

Dear readers,

The purpose of this newsletter is to disseminate the results of the project **Status and Trends of European Pollinators (STEP)** among stakeholders and the general public and to continue the dialogue between administrators, managers and policy-makers from one side and the scientific community on the other side on pollinator-related issues. It will be used as a communications tool for dissemination of information to interested parties and will keep them informed of all planned activities and recent news. The STEP project will run from February 2010 until January 2015.

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We are proud to present the second newsletter of the *STEP* project. The newsletter will provide you information about the progress, recent achievements, and important activities related to pollinators and insect-pollinated plants. More information is provided on our website [www.step-project.net](http://www.step-project.net). Via the website you will be able to access further in-depth information about project results, PR material, all publications of the project, as well as detailed partner information. Information about job opportunities and training workshops can also be found there. The main target groups of the newsletter are administrations and NGOs in the policy and management field, as well as scientists working on scale-related biodiversity conservation issues.

We hope this newsletter will keep you informed on the state-of-the-art developments in the field of pollinator biodiversity and pollination services and will greatly facilitate your work.

Kindest regards,

**Prof. Simon G. Potts**  
STEP Project Co-ordinator



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## 1. Recent progress and results from STEP

### STEP Stakeholder Workshop, Brussels, 28 September 2010: "Identifying the most important governing questions related to the pollinator loss"

One of the goals of STEP is to establish communication links to a wide range of stakeholders across Europe and beyond, including policy makers, beekeepers, farmers, academics and the general public. To identify which are the most important 'governing questions' related to pollinator loss, in September 2010 STEP organised a workshop where various stakeholder groups were invited. The meeting was attended by 21 participants, including researchers, officials from DG SANCO, DG Research, DG Environment, national level administration, nature conservation agencies and networks, and entrepreneurs. The attendees discussed and identified the most important problems related to pollination loss. These include loss of biodiversity, loss of ecosystem services, food security and health issues related to agricultural production. The workshop explored how pollinator loss has profound links to biodiversity loss in general and the decline of ecosystem services in particular. Pollinator loss is a multiple sustainability issue and potentially has significant negative effects on human wellbeing from many perspectives (e.g. health, economy, and culture).



STEP coordinator gives an overview of our current understanding of pollinator loss to the workshop participants. Photo: Pavel Stoev.

### STEP 2<sup>nd</sup> Annual meeting, Fruška Gora, Serbia 28-31 March, 2011

Forty five members of the STEP consortium met for four days in Serbia to discuss progress to date and formulate plans for the coming year. Topics of discussion included collation of existing datasets on pollinators and plants to analyse better the extent and location of declines in Europe; progress on the analysis of drivers of pollinator loss including climate, habitat loss, pesticides, diseases and invasives; development of synthesis papers on the impacts of pollinator loss; assessing the effectiveness of various mitigation options for protecting European pollinators; finalizing the large-scale fieldwork campaign across Europe; and policy and dissemination activities.

STEP were very pleased to welcome several leading researchers from the USA to a special workshop on "Linking land use, pollinators and crop pollination"; these included Christina Kennedy, Claire Kremen, Eric Lonsdorf, and Neal Williams. Two intensive days of presentations and wide ranging discussions were highly productive resulting in several joint activities for the future. We look forward to continued ongoing collaborations with US partners, as we face the same fundamental research and conservation challenges on both sides of the Atlantic.



Break out group discussing the various impacts of pollinator loss on agricultural production. Photo: Simon Potts.



Attendees at the STEP Annual meeting in Fruška Gora, Serbia. Photo: Riccardo Bommarco.



Oliver Schweiger (Deputy Coordinator of STEP) presents progress on the analysis multi-scale drivers of pollinator loss. Photo: Pavel Stoev.

## 2. Selected recent outputs from STEP

During the first project phase (Feb 2010 to July 2011) STEP prepared more than 30 scientific papers, two PhD theses and 1 Masters thesis. STEP members have also taken part in several TV documentaries and news interviews. The project has been presented at more than 50 symposia, including the European Parliament. Six workshops were organized during the first project phase, including an international stakeholder workshop.

Project members took part in the production of documentaries or gave interviews for the news or TV media which were broadcasted and watched by thousands of people in Germany, France, Spain, Italy, UK and elsewhere. On 18 May 2010 ARTE, the French-German TV channel broadcast a 1.5 hour long documentary entitled 'Le mystère de la disparition des abeilles' ('The mystery of bee disappearance') where the STEP members Bernard Vaissière (INRA) and Peter Neumann (EVD) were involved as consultants and spoke on themes related to pollination and pollinator loss. The documentary was broadcasted simultaneously in France and Germany. The film provoked the interest of journalists and several articles have been published in the French press.

Alexandra Klein gave an interview for the German WDR Markt Scanner on the consequences of bees dying and its impact on the ecosystems. Montserrat Vila (CSIC) spoke on the Andalusian regional TV public channel about the 'Crisis de los insectos polinizadores'. Marino Quaranta (PISA) gave an interview for the Rai TG3 in Umbria on the importance of bees. David Kleijn (ALTERRA) spoke on the news of the Dutch national TV, and Riccardo Bommarco (SLU) was interviewed in Swedish national public radio on similar issues.

In the past 18 months more than 130 news and 17 events announcements have been posted on the STEP website which has had 4,797 visits from 99 countries and 15,670 page views. We have also created profiles of STEP on Twitter and Facebook.

Some key scientific publications are highlighted below.

### 2.1 Pollination Services in the UK: How Important are Honeybees?

Sharp declines in UK honeybees have caused major national concern about the security of crop production, and with good reason concludes a new study from STEP partners at the University of Reading.

The study, published in the journal *Agriculture Ecosystems and Environment*, evaluated the UK's demand for pollination services, measured in beehives over more than 20 years. The findings demonstrate that the UK's demand for honeybees has risen by more than 50% since 1984 with close to a million hectares of insect pollinated crops being planted in 2007.

Unfortunately for UK farmers, the study also found that, even under the most generous assumptions, stocks of honeybees could not supply more than a third of this demand in 2007, representing the low point in more than two decades of declining pollination service security. However, despite these severe declines in what is commonly assumed to be the UK's primary pollination service provider, yields of most insect pollinated crops have risen substantially.



***Osmia bicornis* (= *O. rufa*), a small wild bee, which is one of the unsung heroes of crop pollination.**



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The authors suggest that wild pollinators, such as bumblebees or some of the UK's 240 species of solitary bees may be filling the gap, citing numerous studies where these species outperform honeybees as crop pollinators. At the same time, the study cautions against relying on either group alone, noting studies in Scotland and the US where a combination of species are required to maximise crop yield and quality.

These findings may also explain why yields of mass flowering crops such as oilseed rape and field beans, which wild bees are often too scarce to pollinate, have not matched expectations from field studies. With demand for pollination services likely to rise substantially, the study calls for urgent action to protect the wild and managed pollinators that supply these services.



**In Europe, farmland with high levels of biodiversity are restricted to agriculturally marginal landscapes, such as in mountainous areas. Engadin, Switzerland, July 2011. Photo: David Kleijn.**



**Intensively managed farmland supports few species. Many bird species that once were common on farmland, such as the Lapwing *Vanellus vanellus*, rapidly decline from *intensively* managed areas. Photo: Ruben Smit**

Breeze, T.D., Bailey, A.P., Balcombe, K.G. & Potts, S.G. 2011. Pollination Services in the UK: How Important are Honeybees? *Agriculture Ecosystems and Environment*, 142 (3-4): 137-143.

## **2.2 Does conservation on farmland contribute to halting the biodiversity decline?**

The last few decades have seen a tremendous increase in initiatives to conserve biodiversity. Nevertheless, biodiversity has continued to decline. Focussing on European farmland species, we review what is known about the impact of conservation initiatives on biodiversity and how they contribute to biodiversity policy objectives.

A wealth of papers has been published the last ten years on studies examining the ecological effects of conservation management on farmland biodiversity. Combined, these studies suggest that effects of conservation on biodiversity depend on the structural complexity and farming intensity of the landscape as well as on the extent to which measures actually improve the habitat for the target species group.

The context-dependent effectiveness of conservation suggests that conservation initiatives targeting intrinsic biodiversity objectives should be implemented in extensively managed and structurally complex areas because in these areas biodiversity is still high and endangered species occur in large numbers and high densities. Conservation initiatives with functional objectives should be targeted at more intensively farmed and structurally simple areas because in these areas ecosystem services are likely to be reduced due to the intensive farming practices and here the potential contribution of ecosystem services is higher.

Conservation policy objectives are generally formulated at the national level but conservation management is typically implemented at the local level. So far hardly any studies have linked local conservation effects to national biodiversity trends. It is therefore unknown how, for example, the extensive European agri-environmental budget for conservation on farmland contributes to the policy objectives to halt biodiversity decline.

Kleijn, D., Rundlöf, M., Scheper, J., Smith, H.G. & Tschamtker, T. (2011) Does conservation on farmland contribute to halting the biodiversity decline? *Trends in Ecology and Evolution*, 26: 474-481.

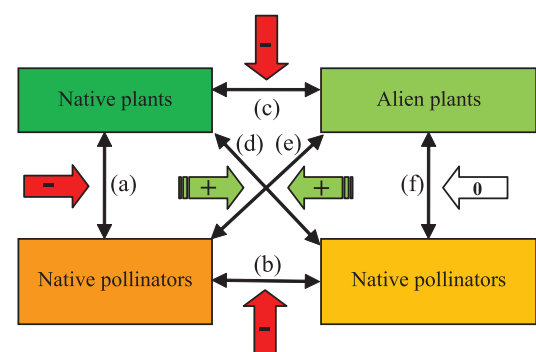


### 2.3 Multiple stressors on biotic interactions: how climate change and alien species interact to affect pollination

One output of STEP was to review the combined and interacting effects of climate change and alien species on the interactions within native plant–pollinator networks. We reviewed more than 200 publications in international scientific journals and the major conclusions are the following:

1. The combined effects of climate change and alien species will lead to the generation of novel plant and pollinator communities. Within these novel communities established interactions may be disrupted while in turn new interactions will be possible.
2. Climate change in particular is likely to impact native plant–pollinator interactions negatively in many ways. For instance, temporal and spatial co-occurrence can be affected as well as the matching of morphological or energetic demands when phenology, distribution, morphological structure of the communities, energetic needs of pollinators or pollen and nectar provision are altered by changing climatic conditions.
3. Alien species are commonly viewed as having negative effects on native species, especially when their competitive ability is high or increased by climate change. Their effects might even be enhanced by the fact that alien plants and alien pollinators tend to form invader complexes facilitating each other.
4. Effects of alien species can also be positive when they substitute the role and function of species that are lost due to climate change. Thus, novel pollinators and plants are readily integrated into native plant–pollinator networks and can provide additional pollen and nectar resources or crucial pollination services.
5. Such buffer capacities are not unlimited and although they may well modulate the responses to climate change, they will not necessarily circumvent changes in plant–pollinator interactions and consequent species extinctions.
6. Yet, net effects of alien species and novel communities are still hard to predict. But projections into possible futures show that generalist species will be least affected by the consequences of climate change, while specialist species can profit, if at all, only little from potential buffer effects provided by alien species and novel communities.
7. The findings of this review highlight the importance of considering both multiple drivers and species interactions in concert. To predict reliably the consequences of global change for biodiversity, ecosystem functioning and the provision of ecosystem services, a great challenge for future research will be to assess net effects of multiple drivers.

Schweiger, O., Biesmeijer, J.C., Bommarco, R., Hickler, T., Hulme, P.E., Klotz, S., Kühn, I., Moora, M., Nielsen, A., Ohlemüller, R., Petanidou, T., Potts, S.G., Pyšek, P., Stout, J.C., Sykes, M.T., Tscheulin, T., Vilà, M., Walther, G.R., Westphal, C., Winter, M., Zobel, M., Settele, J. 2010. Multiple stressors on biotic interactions: how climate change and alien species interact to affect pollination. *Biological Reviews*, 85: 777-795.



**Indirect effects of climate change (thick arrows) on interactions (thin arrows a-f) within a simplified pollination network of local and novel plants and pollinators. Red arrows, negative effects; green arrows, positive effects; white arrow, no effects.**



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**Pollination service in Grapefruit plantations (*Citrus x paradisi*) in NW Argentina is provided by the nearby Yungas forest. Photo: Natacha P. Chacoff and Carolina Monmany.**



**A ground-nesting, non-managed sand bee *Andrena* spp. visiting blueberry flowers (*Vaccinium corymbosum*) to collect pollen and nectar and in return delivers valuable pollination services to the crop. Photo: Rufus Isaacs.**

## 2.4 Natural areas stabilize crop pollination services

Natural areas near to agricultural land stabilize fruit set of flowering crops world-wide by increasing the average and decreasing the variability of pollination services, according to a new study published in the international journal Ecology Letters.

The article reports collaborative work produced by researchers from 11 countries. The study tackles an important topic for ecosystem services delivery, asking if the pollination stability over space and time is affected by isolation of crop fields to natural and semi-natural areas. The research team synthesized for the first time data from 29 studies in contrasting biomes, crop species, and pollinator communities. Landscape effects on the stability of pollination services have seldom been analyzed even in individual studies.

The team found that increasing distance to natural or semi-natural areas reduced the spatial and temporal stability as well as mean levels of flower-visitor richness, flower-visitation rate (all insects except honey bees), and fruit set. In contrast, honey bees, which are managed in many agroecosystems and represented >25% of visits in most studies, showed no changes in the magnitude or stability of visitation to crop flowers. Thus further highlights the importance of wild flower-visitors contributions to crop productivity and reliability. These results suggest common effects of landscape change on the stability of pollination services for contrasting crops and landscapes around the world. Therefore policies favouring the incorporation of natural or semi-natural areas into agricultural landscapes are highly valuable.



**Some non-managed, ground-nesting bee species provide pollination services to Almond orchards (*Prunus dulcis*) but only when semi-natural areas like Chaparral in California are nearby. Photo: Alexandra-Maria Klein.**

Garibaldi, L.A., Steffan-Dewenter, I., Kremen, C., Morales, J.M., Bommarco, R., Cunningham, S.A., Carvalho, L.G., Chacoff, N.P., Dudenhöfer, J.H., Greenleaf, S.S., Holzschuh, A., Isaacs, R., Krewenka, C., Mandelik, Y., Mayfield, M.M., Morandin, L.A., Potts, S.G., Ricketts, T.H., Szentgyörgyi, H., Viana, B.F., Westphal, C., Winfree, R., Klein, A.M. 2011. Stability of pollination services decreases with isolation from natural areas despite honey bee visits. Ecology Letters, 14 (10): 1062-1072.

## 2.5 Pollination services at risk following declines of Swedish bumblebees

Scientists from the Swedish University of Agricultural Sciences and the University of Lund discovered that the community composition of bumble bee species and their relative abundances have changed drastically over the last 70 years in Sweden. Over the same period, the average seed yield of red clover has declined and variation in yield has doubled, suggesting that the current dependence on few species for pollination of red clover has been detrimental especially to stability in seed yield.

Notable efforts were made from the 1940s to the 1960s to explore pollination and seed production of red clover (*Trifolium pratense*), which is an important forage crop that is dependent on pollination by bumble bees for seed set. Detailed historic records from the 1940s and 1960s were compared to present data on relative abundances of bumble bee species collected in 2008-2010 in 44 red clover fields across Sweden.

The results show that two species (*Bombus terrestris* and *B. lapidarius*) have increased from 40% in the 1940s to entirely dominate present communities with 89%. Previously common bumble bee species have become rare and even red-listed. For instance, *B. hortorum* and *B. pascuorum* have decreased tenfold in relative commonness, from around 20% to 2% of the observed bumble bees in a flowering clover-field. Notable is also the decline for *B. distinguendus* from 11% to 0.7% and is currently listed as near threatened in Sweden.

It is possible that such changes in community composition precede extinctions. In our efforts to conserve species and manage ecosystem services it appears important to promote not only species-rich, but also more evenly composed communities of service-providing organisms.



**The Garden bumble bee (*Bombus hortorum*) has declined in commonness. Here it visits Red clover (*Trifolium pratense*). Photo: Maj Rundlöf.**

Bommarco, R., Lundin, O., Smith, H.G., Rundlöf, M. 2012. Drastic historic shifts in bumble bee community composition in Sweden. *Proceedings of the Royal Society - Series B*, 279: 309-315.



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### 3. Conferences

*Drivers of pollinator loss in Europe Session at the 12<sup>th</sup> European Ecological Federation Conference, Avila, Spain*

A special session on drivers of pollinator loss in Europe was organized at the 12<sup>th</sup> EEF conference by STEP partner Monserat Villa. The session started with an invited talk by Dr Neal Williams from the University of Davis who presented some aspects on the influence of land use changes in California on pollinators. It was followed by 8 presentations on the effect of urbanization, agriculture including pesticide use, climate and invasions on pollinator diversity and composition. Many of these studies were empirical, based on current field studies but also explored historic and highly valuable databases on pollinator surveys conducted in Northern European countries.

*STEP symposium at EurBee 2012 in Halle, Germany*

The 5th European Conference of Apidologie, EurBee, will take place from 3-7th September 2012 in Halle an der Saale, Germany ([www.eurbee2012.uni-halle.de/](http://www.eurbee2012.uni-halle.de/)). Although originally focussed on honeybees, other bees and pollinators as well as pollination topics are increasingly represented at this biennial meeting. Simon Potts has been invited by the scientific organizers to put together a STEP symposium. This symposium will deliver key findings from the STEP project relevant to researchers, farmers, conservationists, beekeepers, policy makers and the general public. Preliminary suggestions for speakers included Koos Biesmeijer, Oliver Schweiger, Riccardo Bommarco, David Kleijn, Ingolf Steffan-Dewenter, Peter Sørensen and Stuart Roberts. However, all suggestions are welcome and registration is encouraged. Please contact Simon Potts (symposium organizer) or Koos Biesmeijer (one of the scientific organizers of EurBee).

### 4. Partnering projects

*The Pollinators of the Aegean: diversity & threats (POL-AEGIS)*

The STEP partner, the Laboratory of Biography and Ecology at the University of Aegean, Greece will be coordinating a project called *POL-AEGIS*. The project is funded by the EU and the Ministry of Education of Greece and will run from 2012 to 2015. It will focus on assessment of ecological and genetic diversity of pollinators in the Aegean region and will investigate the magnitude of different drivers affecting pollinator diversity. The project will also contribute towards the resolution of the Linnaean shortfall in Greece.

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