

Role of Pollinators in Agriculture

FAST FACTS

- 35% of food crop production worldwide depends on animal pollinators, including honey bees.¹
- Of the 115 crop species that provide 90 percent of food supplies for 146 countries, 71 are bee-pollinated.²
- The total economic value of insect pollination worldwide amounted to \$210 billion (€153bn) in 2005, which represented 9.5% of the total value of agricultural production used for human consumption.³
- Through their pollination services and honey production, honey bees are estimated to be worth \$5bn (€3bn) to New Zealand's economy,⁴ \$15bn (€10.25bn) to the US,⁵ \$19bn (€14bn) to the EU, over \$69bn (€50bn) to East Asia⁶ and \$1bn (€0.75bn) to Canada.⁷
- Insect pollination is thought to be the main reproductive mechanism in 78% of temperate flowering plants, and is essential to maintaining plant genetic diversity.⁸
- Some crops, including blueberries and cherries, are 90-percent⁹ dependent on honey bee pollination; one crop, almonds, depends entirely on insect pollination at bloom time.¹⁰
- California has 800,000 acres of almond groves, which demand the annual pollination of bees.¹¹
- California's almond pollination alone requires the services of 1.5 million bee hives.¹²
- There are 620,000 beekeepers in the EU, producing 220,000 tons of honey every year.¹³
- There are over 25,000 species of different bees in the world.¹⁴

QUOTES

- "The pollination work of honey bees increases the yield and quality of United States crops by approximately \$15 billion annually, including over \$6 billion in California."
-Beekeeper Gene Brandi¹⁵
- "Bees have great intrinsic value to people across the UK and were widely regarded as a key symbol of the natural world by respondents in a survey of attitudes towards nature

¹ <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1702377/>

² <http://www.fao.org/ag/magazine/0512sp1.htm>

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http://www.researchgate.net/publication/23647989_Economic_valuation_of_the_vulnerability_of_world_agriculture_confronted_with_pollinator_decline

⁴ <http://nba.org.nz/about-bees/interesting-facts>

⁵ <http://www.abfnet.org/displaycommon.cfm?an=1&subarticlenbr=14>

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http://www.researchgate.net/publication/23647989_Economic_valuation_of_the_vulnerability_of_world_agriculture_confronted_with_pollinator_decline, Table 3 in the Full Text

⁷ <http://www.honeycouncil.ca/industry.php>

⁸ <http://www.step-project.net/files/DOWNLOAD2/pb13981-bees-pollinators-review.pdf>, Page 6

⁹ <http://rspb.royalsocietypublishing.org/content/274/1608/303.full>

¹⁰ <http://www.abfnet.org/displaycommon.cfm?an=1&subarticlenbr=14>

¹¹ <http://davis.patch.com/groups/going-green/p/troubling-honey-bee-shortage-in-california-almond-orchards>

¹² <http://davis.patch.com/groups/going-green/p/troubling-honey-bee-shortage-in-california-almond-orchards>

¹³ <http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0079018>

¹⁴ http://www.ibra.org.uk/categories/faq#FAQ_5

¹⁵ <http://www.desertusa.com/insects/honey-bee-and-agriculture.html>

conducted by Defra.”

-UK Department for Environment Food & Rural Affairs (DEFRA)¹⁶

- “It cannot be denied that the honey bee is the greatest pollinating machine when it comes to agriculture.”
-The Nature Conservancy¹⁷
- “There is an important link between the health of American agriculture and the health of our honey bees for our country's long term agricultural productivity.”
-Agriculture Deputy Secretary Kathleen Merrigan¹⁸
- “Did you ever wonder where apples come from or how an apple tree makes apples? Actually, apples start as flowers on the apple tree. Without the help of bees though, the flowers would bloom and then wither and drop without ever having a chance to become an apple.”
-Dr. Gloria Hoffman, USDA Scientist¹⁹
- “Honey bees are the most important pollinator – about 90% of pollinator-dependent crops are reliant on the honey bee.”
-Carol Poole, SANBI Applied Biodiversity Research Division, discussing bee pollination in South Africa²⁰
- “A decline in managed bee colonies puts great pressure on the sectors of agriculture reliant on commercial pollination services. This is evident from reports of shortages of bees available for the pollination of many crops.”
-USDA and EPA²¹

Factors Affecting Pollinator Health

FAST FACTS

- The US EPA has identified the *Varroa* mite as “the major factor underlying colony loss in the US and other countries.”²²
- The *Varroa* mite did not emerge in Europe until the late 1970s, but it is now prevalent throughout the EU.²³
- In 1985, *Varroa* was detected on the Spanish-French border. 40% of colonies collapsed within the first year of detection.²⁴
- According to the European Commission, laboratories reported *Varroa* as the largest single cause of bee mortality, outweighing pesticides by a factor of 15 to 1.²⁵
- Large unexplained bee disappearances are nothing new. In the past 150 years, there have been large numbers of bee die-offs, including at least nineteen such incidents between 1868 and 1980.²⁶

¹⁶ <http://www.step-project.net/files/DOWNLOAD2/pb13981-bees-pollinators-review.pdf>

¹⁷ <http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/indiana/journeywithnature/bees-agriculture.xml>

¹⁸ <http://yosemite.epa.gov/opa/admpress.nsf/0/E04602A5E7AA060685257B5F004A12D3>

¹⁹ <http://cals.arizona.edu/pubs/insects/ahb/inf10.html>

²⁰ <http://www.sanbi.org/sites/default/files/documents/documents/gppfppt.pdf>

²¹ <http://yosemite.epa.gov/opa/admpress.nsf/0/E04602A5E7AA060685257B5F004A12D3>

²² <http://yosemite.epa.gov/opa/admpress.nsf/0/E04602A5E7AA060685257B5F004A12D3>

²³ <https://secure.fera.defra.gov.uk/beebase/downloadDocument.cfm?id=16>

²⁴ <http://fera.co.uk/ccss/documents/syngentaBeeDiseaseReportJan13.pdf>

²⁵ <http://www.ebcd.org/pdf/presentation/304-Laddomada.pdf>, Page 10

²⁶ <http://ento.psu.edu/pollinators/publications/underwood>, Page 5

- Unexplained incidents of large-scale bee mortality date back to at least 950 AD.²⁷
- Weather, especially unusually cold weather, can have a negative effect on bee colony health and lead to high losses.²⁸
- Winter bee losses vary depending on the winter and the location. For example, in the UK beekeepers lost 33.8% of colonies in the 2012/2013 winter as opposed to 16.2% of colonies from the winter before. The British Beekeepers Association attributes the high losses to poor and unpredictable weather.²⁹
- Canadian beekeepers report challenges in honey bee winter survival with average overwintering losses fluctuating between 12 and 40%.³⁰
- At temperatures of 1.94° C or below, a bee's body freezes solid.³¹
- Winter bee losses result primarily from starvation, which in turn can be caused by many factors, including lack of honey and even improper position of the honey within the hive.³²
- A study by Underwood and vanEnglesdorp found six instances of large-scale colony collapse in the United States before the 1930s (when modern synthetic pesticides were first used in the US).³³
- UN Environmental Program reports that (despite disease and health problems) honey bee hives have increased 45% worldwide over the past 50 years.³⁴
- The European Commission lists 34 different viruses, bacteria, mites, and other pathogens negatively affecting bee health.³⁵ More are being discovered all the time.³⁶
- Even non-neonicotinoid areas of Europe have seen enormous bee-health problems.³⁷
- Britain's Department of Food, Environment and Rural Affairs examined lab results claiming to find "sub-lethal" effects of neonicotinoids on bees, and found the studies to be seriously flawed.³⁸
- A recent large-scale field study, using real doses of neonicotinoids rather than those amplified artificially in a laboratory, found no link between bee health and neonicotinoid seed treatments.³⁹
- Poor beekeeping can lead to the premature deaths of many bees and even entire colonies, particularly if the beekeeper is not vigilant about looking for signs of *Varroa* infection.⁴⁰
- The Asian hornet is an aggressive predator of honey bees and in 2005 it extended its geographical range from Asia to mainland Europe following an accidental introduction to

²⁷ <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1892840/>

²⁸ <http://www.pbs.org/newshour/rundown/2012/08/beekeepers-feel-the-sting-of-climate-change.html> "But upon arrival, a series of frosts killed 200 of his hives, each of which contained 70,000 bees. The bees that did survive found the weather too cool and windy to fly"

²⁹ http://www.bbka.org.uk/files/pressreleases/bbka_release_winter_survival_survey_13_june_2013_1371062171.pdf

³⁰ <http://www.capabees.com/2013/06/24/capa-statement-on-honey-bees-losses-in-canada-2011/>

³¹ <http://www.beesource.com/resources/usda/overwintering-of-honey-bee-colonies/>

³² <http://www.beesource.com/resources/usda/overwintering-of-honey-bee-colonies/>

³³ http://www.bt.ucsd.edu/synthetic_pesticide.html and <http://ento.psu.edu/pollinators/publications/underwood>

³⁴ http://www.unep.org/dewa/Portals/67/pdf/Global_Bee_Colony_Disorder_and_Threats_insect_pollinators.pdf

³⁵ <http://www.ebcd.org/pdf/presentation/304-Laddomada.pdf>, Page 7

³⁶ <http://dailycaller.com/2013/09/05/whats-killing-the-bees-home-sweet-toxic-hive/2/>

³⁷ http://www.ncpa.org/sub/dpd/index.php?Article_ID=22938

³⁸ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/221052/pb13937-neonicotinoid-bees-20130326.pdf

³⁹ <https://dspace.lib.uoquelp.ca/xmlui/bitstream/handle/10214/2621/32546.pdf?sequence=1>

⁴⁰

http://gallery.mailchimp.com/5fd2b1aa990e63193af2a573d/files/What_Happened_to_the_Bees_This_Spring2013_opt.pdf pages 4 and 12

France. The adult hornets will predate adult honey bees, often attacking in large numbers, and destroying entire colonies.⁴¹

- Australia, where the *Varroa* mite is not present, has a bee population healthy enough that it exports queen bees to replenish colonies abroad.⁴²
- There are a large number of viruses which affect honey bees, but until the spread of the *Varroa* destructor mite, these viruses were generally considered harmless.⁴³
- Colony Collapse Disorder is complex and cannot be attributed to modern pesticides. Between 1868 and today there have been 23 documented cases of major colony collapses, all but four of which took place before the introduction of neonicotinoid pesticides in the 1990s.⁴⁴
- The *Varroa* mite is a relatively recent worldwide scourge of bees, having left southeast Asia in the early 1900s and not reaching North America or Western Europe until the past few decades.⁴⁵
- Reports of large bee losses are rare in South America, Africa, and Australia.⁴⁶
- Between 1961 and 2007, honey bee populations rose 426% in Asia, 130% in Africa, 86% in South America, and 39% in Oceania.⁴⁷
- In Canada, which heavily uses neonicotinoid pesticides on its canola crop, overall honey yields and the average yield per colony have both increased.⁴⁸
- When the UK Food and Environment Research Agency tested the effects of neonicotinoid pesticides on bumblebees under field-realistic conditions, they found no deleterious effects.⁴⁹

QUOTES

- “This [Varroa] is the most dangerous threat that we have of bees around the world...it’s a bloodsucker. It sucks the blood of the bees basically and as it’s doing so, it transmits viruses.”
-Dr. Denis Anderson, Bee Pathologist, on *Varroa*⁵⁰
- “You are the only place [Australia] that doesn’t have them [*Varroa* mites] now and your country is blessed. The need to keep your country clean and clear of these is crucial.”
-Shad Sullivan, Pollination Service Owner, on the absence of *Varroa* in Australia⁵¹
- “This data provides clear evidence that, of all the suggested mechanisms of honey bee loss, virus infection brought in by mite infestation is a major player in the decline. The findings mirror other known mechanisms of virus spread and reinforce the need for beekeepers to control *Varroa* infestation.”
-Ian Jones, Professor of Virology at the University of Reading, referring to ‘Global Honey

⁴¹ <http://fera.co.uk/ccss/documents/syngentaBeeDiseaseReportJan13.pdf>

⁴² http://www.researchgate.net/publication/228361576_Honey_bee_colony_losses_and
<http://www.planthealthaustralia.com.au/national-programs/national-bee-pest-surveillance-program/>

⁴³ <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2883145/>

⁴⁴ <http://ento.psu.edu/pollinators/publications/underwood>, page 5, and <http://www.ncbi.nlm.nih.gov/pubmed/20737790>

⁴⁵ <http://www-personal.umich.edu/~copyrgh/image/solstice/win06/Sammataro/varroa2006.html>

⁴⁶ http://www.researchgate.net/publication/228361576_Honey_bee_colony_losses, Figure 1

⁴⁷ <http://ento.psu.edu/publications/van-mex-2010>, Page 2

⁴⁸ [http://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/sdd1600](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/sdd1600), and <http://www.ipolitics.ca/2013/12/20/whats-really-killing-the-bees/> “Leaf-cutter bees in Canada’s canola fields — almost all of which are neonicotinoid-treated — receive multiple and far more intense exposure to these pesticides than honeybees ever could.”

⁴⁹ <http://fera.co.uk/ccss/documents/defraBumbleBeeReportPS2371V4a.pdf> Pages 2 and 3

⁵⁰ <http://sixtyminutes.ninems.com/stories/tarabrown/560012/bee-afraid>

⁵¹ <http://sixtyminutes.ninems.com/stories/tarabrown/560012/bee-afraid>

Bee Viral Landscape Altered by a Parasitic Mite' by Martin, S. et al., published in Science on Thursday 7th June⁵²

- “CCD started in California bees in the winter of 2004/2005, prior to them ever being exposed to seed treated crops.”
-Randy Oliver, Beekeeper⁵³
- “In both 2007 and 2009 another paper pointed out that there were at least 18 historical episodes of similar large-scale losses of honey bees dating back to 1869, at least several of which had symptoms similar enough that they cannot be ruled out as being the exact same ailment. Yet, how often have you seen any of the scientists and journalists and beekeepers acknowledging that any theories about the cause of CCD need to accommodate the evidence for similar bee crashes that pre-date neonicotinoid pesticides, high-fructose corn syrup (HFCS), migratory beekeeping, cell phones, genetically modified crops, or any of the other human-made “causes” that have been run up the proverbial flagpole?”
-Dr. Doug Yanega, Senior Museum Scientist at the University of California⁵⁴
- “Untreated hives of European honey bees infested with *Varroa* are likely to die within 3 to 4 years. In other countries, populations of feral (wild) European honey bees that aren't managed by bee keepers, have fallen by more than 90 per cent following the establishment of *Varroa*.”
-Australian Government, Department of Agriculture⁵⁵
- “Because of the utility of bees in pollination, they now move from coast to coast each year. With a million or more colonies coming into California each year to deal with the crops in the San Joaquin Valley, diseases that may start in Florida are now quickly transmitted to other bees and spread across the country.”
-James Gibbs, co-owner of Chaparral Honey⁵⁶
- “Ask yourself this: if neonic residues were actually so harmful to bees, how is it that the Canadian beekeepers, whose bees forage largely on seed treated canola, feeding solely upon a diet of canola nectar and pollen with well documented residues of clothianidin, experience very low winter losses, despite the long Canadian winter (so long as they control *Varroa* and nosema)? And how is it that the vast majority of beekeepers in the U.S. Corn Belt report that their colonies thrive and that they have far fewer pesticide issues these days than in the past?”
-Randy Oliver, Beekeeper⁵⁷
- “The decline in honey bee health is a complex problem caused by a combination of stressors.”
-USDA and EPA⁵⁸
- “The parasitic *Varroa* mite is recognized as the major factor underlying colony loss in the U.S. and other countries. There is widespread resistance to the chemicals beekeepers use to control mites within the hive. New virus species have been found in the U.S. and several of these have been associated with Colony Collapse Disorder (CCD).”

⁵² <http://www.sciencemediacentre.org/expert-reaction-to-study-of-varroa-mites-and-deformed-wing-virus-in-honey-bees-2-2/>

⁵³ http://gallery.mailchimp.com/5fd2b1aa990e63193af2a573d/files/What_Happened_to_the_Bees_This_Spring2013_opt.pdf

⁵⁴ <http://membracid.wordpress.com/2013/05/03/quest-post-honey-bees-ccd-and-the-elephant-in-the-room/>

⁵⁵ <http://www.daff.gov.au/animal-plant-health/pests-diseases-weeds/bee/honeybees-faqs>

⁵⁶ <http://www.utsandiego.com/news/2013/apr/12/bees-colony-collapse-disorder-causes/?page=2#article-copy>

⁵⁷ http://gallery.mailchimp.com/5fd2b1aa990e63193af2a573d/files/What_Happened_to_the_Bees_This_Spring2013_opt.pdf

⁵⁸ <http://yosemite.epa.gov/opa/admpress.nsf/0/E04602A5E7AA060685257B5F004A12D3>

- USDA and EPA⁵⁹
- “*Varroa* functions as a sort of HIV, activating a host of other viruses that are harmful to bees. The tiny mites suck bees’ blood (haemolyph) and are almost impossible to eradicate from an infected colony. Even worse, bees who travel from all over the country to pollinate almonds mix with one another, exchanging their various viruses, parasites and infections. These populations then take their unwelcome health threats back to their home states to spread around to local bees.”
-Steve Milloy, biostatistician, environmental and public health consultant who runs JunkScience.com⁶⁰
- “...the experience in Canada is that we have had 10 years of large scale use [of neonicotinoid pesticides] on canola with no observed ill effect.”
-Heather Clay, Chief Executive Officer, Canadian Honey Council⁶¹
- “What most researchers and the public miss is the significant and often dominant presence of these airborne contaminants inside beehives. In other words, it’s a messy world inside the beehive and pesticides aren’t the only toxic materials.”
-J.J. Bromenshenk and Colin Henderson, Professors at the University of Montana⁶²
- “The number of identified bee viruses has gone from just a few in the 1970s, to nearly 30 today. It continues to grow.”⁶³
-J.J. Bromenshenk and Colin Henderson, Professors at the University of Montana -- Missoula

Protecting Pollinators

FAST FACTS

- Good stewardship practices by the crop protection industry, farmers, and beekeepers are necessary for protecting the health of pollinators.
- The crop protection industry is committed to educating farmers on stewardship best practices to limit any risks to pollinators.
- The crop industry relies on our pollinators and wants to keep them safe and healthy.
- Farmers can improve pollinator habitats by planting flower borders around crop areas.
- Beekeepers must be vigilant in monitoring for disease and mite levels in a colony.

QUOTES

- “Since the debacle, I’ve heard from plenty of beekeepers whom I’ll refer to as the “silent majority,” who experienced “normal” colony winter losses in the 5-25% range, and who successfully filled their pollination contracts. Although the hearts of all beekeepers go out to those who suffered severe colony losses, many felt that some of those losses could have been prevented if the afflicted beekeepers had been more proactive than reactive.”
-Randy Oliver, Beekeeper⁶⁴

⁵⁹ <http://yosemite.epa.gov/opa/admpress.nsf/0/E04602A5E7AA060685257B5F004A12D3>

⁶⁰ <http://www.apinews.com/en/news/item/23156-usa-is-the-almond-stress-the-cause-of-the-colony-collapse-disorder->

⁶¹ <http://www.honeycouncil.ca/documents/CanolaSthAB2009.pdf>

⁶² <http://dailycaller.com/2013/09/05/whats-killing-the-bees-home-sweet-toxic-hive/>

⁶³ <http://dailycaller.com/2013/09/05/whats-killing-the-bees-home-sweet-toxic-hive/>

⁶⁴ http://gallery.mailchimp.com/5fd2b1aa990e63193af2a573d/files/What_Happened_to_the_Bees_This_Spring2013_opt.pdf