The Bayer Bee Care Program

Tackling the Risks and Opportunities for Pollinators through Science

For millenia, different human cultures across the world have recognized the importance of bees and other pollinators, both wild and managed species. Yet, there is evidence that some pollinator populations are changing, due to several interrelated factors. Fortunately, there are ways to tackle the risks and opportunities associated with pollinators and pollination, and Bayer contributes via its Bee Care Program.

A major assessment by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), published in 2016, highlights just how essential pollination is – for nature, for agriculture and economically – and outlines the opportunities and ways forward for protecting pollinator species.

Bayer's Bee Care Program is already tackling some of the threats and opportunities identified in this assessment: developing innovative ways to conserve insect pollinator species, by gaining knowledge about bee health, pollinator communities in agricultural landscapes, and pollinator biodiversity. Moreover, by identifying further bee species for commercial pollination.

The value of pollination

Bees and other pollinators provide us with a range of services, with crop pollination being one of the most important. As the IPBES[1] assessment reports:

// nearly 90 percent of wild, flowering plants depend, at least in part, on animal pollination – predominantly by insects
// more than three-quarters of the leading global food crops rely, to some extent, on animal pollination
// the annual global value of crops directly attributable to animal pollinators is 235 - 577 billion US dollars – equivalent to 5 - 8 percent of global crop production.

Bees are the main pollinator species in many ecosystems[2] and honey bee populations are increasing in all regions of the world. Yet, many wild bees, and some other pollinator species, are experiencing declines. Current knowledge about the causes of these declines is incomplete, due partly to a lack of wild bee monitoring programs and long-term data.[3] The datasets that do exist focus mostly on bumble bee species, or heavily populated and industrialized regions, which may not be representative of global trends.

A loss of pollinators could threaten agricultural livelihoods. If a lack of pollinators becomes the limiting factor in crop production, for example, it has a direct economic impact.[4]

It is estimated that 5 - 8 percent of current global, annual crop production – valued at 235 - 577 billion US dollars – is directly attributable to animal pollinators.[6]

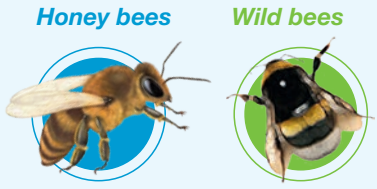
As the IPBES assessment explains, there is indication that several factors can negatively affect some pollinator populations. These include:

// Land-use change, particularly the loss of wildflower-rich grasslands and nesting sites
// Habitat fragmentation
// Agricultural intensification
// Competition from non-native species[5]
// Inappropriate use of pesticides
// Pests and diseases
// Changing weather patterns

While talk of a global pollinator crisis is overstated, there is an urgent need to identify the exact causes of the population declines seen for specific pollinators and to discover why other populations are thriving – and ultimately develop new ways to protect all pollinators.

Our dependence on these creatures is expected to increase as the global human population rises, and with it our need for food. As such, it will be necessary to increase efforts to monitor pollinators and identify new opportunities for farming communities to continue playing an active role. **The IPBES assessment sets out a clear strategic way forward – and the Bayer Bee Care Program is playing its part.**

Challenges to Pollinator Health



	Honey bees	Wild bees
Pests and diseases	Relevant	Not well studied
Beekeeping practices	Relevant	Not relevant
Nutrition and habitat	Relevant	Land use change, habitat fragmentation and loss
Weather	Relevant	Climate change for certain species
Genetic factors	Relevant	Not relevant
Agronomic practices	Relevant	Especially land use change, habitat fragmentation and loss

"A growing number of pollinator species, worldwide, are being driven towards extinction by a range of pressures – many of them man-made – threatening millions of jobs and hundreds of billions of dollars in food production. The IPBES Pollination Assessment not only brings together the best-available evidence of these trends but also highlights ways to safeguard pollinator populations effectively."

Dr. Anne Larigauderie, IPBES Executive Secretary

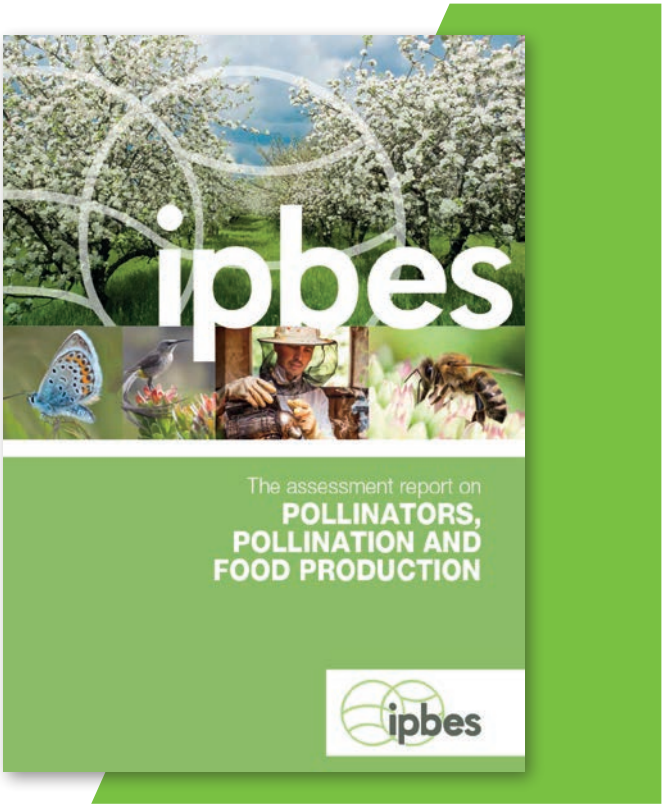
The IPBES assessment

The IPBES is an intergovernmental body that assesses the state of biodiversity and the ecosystem services provided to society by biodiversity. In 2016, it published *The Assessment Report on Pollinators, Pollination and Food Production*, which highlights the many benefits of pollinators. This impressive piece of work was written by experts from around the world, who analyzed over 3,000 scientific publications to bring together the current knowledge on this important topic.

For example, the assessment outlines the value of pollinators in terms of their ecosystem services, their importance to agriculture and food production and their economic value in different global regions. It also highlights some of their less-often considered benefits, such as their contributions to producing medicines and biofuels, their part in rural livelihoods in poorer countries and the cultural and spiritual roles that many pollinators – especially bees – play.

Importantly, the assessment provides an authoritative overview of the status and trends for pollinators and pollination and the risks and opportunities facing pollinators. While there are causes for concern, it notes several encouraging trends, such as the increasing number of managed honey bee hives in recent years.

It also identifies several strategic drivers of change and the policies and management options available. Together, these will enhance the protection of pollinators and ensure that the essential ecosystem services they provide continue into the future.



For more information about the IPBES report:
www.ipbes.net

"As one of 80 contributors to this assessment report, I was struck by the magnitude of the issues; but, at the same time, I am encouraged by the dedication and resourcefulness of the many stakeholders who are working to improve pollinator health."

Dr. Christian Maus
Global Lead Scientist Bayer Bee Care

Introducing the Bayer Bee Care Program

Wherever farmers are busy producing food, Bayer is committed to promoting the latest technologies that help them to be competitive, productive and sustainable. Bees and other pollinators are essential to this, as many crops need to be pollinated by insects to enable seed and fruit production. As pollination is key to our customers – the farmers – it is in Bayer's interests to promote and protect the health of pollinators. We do this via our Bee Care Program.

"Protecting crops and ensuring bee health is not an 'either-or' option, but a 'must'," says Coralie van Breukelen-Groeneveld, Global Head Bayer Bee Care. "Within the Bee Care Program the aim is to strike a balance between contributing to the health, wellbeing and diversity of pollinators, while helping farmers to optimize their agricultural productivity."

The Bayer Bee Care Program, which started in 2011, has three 'pillars', each of which focuses on major opportunities for, and threats to, bees and other pollinators. Each project undertaken by the Bee Care Program contributes to one or more of these pillars:

// **Feed A Bee:** foraging and nutrition; pollinator biodiversity
// **Healthy Hives:** control of honey bee pests and diseases (e.g. the *Varroa* mite); optimizing beekeeping practices; hive management by beekeepers[7]
// **Sustainable Agriculture:** the responsible use of agricultural products; beekeeper-farmer relations; crop pollination

Coralie van Breukelen-Groeneveld checks out the wild bees at the Federal University of Ceara, a project partner in Brazil.

"Building on our experience and expertise in the field of animal health, one of the program's first aims was to find a solution to *Varroa*,[8] which falls under our Healthy Hives pillar," explains Coralie van Breukelen-Groeneveld.

"Feed A Bee allows us to tackle the topic of foraging and nutrition, be it in agricultural landscapes through ecological enhancement measures, or in gardens, parks and along roadsides. And Sustainable Agriculture is what Bayer stands for: it allows us to improve and explain the responsible use of pesticides – in ways that minimize harm to pollinator species – and share knowledge on how pollination can benefit farmers."

Much of the Bee Care Program's most exciting – and essential – work falls under its Science Program. Comprising more than 30 projects globally, the aim of the Science Program is to develop and test locally-appropriate, tailor-made solutions that provide real benefits to farmers and bees. These projects focus on many subjects, including pollinator ecology, honey bee health, crop pollination efficiency and further reducing the risks of pesticides to pollinators.

Much of the Bee Care Program's most exciting – and essential – work falls under its Science Program.

Collaboration is the key
Through its Bee Care Centers in Germany and the USA, Bayer brings scientific excellence, expert knowledge and a wealth of experience to collaborations with a range of international partners around the world – from scientists at universities and research centers, to beekeeping organizations.

"Bayer is committed to protecting pollinators, contributing to their health and safety – and I cannot emphasize enough how important collaboration is in helping us achieve this."

Coralie van Breukelen-Groeneveld
Global Head Bayer Bee Care

Bayer takes pride in contributing to this cutting-edge research. Being seen as a trustworthy partner depends on being scientifically competent and active and our track record in the fields of crop protection and animal health ensures this.

Through multi-year scientific studies, Bayer and its partners are increasing the global knowledge-base about bees, testing innovative solutions to key threats, and pursuing new approaches to agriculture that balance production with sustainability – and fully integrate the needs of pollinators. The overall aim is to create a complete picture about the benefits that pollinators provide, and the opportunities and threats facing them, by providing everyone in the sector with up-to-date information.

Importantly, all these activities support the strategic responses outlined in the IPBES assessment.

FACTS AND FIGURES

Bayer's Bee Care Program:

// has more than 30 research projects, which run for 2 - 6 years, in 27 countries across five continents

// collaborates with 28 institutions, including universities, research centers, NGOs and museums

// has Bee Care Centers in Germany and the USA

// supports six MSc students (two each in Colombia, Kenya, and Thailand), and four PhD students (one each in Chile, France, Germany and Kenya).

"For IPBES's work to have the greatest possible impact, we need more decision-makers in every sphere, especially in the private sector, to contribute to and act on the evidence and policy options presented in the IPBES assessments."

Dr. Anne Larigauderie
IPBES Executive Secretary

How is the Bee Care Program contributing to the IPBES's Strategic Responses?

The IPBES assessment sets out the key strategic actions needed to respond to the major risks and opportunities associated with pollinators and pollination. Bayer takes these findings very seriously and agrees with the way forward that is presented. In response, we are already working on several of the actions identified in the assessment.

Develop and promote the use of technologies that reduce pesticide drift, and agricultural practices that reduce exposure to pesticides

// 'Dropleg' technology

// Optimization of seed treatment and planting technology to avoid pesticide dust drift

Prevent infections and treat diseases of managed pollinators; regulate trade in managed pollinators

Several Healthy Hives projects, which focus on:

// Monitoring bee health and influencing factors

// Optimizing beekeeping practices

// Solutions for the *Varroa* mite, including the Varroa Gate technology

// Alternative methods of *Varroa* control

// *Varroa*-resistant bees

// Solutions for pests and pathogens other than *Varroa*

Create uncultivated patches of vegetation such as field margins with extended flowering periods

// Pollinator diversity project in the Upper Rhine Valley in Germany

// Impacts of natural vegetation and landscape on avocado pollination in Central Chile

// Effects of orchard hedgerows on apple pollination in Germany

Inform farmers about pollination requirements

// Vegetable pollination project in Kenya

// Melon pollination in Brazil

Monitor and evaluate pollination on farms

// Impacts of natural vegetation and landscape on avocado orchards in Central Chile

// Effects of orchard hedgerows on apple pollination in Germany

// Coffee pollination in Colombia

// Native bees for coffee pollination in Colombia

// Pollination community studies in key crops of South America

Develop alternative managed pollinators

// Development of new, managed, native pollinators in Brazil, Kenya, Thailand

Education and outreach programs

// Improved melon pollination by optimized hive management in Brazil

// Healthy Hives 2020 LATAM

// Brochures on the *Varroa* mite and the Small Hive Beetle

Increase taxonomic expertise through education, training and technology

// Crop Attractiveness Evaluation

// Native bees for crop pollination in East and Central Africa

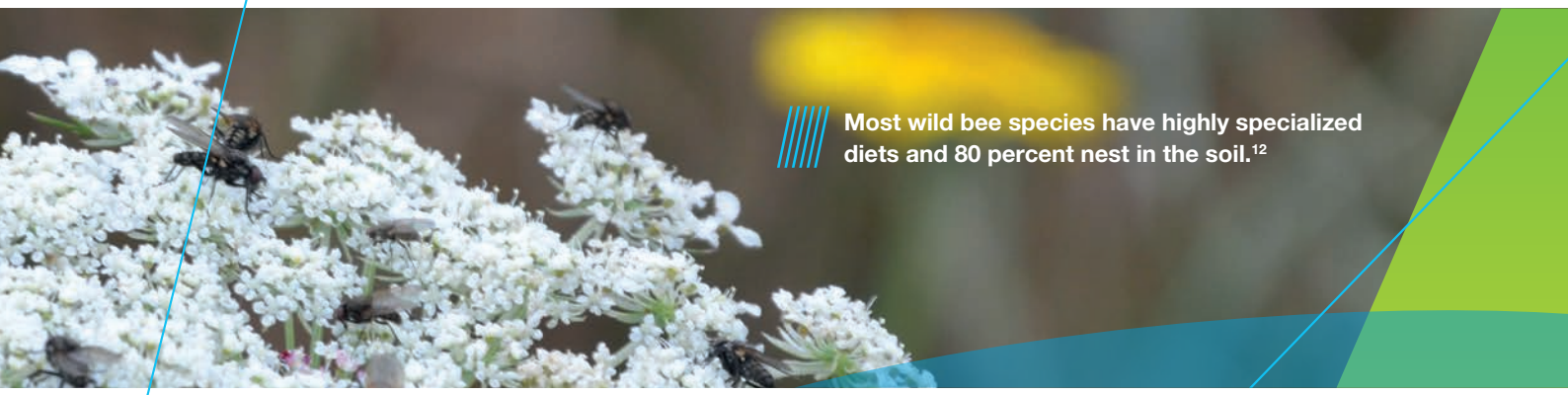
// Project to develop standards for wild bee monitoring in Germany

// Online pollen catalog

Figure 1: Identifies how Bayer's research portfolio and scientific projects are targeted to support the ambitions of the IPBES, while the case studies in this briefing provide examples of our collaborations.

A major challenge for protecting and enhancing pollinator populations, highlighted in the IPBES assessment and elsewhere,[9] is the lack of long-term, geographically diverse data on the status of different species. Among the datasets that exist, most are focused on certain regions (notably North America and northwest Europe) or certain species, such as bumble bees.[10] Broadening our knowledge about other bees and pollinator species will be a huge step forward.

There are more than 20,000 species of bee globally, yet they are under-represented in conservation planning and protection.[11]



Most wild bee species have highly specialized diets and 80 percent nest in the soil.[12]

Scientists across the globe are working with the Bayer Bee Care Center to address this. Under the Sustainable Agriculture and Feed A Bee pillars, we are broadening the focus of research beyond managed honey bees to encompass all pollinators – in line with the strategic direction set out in the IPBES assessment.

Feed A Bee and Sustainable Agriculture
Reliable, season-long foraging sources that provide pollen and nectar are a key factor for maintaining the health of honey bees.[13] Wild bees also require suitable foraging habitats, as well as appropriate nesting sites and materials for nesting structures.

Yet, as the IPBES assessment notes, intensive agriculture is affecting the provision of these resources. Landscape fragmentation is disrupting the foraging patterns of wild pollinators in many heavily-farmed regions, while habitat loss is a key driver of the decline of some wild species.

Bayer's Feed a Bee / Sustainable Agriculture scientific activities explore ways to create and maintain pollinator-friendly habitats in the agricultural landscape that meet all the needs of a diverse range of pollinator species, as well as the needs of farmers. There are 15 multi-year scientific projects under these two pillars.

Focus topics include:

// Pollinator biodiversity in agricultural landscapes
// Alternative pollinators for agricultural crops
// Safe use of crop protection products
// Bee nutrition
// In-crop pollinator communities
// Optimizing crop pollination

Through their performance, pollinators contribute up to eight percent to annual, global crop production (agricultural tonnage).

Bayer's Feed A Bee scientific activities, which are intertwined with its work on Sustainable Agriculture, explore ways to meet the needs of a diverse range of pollinator species, as well as the needs of farmers.

Many pollinator projects focus on restoring floral resources; seed mixes should produce flowers that combine long-blooming plants and those preferred by a diversity of pollinators.[14]

Case study: Enhancing pollinator biodiversity in Germany
In many cases, simple biodiversity-management measures can help to mitigate the loss of crop-visiting bee species in arable landscapes.[15] Since 2010, Bayer has been working with the Institute for Agro-Ecology and Biodiversity (IFAB) and the Institute for Landscape Ecology and Protection of Nature (ILN) in southwest Germany to assess the effects on pollinator communities of different biodiversity-enhancing measures, such as flowering strips along maize and cereal fields.[16]

"There was a consensus that flowering strips are beneficial – but little quantitative evidence," explains Dr. Christian Maus, Global Lead Scientist at the Bayer Bee Care Center. "We wanted to conduct long-term comparative studies, with control sites and 'ecologically-upgraded' sites, to see how different measures help us find a balance between agriculture and biodiversity."

Results suggest that there are substantial differences between the ecologically-upgraded sites and the control sites. "We've seen more endangered species take up residence here," says Dr. Rainer Oppermann, Head of IFAB. "The entire ecological food web benefits when there are more species." Species that have increased include wild bees and butterflies – but these impacts were not immediately evident. "It takes time to see results," says Dr. Maus.

The project provided further useful insights, such as the best mixtures of flowers and how to manage flowering strips over time. These will provide the basis for practical guidance that can be shared more widely, for example identifying the measures that are easiest to implement.

Another project, also in southwest Germany and run in partnership with the University of Freiburg and the Kompetenzzentrum Obstbau-Bodensee (KOB), is identifying the effects of hedges on apple pollination. Working in 20 apple orchards that apply integrated pest management practices, the three-year project is comparing four different types of hedges to determine which promote bee diversity and pollination services most effectively, in terms of apple yield and quality.

Dr. Rainer Oppermann, Head of the Institute for Agro-Ecology and Biodiversity (IFAB), in the field.

"The IPBES assessment makes several references to biodiversity loss; we are looking at how to strike a balance between agriculture and biodiversity and how to reverse losses through appropriate measures."

Dr. Christian Maus
Global Lead Scientist Bayer Bee Care

Arno Schanowski, Institute for Landscape Ecology and Protection of Nature (ILN) (right) and Dr. Christian Maus, Global Lead Scientist at the Bayer Bee Care Center, surveying wild bees and butterflies in a wildflower area.

Of the 100 crops providing 90 percent of the world's food, 70 benefit, to some extent, from pollination by bees and other insects.

Case study: Examining the effects of natural surrounding vegetation on avocado pollination in Chile

There is evidence that the wider landscape beyond agricultural areas influences the diversity and abundance of pollinator populations within these areas. A two-year project in central Chile[17] is investigating the effect of the natural surrounding vegetation on avocado pollination efficiency, as well as the relative contributions of wild pollinators and honey bees to that efficiency.

This research, which is being undertaken in three large orchards, is much needed in Chile. The country has around 26,000 hectares of commercial avocado orchards, and around half of the crop is exported. "This is one of the first such projects here in Chile, combining research into crop-pollinator dynamics with the socioeconomic benefits of improving crop yields," says Sharon Rodriguez from the Fraunhofer Chile Research Foundation, the collaborating partner. "We hope it will bring benefits for bees, the environment and growers alike."

Marnix Doorn, Business Development Manager at the Fraunhofer Chile Research Foundation goes on to say, "70 - 90 percent of Chile's fruit production depends on pollination by bees. They are a farmer's 'best workers' – responsible for year-round productivity."

As the global human population increases and the demand for food rises, agricultural production will need to be intensified – placing an ever-greater demand on pollinator species.[18] And if agriculture is to be sustainable, farmers must be able to increase their profitability and yields while protecting the environment on which they depend.

Through its Sustainable Agriculture work, Bayer looks to provide farmers with efficient, innovative technologies and methods that protect their crops from pests and diseases, while helping them to protect the pollinators on their land. Maintaining a focus on both strands is essential: as highlighted in the IPBES assessment, pollinators contribute up to eight percent of crop production, while crop protection products can cut production losses (caused by pests, weeds and diseases) by 50 percent.[19]

Dr. Juliana Jaramillo, Global Scientist at the Bayer Bee Care Center, checks out the avocado orchards of the project in Chile.

"The project takes a holistic approach. It is helping us to understand the roles played by the natural surrounding vegetation, the landscape and crop conditions, and their effects on the quality and quantity of produce."

Dr. Juliana Jaramillo

Honey bee hives in an avocado plantation in Chile.

The volume of pollinator-dependent crop production has increased by 300 percent over the last five decades.[20]

Given the close links between agriculture and pollination and the threats that certain agricultural practices pose to pollinators, there is a clear rationale for focusing pollinator protection and restoration efforts on agricultural land.[21] Indeed, some of the projects under the Sustainable Agriculture pillar look to optimize bee protection and crop protection at the same time, through innovative application technologies that reduce the exposure of bees and other pollinators to crop protection products.

The 'Dropleg' application technology minimizes pollinators' exposure to pesticides when foraging on blossoms and reduces drift losses.

For example, the 'Dropleg' modified spray machinery applies pesticides underneath the crop-flowering canopy instead of on top. This minimizes pollinators' exposure when foraging on blossoms and reduces drift losses for certain treatments in certain crops. Further projects focus on other aspects of sustainable agriculture. For example, field studies of different crops are increasing our understanding of different local pollinator communities for a range of crops. So far, Bayer has performed crop studies in Brazil (various crops), Chile (grapes), Colombia (beans) and Peru (citrus), all in collaboration with local bee experts.

Bayer's multi-year projects are run in collaboration with partners in Australia, Brazil, Canada, Colombia, Chile, Germany, Japan, Kenya, New Zealand, India and Thailand. Most include the training of postgraduate students and farmers on best management practices, and outreach to the public. In India, for example, Bayer is contributing to a CropLife project that provides subsidized honey bee hives, alongside training in crop protection and beekeeping, to increase the productivity of onion and pomegranate farmers.

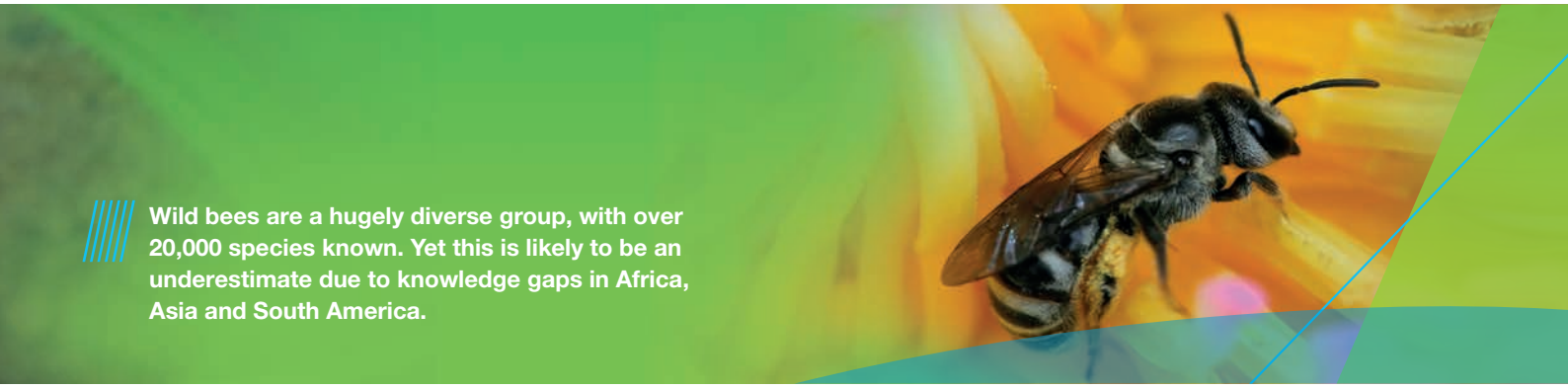
Case study: Optimization of crop pollination management and yield in melons

Research in northeastern Brazil examined the pollination efficacy and health of honey bee colonies as managed pollinators in a major melon-producing region. Melons are highly dependent on bees for pollination, and this region, which covers around 12,000 hectares, is home to around 450,000 beehives.

Working with the Federal University of Ceará and melon growers, Bayer sought to establish how to increase yields through optimized crop pollination management. "Our main goal was to find out whether the melon crop in Brazil is 'under-pollinated', limiting fruit productivity," explains Claudia Quaglierini, Bee Care Manager at Bayer in Brazil. "We also wanted to know how to increase the level of insect pollination."

The results identified that hive management was a limiting factor. "In checking the state of honey bee colonies, we found that many were weak and a number of hives were in a bad condition," says Professor Breno Magalhães Freitas, agronomist and pollinator scientist at the Federal University of Ceará.

The results indicated that there was room for improvement in hive management techniques, for example, through the timely replacement of queens and better distribution of hives (e.g. adjacent to the crop, placed with consideration to factors such as shade). There were also recommendations for changes to agricultural practices, such as improved coordination of pollination management with pesticide application.[22]



Wild bees are a hugely diverse group, with over 20,000 species known. Yet this is likely to be an underestimate due to knowledge gaps in Africa, Asia and South America.

The underestimated importance of Native Bees

When people think about bees, many will immediately bring to mind an image of honey bees in hives, cared for by a beekeeper. And no species is more important to agriculture than the European Honey Bee (*Apis mellifera*). Yet, this is a non-native species outside of Europe, Africa, and parts of Asia, and often they are not the most efficient pollinators. In many regions, particularly important pollinators are wild, unmanaged native bees,[23] which fully pollinate some crops and are frequent flower visitors in others.[24]

This focus is overdue: we cannot rely solely on managed honey bees in the future; wild pollinators are likely to play an increasing role in crop pollination, especially in tropical and subtropical regions. We, therefore, need to improve our understanding of different native species' relative contributions to pollination, their roles and abundance in different ecosystems and their life cycles and biology.

Bayer and partners are at the forefront of this work. Together, we are conducting a number of research projects with native bees to find local solutions to the threats they face and to ensure these vital pollinators get the protection they need to thrive. Our partners are examining a range of characteristics, such as wild species' different pollination techniques (e.g. the times of day they are active) and relative contributions to pollinating particular crops, as well as the sensitivity of certain bees to pesticides. This will help to identify the most useful wild species and establish how they can complement managed bees. Further research is underway to develop and adapt breeding techniques for selected species.

African stingless bees could probably be an alternative for honey production and pollination services in various crops.

Case study: Stingless bees as alternative pollinators
Our dependence on bee-pollinated crops is rising faster than the supply of honey bees.[25] To tackle this, Bayer and its collaborators are identifying which species could play a future role in crop pollination. A major initiative in Africa is evaluating the pollination efficiency of ten stingless bee species, for eight horticultural crops and for macadamia nuts.

Scientists are looking at a range of characteristics, including nesting ecology, genetic diversity and phylogeny.[26] The aim is to better understand the pollination efficiency of different species compared with the honey bee – information that will be shared with farmers via a booklet. The research team is also hoping to identify new species of stingless bee.

Collaboration is central to everything the Bee Care Program does. This project, which extends across Botswana, Cameroon, the Democratic Republic of the Congo, Ethiopia and Kenya, involves numerous partners, including the bee health reference laboratory of the International Centre of Insect Physiology and Ecology (icipe), the Cameroon Ministry of Agriculture, the Royal Museum for Central Africa (Belgium) and the Resource Ecology Department at Wageningen University, Netherlands. "The support we receive from Bayer helps us to generate knowledge, which we can use to promote African stingless bees for honey production and pollination," says Dr. Nkoba Kiatoko, Scientist and project manager at icipe. "This will additionally contribute to sustaining meliponiculture [beekeeping with stingless bees] among African farmers, helping them to generate an income through hive products and pollination."

This is one of various projects helping to increase our understanding of stingless bees and other native bees as alternative pollinators. Others include research in Brazil with the Federal University of Ceará that is examining the efficiency of different species as pollinators for crops including melons and cashews. Another project, being run in Thailand by Kasetsart University and Bayer Thailand, is examining the potential of stingless bees as pollinators for mango.

Let's talk about Bees

"It is critically important that research institutions and industry partners work together. Through our partnership with the Bayer Bee Care Center, we have been able to make interventions that improve the understanding and conservation of pollinators in Kenya."

Dr. Esther Kioko
Senior Research Scientist, National Museums of Kenya

Case study: Understanding and managing pollinators for improved vegetable production in Kenya
Bayer works with farmers at all scales of farming operation, and this project focuses on the seasonal diversity and abundance of vegetable pollinators in small-scale farms in eastern Kenya.[27] Working with the National Museums of Kenya and Jomo Kenyatta University of Agriculture and Technology, scientists are assessing the efficiency of different pollinator species, measuring variables such as vegetable yield and quality. The project is also looking at the seasonal behavior of pollinators. Capacity-building and outreach activities are a cornerstone of this work. The research findings will be used to develop information packages for farmers and the project team will also train female farmers on different measures to conserve pollinators.

"This project is timely!" says Dr. Esther Kioko, Senior Research Scientist at the National Museums of Kenya. "Smallholder women farmers play a critical role in food production but they are desperately in need of relevant research support, technical advice, appropriate knowledge and technology. With this project, they will be able to evaluate their farming practices and improve the availability of forage for pollinators, which is necessary for improving crop yields."

Bayer's Bee Care Program is about more than scientific excellence: the research findings from all three pillars under the Science Program are communicated to a wide range of stakeholders, including industry partners, scientists, farmers, beekeepers, governmental agencies, nongovernmental organizations and representatives of the food value chain.

By emphasizing regular and effective communication, the Bee Care Program ensures that the most important lessons and messages reach those who need them. This is central to disseminating and testing the many promising developments coming out of Bayer's scientific endeavors.

Research partnerships between industry and academia not only produce a wealth of valuable data for the good of society; they also create an essential space for dialog. "In general, the Bee Care Centers facilitate the exchange of knowledge and experience and provide the opportunity to address questions and concerns," says Coralie van Breukelen-Groeneveld. "This provides transparency about our activities, and creates opportunities to cooperate on pollinator protection via collaborations and partnerships."

Education and awareness-raising are further aspects of our outreach. "Bayer's projects produce important insights which we are keen to share," she explains. "This information and facts help to increase the understanding, among farmers and other stakeholders, about the importance of pollinators and issues, such as the complexity of pollinator protection and best practices for sustainable beekeeping."

In Conclusion

There are many reasons for protecting pollinators. Alongside the concern that many of us have for the natural world, the IPBES assessment outlines the economic arguments – such as the value of the ecosystem services they provide – and, of course, their essential role in ensuring the continued supply of many important agricultural crops.

Talk of a general pollinator decline that would affect all species globally is premature but environmental crises are often recognized too late.[28] Ensuring diversity in ecosystems, including agricultural landscapes, offers some 'insurance', stabilizing ecosystem services over time and space. Bee species that do not currently pollinate crops may do so in the future[29] – we need to act now to preserve them.

The IPBES outlines ways to move forward to achieve this, and how we can capitalize on the existing opportunities to make our farming systems more productive and sustainable. Through its many scientific collaborations worldwide, Bayer is playing a leading role in this, helping to produce the data and knowledge needed to develop effective solutions to the threats that pollinators face, and to take advantage of the opportunities.

The interactions between the climate, environmental factors, agricultural practices, and the pests and diseases afflicting certain crops and their specific pollinators are complex. There is no 'one size fits all' solution to protecting pollination services and increasing agricultural productivity across all countries or species.

We are on top of the growing knowledge-base about wild bees – a major opportunity, as these can be alternative pollinators for agricultural crops – and pioneers in studying new species for managed pollination on three continents.

"By joining forces, we have the highest chance of contributing, with tangible results, to the protection of bees and other pollinators."

Coralie van Breukelen-Groeneveld
Global Head Bayer Bee Care

We also tackle some of the threats facing honey bees, for example through efforts to combat pests including the Small Hive Beetle and the Asian Hornet.[30]

Red Mason Bee
(Osmia bicornis)

Asian Hornet *(Vespa velutina)*
killing a bee.

And, wherever farmers are producing food, Bayer is committed to helping them be competitive, productive and sustainable – by working with them to protect and support the pollinators upon which they, and all of us, depend.

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Endnotes

1 IPBES (2016)
2 Winfree (2010)
3 ibid.
4 Winfree (2010) Op. cit.
5 See Winfree (2010) for a detailed description of these threats.
6 IPBES (2016) Op. cit.
7 This article focuses on the Feed a Bee and Sustainable Agriculture pillars. More information about Healthy Hives projects can be found at: https://beehealth.bayer.us/bayer-bee-care/bee-care-research/healthy-hives
8 The parasitic *Varroa* mite is known to severely affect especially the European Honey Bee *Apis mellifera*. It was identified in the IPBES assessment as a significant concern in temperate zones of the Northern Hemisphere.
9 See, for example, Bartomeus et al. (2013)
10 ibid.
11 Winfree (2010) Op. cit.
12 Michener (2007)
13 Van Breukelen-Groeneveld (2017)
14 Winfree (2010) Op. cit.
15 Kleijn et al. (2015)
16 See: http://beecare.bayer.com/media-center/beenow/detail/putting-nature-back-into-the-fields
17 See: https://beecare.bayer.com/media-center/beenow/detail/working-towards-a-better-harvest
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18 Ghazoul (2005)
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20 IPBES (2016) Op. cit.
21 ibid.
22 For further information, see: https://beecare.bayer.com/media-center/beenow/detail/boosting-productivity-through-fruitful-partnerships
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25 ibid.
26 The history of the evolutionary relationships of a group of organisms.
27 See: https://beecare.bayer.com/media-center/news/detail/bayer-bee-care-program-signs-up-for-kenyan-pollination-project
28 Ghazoul (2005) Op. cit.
29 Kleijn et al. (2015) Op. cit.
30 Van Breukelen-Groeneveld (2017) Op. cit.

Further Information

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