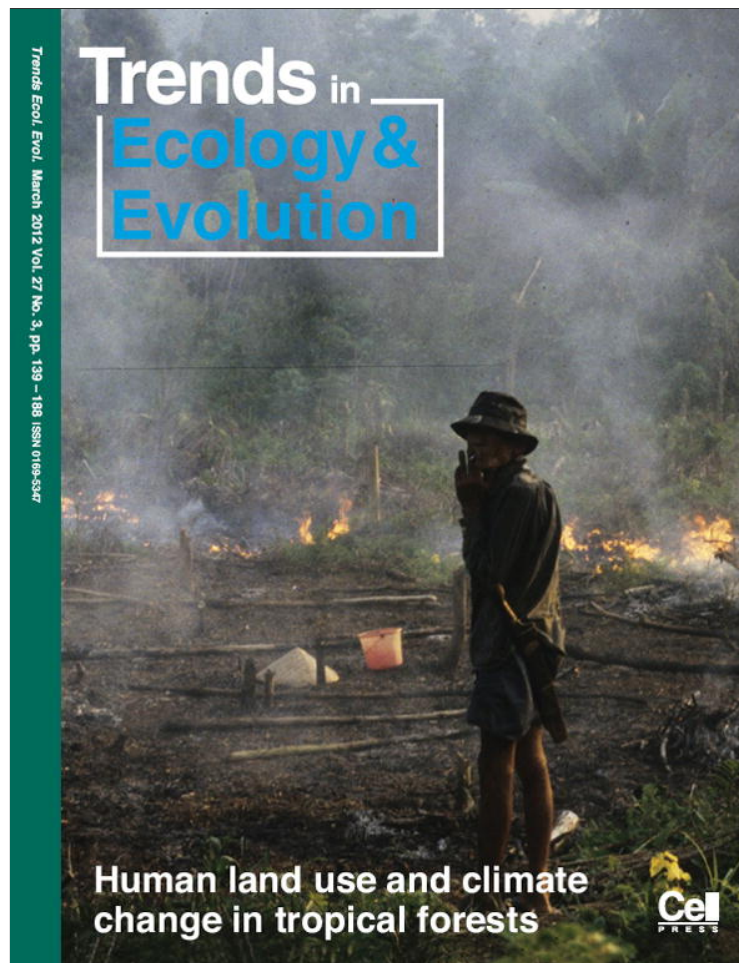


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Overplaying the role of honey bees as pollinators: A comment on Aebi and Neumann (2011)

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In a recent letter to *TREE* [1], Alexandre Aebi and Peter Neumann propose a novel approach to researching the wide-scale losses of honey bee (*Apis mellifera*) colonies in the Northern hemisphere. We recognise the importance of understanding the causes of colony collapse for honey production and for a subset of the agricultural industry. However, we fundamentally question the authors' starting assertion that honey bees 'are essential pollinators for the maintenance of natural biodiversity and agriculture' [1]. This assertion has a substantial history (e.g. [2]), and appears to be lodged in both the academic (e.g. [3]) and the public consciousness, but in fact lacks empirical support.

Studies by Tom Breeze, Simon Potts and colleagues at the University of Reading [4], demonstrate that honey bees are not nearly as important for agricultural pollination as is usually assumed and that, in the UK, most insect pollination of crops is carried out by wild bees, hoverflies (family Syrphidae) and other native pollinators. Likewise, in California, where over one million honey bee colonies are trucked in from across the USA to pollinate almonds, yields (and acreage under cultivation) have continued to increase from 1840 lb per acre (610 000 acres) in 2006 when Colony Collapse Disorder (CCD) first appeared, to 2600 lb per acre (750 000 acres) by 2011 [5], suggesting that the importance of honey bee pollination services is also overestimated for crops in North America.

In natural plant communities, honey bees are even less important as pollinators than they are in agricultural systems, which is as expected, given that honeybees are not a native species in most regions. Surveys conducted in the UK during the late 19th century (e.g. [6]), long before the collapse in honey bee numbers, indicate that honey bees were not a significant part of the pollinating fauna, as does a critical examination of more recent literature. Unpublished surveys by two of us (JO and VP) show that honey bees on average typically comprise only approximately 3.3% (range 0.0–21.1%) of total pollinator

abundance in British wild plant communities, compared with native bees (mean = 22.1%, range = 5.3–77.5%) and hoverflies (mean = 45.8%, range = 3.1–76.0%). Similar surveys in Ireland (JCS, unpublished data) demonstrate that honey bees comprise 2.1% (range 0.22–3.8%) of total flower visitors, compared with other wild bees (mean = 35.6%, range = 17.3–59.8%) and hoverflies (mean = 53.0%, range = 33.5–70.1%). Honey bee abundances at the top end of the range probably reflect proximity to unusually high densities of managed hives.

Generally low abundance, along with a limited ability of each individual to transfer pollen among flowers (e.g. [7]) together combine to indicate a low value of honey bees as pollinators in wild plant communities, and thus as contributors to the maintenance of biodiversity. Domesticated honey bees can in fact harm biodiversity through competition with wild pollinators for floral resources [8], via pollination (and thus facilitation) of invasive plants [9], and via host switching of pathogens from honey bees to wild bees [10]. In California, a region of high biodiversity, honey bee abundances in natural plant communities exceed the values given above (mean 22.8%, range 0.9–49.6%) but are negatively correlated with native bee abundances ($r = -0.96$, $P = 0.044$; RA, unpublished data). Indeed, one can argue that recent 'Save the Honey Bee' campaigns by a wide range of commercial and non-governmental organisations might do more harm than good with respect to the maintenance of biodiversity and ecosystem services provided by other pollinators.

The unsupported biodiversity-conservation argument for the value of honey bee research is widely promoted in the published and broadcast media. Based on a survey of online national newspaper and broadcast media websites, we estimate that between June 2010 and April 2011, almost 40% of UK media references to pollinators mentioned honey bees, compared with approximately 10% that referred to native bumblebees (*Bombus* spp.), despite the latter being far more important as pollinators of both crops

and native plants in the UK, and under much greater threat of extinction. We are concerned that this cycle of scientists advancing questionable arguments for the importance of their work and the media accepting these arguments without scrutiny could result in a skewing of public attention and research funding in favour of honey bee diseases to the detriment of awareness and research on native pollinator declines and extinctions that would have a much greater effect on plant biodiversity. Twenty-three species of bees and 18 species of butterfly have been lost from England during the past 200 years and a reduction in numbers of wild bees and hoverflies in parts of Europe has been mirrored by declines in the plants they pollinate [11]. Maintenance of the terrestrial flora of the world is indeed critically dependant on animal pollinators [12]. By conflating problems in the honey bee industry with the much more acute conservation issue of losses of native pollinators, honey bee researchers do damage to the whole community of researchers working on bee biology and pollination more generally.

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Back to the future: *Apis* versus non-*Apis* pollination

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Twenty years after the exchange between Sarah Corbet and Roger Morse in TREE considering the relative importance of pollinating honey bees, *Apis mellifera*, versus other species [1], this debate continues. Ollerton *et al.* [2] disregarded the main issue of our article about endosymbionts [3], although pathogen prevalence can predict native bee decline [4] and endosymbionts may play a role [3]. Instead, they took issue with our first sentence because it extolled honey bees. We claimed honey bees are essential pollinators for crops and wild plants but Ollerton and colleagues maintained that ‘By conflating problems in the honey bee industry with the much more acute conservation issue of losses of native pollinators, honey bee researchers do damage to the whole community of researchers working on bee biology and pollination more generally’ [2].

We believe arguments presented to support their critique are weak. Many consist of unpublished data or focus on the UK with little thought to the rest of the world. Thus, the conclusions of Tom Breeze *et al.* [5] did not take into account certain prominent changes in the dependence of UK crops on insect pollination, for example the development of self-fertile true hybrids in oilseed rape *Brassica napus* (<http://www.nk.com/fmt/colza/syngenta-winter-oilseed-rape-breeding>). Indeed, their subtitle might as well have been ‘How important are bumble bees?’ because these pollinators are also in decline [6] although yields of pollinator-dependent crops have, nonetheless, increased [5]. Regarding almond yields in California since 2006, production did increase as new orchards came into bearing and such young orchards are more productive than older plantings (Joe Connell, personal communication). Furthermore, more honey bee colonies are shipped to California for almond pollination as pollination fees increased 50% over that period [7],

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