et al 1983). In all cases there is an overlap with the introduction and pollination period of *B. impatiens*.

B. (*Crotchiibombus*) *crotchii*	Queen: mid February to late October Workers: early April to mid September Males: early May to mid September
B. (*Fervidobombus*) *californicus*	Queen: mid February to mid October Workers: early March to late October Males: early May to mid October
B. (*Fervidobombus*) *sonorus*	Queen: early January to mid December Workers: early March to mid November Males: early June to late November
B. (*Bombus*) *occidentalis*	Queen: early February to late November

	Workers: early April to mid November Males: early April to mid November
B. (*Pyrobombus*) *bifarius*	Queen: early April to late September Workers: mid May to late September Males: early June to mid October
B. (*Pyrobombus*) *edwardsii*	Queen: all year (mid August to late July) Workers: early February to mid August Males: early February to late September
B. (*Pyrobombus*) *mixtus*	Queen: early April to late October Workers: early April to late September Males: early May to late September
B. (*Pyrobombus*) *vandykei*	Queen: mid March to late October Workers: early March to mid September Males: early May to late September
B. (*Pyrobombus*) *vosnesenskii*	Queen: all year Workers: early February to late October Males: early March to mid November

THREATENED OR ENDANGERED POLLINATORS IN THE RELEASE AREA

On page 8 of the CEQA Initial Study (Section 3.1.2. Endangered Species) it states: "No California pollinating insects are currently on any; rare, threatened, endangered, fully protected or species of special concern list of the California Department of Fish and Game. The U.S. Fish and Wildlife service does not list any bee species in TESS (Threatened and Endangered Species database System)".

This approach is too narrow in its definition and is somewhat disingenuous as an argument for allowing release of *B. impatiens*. The lack of listings in California does not represent a lack of species of bees and other pollinators in the state that deserve protection. The California Endangered Species Act (CESA) defines species as "a native species or subspecies of a bird, mammal, fish, amphibian, reptile, or plant" (California Fish and Game Code §2062-2080), so insects cannot be listed. However, the California Natural Diversity Database (http://www.dfg.ca.gov/bdb/html/cnddb.html) maintains a list of Special Status Species. These are species which may or may not be state or federally listed, but merit attention due to their rarity or possible threats to their continued existence. On this list there are twelve bees, including *B. franklini* and *B. occidentalis*. There are also twenty-eight butterflies and moths, including thirteen listed as endangered under the federal Endangered Species Act and three listed as threatened, and the Delhi Sands flower-loving fly, another federally endangered species. All of these may be considered pollinators and all deserve protection.

Bombus franklini is also included on the *Red List of Pollinator Insects of North America* (Thorp 2005), it is currently being proposed for the IUCN Red List, and the U.S. Fish and Wildlife Service has initiated preparation of a Candidate Notice of Review. Also, the Xerces Society and Dr. Robbin Thorp are preparing a Petition for Emergency Listing of *B. franklini* under the U.S. Endangered Species Act. Historic records of *B. franklini* have been identified in museum material from as far south in California as northern Trinity

County, 40° 58'north latitude (Thorp 2005). This is only 150 miles north of the northern limit of the proposed project, not 400 miles north as stated in the CEQA document.

Bombus occidentalis also appears to be in steep decline (Thorp and Shepherd 2005). Evidence indicates that the principal cause for these population declines is the introduction of exotic disease organisms and pathogens via trafficking in commercial bumble bee queens and colonies for greenhouse pollination of tomatoes (Thorp and Shepherd 2005). The Xerces Society and Dr. Robbin Thorp are presently preparing a detailed status review of this species and will likely submit a petition to list *B. occidentalis* as endangered under the U.S. Endangered Species Act in 2007.

ASSESSMENT OF IMPACTS PRIOR TO RELEASE OF AN ALIEN ORGANISM

Before the release of any alien biological control organism, a rigorous program of research would be required to understand the biology of the organism and to identify the impacts of its release upon the ecosystem. Even for managed pollinators, trials are completed within field enclosures to establish the effectiveness of pollination, stocking levels, etc. Nothing like this appears to have been done for *B. impatiens*. The risk assessment for release of *B. impatiens* has been based on a literature search, not field research, and provides an inadequate basis upon which to make a decision of this magnitude.

REGULATION OF *BOMBUS IMPATIENS* TRANSPORT, USE, AND DISPOSAL

For honey bees transported into the state of California, there is a well-established regulatory mechanism that includes border inspections. Will CDFA be creating a similar network of inspectors and regulations to manage importation of *B. impatiens*? Or will CDFA be ceding this responsibility to Michigan Department of Agriculture inspectors, and to Koppert and its logistics partners?

We know too little of the biology, parasitism, and virulence of most bumble bee disease organisms. We know virtually nothing about strain differences or sibling species differences from different regions. This lack of knowledge makes the risk of introduction significant. Will Deformed Wing Virus and other viruses that may be shared between bumble bees and honey bees be included in the list of diseases inspected?

There is no indication in the proposal of who will be responsible for the monitoring and oversight of the in-field use and disposal of *B. impatiens* colonies. Will CDFA establish a group of inspectors to monitor *B. impatiens* colonies on farms, in order to ensure that growers are following mitigation measures and that these measures are successful? How will the contract between Koppert and the growers be monitored to ensure all measures are being followed adequately?

As stated above there are many potential ways in which the colonies can be damaged in the field, including bird attack, rodent infestation, or theft, but apparently no way to know if mitigation works. There is also a risk of escape associated with disposal, a critical stage in preventing escape of *impatiens*, and yet disposal is apparently unregulated and left to the discretion of the growers.

EFFECTIVENESS OF *BOMBUS IMPATIENS* AS A CROP POLLINATOR

Periodic reports of pollination deficits in California due to shortages of honey bees pertain primarily to almond, and to very few other crops whose bloom period overlaps that of almond (Sumner and Boriss 2006). Following the bloom period of almond there is a surplus of strong honey bee colonies that are more than capable of servicing the majority of crops in California that require or benefit from bee pollination. At this time, honeybees can be rented for a reasonable price.

It is widely recognized that bumble bees are excellent pollinators of tomatoes, eggplant, peppers, and other crops in the family Solanaceae. They are also good pollinators of watermelon and other cucurbits, red clover, and even sunflowers, but there is limited evidence of their value as almond pollinators.

Very few data are available on the effectiveness of bumble bees in almond pollination (Thorp 1993, 1995, 1996; Davies 1995; and Dag et al. 2006). The available data pertain to commercially produced colonies of *B. occidentalis* and the related *B. terrestris*, not to *B. impatiens*. Thompson and Goodell (2001) provide some insight on bumble bees as almond pollinators, contrasting honey bees with bumble bees in California almonds. This study found that "*Apis* and *Bombus* removed and deposited similar amounts of pollen on almond flowers" but that *Bombus* could "reduce pollen delivery in almond orchards if *Apis* already serve as primary pollinators." Thus, placing B. impatiens colonies in almond orchards that are serviced by honey bees could actually reduce fruit set. In Israel, Dag et al. (2006) conclude from their "preliminary experiment" that bumble bees "can improve pollination levels in almond orchards." They speculate that "this is presumably due to their better mobility among cultivars, faster working rate and, possibly, their ability to work at lower temperatures relative to honeybees." It is not clear whether bumble bees would increase or decrease almond fruit set, and further validation is needed. Before allowing its release, it should be established whether or not *B. impatiens*, a non-native bumble bee currently classified as a plant pest, is an effective pollinator of almonds.

There are also questions surrounding its management and the economics of its use that remain unanswered (and possibly unasked). How many *B. impatiens* colonies will be needed per acre of crop? Will the colonies have enough active workers during the bloom period of the crop? Has a cost-benefit analysis been completed to establish whether the use of *B. impatiens* will be financially viable for growers? For example, in the mid-west, bumble bees are excellent pollinators of cranberries, but the economics of using them don't work out: They are simply too expensive to be useful (James Cane, pers. comm.). Where is the research that says *impatiens* will work for almonds? Until answers are known, the risks associated with releasing an alien pollinator species are too high.

A better supplemental pollinator for almond pollination would be the native blue orchard bee, *Osmia lignaria propinqua*. Research in California on this bee initiated by Torchio and Thorp with support from the Almond Board of California in the 1980's demonstrated its effectiveness as a pollinator of almond. Management and value of this bee as a commercial tree fruit pollinator has recently been summarized by Bosch and Kemp (2001).

If bumble bees are to be added as a supplement in the almond pollination system, we should be studying the pollination effectiveness, commercial production feasibility, and cost effectiveness of our native bumble bee *B. vosnesenskii*.

A TEMPORARY SOLUTION WITH LONG-TERM RISKS

It is stated on page 59 of the CEQA Initial Study (Appendix B, page 22 of 28) "Koppert is currently investigating species native to California for use in commercial rearing, but has not perfected the rearing techniques to allow for reliable commercial production and availability. To meet the current pollination needs, *B. impatiens* is being proposed for temporary use for field pollination of crops in California. Once a native bumblebee from California has been developed for reliable commercial production, *B. impatiens* will no longer be used for field pollination of crops in California."

If there are other, California-native bumble bees in development, why take the risk of introducing an alien species, especially one that is unproven as a pollinator of almonds and for which there are many unanswered questions about its management?

It may also be an unsafe assumption that the answer to current and future pollination needs will be a bumble bee and not one of the myriad other species of crop-pollinating bees. For example, mason bees (*Osmia*) are being developed as an almond pollinator, squash bees (*Peponapis*) are efficient pollinators of cucurbits, and native bees such as *Anthophora* and *Agapostemon* can buzz-pollinate tomatoes and other field crops.

The Ecological Risk Analysis prepared by Ardea Consulting on behalf of Koppert (Appendix B of the CEQA Initial Study) did not reasonably analyze the commercial production of *B. occidentalis* or *B. vosnesenskii* to serve in the place of introducing the non-native and exotic species *B. impatiens.* The Xerces Society recommends that Koppert focus on expediting its current investigation of species native to California for commercial rearing in California as a long-term solution.

CEQA COMPLIANCE

Article 6 Section 15070 of the State CEQA Guidelines states:

> A public agency shall prepare or have prepared a proposed negative declaration or mitigated negative declaration for a project subject to CEQA when:
>
> (a) The initial study shows that there is no substantial evidence, in light of the whole record before the agency, that the project may have a significant effect on the environment, or
>
> (b) The initial study identifies potentially significant effects, but:
>
> (1) Revisions in the project plans or proposals made by, or agreed to by the applicant before a proposed mitigated negative declaration and initial study are

> released for public review would avoid the effects or mitigate the effects to a point where clearly no significant effects would occur, and
>
> (2) There is no substantial evidence, in light of the whole record before the agency, that the project as revised may have a significant effect on the environment.

"Bumble bee (*Bombus impatiens*) pollination of field crops in the state of California. California Environmental Quality Act Initial Study and Mitigated Negative Declaration" does not meet any of these criteria. The document is fatally flawed and the ecological risks associated with importation ***can not*** be dealt with through the prescribed risk mitigation measures.

According to the CEQA regulations the agency has two courses of action. The California Department of Food and Agriculture can either deny the requested permit to introduce *B. impatiens* into California or prepare a full Environmental Impact Report (EIR) to detail all the environmental impacts of this potential project.

According to CEQA Article 1, Section 15002 of the State CEQA Guidelines, an EIR is required when:

> (1) An EIR is prepared when the public agency finds substantial evidence that the project may have a significant effect on the environment. (See: Section 15064(a)(1).)
>
> (g) Significant Effect on the Environment. A significant effect on the environment is defined as a substantial adverse change in the physical conditions which exist in the area affected by the proposed project. (See: Section 15382.) Further, when an EIR identifies a significant effect, the government agency approving the project must make findings on whether the adverse environmental effects have been substantially reduced or if not, why not. (See: Section 15091.)

As detailed above in these comments, there is "substantial evidence that the project may have a significant effect on the environment." As stated above, the prescribed risk mitigation measures are not sufficient to alleviate this significant environmental effect.

The fatal flaw in the CEQA document is that their proposed mitigation measures *will not* reduce the level of potential impact to less than significant. First, this proposed timeframe for introduction will not serve as a useful mitigation because of the overlap in life histories with native bumble bees. Second is that *there is no regulatory mechanism to ensure the destruction of the hives*. There is a contract, but who is going to go and check that each hive has been destroyed?

Also, the mitigation measure for pathogens is inadequate on its face since if they test the bees for disease and find it, they will likely have been spread in former shipments.

CONCLUSION

The "Bumble bee (*Bombus impatiens*) pollination of field crops in the state of California California Environmental Quality Act Initial Study and Mitigated Negative Declaration" failed to provide practicable, reasonable and suitable alternatives that are required when preparing a risk assessment. We strongly disagree with the proposed finding that ecological risks associated with importation of *Bombus impatiens* can be dealt with through prescribed risk mitigation measures. The risk mitigation measures that would be relied upon to prevent adverse ecological impacts are far to vulnerable be relied upon as a basis for granting the importation of *Bombus impatiens*. The Xerces Society urges the CDFA Division of Plant Health and Pest Prevention Services not to approve the requested permit for importing *Bombus impatiens*.

Sincerely,

Scott Hoffman Black Executive Director Xerces Society for Invertebrate Conservation 4828 SE Hawthorne Portland, OR	Matthew Shepherd Pollinator Conservation Director Xerces Society for Invertebrate Conservation 4828 SE Hawthorne Portland, OR
Claire Kremen Asst. Prof of Arthropod Biodiversity Dept of Environmental Science Policy and Management 137 Mulford Hall University of California Berkeley, CA 94720-3114	Robbin Thorp, Professor Emeritus Department of Entomology University of California One Sheilds Avenue Davis, CA 95616
Jim Lyon Senior Vice-President National Wildlife Federation Office of Congressional and Federal Affairs 1400 Sixteenth Street, N.W., Suite 501 Washington D.C. 20036-2266	Gabriela Chavarria, Ph.D. Director, Science Center Natural Resources Defense Council 1200 New York Ave. NW, Suite 400 Washington, DC 20005
Kim Delfino California Program Director Defenders of Wildlife 1303 J Street, Suite 270 Sacramento, CA 95814	John Losey, Ph.D. Department of Entomology Comstock Hall Cornell University Ithaca, NY 14853

Peter F. Brussard, Ph.D. Department of Biology, M.S. 314 University of Nevada Reno, NV 89557	Gordon Frankie University of California Division of Insect Biology 201 Wellman Hall #3112 Berkeley, CA 94720-3112
Cory S. Sheffield Department of Biology York University 4700 Keele Street Toronto, ON Canada, M3J 1P3	Sarah S. Greenleaf, Ph.D. postdoctoral scientist Department of Plant Pathology University of California-Davis 1 Shields Avenue Davis, CA 95616
Vance Russell Landowner Stewardship Program Audubon California 5265 Putah Creek Road Winters, CA 95694	Dan Silver Executive Director Endangered Habitats League 8424-A Santa Monica Blvd., #592 Los Angeles, CA 90069-4267
Dr. Boris C. Kondratieff Professor of Entomology Colorado State University Fort Collins, CO 80523	Emily B. Roberson Native Plant Conservation Campaign PMB 151 1459 18th Street San Francisco, CA 94107
Scott Thomas, Conservation Director Sea and Sage Audubon Society P.O. Box 5447 Irvine, CA 92616	Jess Morton, Treasurer Palos Verdes/South Bay Audubon Society P.O. Box 2582 Palos Verdes Peninsula, CA 90247
Dave Werntz Science and Conservation Director Conservation Northwest 1208 Bay St., Suite 201 Bellingham, WA 98225	Robert S. Jacobson, M.S. P. O. Box 2164 Lenoir, NC 28645-2164
Michael Klein Entomologist Klein-Edwards Professional Services PO Box 4326 San Diego, CA 92164-4326	Erin Robertson Senior Staff Biologist Center for Native Ecosystems 1536 Wynkoop Street, Suite 302 Denver, Colorado 80202

LITERATURE CITED

Barthell, J.F., G.W. Frankie, and R.W. Thorp. 1998. Invader effects in a community of cavity nesting megachilid bees (Hymenoptera: Megachilidae). *Environ. Entomol.* 27: 240-247.

Bosch, J, and W. Kemp. 2001. *How to Manage the Blue Orchard Bee As an Orchard Pollinator*. Handbook Series, Book 5, Sustainable Agriculture Network. Beltsville, MD: National Agricultural Library. (88 pp.)

Colla, S. R., M. C. Otterstatter, R. J. Gegear, and J. D. Thomson. 2006. Plight of the bumble bee: Pathogen spillover from commercial to wild populations. *Biol. Cons.* 129(4):461-467.

Dag, A., I. Zipori, and Y. Pleser. 2006. Using bumblebees to improve almond pollination by the honeybee. *J. Apicultural Research* 45(3):215-216.

Darvill, B., M. E. Knight,and D. Goulson. 2004. Use of genetic markers to quantify bumblebee foraging range and nest density. *Oikos* 107:471–478.

Davies, J. L. 1995. *Caged almond pollination by bumble bees (*Bombus occidentalis*)*. MS Thesis, California State University, Chico. 41 pp.

Genersch, E., C. Yue, I. Fries, and J. R. de Miranda. 2006. Detection of Deformed wing virus, a honey bee viral pathogen, in bumble bees (*Bombus terrestris* and *Bombus pascuorum*) with wing deformities. *J. Invertebrate Pathology*. 91: 61-63.

Goka, K., K. Okabe, S. Niwa, and M. Yoneda. 2000. Parasitic mite infection in introduced colonies of European bumblebees, *Bombus terrestris*. *Japanese J. Appl. Entomol. Zool.* 44:47-50 (in Japanese with English abstract).

Goka, K., K. Okabe, M. Yoneda, and S. Niwa. 2001. Bumblebee commerce will cause worldwide migration of parasitic mites. *Mol. Ecol*. 10:2095-2099.

Goulson, D. 2003. Effects of introduced bees on native ecosystems. *Ann. Rev. of Ecol. and Evol. Syst.* 34:1-26

Greenleaf, S. S., N. Williams, R. Winfree, and C. Kremen. 2007. Bee foraging ranges and their relationship to body size. *Oecologia*. To appear.

Heinrich, B. 2004. *Bumblebee Economics*. Cambridge, MA: Harvard University Press. 288 pp.

Knight, M. E., A. P. Martin, S. Bishop, J. L. Osborne, R. J. Hale, R. A. Sanderson, and D. Goulson. 2005. An interspecific comparison of foraging range and nest density of four bumblebee (*Bombus*) species. *Molecular Ecology* 14:1811-1820.

Linsley, E. G. 1944. Vernal flight of males in some western bumblebees (Hymenoptera, Bombidae). *Bull. Brooklyn Entomological Society.* 39(2):48-49.

Macfarlane, R. P., J. L. Lipa & H. J. Liu. 1995. Bumble bee pathogens and internal enemies. *Bee World*. 76(3):130-148.

Pyke, G. H. 1982. Local geographic distributions of bumblebees near Crested Butte, Colorado: competition and community structure. *Ecology* 63:555-573.

Sheffield, C.S., P.G. Kevan, R.F. Smith. S.M. Rigby, and R.E.L. Richards. 2003. Bee species of Nova Scotia, Canada, with new records and notes on bionomics and floral relations (Hymenoptera: Apoidea). *J. Kansas Entomol. Soc.* 76: 357-384.

State of California Environmental Quality Guidelines. 2006**.** Title 14. California Code of Regulations. [Online at http://www.ceres.ca.gov/ceqa/index.html.]

Stephen, W. P. Solitary Bees in North American Agriculture: a Perspective. Pp. 41-66. In K. Strickler and J. H. Cane (eds.). *For nonnative crops, whence pollinators of the future?* Thomas Say Publications in Entomology: Proceedings. Lanham, MD: Entomological Society of America. (204pp.).

Sumner, D.A., and H. Boriss. 2006. Bee-conomics and the Leap in Pollination Fees. *Agricultural and Resource Economics Update*, 9(Jan/Feb, 2006): 9–11. Online. [Available at: http://www.agecon.ucdavis.edu/uploads/update_articles/v9n3_3.pdf.]

Thomson, J. D. and K. Goodell. 2001. Pollen removal and deposition by honeybee and bumblebee visitors to apple and almond flowers. *J. of Appl. Ecol.* 38:1032-1044.

Thorp, R. W. 1993, 1995, 1996. Reports to the Almond Board of California. (Unpublished data)

Thorp, R. W. 2005. Profile: *Bombus franklini*. In Shepherd, M. D., D. M. Vaughan, and S. H. Black (Eds). *Red List of Pollinator Insects of North America*. CD-ROM Version 1 (May 2005). Portland, OR: The Xerces Society for Invertebrate Conservation.

Thorp, R. W., D. S. Horning, Jr., and L. L. Dunning. 1983. *Bumble Bees and Cuckoo Bumble Bees of California (Hymenoptera: Apidae)* Bulletin of the California Insect Survey, Volume 23. Berkeley: University of California Press.

Thorp, R. W., and M. D. Shepherd. 2005. Profile: Subgenus *Bombus*. In Shepherd, M. D., D. M. Vaughan, and S. H. Black (Eds). *Red List of Pollinator Insects of North America*. CD-ROM Version 1 (May 2005). Portland, OR: The Xerces Society for Invertebrate Conservation.

Personal Communication

James Cane, research entomologist, USDA-ARS Bee Biology and Systematics Laboratory, Logan, UT.

Liz Day, independent researcher, Indianapolis, IN

Sarah Greenleaf, postdoctoral scientist, University of California, Davis, CA

Cory Sheffield, postdoctoral researcher, York University, Toronto, ON