



February 2016

# BEE HEALTH

## USDA and EPA Should Take Additional Actions to Address Threats to Bee Populations

## Why GAO Did This Study

Honey bees and other managed and wild, native bees provide valuable pollination services to agriculture worth billions of dollars to farmers.

Government and university researchers have documented declines in some populations of bee species, with an average of about 29 percent of honey bee colonies dying each winter since 2006. A June 2014 presidential memorandum on pollinators established the White House Pollinator Health Task Force, comprising more than a dozen federal agencies, including USDA and EPA.

GAO was asked to review efforts to protect bee health. This report examines (1) selected USDA agencies' bee-related monitoring, research and outreach, as well as conservation efforts, and (2) EPA's efforts to protect bees through its regulation of pesticides. GAO reviewed the White House Task Force's national strategy and research action plan, analyzed data on USDA research funding for fiscal years 2008 through 2015, reviewed EPA's guidance for assessing pesticides' risks to bees, and interviewed agency officials and stakeholders from various groups including beekeepers and pesticide manufacturing companies.

## What GAO Recommends

GAO recommends, among other things, that USDA coordinate with other agencies to develop a plan to monitor wild, native bees, and evaluate gaps in staff expertise in conservation practices, and that EPA identify the most common mixtures of pesticides used on crops. USDA and EPA generally agreed with the recommendations.

View [GAO-16-220](#). For more information, contact Steve D. Morris at (202) 512-3841 or [morris@gao.gov](mailto:morris@gao.gov).

## BEE HEALTH

### USDA and EPA Should Take Additional Actions to Address Threats to Bee Populations

## What GAO Found

The U.S. Department of Agriculture (USDA) conducts monitoring, research and outreach, and conservation that help protect bees, but limitations in those efforts hamper the department's ability to protect bee health. For example, USDA has increased monitoring of honey bee colonies managed by beekeepers to better estimate losses nationwide but does not have a mechanism in place to coordinate the monitoring of wild, native bees that the White House Pollinator Health Task Force's May 2015 strategy directs USDA and other federal agencies to conduct. Wild, native bees, which also pollinate crops, are not managed by beekeepers and are not as well studied. USDA officials said they had not coordinated with other agencies to develop a plan for monitoring wild, native bees because they were focused on other priorities. Previous GAO work has identified key practices that can enhance collaboration among agencies, such as clearly defining roles and responsibilities. By developing a mechanism, such as a monitoring plan for wild, native bees that establishes agencies' roles and responsibilities, there is better assurance that federal efforts to monitor bee populations will be coordinated and effective. Senior USDA officials agreed that increased collaboration would improve federal monitoring efforts.

USDA also conducts and funds research and outreach on the health of different categories of bee species, including honey bees and, to a lesser extent, other managed bees and wild, native bees. Consistent with the task force strategy and the 2008 Farm Bill, USDA has increased its conservation efforts on private lands to restore and enhance habitat for bees but has conducted limited evaluations of the effectiveness of those efforts. For example, a USDA-contracted 2014 evaluation found that agency staff needed additional expertise on how to implement effective habitat conservation practices, but USDA has not defined those needs through additional evaluation. By evaluating gaps in expertise, USDA could better ensure the effectiveness of its efforts to restore and enhance bee habitat plantings across the nation. USDA officials said that increased evaluation would be helpful in identifying where gaps in expertise occur.

The Environmental Protection Agency (EPA) has taken steps to protect honey bees and other bees from risks posed by pesticides, including revising the label requirements for certain pesticides, encouraging beekeepers and others to report bee deaths potentially associated with pesticides, and urging state and tribal governments to voluntarily develop plans to work with farmers and beekeepers to protect bees. EPA also issued guidance in 2014 that expanded the agency's approach to assessing the risk that new and existing pesticides pose to bees. The task force strategy also calls for EPA to develop tools to assess the risks posed by mixtures of pesticide products. EPA officials agreed that such mixtures may pose risks to bees but said that EPA does not have data on commonly used mixtures and does not know how it would identify them. According to stakeholders GAO interviewed, sources for data on commonly used or recommended mixtures are available and could be collected from farmers, pesticide manufacturers, and others. By identifying the pesticide mixtures that farmers most commonly use on crops, EPA would have greater assurance that it could assess those mixtures to determine whether they pose greater risks than the sum of the risks posed by individual pesticides.

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**Abbreviations**

APHIS	Animal and Plant Health Inspection Service
ARS	Agricultural Research Service
CRIS	Current Research Information System
CRP	Conservation Reserve Program
CSP	Conservation Stewardship Program
EIIS	Ecological Incident Information System
EQIP	Environmental Quality Improvement Program
EPA	Environmental Protection Agency
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FSA	Farm Service Agency
Interior	Department of the Interior
IPM	Integrated Pest Management
NASS	National Agricultural Statistics Service
NIFA	National Institute of Food and Agriculture
NRCS	Natural Resources Conservation Service
OECD	Organization for Economic Cooperation and Development
OMB	Office of Management and Budget
OPP	Office of Pesticide Programs
PCA	Plant Conservation Alliance
PRIA	Pesticide Registration Improvement Act
SAFE	State Acres for Wildlife
SFIREG	State-FIFRA Issues, Research, and Evaluation Group
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey

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February 10, 2016

The Honorable Barbara Boxer  
Ranking Member  
Committee on Environment and Public Works  
United States Senate

The Honorable Kirsten Gillibrand  
Ranking Member  
Subcommittee on Livestock, Marketing, and Agriculture Security  
Committee on Agriculture, Nutrition, and Forestry  
United States Senate

The Honorable Dianne Feinstein  
United States Senate

Bees play a vital role in agriculture by pollinating crops that are worth billions of dollars to farmers, while also providing environmental value to other landowners and natural ecosystems by pollinating flowering plants. The health of bee populations, therefore, is important to the nation's well-being. In recent years, beekeepers, farmers, scientists, and others have been increasingly concerned about the health of European honey bees that are commercially managed for honey production and pollination services; other managed bees; and wild, native bees.<sup>1</sup> Annual surveys of U.S. beekeepers since 2006 indicate that, on average, about 29 percent

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<sup>1</sup>The scientific name of the European honey bee is *Apis mellifera*. Hereafter, in this report, we refer to them as honey bees. Other managed bees include orchard mason bees (*Osmia lignaria*), alfalfa leafcutting bees (*Megachile rotundata*), and bumble bees (*Bombus spp.*). Orchard mason bees and some bumble bees are native to the United States, while alfalfa leafcutting bees are not. In this report, wild, native bees refer to unmanaged bees that are native to the United States. There are an estimated 4,000 or more species of wild, native bees in the United States. We acknowledge that nonnative bees, including honey bees, may also be unmanaged, i.e., wild.

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of honey bee colonies have been dying over the winter.<sup>2</sup> Government and academic researchers have documented long-term declines for some populations of other bee species, including bumble bees, but little is known about trends for populations of the estimated 4,000 or more species of wild, native bees in the United States.

A June 2014 presidential memorandum on pollinators established the White House Pollinator Health Task Force, comprised of more than a dozen federal agencies and co-chaired by the Secretary of Agriculture and the Administrator of the Environmental Protection Agency (EPA).<sup>3</sup> In response to direction in the memorandum, the task force issued a May 2015 national strategy for protecting bees and other pollinators from a range of possible threats, including pests and pathogens, reduced habitat, lack of nutritional resources, and exposure to pesticides.<sup>4</sup> The task force's strategy contains three overarching goals, two of which relate to bees: (1) reducing honey bee colony losses during winter to no more than 15 percent within 10 years; (2) increasing the Eastern population of the monarch butterfly to 225 million butterflies occupying an area of approximately 15 acres in the overwintering grounds in Mexico, through domestic and international actions and public-private partnerships, by 2020; and (3) restoring or enhancing 7 million acres of land for pollinators over the next 5 years through federal actions and public-private partnerships.<sup>5</sup> The White House Task Force also issued the Pollinator Research Action Plan in May 2015, which it described as a road map for

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<sup>2</sup>The Bee Informed Partnership's national survey of managed honey bee annual colony losses, carried out in cooperation with the U. S. Department of Agriculture (USDA) and the Apiary Inspectors of America, is a survey of beekeepers. Despite efforts to reach out to beekeepers nationwide, the partnership's colony loss data cannot be generalized to beekeepers who did not participate in the survey. The partnership is a collaboration of efforts across the country from research laboratories and universities in agriculture and science. It is supported by USDA's National Institute of Food and Agriculture.

<sup>3</sup>The White House, *Presidential Memorandum – Creating a Federal Strategy to Promote the Health of Honey Bees and Other Pollinators*, Office of the Press Secretary (2014).

<sup>4</sup>White House Pollinator Health Task Force, *National Strategy to Promote the Health of Honey Bees and Other Pollinators*, May 19, 2015.

<sup>5</sup>We do not discuss the second goal in this report.

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federally-supported pollinator health research, contingent upon available funding.<sup>6</sup>

The U.S. Department of Agriculture (USDA) and EPA have several programs that contribute to protecting bee health. USDA's National Agricultural Statistics Service (NASS) surveys beekeepers to document the number of active managed colonies of honey bees and honey production levels. USDA's programs for research and outreach are primarily conducted or funded by its two largest research agencies, the Agricultural Research Service (ARS) and the National Institute of Food and Agriculture (NIFA).<sup>7</sup> USDA's Farm Service Agency (FSA) and Natural Resources Conservation Service (NRCS), which oversee conservation programs for private lands, provide financial and technical support to landowners to encourage habitat conservation, including conservation intended to provide bees and other pollinators with forage<sup>8</sup> and nesting areas.<sup>9</sup> EPA plays a role in protecting bees as part of its regulation of pesticides under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).<sup>10</sup> EPA makes regulatory decisions that affect pesticides used by farmers and other landowners, as well as pesticides used by beekeepers

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<sup>6</sup>White House Pollinator Health Task Force, *Pollinator Research Action Plan*, May 19, 2015.

<sup>7</sup>We use the term outreach in this report to mean efforts to communicate with and educate stakeholders about bees. This includes communication and education performed by USDA's Cooperative Extension System. The Cooperative Extension System is a partnership between land-grant universities and USDA. Established by the Morrill Act of 1862, the Land-Grant University System is composed of more than 100 colleges and universities around the country. These institutions receive federal support and are required to provide relevant information to the public through the extension system.

<sup>8</sup>Forage refers to the food or nesting materials gathered by bees for themselves or their offspring.

<sup>9</sup>Other USDA agencies and programs may also affect bee health but are not primarily responsible for addressing it and, therefore, are not covered by the scope of this report. For example, this report does not address research by USDA's Economic Research Service or Forest Service; efforts by the Forest Service to provide bee habitat; or monitoring of bee pests and diseases by the Animal and Plant Health Inspection Service (APHIS).

<sup>10</sup>Under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), EPA registers pesticides for distribution, sale, and use in the United States and prescribes labeling and other regulatory requirements to prevent unreasonable adverse effects on the environment. To obtain a registration, a company or person (registrant) must provide data in support of registration, including tests and results, flagging any potential adverse effects to human health or the environment.

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to combat pests that infest bee hives.<sup>11</sup> In particular, EPA determines whether pesticides may cause unreasonable adverse effects to the environment, including bees and other organisms, when used in accordance with widespread and commonly recognized practice.<sup>12</sup>

In this context, you asked us to review specific USDA and EPA efforts to protect bee health. Our objectives were to evaluate (1) the bee-related monitoring, research and outreach, and conservation efforts of selected USDA agencies; and (2) EPA's efforts to protect bees through its regulation of pesticides.

To examine USDA's monitoring, research and outreach, and conservation efforts with respect to bees, we selected five USDA agencies: NASS, ARS, NIFA, NRCS, and FSA, because they have been most involved in addressing bee health issues. We reviewed the methodology of the NIFA-funded Bee Informed Partnership's national survey of commercial beekeepers on their honey bee colony losses, to assess the reliability of the survey and determined that, while the data are not generalizable to the nation, they illustrate the experiences of the respondents with respect to colony losses. We analyzed the methodology that NASS used in a 2015 survey of beekeepers about honey bee colony losses and the efforts within USDA to monitor wild, native bees. We also reviewed our prior body of work on interagency collaboration, as agencies within USDA carry out work related to bee monitoring in conjunction with other agencies; from that work, we selected practices that were related to

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<sup>11</sup>Pesticides include, among other substances, herbicides (i.e., weed killers), plant growth regulators (i.e., chemicals used to alter the expected growth, flowering, or reproduction rate of plants), insecticides (i.e., chemicals used to kill insects and other arthropods), insect growth regulators (i.e., chemicals used to disrupt the molting, maturity from pupal stage to adult, or other life processes of insects), miticides (i.e., chemicals used to kill mites that feed on plants and animals), fungicides (i.e., chemicals used to kill fungi, including blights, mildews, molds, and rusts), and nematicides (i.e., chemicals used to kill nematodes—microscopic, worm-like organisms that feed on plant roots).

<sup>12</sup>Under FIFRA, EPA must take into account both the costs and benefits of the use of any pesticide.



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challenges that we or agency officials identified and used the practices to assess interagency collaboration at USDA concerning bee monitoring.<sup>13</sup>

We analyzed funding data for ARS and NIFA from fiscal year 2008 through fiscal year 2015 and fiscal year 2008 through fiscal year 2014, respectively, to document the agencies' support for bee-related research and outreach. We selected fiscal year 2008 as the starting point to reflect 2008 Farm Bill initiatives;<sup>14</sup> data from fiscal years 2015 and 2014 were the most recent data available for ARS and NIFA, respectively. We assessed the reliability of ARS and NIFA funding data by comparing agency-provided data with data found in USDA's Current Research Information System (CRIS) and reviewing the agencies' management controls and determined that these data were sufficiently reliable for the purpose of reporting on bee-related research projects. We reviewed how ARS and NIFA categorize research data in USDA's CRIS database and compared the CRIS categories to those used in the task force strategy and research action plan. We also reviewed an evaluation of NRCS's technical assistance efforts and examined the agency's response to conclusions about the level of bee habitat conservation expertise within the agency. Further, we examined the data FSA and NRCS collect from their bee habitat conservation efforts to determine the extent to which the data could be used to evaluate the agencies' progress in meeting the task force strategy's goal to restore and enhance pollinator habitat. To assess the reliability of these data, we reviewed management controls over the information systems that maintain the data and found them sufficiently reliable for our reporting purposes. We interviewed USDA officials regarding all of these activities.

To examine EPA's efforts to protect bees, we gathered information on its regulation of pesticides under FIFRA. Specifically, we reviewed the agency's 2011 interim and 2014 final guidance for assessing the risk that

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<sup>13</sup>GAO, *Results-Oriented Government: Practices That Can Help Enhance and Sustain Collaboration among Federal Agencies*, [GAO-06-15](#) (Washington, D.C.: Oct. 21, 2005); *Managing for Results: Key Considerations for Implementing Interagency Collaborative Mechanisms*, [GAO-12-1022](#) (Washington, D.C.: Sept. 27, 2012); *Managing for Results: Implementation Approaches Used to Enhance Collaboration in Interagency Groups*, [GAO-14-220](#) (Washington, D.C.: Feb. 14, 2014).

<sup>14</sup>The Food, Conservation, and Energy Act of 2008, Pub. L. No. 110-246, 122 Stat.1651.

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pesticides posed to bees.<sup>15</sup> We also reviewed a 2012 document containing comments from EPA's FIFRA Scientific Advisory Panel regarding the agency's risk assessment framework. We examined how EPA has applied the new guidance to particular pesticides. We reviewed data and interviewed agency officials about the status of EPA's pesticide registration and registration review programs. In particular, we gathered information about pesticides that have been associated with bee kill incidents, as indicated by EPA's Ecological Incident Information System (EIIS). To assess the reliability of the EIIS data, we discussed with EPA officials the methods by which the agency collects and assesses the EIIS data and determined that, while the data had limitations that are discussed in the report, they were sufficiently reliable for the purpose of identifying pesticides potentially associated with bee kills. We also reviewed documents and interviewed agency officials regarding EPA's efforts to encourage states to develop voluntary managed pollinator protection plans.

In addition, to address both objectives, we gathered stakeholders' views on what efforts, if any, USDA and EPA could make to protect bee health. Specifically, we interviewed a nonprobability sample of stakeholders from 35 of the following types of organizations, identified through interviews with agency officials and other interested parties: farm groups, including those generally representing conventional or organic farming and commodity groups whose crops are largely pollinated by managed bees, e.g., apple and almond growers; groups representing commercial beekeepers; pesticide manufacturing companies; state government; universities; and conservation and environmental groups.<sup>16</sup> USDA and EPA reviewed the stakeholder list and made suggestions. We also obtained advice from a member of the National Academy of Sciences with extensive experience on bee and pollinator

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<sup>15</sup>*Interim Guidance on Honey Bee Data Requirements*, EPA Office of Pesticide Programs, Environmental Fate and Effects Division, October 2011. *Guidance for Assessing Pesticide Risks to Bees*, co-authored by the Office of Pesticide Programs, United States Environmental Protection Agency, Washington, D.C.; the Health Canada Pest Management Regulatory Agency, Ottawa, ON, Canada; and the California Department of Pesticide Regulation, Sacramento, CA, June 19, 2014.

<sup>16</sup>In a nonprobability sample, some units in the population have no chance, or an unknown chance, of being selected. In nonprobability sampling, a sample is selected based on knowledge of the population's characteristics or from a subset of a population. This kind of sample is not designed to produce estimates of the entire population; that is, it is not generalizable.

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research about how to achieve a balanced list of stakeholders with varied expertise and knowledge. We interviewed the stakeholders using a data collection instrument and conducted a content analysis of the stakeholders' responses, whereby we organized their comments into relevant categories. In particular, we asked stakeholders about their familiarity with agency efforts to protect bee health, as well as their views on any suggestions for efforts the agencies should make to further protect bee health. Because we used a nonprobability sample of stakeholders, their views cannot be generalized to all such stakeholder organizations but can be illustrative. In addition, the views expressed by the stakeholders do not represent the views of GAO. Further, we did not assess the validity of the stakeholders' views on what efforts USDA and EPA should make to protect bee health. For more detail on our objectives, scope, and methodology, see appendix I. We incorporated relevant stakeholders' views into our discussion of USDA and EPA efforts to protect bees and present a more comprehensive summary of their views in appendix II.

We conducted this performance audit from October 2014 to February 2016 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

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## Background

This section provides information on the role and economic value of bees, bee population trends, factors affecting bee health, effects of bee losses on agriculture and ecosystems, and the roles and responsibilities that USDA's ARS, FSA, NASS, NIFA, and NRCS, and EPA have played with respect to addressing bee health issues.

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## The Role and Economic Value of Bees

Pollinators—including honey bees, other managed bees, and wild, native bees—are critical to our nation's economy, food security, and environmental health.<sup>17</sup> Honey bees—nonnative insects introduced to the United States in the 1620s by early settlers—are the most recognizable

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<sup>17</sup>A variety of animals, such as bees, wasps, flies, butterflies, moths, bats, beetles, and birds, serve as pollinators. This report focuses on bees only.

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pollinators of hundreds of ecologically and economically important crops and plants in North America. In 2014, USDA reported that crops pollinated by honey bees directly or indirectly account for up to one-third of the U.S. diet.<sup>18</sup> The most recent study on the value of pollinators to U.S. food and agriculture was published in 2012 and estimated that, as of 2009, the total value of crops that were directly dependent on honey bee pollination, including almonds, apples, and cherries, was almost \$12 billion.<sup>19</sup> The study estimated that, also as of 2009, the total value of crops that were indirectly dependent<sup>20</sup> on bees, such as hay, sugar beets, asparagus, and broccoli, was more than \$5 billion.<sup>21</sup> In addition, according to a 2015 USDA-NASS report, honey bees produced more than \$385 million worth of honey in 2014.<sup>22</sup>

Approximately 1,500 to 2,500 commercial U.S. beekeepers manage honey bee colonies, according to an estimate by the American Beekeeping Federation.<sup>23</sup> Many commercial beekeepers travel across the country to provide pollination services for farmers' crops and to support honey production. According to the 2014 USDA report, in 2012, almonds, sunflowers, canola seed, apples, cherries, and watermelons were among the top crops that were sources of pollination service fee revenue for beekeepers.<sup>24</sup> About 1.6 million honey bee colonies—approximately 60 to

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<sup>18</sup>USDA Economic Research Service, *Fruit and Tree Nuts Outlook: Economic Insight – U.S. Pollination-Services Market*, FTS-357SA (Washington, D.C.: Sept. 26, 2014).

<sup>19</sup>N.W. Calderone, "Insect Pollinated Crops, Insect Pollinators, and U.S. Agriculture: Trend Analysis of Aggregate Data for the Period 1992–2009." *PLoS ONE* 7(5) (2012): e37235. Adjusting only for inflation between 2009 and 2015, we estimate the value of the crops that were directly dependent on honey bee pollination in 2009 to be about \$13.03 billion in constant 2015 dollars (adjusted by the Consumer Price Index).

<sup>20</sup>Crops that indirectly depend on pollination do not require pollination but are grown from seeds that result from pollination.

<sup>21</sup>Calderone (2012). The estimated value of crops indirectly dependent on honey bee pollination in 2009 is about \$6.01 billion in constant 2015 dollars (adjusted by the Consumer Price Index).

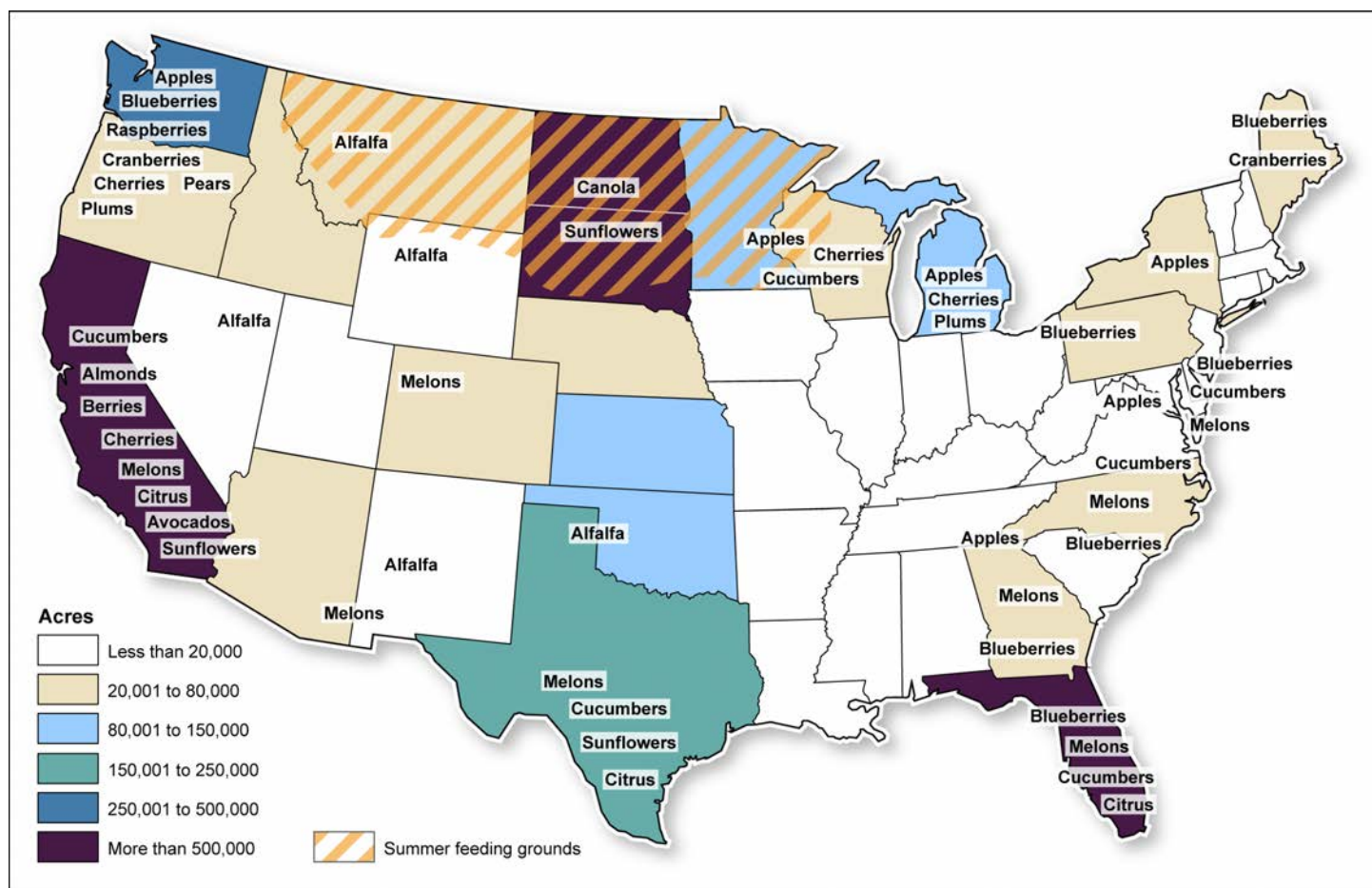
<sup>22</sup>NASS, Honey Report, March 2015.

<sup>23</sup>The American Beekeeping Federation classifies beekeepers based on the number of honey bee colonies they maintain: small-scale (less than 25 colonies), sideline (25 to 300 colonies), and commercial (more than 300 colonies and deriving most or all of their income from beekeeping).

<sup>24</sup>USDA Economic Research Service (2014).

75 percent of all U.S. commercial honey bee colonies—provide pollination services to California’s almond orchards early each spring.<sup>25</sup> Figure 1 shows the estimated acreage of crops for which beekeepers provide pollination services and the location of summer feeding grounds for commercially managed bees.

**Figure 1: Estimated Acreage of Crops Pollinated by Managed Bees in the United States**



Sources: Adapted by U.S. Department of Agriculture (USDA), Economic Research Service from Kautzmann (2011), with input from commercial beekeepers and agriculture experts, including Dr. Jeff Pettis and Dr. David Epstein, an entomologist and authority on pollinators with the USDA’s Office of Pest Management Policy; crop production acres are from USDA, National Agricultural Statistics Service, 2012 Agricultural Census, 2014; Map Resources (map). | GAO-16-220

<sup>25</sup>The Almond Board of California and USDA Economic Research Service (2014).

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In addition to honey bees, certain managed bees and wild, native bees also provide valuable pollination services. Whereas honey bees comprise an estimated 98 percent of managed bees in the United States, other managed bee species—including bumble bees, alfalfa leafcutting bees, and orchard mason bees—comprise the remaining 2 percent, according to a representative of the Pollinator Stewardship Council.<sup>26</sup> These other managed bees pollinate alfalfa, almonds, apples, cherries, and tomatoes. Wild, native bee species may also pollinate agricultural crops. In 2009, crops directly and indirectly dependent on pollination by other managed bees; wild, native bees; and other insects were valued at almost \$10 billion according to the 2012 study of the value of pollinators to U.S. food and agriculture.<sup>27</sup> In addition, a 2007 National Research Council study found that wild, native bees provide most of the pollination in natural plant communities, which contributes to valuable ecosystem services, including water filtration and erosion control.<sup>28</sup>

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## Bee Population Trends

According to the White House Task Force's 2015 Pollinator Research Action Plan, in 2006, some beekeepers in the United States began to notice unusually high mortality among their honey bee colonies over the winter months. From 2006 to 2014, beekeepers who responded to the Bee Informed Partnership's nongeneralizable national survey of managed honey bee colony losses reported that an average of about 29 percent of their bee colonies died each winter. Those losses exceeded the approximately 13 to 19 percent winter loss rate that beekeepers indicated in the surveys were acceptable. Furthermore, when winter losses are combined with losses at other times of the year, total annual losses can be higher. For example, a preliminary report from the Bee Informed Partnership indicated that beekeepers who responded reported total

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<sup>26</sup>The mission of the Pollinator Stewardship Council is to defend managed and native pollinators vital to a sustainable and affordable food supply from the adverse impact of pesticides.

<sup>27</sup>Calderone 2012. Adjusting only for inflation from 2009 to 2015, we estimate that the value of crops directly dependent on bees and insects other than honey bees in 2009 to be about \$3.84 billion in constant 2015 dollars (adjusted by the Consumer Price Index). In addition, we estimate the value of crops indirectly dependent on bees and insects other than honey bees in 2009 to be about \$7.15 billion in constant 2015 dollars (adjusted by the Consumer Price Index).

<sup>28</sup>National Research Council, *Status of Pollinators in North America*, National Academies Press (Washington, D.C., 2007).

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annual losses of more than 40 percent of colonies from April 2014 through March 2015. Whereas nongeneralizable data on short-term losses in honey bee colonies are available, the status of other managed bees and most of the wild, native bee species in the United States is less well-known.<sup>29</sup>

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## Factors Affecting Bee Health

According to the White House Task Force's strategy and research action plan, intensive public and private research in the United States and abroad over the past 8 years has shown that no single factor is responsible for the general problems in pollinator health, including the loss of honey bee colonies or declines in other bee populations. The task force stated that bee health problems are likely caused by a combination of stressors.<sup>30</sup> Some of these stressors, in no particular order, include

- habitat loss, degradation, and fragmentation, including reduced availability of sites for nesting and breeding;
- poor nutrition, due in part to decreased availability of high quality and diverse forage;
- pests (e.g., the mite *Varroa destructor*<sup>31</sup>) and disease (e.g., viral, bacterial, and fungal diseases);
- pesticides and other environmental toxins; and
- migratory stress from long-distance transport.

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## Effects of Bee Losses on Agriculture and Ecosystems

Continued losses of honey bees; other managed bees; and wild, native bees threaten agricultural production and the maintenance of natural plant communities. Commercial beekeepers are concerned that honey bee colony losses could reach an unsustainable level for the industry. According to a 2014 USDA report, the cost of honey bee almond pollination services is believed to have risen in connection with the

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<sup>29</sup>Pollinator trends are generally tracked by comparing current population levels to historical population levels. While assessments of honey bee status are measured in part by examining the number of managed hives registered for honey production, assessments of native bee status rely on disparate historical collection data and limited contemporary surveys.

<sup>30</sup>In addition to the impacts of each individual stressor, stressors interact and, in some cases, act together to impair pollinator health.

<sup>31</sup>The *Varroa* mite is an external parasite that feeds on honey bee blood.

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increased cost of maintaining hives in the midst of industry-wide overwintering losses.<sup>32</sup> Officials we interviewed from a commercial beekeeping organization said that, for beekeepers, meeting the growing demand for pollination services in agricultural production has become increasingly difficult, particularly as a result of bee colony losses. Although the number of managed honey bee colonies has been relatively consistent since 1996, ranging from about 2.4 to 2.7 million colonies, the level of effort by the beekeeping industry to maintain colony numbers has increased, according to the White House Pollinator Health Task Force's strategy.<sup>33</sup> For example, beekeepers face increasing production costs, which include sugar, protein, medications, and miticides (chemicals that kill the mites that can infest bee hives). Furthermore, when winter colony losses are high, beekeepers may compensate for these losses by splitting one colony into two, supplying the second colony with a purchased queen bee and supplemental food to build up colony strength. Using this method, the commercial honey beekeeping industry has generally been able to replenish colonies lost over the winter, but at a cost. These increased maintenance costs can result in increased rental fees for farmers renting the hives.

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## Specific Roles and Responsibilities of USDA and EPA in Addressing Bee Health Issues

Five USDA agencies within the scope of our review—NASS, ARS, NIFA, FSA, and NRCS—as well as EPA have specific roles and responsibilities with respect to addressing bee health issues.

USDA has surveyed beekeepers in the United States since the late 1930s to determine the number of honey bee colonies and the amount of honey produced. The survey, now conducted by NASS, is called the Bee and Honey Inquiry. NASS maintains a list of beekeeping operations in the nation and has been surveying beekeepers in all states except Alaska since the 1970s to gather data on honey bee colonies, including the number of colonies producing honey, total pounds of honey produced, and total value of production by state for a production year.

ARS, USDA's largest research agency, conducts research within several of its laboratories that could protect bee health. NIFA, USDA's primary

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<sup>32</sup>USDA Economic Research Service (2014).

<sup>33</sup>White House Pollinator Health Task Force, *National Strategy to Promote the Health of Honey Bees and Other Pollinators*, May 19, 2015.



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agency providing research grants to universities, provides competitive grants to conduct research related to bee health and to disseminate the results through the Cooperative Extension System. CRIS, which is managed by NIFA, contains information on ARS and NIFA research and outreach. CRIS provides documentation and reporting for agricultural, food science, human nutrition, and forestry research, education and extension activities for USDA, including those related to bee health.

FSA and NRCS oversee conservation programs that, among other things, help provide habitat for bees. FSA administers the Conservation Reserve Program (CRP), which implements long-term rental contracts with farmers to voluntarily remove certain lands from agricultural production and to plant species that will improve environmental health and quality, such as improving forage plantings for bees and other pollinators. The long-term goal of the program is to reestablish valuable land cover to help improve water quality, prevent soil erosion, and reduce loss of wildlife habitat. NRCS administers the Environmental Quality Improvement Program (EQIP), which implements short- to long-term contracts with farmers to voluntarily implement practices to conserve natural resources and deliver environmental benefits, such as created wildlife habitat, which may benefit bees. In addition, NRCS administers components of the Agricultural Conservation Easement Program, in which plantings may benefit bees or other pollinators.<sup>34</sup> NRCS has primary responsibility for providing to landowners the technical assistance needed to plant the pollinator-friendly habitats. NRCS assists farmers through a network of staff at headquarters, state, and county offices. In addition to supporting overall pollinator habitat across the nation, FSA and NRCS are focusing CRP and EQIP pollination resources on five upper Midwest states (Michigan, Minnesota, North Dakota, South Dakota, and Wisconsin) that are home to a significant percentage of honey bee colonies during the summer months.

Under FIFRA, EPA is responsible for regulating pesticides, including those used on crops and other plants and those used by beekeepers to

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<sup>34</sup>The Agricultural Conservation Easement Program provides financial and technical assistance to help protect wetlands, agricultural uses, and grazing and related conservation values on eligible lands. Under the Agricultural Land Easements component, NRCS helps American Indian tribes, state and local governments, and nongovernmental organizations protect agricultural lands by limiting nonagricultural uses on the land. Under the program's Wetlands Reserve Easements component, NRCS helps to restore, protect, and enhance enrolled wetlands.

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combat bee pests. As part of this responsibility, EPA reviews applications from pesticide manufacturers seeking to obtain a registration for new pesticides or new uses of existing pesticides. Under FIFRA, pesticide registrants are required to report to EPA any information related to known adverse effects to the environment caused by their registered pesticides.<sup>35</sup> In addition, the Food Quality Protection Act of 1996 amended FIFRA to require that EPA begin a review of the registrations of all existing pesticide active ingredients. As further amended in 2007 by the Pesticide Registration Improvement Renewal Act, FIFRA requires all reviews be completed by October 2022. According to EPA's website, the FIFRA requirement applies to about 1,140 pesticides. EPA has chosen to review the registration of all of these pesticides in about 740 "cases." A case may cover more than one pesticide active ingredient that are closely related in chemical structure and toxicological profile. The Pesticide Registration Improvement Act of 2003 (PRIA) amended FIFRA to require that EPA issue annual reports containing a review of its progress in carrying out its responsibilities for reviewing new and registered pesticides.

Other agencies, including some within USDA, also have programs related to bee health. For example, USDA's Forest Service has conducted some research and monitoring and conserves habitat to protect bee populations. The U.S. Geological Survey (USGS) within the Department of the Interior (Interior) has monitored wild, native bee populations.<sup>36</sup> Interior's National Park Service and the National Science Foundation have also funded research on bee health, and Interior's Bureau of Land Management is making changes to land-management programs by incorporating native, pollinator-friendly plants in its management practices.<sup>37</sup>

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<sup>35</sup>In 1994, EPA created EIIIS, its database on adverse pesticide incidents, to store information extracted from incident reports from pesticide registrants and others.

<sup>36</sup>The U.S. Geological Survey is an agency within the Department of the Interior that provides scientific information on, among other things, the health of the U.S. environment and ecosystems.

<sup>37</sup>Other agencies within the White House Pollinator Health Task Force may also have taken actions to protect bee health. However, these agencies were generally not the focus of this review.

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## Selected USDA Agencies Conduct Monitoring, Research and Outreach, and Conservation to Protect Bees, but Limitations Exist within Those Efforts

Five selected USDA agencies conduct monitoring, research and outreach, and conservation to protect bees, but limitations within those efforts hamper the agencies' ability to protect bee health. In 2015, USDA agencies increased honey bee colony monitoring to better estimate honey bee colony losses nationwide, but as a co-chair of the White House Pollinator Health Task Force with EPA, the department has not worked with task force partners to coordinate a native bee monitoring plan. In addition, USDA has conducted and funded research and outreach, primarily by ARS and NIFA, on the health of different categories of bees, including honey bees and, to a lesser extent, other managed and wild, native bees, but CRIS, which tracks USDA-funded research and outreach, is not currently designed to enable tracking or searching of projects by bee category. Furthermore, USDA's FSA and NRCS have increased funding and taken other actions to promote bee habitat, but neither agency has a method to count all of the acres that landowners have restored or enhanced to benefit bees and other pollinators, and limitations in their evaluation of those actions may hinder their conservation efforts.

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## USDA Agencies Increased Honey Bee Colony Monitoring in 2015 but Have Not Worked with Federal Partners to Coordinate a Native Bee Monitoring Plan

USDA agencies have taken some actions to increase monitoring of honey bees, other managed bees, and wild, native bees, but USDA, which co-chairs the White House Pollinator Health Task Force with EPA, has not worked with its partners on the task force to coordinate a native bee monitoring plan.

### Monitoring Honey Bees

In April 2015, NASS, which conducts USDA bee surveys, initiated colony loss surveys to provide quarterly estimates of honey bee colony losses in the United States. NASS officials told us that the results of these surveys will improve data on colony losses from prior USDA-funded surveys. According to the task force's strategy, federal agencies plan to use data from these surveys to assess progress toward the strategy's goal of reducing winter honey bee colony losses to no more than 15 percent by 2025.<sup>38</sup> USDA has conducted surveys of beekeepers in the United States

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<sup>38</sup>The Task Force stated it will develop additional goal metrics for summer and total annual colony losses.

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to track the number of honey bee colonies in the country since the late 1930s, but those surveys have not gathered beekeepers' observations or data about bee health problems.

Before NASS's new surveys, NIFA provided most of the funding for the Bee Informed Partnership to survey beekeepers about colony losses and honey bee health from 2006 through 2015. The surveys showed that, on average, about 29 percent of respondents' honey bee colonies have been dying over the winter, but the results cannot be generalized beyond the survey respondents. The partnership has used a variety of methods to reach out to all beekeepers in the country and in recent years received responses from over 6,000 beekeepers.<sup>39</sup> However, the partnership has not calculated or estimated response rates to the surveys and has not reported whether nonrespondents might differ from the respondents in terms of survey answers. Because of this, the results cannot represent beekeepers in general.

In a letter to the Office of Management and Budget (OMB) commenting on the new NASS survey, the partnership stated that NASS is well-equipped to take over the honey bee colony loss surveys with its new quarterly and annual surveys. According to NASS officials, improvements will be possible in the new NASS surveys in part because NASS maintains a comprehensive list of beekeepers from which it can select a random sample. According to an agency document and official, the quarterly survey will capture data from beekeeping operations with five or more colonies, and operations with fewer than five colonies will receive one annual survey in December. NASS officials said that their estimates of U.S. colony losses during 2015 will be available in May 2016. NASS has also added questions to the annual Bee and Honey Survey on the costs associated with colony maintenance, which may include costs associated with colony losses.

In addition, USDA's Animal and Plant Health Inspection Service (APHIS) has coordinated a national survey of honey bee pests and diseases annually since 2009 with the University of Maryland and ARS. However, that survey does not provide estimates of colony losses in the United States.

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<sup>39</sup>In the 2012-2013 survey, for example, the partnership sent e-mail invitations using a variety of e-mail lists and placed advertisements and notices in beekeeping journals and social media.

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## Monitoring Other Managed Bees

According to NASS officials, NASS does not conduct surveys to estimate populations or colony losses of other managed bees, such as bumble bees, alfalfa leafcutting bees, and orchard mason bees, because NASS does not consider them to be within the scope of their responsibilities for farm livestock commodities. USDA's ARS and NIFA conduct and fund limited monitoring activities in agricultural settings to estimate populations and health issues for these other types of managed bees. However, the research action plan established as a priority engaging NASS in collecting data on the commercial sales of nonhoney bee pollinators to understand the economic value of alternative pollinators. To address this priority, NASS included in a new survey on the cost of pollination—which largely focuses on honey bees—questions on the cost to agricultural producers for products such as wildflowers and pollination by other managed bees and native bees. NASS began data collection for this new survey in December 2015.

## Monitoring Wild, Native Bees

USDA agencies, including ARS and NIFA, have conducted and supported limited monitoring of wild, native bees, according to USDA documents and officials. For example, one NIFA-funded project at Pennsylvania State University begun in 2010 seeks to establish baseline biodiversity and abundance data for native bees in and adjacent to Pennsylvania orchards, determine which species are pollinators, and quantify their relative significance and economic importance, according to the project summary in CRIS. In addition, in 1997, ARS's laboratory in Logan, Utah, began monitoring wild, native bees in parks, forests, and other areas in the United States as part of their efforts to develop alternative pollinators for U.S. agriculture, according to ARS scientists. In one project, ARS has annually conducted surveys of bumble bee populations for 5 to 8 years at five sites in Nevada, Oregon, and Utah. The goal is to provide insight into natural population dynamics of native bees in native habitat and identify bumble bee population trends by species on the basis of 10 years of surveys. According to the project description, bumble bee declines have been documented over the last decade, but long-term studies of bumble bee community dynamics are lacking, and such monitoring will help determine whether a fluctuation in a bumble bee population is a natural cycle or something unusual.

In its 2007 report on the status of pollinators, the National Research Council stated that wild, native bees are arguably the most important and

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least studied groups of pollinators.<sup>40</sup> The report recommended establishing a baseline for long-term monitoring, and a coordinated federal approach with a network of long-term pollinator-monitoring projects that use standardized protocols and joint data-gathering interpretation. The report also stated that pollinator monitoring programs in Europe have effectively documented declines in pollinator abundance, but there is no comparable U.S. monitoring program. Stakeholders from pesticide manufacturing, university research, and conservation/environmental groups we interviewed said that USDA should take additional actions to monitor wild, native bees because current monitoring is insufficient and will not facilitate provision of trends in these bee populations. Stakeholders from some groups suggested that USDA and other agencies, such as USGS, should coordinate federal monitoring efforts. A stakeholder from a university said that USDA should develop a coordinated assessment policy for native bees to provide information on their status because, without such a policy, agencies will not know which species are declining, endangered, or extinct.

The 2014 presidential memorandum on pollinators called for the White House Task Force to assess the status of native bees and other pollinators. The subsequent White House Task Force strategy and research action plan state that native bees are affected by habitat loss and degradation, and that there is strong evidence, for some species, that such factors have led to population declines. For example, the research action plan states that collapses in bumble bee species have been statistically documented, but little is known about trends for wild, native bees, most of which are solitary, rather than social, bees. The research action plan also states that (1) the scope of native bee monitoring is limited by available funding, (2) assessments of native bees' status rely on disparate historical collection data and limited contemporary surveys, and (3) a survey of bees in various ecosystems is needed to determine the status of native pollinators.

The White House Task Force's research action plan identified several priority actions, with corresponding lead and support agencies responsible for different aspects of the monitoring. For example, the research action plan identifies ARS, USGS, and the Fish and Wildlife

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<sup>40</sup>National Research Council, *Status of Pollinators in North America*, National Academies Press (Washington, D.C., 2007).

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Service as three of the lead agencies for the priority actions to develop baseline status data and to assess trends in pollinator populations. And the research action plan identifies NIFA, NASS, the National Science Foundation, the Forest Service, and the National Park Service as primary support agencies for these priority areas. Although the research action plan identifies which agencies have responsibility for monitoring pollinators, it does not identify the development of a mechanism, such as a monitoring plan, to coordinate the efforts of those agencies related to native bees. As of September 2015, USDA did not have plans to work with task force members to coordinate development of such a mechanism for wild, native bees. Some officials said that USDA has not coordinated with other task force agencies to develop a wild, native bee monitoring plan because they were developing the broader task force strategy. The research action plan also does not define and articulate the common outcome or identify specific roles and responsibilities for each lead or support agency. Key practices for agency collaboration that we identified in an October 2005 report call for agency staff to work together across agency lines to define and articulate the common federal outcome or purpose they are seeking to achieve that is consistent with their respective agency goals and mission. Another key practice we identified calls for collaborating agencies to work together to define and agree on their respective roles and responsibilities, including how the collaborative effort will be led.<sup>41</sup>

In addition, we identified, in a February 2014 report, key practices for agency collaboration that call for establishing shared outcomes and goals that resonate with, and are agreed upon, by all participants and are essential to achieving outcomes in interagency groups.<sup>42</sup> Furthermore, although the research action plan mentions stakeholders and partnerships, it does not articulate how they will be included in addressing priority actions related to monitoring native bees. In September 2012, another key practice we identified calls for ensuring that the relevant stakeholders have been included in the collaborative effort. This collaboration can include other federal agencies, state and local entities, and private and nonprofit organizations.<sup>43</sup> By developing a mechanism,

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<sup>41</sup> [GAO-06-15](#).

<sup>42</sup> [GAO-14-220](#).

<sup>43</sup> [GAO-12-1022](#).

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such as a monitoring plan for wild, native bees that would (1) establish roles and responsibilities of lead and support agencies and their shared outcomes and goals and (2) obtain input from relevant stakeholders, there is better assurance that a coordinated federal effort to monitor bee populations will be effective. One senior USDA official stated that coordinating with the other task force agencies to develop a wild, native bee monitoring plan would be very important for gathering data to show the status of wild, native bees in the future. Key USDA and USGS officials with bee-related management responsibilities agreed that developing such a monitoring plan would help them establish a consistent approach across their agencies. The officials also said that USDA and other agencies should establish a team of federal scientists to coordinate the development of a federal monitoring plan for wild, native bees that would establish monitoring goals and standard methods and involve state and other stakeholders. Some USDA and USGS officials said that without a team to coordinate a monitoring plan, individual agency efforts may be ineffective in providing the needed information on trends in wild, native bees in the United States.

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### USDA Bee Research and Outreach Have Focused Primarily on Honey Bee Health, but Limitations in Its Research Information System Hinder Efforts to Track Research Projects

USDA has conducted and funded research and outreach, primarily by ARS and NIFA, on the health of different categories of bees, including honey bees and, to a lesser extent, other managed and wild, native bees, but CRIS, which tracks USDA-funded research and outreach, does not currently facilitate tracking or searching of projects by bee category.<sup>44</sup> ARS's honey bee projects have focused on projects for many health concerns. For example, the ARS laboratory in Baton Rouge, Louisiana, has focused for many years on breeding honey bees that are resistant to *Varroa* mites. Also, ARS's laboratory in Beltsville, Maryland, has conducted research to develop management strategies for diagnosing and mitigating disease, reducing the impacts of pesticides and other environmental chemicals, and improving nutrition. ARS's laboratory in Logan, Utah, is identifying how farmers may use different pollinators, including managed and wild, native bees. This research includes

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<sup>44</sup>According to USDA officials, other USDA agencies, such as the Forest Service, have not conducted as much research on bees as ARS and NIFA. According to Forest Service officials, the agency conducts research on agroforestry, forestry, ecological, full life-cycle, and landscape-scale factors of bee sustainability. However, our review did not examine Forest Service research activities.



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developing methods for mass production, use, and disease control for a selection of bees.

ARS scientists have regularly disseminated the results of their research at national, regional, state, and local bee-related conferences and events. ARS officials have also conducted outreach at meetings to provide information to commodity growers, such as the Almond Board of California. One ARS scientist noted that he had attended 27 state and other types of beekeeper meetings over the past 5 years. Another ARS scientist told us that he spends about 25 percent of his time conducting outreach with beekeepers. In addition, ARS scientists have published dozens of articles summarizing their research results in scientific journals.

From fiscal year 2008 through fiscal year 2015, ARS obligated \$88.5 million for projects focused on bee health and \$1.6 million for projects on the effect of pollination by different types of bees on crop or plant production.<sup>45</sup> Of the \$88.5 million obligated, our analysis determined that \$72.6 million was for projects primarily focused on honey bee health, an additional \$6.3 million was for projects with a combined focus on the health of honey bees and other bees, and \$9.6 million was for projects focused only on other managed bees or wild, native bees.<sup>46</sup> According to ARS officials, all ARS funding for research on wild, native bees has been for the purpose of developing new uses for managed bees in commercial agriculture.

Unlike ARS, which itself conducts research, NIFA provides funds for research through grants. For fiscal years 2008 through 2014, NIFA's competitive grants for research on bee health were largely focused on honey bees, with some efforts focused on managed and wild, native

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<sup>45</sup>Research on pollinator effectiveness examines the effect of pollination by different types of bees on crop or plant production. ARS also obligated \$1.7 million to other bee-related research topics, including the effect bees have on gene flow from genetically modified plants to other plants.

<sup>46</sup>We analyzed ARS projects to determine whether they addressed bee health or pollinator effectiveness. We then determined whether the projects on bee health addressed (1) honey bees only, (2) honey bees and other bees, or (3) other managed bees and wild, native bees. See appendix I for details of our methodology.

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bees.<sup>47</sup> For example, NIFA obligated funds for a 2012 grant to a team of scientists and outreach specialists at Michigan State University, the University of California-Davis, and other institutions that works with growers to develop best practices for pollinator habitat enhancement and farm management practices to bolster managed and wild, native bee populations. The project is examining the performance, economics, and farmer perceptions of different pollination strategies in various fruit and vegetable crops, according to the project website. These strategies include complete reliance on honey bees, farm habitat manipulation to enhance suitability for native bees, and use of managed, native bees alone or in combination with honey bees.

For fiscal years 2008 through 2014, NIFA obligated \$29.9 million on competitive grant projects focused primarily or partially on bee health, and \$11.6 million on projects focused on pollination effectiveness.<sup>48</sup> Of the \$29.9 million, our analysis of individual grant project objectives and descriptions determined that NIFA provided \$16.7 million to projects on honey bee health, \$9.8 million to projects on the health of honey bees and other bees, and \$3.4 million to projects on the health of wild, native bees.<sup>49</sup>

In addition to funding competitive grants, NIFA provides support for bee research at land-grant institutions through capacity grants to the states on

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<sup>47</sup>NIFA offers competitive grants to institutions and other entities to enable USDA to (1) attract a wide pool of applicants to work on agricultural issues of national interest and (2) select the highest quality applications submitted by highly qualified individuals, institutions, or organizations.

<sup>48</sup>NIFA also provided \$1.0 million for research on other bee-related issues, including the effect of bees on gene flow from genetically modified plants to other plants.

<sup>49</sup>We analyzed NIFA-funded projects to determine whether they addressed bee health or pollinator effectiveness. We then determined whether the projects on bee health addressed (1) honey bees only, (2) honey bees and other bees, or (3) other managed bees and wild, native bees. Because NIFA's database does not identify what percentage of the obligations the agency directed to each project topic, the obligations were for projects that primarily or partially addressed these topics and categories of bees, so some of these projects included nonbee-related research. See appendix I for details of our methodology.

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the basis of statutory formulas.<sup>50</sup> From fiscal year 2008 through fiscal year 2014, these institutions expended \$10.7 million in NIFA grants for research related to bees. Furthermore, state institutions have used NIFA capacity grants to support bee-related extension and education activities through the Cooperative Extension System, such as teaching best management practices to beekeepers, according to an agency budget official. However, because NIFA and its partners do not track capacity grant funding related to extension activities by subject, we were not able to determine the amount of extension funding dedicated to bee-related activities. In addition, according to estimates by the Economic Research Service, overall research funding has declined in inflation-adjusted dollars, from 1980 to 2014, which may have resulted in a reduction in the number of cooperative extension bee specialists.<sup>51</sup> According to NIFA officials, about 28 bee specialists are currently supported by the Cooperative Extension System in the United States and its territories. That number has declined from an estimated 40 extension bee specialists in 1986, largely due to funding reductions. In addition, according to NIFA officials, the reduction in extension funding may have reduced expertise in related areas, including Integrated Pest Management (IPM), which focuses on long-term prevention of pests or their damage through a combination of techniques, such as biological control, habitat manipulation, modification of cultural practices, and use of resistant varieties, paired with monitoring to reduce unnecessary pesticide applications. IPM extension agents routinely advise farmers on alternatives to pesticides and pesticide application methods that reduce risk to bees and other pollinators.

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<sup>50</sup>Through several program authorities, NIFA provides funds for research and extension to land-grant colleges and universities, schools of forestry, and schools of veterinary medicine. These are known as capacity grants. Capacity funding helps ensure that the land-grant university system and other partners maintain the capacity to conduct research, education, and extension activities. Local or regional university leaders decide which specific projects are to be supported by an institution's formula grant allotment. The institutions receiving the funding determined how much of their capacity funds they wanted to expend for bee-related projects. The institutions categorized these projects as bee-related, and NIFA confirmed the categorization.

<sup>51</sup>Sun Ling Wang, "Cooperative Extension System: Trends and Economic Impacts on U.S. Agriculture," *Choices*, Agricultural & Applied Economics Association, 1st Quarter of 2014. The author, an economist with USDA's Economic Research Service, used the service's research price index as the deflator and updated her findings through 2014 for GAO.

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USDA's CRIS provides overall funding data and descriptions of bee-related research and outreach but does not facilitate tracking projects and funding by the categories of bees addressed by the White House Task Force's strategy and research action plan. In addition, the research action plan identifies key research needed to fill knowledge gaps for honey bees; other managed bees; wild, native bees; and other pollinators. However, the three categories for bees and other pollinators used in CRIS to code USDA projects are "honey bees," "bees, honey and other pollinators," and "other pollinators," so that bee-related research projects that could help fill the identified knowledge gaps may not be easily identified in CRIS. For example, NIFA guidance on reviewing certain competitive grant applications states that national program leaders must check CRIS to determine if the proposed work has already been funded by NIFA or ARS and to ensure that it is not unnecessarily repeating work not yet published. In addition, ARS guidance directs the agency's scientists to search CRIS for potentially duplicative projects when preparing project plans. Because projects may have multiple objectives, it would be time-consuming to readily identify and track completed and ongoing bee-related research by category of bee. Both the NIFA staff and the researchers would have to search the codes for the up to three different CRIS categories and then review the descriptions and the multiple objectives for all projects with those codes.

By updating the categories of bees in CRIS to reflect the categories of bees discussed in the White House Task Force's strategy and research action plan, USDA could increase the accessibility and availability of information about USDA-funded research on bees. Senior USDA officials said that CRIS would be more useful within the department and to others seeking to identify bee-related research projects and project funding by topic if USDA revised it to indicate the categories of pollinators that are consistent with the research action plan. ARS and NIFA officials agree improvements to CRIS could help managers track research spending over time by the categories of bees identified in the research action plan. One NIFA official estimated that revisions to CRIS could be done cost-effectively using minimal staff time.

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FSA and NRCS Have Taken Actions That Promote Bee Habitat Conservation, but Limitations Could Hinder the Agencies' Conservation Efforts

FSA and NRCS Have Taken Many Actions That Promote Bee Habitat Conservation

FSA and NRCS have taken many actions to promote bee habitat conservation since 2008, but limitations in research, tracking of pollinator habitat, and evaluation of the agencies' conservation efforts could hinder those efforts.

The Farm Bill of 2008 authorized USDA to encourage the use of conservation practices that benefit native and managed pollinators and required that USDA review conservation practice standards to ensure the completeness and relevance of the standards to, among other things, native and managed pollinators. In August 2008, and again in May 2015, NRCS in partnership with the Xerces Society and San Francisco State University published guidance identifying several conservation programs,<sup>52</sup> including CRP, EQIP, and NRCS's Conservation Stewardship Program (CSP)<sup>53</sup> that could be used to promote pollinators on working lands.<sup>54</sup> This guidance identified 37 practices to create or enhance pollinator habitat by providing more diverse sources of pollen and nectar, and shelter and nesting sites, among other things.

According to FSA and NRCS officials, CRP and EQIP are the largest USDA private land conservation programs benefiting pollinators. Participants voluntarily sign up or enroll in FSA or NRCS conservation programs and in specific practices within those programs. As of August 2015, FSA had over 132,000 acres enrolled in pollinator-specific CRP practices, with a remaining allocation of 67,000 acres that could be

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<sup>52</sup>The Xerces Society for Invertebrate Conservation is a nonprofit organization that protects wildlife through the conservation of invertebrates and their habitat. The organization partners with NRCS to support pollinator conservation efforts.

<sup>53</sup>Through CSP, participants take additional steps to improve resource condition including soil quality, water quality, water quantity, air quality, and habitat quality, as well as energy. CSP provides two types of payments through 5-year contracts: annual payments for installing new conservation activities and maintaining existing practices; and supplemental payments for adopting a resource-conserving crop rotation.

<sup>54</sup>NRCS, the Xerces Society for Invertebrate Conservation, and San Francisco State University, *Using Farm Bill Programs for Pollinator Conservation*, August 2008. This information was updated in 2015; NRCS, the Xerces Society for Invertebrate Conservation, and San Francisco State University, *Using Farm Bill Programs for Pollinator Conservation*, May 2015.

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enrolled under these practices. In 2014, FSA announced an additional \$8 million in incentives to enhance CRP cover crops to make them more pollinator-friendly. FSA is offering incentives to CRP participants in the five states that are home to most honey bee colonies during the summer—Michigan, Minnesota, North Dakota, South Dakota, and Wisconsin—to establish pollinator habitat. According to an FSA official, because CRP participants began to implement habitat enhancements in fiscal year 2015, FSA does not yet have information on the number of acres of habitat established. Also, within CRP, the State Acres for Wildlife (SAFE) initiative allows agricultural producers to voluntarily enroll acres in CRP contracts for 10 to 15 years. In exchange, producers receive annual CRP rental payments, incentives, and cost-share assistance to establish, improve, connect, or create higher-quality habitat. As of November 2015, the SAFE initiative was providing pollinator habitat in Michigan, Ohio, and Washington. For example, the goal of the Michigan Native Pollinators SAFE project is to enroll 2,500 acres of enhanced habitat over the next 5 years to benefit native pollinators.

In addition, in fiscal year 2014, NRCS provided more than \$3.1 million in technical and financial assistance to EQIP participants in the five states that are home to most honey bee colonies during the summer to implement conservation practices that would provide pollinator habitat. This funding led to over 220 contracts with participants to establish about 26,800 acres of pollinator habitat, according to NRCS data. NRCS made \$4 million available in fiscal year 2015 through EQIP for honey bee habitat. NRCS also funds other conservation programs that can benefit bees and other pollinators. For example, the CSP provides financial and technical assistance for participants whose operations benefit pollinators. From 2012 through 2014, 17,500 acres were enrolled in one beneficial CSP practice intended to improve habitat for pollinators and other beneficial insects. Another CSP practice for grazing management may benefit pollinators, but the acreage that benefits pollinators is unknown, according to an NRCS official. In addition, NRCS offices in several states, including Montana and South Dakota, seek to benefit pollinators with upland habitat restoration funded by the Wetlands Reserve Program.

NRCS and FSA have taken steps to provide information to field offices, agricultural producers, and others that is useful for pollinator habitat conservation programs. For example, in collaboration with the Xerces Society and academic partners, NRCS has revised and expanded lists of plants that benefit bees and technical guidance for conserving pollinator forage. The NRCS Conservation Innovation Grants program has supported several projects across the country designed to demonstrate

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the value of habitat for pollinators, as well as to expand and improve NRCS's capacity to establish and monitor high-quality bee forage sites. The task force's strategy notes that FSA is working collaboratively with NRCS to promote the use of more affordable, pollinator-friendly seed mixes on CRP land. Some NRCS Plant Materials Centers—which evaluate plants for conservation traits and make them available to commercial growers who provide plant materials to the public—have pollinator forage demonstration field trials under way to determine and demonstrate the effectiveness of forage planted for pollinators. In addition, FSA, NRCS, and Interior's USGS and Fish and Wildlife Service have funded a website that provides information on plant-pollinator interactions to help agencies improve pollinator seed mixes for programs such as CRP and EQIP, according to a USGS official. USGS manages this website, known as the Pollinator Library, to provide information on the foraging habitat of pollinating insects with the goal of improving their habitat.<sup>55</sup> The Pollinator Library is to help users determine which flowers that various insects, including native bees, prefer. The website includes a search feature so users can determine, for example, what types of pollinators have been found on different plant species, by state and land type (such as CRP land). Knowing which flowers pollinators prefer is useful to agencies creating seed mixes for CRP and EQIP habitat enhancement efforts.

Limitations in Research, Tracking Acres of Pollinator Habitat, and Evaluation Could Hinder the Agencies' Conservation Efforts

While USDA agencies have taken steps to improve bee habitat, according to USDA officials and documents, limitations related to (1) research on bee habitat and forage, (2) tracking acres of restored or enhanced pollinator habitat, and (3) evaluating NRCS and FSA conservation efforts, could hinder conservation efforts.

### **Research on Habitat and Forage**

As part of the task force's strategy and research action plan, federal officials evaluated completed research and determined that additional research on bee forage and habitat is needed to support NRCS, FSA, and other entities' conservation efforts. The task force's research action plan notes that there is much more to learn about the relationships between plants and pollinators, including

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<sup>55</sup> [www.npwrc.usgs.gov/pollinator](http://www.npwrc.usgs.gov/pollinator).

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- identifying habitat with the greatest potential for pollinator benefits;
  - developing locally-adapted plant mixes to provide resources for pollinators throughout the year;
  - designing a means for properly collecting, processing, storing, and germinating sufficient seeds for restoration; and
  - developing new concepts and techniques to understand how to establish a broad mix of plants required for restoration based on different factors—e.g., cost-effectiveness and site properties.

In addition, the research action plan identifies priority research actions for federal agencies. For example, one priority action is developing a science-based plant selection decision support tool to assist land managers. According to the research action plan, this tool would help land managers use the most effective and affordable plant materials currently commercially available for pollinator habitat in wildland, agricultural, or urban areas. The strategy for carrying out this action in 2 to 3 years, according to the research action plan, is to identify existing science capacity to produce the decision-support tool. The research action plan identifies ARS, NRCS, and USGS as able to provide collaborative leadership for this action within the Plant Conservation Alliance (PCA).<sup>56</sup> Another priority action is developing a system for monitoring the use of native plant materials.<sup>57</sup> According to the research action plan, the strategy for this action is within 2 years to develop an interagency, online, searchable database to collect and analyze relevant data efficiently (e.g., species, plant material type, location, acreage, year, establishment, impacts on pollinators) to evaluate the use of native plant materials. The research action plan identifies ARS and NRCS as sharing

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<sup>56</sup>The research action plan identifies USDA and Interior as members of the Plant Conservation Alliance (PCA), a collaborative partnership among 12 federal agencies and almost 300 nonfederal cooperators. PCA, through its proposed Interagency Seed Strategy, proposes similar research. According to the research action plan, research coordinated through the PCA framework could ensure focus, optimize resources, and enhance dissemination of results.

<sup>57</sup>According to the research action plan, the federal government currently lacks a mechanism for tracking deployment of native plants, the long-term success of those deployments, and their benefit(s) to pollinators on federally-managed (e.g., the Bureau of Land Management and the U.S. Forest Service) and federally-subsidized (e.g., CRP, EQIP) restoration projects. This missed opportunity to assess success and failure condemns land managers to repeat the same mistakes, according to the plan.



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collaborative leadership within the PCA for this action with the U.S. Forest Service and Interior's USGS and Bureau of Land Management.

### **Tracking Acres of Restored and Enhanced Pollinator Habitat**

In response to the June 2014 presidential memorandum on pollinators, the task force established an overarching goal on pollinator habitat acreage of restoring and enhancing 7 million acres of land for pollinators over the next 5 years through federal actions and public-private partnerships. Under the task force's strategy, USDA agencies, including FSA and NRCS, are to contribute to this goal. FSA and NRCS are able to track acres of pollinator habitat restored and enhanced under pollinator-specific initiatives and practices, according to agency officials. However, they are unable to track acres on which landowners implement practices for other conservation purposes, such as for erosion control, improved water quality, or wildlife habitat, that may also have an additional benefit for pollinators, according to agency officials. According to FSA and NRCS officials, developing a method for tracking most acres with conservation practices benefiting pollinators will be time-consuming and may require some form of estimation. For example, according to FSA officials, the agency may be able to estimate acres of pollinator habitat using information it has on the types of plants landowners have planted. Nevertheless, by developing an improved method, within available resources, to track conservation program acres that benefit pollinators, FSA and NRCS would be better able to measure their contribution to restoring and enhancing the acres called for by the task force strategy's goal. Both agencies agreed that developing an improved method for tracking acres on which pollinator habitat has been restored or enhanced would provide valuable information. As of November 2015, the agencies had begun to discuss and consider methods they might use to track acres on which pollinator habitat has been restored or enhanced but had yet to develop an improved method.

### **Evaluating FSA and NRCS Conservation Efforts**

USDA has funded two evaluations of the effectiveness of FSA and NRCS conservation efforts related to pollinator habitat. First, in 2013, FSA and NRCS began jointly supporting a USGS study to evaluate the effect of CRP and EQIP plantings on honey bee health and productivity in five Midwestern states—Michigan, Minnesota, North Dakota, South Dakota, and Wisconsin. According to a January 2015 USGS progress report, the monitoring will quantify the effect USDA conservation lands have on honey bee health and productivity. For example, USGS is comparing the

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health of honey bee colonies in areas dominated by row crops with the health of colonies located in areas with significant CRP and pasture acreage. The evaluation has begun to show which weeks or months may have a shortage of blooming forage. USGS plans to expand this evaluation in 2016 to additional sites in Michigan and Wisconsin and add a demonstration project to monitor the effect of CRP and EQIP plantings on orchards, according to a USGS official. Information generated from this USGS evaluation will be used to improve pollinator seed mixes for CRP and EQIP, according to FSA and NRCS officials. Second, in 2014, the Pollinator Partnership,<sup>58</sup> under a cooperative agreement with NRCS, issued an independent evaluation of how NRCS field offices were promoting, implementing, monitoring, and documenting pollinator habitat efforts in conservation programs in several states. This evaluation concluded, among other things, that NRCS field offices were eager to support pollinators, but agency staff needed additional expertise to advise landowners how to implement effective conservation practices. However, NRCS has not conducted an evaluation to show where there may be gaps in expertise and how they might be filled; for example, whether the gaps should be filled through additional formal training for staff or through the informal learning that occurs when field staff, using technical assistance funding, monitor the field work to determine which plants are thriving and attracting bees.

According to NRCS officials, headquarters' evaluations of pollinator habitat have been limited, in part, because the agency has been focused on implementing the plantings. The NRCS *National Planning Procedures Handbook* directs an evaluation of the effectiveness of the implemented plan to ensure it is achieving its objectives.<sup>59</sup> The officials said that increased evaluation would be helpful because, while each state office has a biologist and other conservation experts, including partner biologists from nonprofit organizations, there are gaps in technical expertise on pollinator habitat available to some field offices. As a result, some field offices have less ability to effectively plan and monitor pollinator habitat. One university stakeholder suggested that NRCS

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<sup>58</sup>The mission of the Pollinator Partnership, a nonprofit organization, is to promote the health of pollinators, critical to food and ecosystems, through conservation, education, and research.

<sup>59</sup>USDA, NRCS, *Title 180—National Planning Procedures Handbook, Part 600—National Planning Procedures, Subpart C—NRCS Planning Process* (November 2014).

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ensure that each of the approximately 30 states with a significant need for pollinator habitat has a native bee expert. NRCS officials said an evaluation of field office efforts to restore or enhance bee habitat could help identify where expertise gaps occur. Another NRCS official said that the agency could survey its staff to gather their views on the need for additional training or expertise. In addition, one NRCS official said that on-site evaluation of the success of the pollinator habitat is important to understanding the effectiveness of the technical assistance.

NRCS officials also said that additional evaluation is needed to determine if technical assistance funding is adequate to support conservation planning efforts for different pollinator habitats across the country. NRCS funding for technical assistance enables field staff to develop conservation plans for landowners and to assess the implementation of those plans. NRCS's financial assistance funding to landowners helps pay to implement conservation plans. If technical assistance funding is too low, the effectiveness of conservation efforts may be compromised, according to NRCS officials. As total funding for NRCS conservation programs has increased, the percentage available for technical assistance has decreased relative to financial assistance. In 2014, funding for technical assistance was proportionally half of what it was in 2002, relative to the amount of financial assistance that it supported in terms of conservation planning and monitoring. Specifically, according to NRCS officials, for every dollar provided for financial assistance in 2002, about \$1.22 went to technical assistance. However, in 2014, for every dollar provided for financial assistance, about 59 cents was provided for technical assistance.<sup>60</sup> According to USDA officials, the reduced percentage of funding devoted to technical assistance has resulted in NRCS field office staff having less time to plan for and ensure the quality of conservation efforts, including pollinator habitat, because the staff must spend more time in the office managing contracts and ensuring that all financial assistance dollars are obligated.<sup>61</sup> By increasing evaluation of its habitat conservation efforts, including gaps in expertise and technical assistance funding available to field offices, USDA could better ensure

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<sup>60</sup>From fiscal year 2002 through fiscal year 2014, funding for NRCS's conservation programs directed to technical assistance increased 156 percent from \$976 million to about \$1.5 billion, according to NRCS officials. During the same period, funding directed to financial assistance increased 321 percent from \$801 million to \$2.6 billion.

<sup>61</sup>The Secretary of USDA determines the relative proportion of financial assistance to technical assistance for mandatory programs, according to an NRCS official.

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the effectiveness of its efforts to restore and enhance bee habitat plantings across the nation.

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## EPA Has Taken Some Steps to Address Pesticide Threats to Bees, but Potential Threats Remain

EPA has taken steps to address pesticide threats to bees, but potential threats remain. Among other steps, in 2013, EPA revised the label requirements for certain pesticides and in 2015, proposed revisions for certain additional pesticides that are acutely toxic in an effort to reduce bees' exposure. Since at least 2009, EPA has encouraged beekeepers and others to report bee kill incidents potentially associated with pesticides, but agency officials and others point to challenges to accurate reporting and data collection on these incidents. EPA has also encouraged state and tribal governments to voluntarily develop plans to work with farmers and beekeepers to protect bees from pesticides. EPA has revised its guidance for assessing the risks new and existing pesticides pose to bees, but there are limitations to the approach, including a lack of data on pesticides' risks to nonhoney bees and risks that pesticide mixtures pose to bees. Changes to EPA's risk assessment approach will likely extend its schedules for reviewing the registrations of some existing pesticides—including many that are known to be toxic to bees—as the agency gathers and reviews additional data on risks to bees. However, EPA has not revised the publicly available work schedules for pesticides currently under review.

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EPA Revised the Label Requirements for Certain Pesticides and Has Proposed Revisions to Label Requirements for Additional Pesticides Known to Be Acutely Toxic

In August 2013, EPA directed the registrants of four pesticides in a class of chemicals known as neonicotinoids to submit an amendment to revise the labels of products containing those pesticides that were registered for outdoor use on plant foliage.<sup>62</sup> Neonicotinoids are insecticides that affect the central nervous system of insects, causing paralysis and death. Pesticide labels contain directions for use and warnings designed to reduce exposure to the pesticide for people and nontarget organisms, including beneficial insects such as bees. It is unlawful to use any pesticide in a manner inconsistent with its labeling. In proposing the label changes, EPA cited the possible connection between acute exposure to particular pesticides and bee deaths. EPA called for the labels to have a pollinator protection box (also called a “bee advisory box”) and new language outlining the directions for the products’ use, in addition to any restrictive language that may already be on the product labels. The agency directed the registrants to submit revisions to their product labels with EPA’s prescribed language no later than September 30, 2013, and told the registrants that it anticipated that the new product labels would be in place in 2014.<sup>63</sup>

The new language for the pollinator protection box warns of the threat the pesticide poses to bees and other pollinators and instructs the user to follow the new directions for use. The directions for use restrict the use of the pesticide on crops and other plants at times when bees are foraging on those plants. More specifically, the directions generally prohibit foliar use, or use on leaves, until flowering is complete, and all petals have fallen from the plants. However, the new directions for use allow for exceptions to the prohibition under certain conditions, which vary,

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<sup>62</sup>A registrant is the company or individual holding a registration for a pesticide. The four registered nitroguanidine neonicotinoid pesticide active ingredients are clothianidin, dinetofuran, imidacloprid, and thiamethoxam. Another registered neonicotinoid pesticide—acetamiprid—was not covered by EPA’s label changes. The registrant for an additional neonicotinoid—thiacloprid—voluntarily requested that its registration be canceled. EPA granted the request in August 2014 and allowed the registrant to sell and distribute existing stocks of products through February 8, 2016. According to EPA officials, acetamiprid and thiacloprid are considerably less toxic to bees than the other four neonicotinoid pesticides because they are readily metabolized, or chemically transformed, by bees.

<sup>63</sup>According to an EPA official in July 2015, while most of the subject products had been revised to include the new restrictions, some companies chose to delete the outdoor foliar use pattern, and a few chose to cancel their products.

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depending on whether or not managed bees are on-site to provide contract pollination services.<sup>64</sup>

In November 2014, EPA staff told us the label changes to the four neonicotinoids had led to confusion for pesticide users and resentment by some stakeholder groups, but that the agency planned to address these concerns through additional label changes for those and other pesticides that are acutely toxic to bees. In particular, according to EPA officials, pesticide users found that new label language, in some instances, contradicted other parts of the label or was poorly defined. In May 2015, EPA requested public comments on a proposal to make label changes restricting the use of some products containing acutely toxic pesticides<sup>65</sup> on pollinator-attractive crops when managed bees are present for the purpose of providing pollination services, saying that “clearer and more consistent mandatory label restrictions could reduce the potential exposure to bees from pesticides categorized as acutely toxic to bees.”<sup>66</sup> The deadline for public comments on EPA’s proposal was June 29, 2015. Subsequently, that deadline was extended to August 28, 2015. According to EPA officials, as of October 2015, the agency was in the process of reviewing more than 100,000 comments on the label proposal; in part due

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<sup>64</sup>Under the contract pollination scenario, if an application must be made when managed bees are at the treatment site, the beekeeper providing the pollination services must be notified no less than 48 hours prior to the time of the planned application, so that the bees can be removed, covered, or otherwise protected prior to spraying. Under the scenario for food crops and ornamental plants not under contract for pollination services, the pesticides may be applied if one of several conditions is met, including (1) the application is made to the target site after sunset or (2) the application is made to the target site when temperatures are below 55°F. (Bees are less active after sunset and when temperatures cool and are thereby less likely to be exposed.)

<sup>65</sup>EPA has classified as acutely toxic those pesticides with an acutely lethal dose to 50 percent of the bees tested (abbreviated LD50) of less than 11 micrograms per bee.

<sup>66</sup>EPA’s proposed label language for the acutely toxic pesticides would read: “For Foliar Applications of this Product to Sites with Bees On-Site for Commercial Pollination Services: Foliar application of this product is prohibited from onset of flowering until flowering is complete when bees are on-site under contract, unless the application is made in association with a government-declared public health response. If site-specific pollinator protection/pre-bloom restrictions exist, then those restrictions must also be followed.” EPA’s proposal does not apply to pesticides used in seed treatments. The agency noted that “systemic pesticides that have prolonged residual toxicity may not be adequately addressed by the proposed mitigation discussed in this proposal.” EPA said that it would continue to use its registration and registration review programs to assess the risks of individual chemicals, including those used in seed treatments.

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to the number of comments, the officials said they could not estimate when the agency will finalize the proposal.

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### EPA Has Encouraged Beekeepers and Others to Report Bee Kill Incidents Potentially Associated with Pesticides

Since at least 2009, EPA has encouraged beekeepers and others to voluntarily report bee kill incidents—that is, when bees in or near a hive are killed by a suspected exposure to a pesticide, according to agency officials. EPA records reports of bee kills that may have been associated with pesticide use in its Ecological Incident Information System (EIIS) database on adverse pesticide incidents. When EPA receives reports of bee kill incidents, according to agency officials, it considers a range of evidence to evaluate the probability that a specific pesticide was the cause. The evidence could include information about pesticide use near the incident, the known toxicity of the pesticides used in the area, and physical or observational evidence associated with the affected bees. After considering the evidence, EPA categorizes the likelihood that a specific pesticide was associated with the bee kill as highly probable, probable, possible, unlikely, or unrelated.<sup>67</sup> In total, the EIIS data include 306 unique bee kill incidents occurring from 1974 through 2014 and another 90 incidents with no associated year.<sup>68</sup> Of this total of 396 incidents, EPA found sufficient evidence to categorize 201 as highly probable or probable. The 201 incidents were associated with 42 pesticides. (The EIIS data show that 3 bee kill incidents were highly probable or probable but name no specific pesticide.)

According to agency officials, EPA encourages the public to report incidents to their state lead agency (typically the state’s department of agriculture) so that such incidents can be properly investigated. Recognizing that some members of the public may not feel comfortable

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<sup>67</sup>EPA’s user’s manual for the EIIS database contains definitions for each category. They are: *Highly probable*: pesticide was confirmed as the cause through residue analysis or other reliable evidence, or the circumstances of the incident along with knowledge of the pesticide’s toxicity or history of previous incidents give strong support that this pesticide was the cause. *Probable*: circumstances of the incident and properties of the pesticide indicate that this pesticide was the cause, but confirming evidence is lacking. *Possible*: The pesticide possibly could have caused the incident, but there are possible explanations that are at least as plausible. Often used when organisms were exposed to more than one pesticide. *Unlikely*: Evidence exists that a stressor other than exposure to this pesticide caused the incident, but that evidence is not conclusive. *Unrelated*: Conclusive evidence exists that a stressor other than exposure to the given pesticide caused the incident.

<sup>68</sup>According to an EPA document, the baseline year for the EIIS database is “about 1970.”

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with reporting to their state officials, EPA’s website and the “bee advisory boxes” added to certain pesticide labels identify additional options for the public to voluntarily report bee kill incidents. These include reporting through [beekill@epa.gov](mailto:beekill@epa.gov), an e-mail address monitored by EPA’s Office of Pesticide Programs or to report incidents to the National Pesticide Information Center.<sup>69</sup> In addition, EPA enters into cooperative agreements with states. Through these agreements, EPA may delegate certain authority to states to cooperate in enforcing FIFRA. One condition of the cooperative agreement is that states must report information on all known or suspected pesticide incidents involving pollinators to [beekill@epa.gov](mailto:beekill@epa.gov) and send a copy to the relevant EPA regional office. EPA stores data on incident reports from the public, the National Pesticide Information Center, and the states in its EIS database.

Several factors may contribute to underreporting of bee kill incidents, according to EPA staff and others we interviewed. According to officials from EPA and beekeeping and environmental organizations, beekeepers may be reluctant to report bee kills to state agencies or to EPA for one or more of three reasons. First, beekeepers may want to avoid conflicts with farmers with whom they have an arrangement for providing pollination services or for obtaining access to forage for honey production, even if the farmer’s pesticide application practices may have contributed to the incident. Second, beekeepers may want to avoid investigations that may suggest the beekeeper’s hive management practices—specifically, the use of miticides or other pesticides to combat hive pests—contributed to the incident. Third, according to a senior EPA official in the Office of Pesticide Programs, some beekeepers believe that submitting reports in the past has not resulted in a positive response from regulatory authorities and, therefore, is not worth the effort.

According to the senior EPA official, other challenges exist that may make bee kill incident reports inaccurate. For example, beekeepers may not be able to frequently monitor their colonies, so incidents may not be discovered for several days; the passage of time may hamper a conclusive investigation. Honey bees forage over an extensive range. Therefore, it may be difficult to determine to which crops and pesticides

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<sup>69</sup>According to its website, the National Pesticide Information Center provides objective, science-based information about pesticides and pesticide-related topics to enable people to make informed decisions about pesticides and their use. The center is funded by a cooperative agreement between Oregon State University and EPA.



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they have been exposed. Finally, according to the EPA official, the states have increasingly limited budgets to support bee colony inspection programs and pesticide incident inspection programs in general, and may not be able to fully investigate reported incidents.

In addition to the voluntary incident reports from beekeepers and others, FIFRA requires that pesticide registrants report factual information they are aware of concerning adverse effects associated with their products—including the death of nontarget organisms such as bees.<sup>70</sup> The information reported by a registrant is known as a FIFRA 6(a)(2) Incident Report. However, according to EPA staff, FIFRA 6(a)(2) reports are not particularly useful in providing details on bee kills because FIFRA and its implementing regulations do not require registrants to identify bees as the species harmed by a pesticide. Instead, bees are recorded within a larger category of “other nontarget” organisms. In addition, registrants do not need to report individual incidents involving “other nontarget” organisms when they occur. Instead, registrants can “aggregate” incidents that occur over a 90-day period and report those aggregated data to EPA 60 days after the end of the 90-day period. While these FIFRA reporting requirements apply generally to pesticide registrants, as we noted earlier, EPA modified its requirements for the registrants of four neonicotinoid pesticides. In its July 22, 2013, letter notifying the registrants of its plans to modify the pesticides’ labels to be more protective of bees, EPA also instructed the registrants to report bee kill incidents within 10 days of learning of the incident and that information on bee kills must not be aggregated, regardless of the number of individual pollinators involved in any incident.

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<sup>70</sup>FIFRA Section 6(a)(2) states that “If at any time after the registration of a pesticide the registrant has additional factual information regarding unreasonable adverse effects on the environment of the pesticide, the registrant shall submit such information to the Administrator.” EPA’s regulations implementing section 6(a)(2) expressly require pesticide registrants to report adverse events that involve damage to nontarget organisms in addition to fish, wildlife, and plants. Nontarget organisms could include beneficial insects, which could include bees. EPA’s implementing regulations can be found in title 40 of the *U.S. Federal Code of Regulations* at part 159.

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## EPA Has Encouraged State and Tribal Governments to Voluntarily Develop Plans to Protect Managed Bees from Pesticides

In response to a directive from the June 2014 presidential memorandum on pollinators, EPA has encouraged state and tribal environmental, agricultural, and wildlife agencies to voluntarily develop managed pollinator protection plans (protection plans) that focus on improved communication between farmers and beekeepers regarding the use of pesticides and the proximity of managed bees. EPA is working with two organizations to encourage states and tribes to implement the protection plans: (1) the State-FIFRA Issues, Research, and Evaluation Group (SFIREG)<sup>71</sup> and (2) the Tribal Pesticide Program Council.<sup>72</sup> In December 2014, SFIREG issued draft guidance for state lead agencies for the development and implementation of state protection plans. According to the guidance, the scope of the plans is limited to managed bees not providing contracted pollination services at the site of application. As such, the protection plans are intended to reduce pesticide exposure to bees that are adjacent to, or near a pesticide treatment site where bees can be exposed via drift or by flying to and foraging in the site of application. According to SFIREG's draft guidance, many of the strategies to mitigate the risk of pesticide exposure to managed pollinators are also expected to reduce the risk to native bees and other pollinators. The voluntary protection plans would supplement EPA's proposal to make label changes restricting the use of acutely toxic pesticides, described above, to protect managed bees that are under pollination contracts between farmers and beekeepers. According to the task force's strategy, one of the key elements of the state protection plans are the metrics that will be used to measure their effectiveness in reducing honey bee losses. Those metrics, according to the strategy, may differ across states and tribes.

Because the development of the protection plans is voluntary, EPA will not approve or disapprove them, and measures of the plans' effectiveness will be state- or tribe-specific, according to agency officials. According to EPA officials, as of January 2016, seven states had protection plans in place: Arkansas, California, Colorado, Florida, Iowa, Mississippi, and North Dakota, while all but a few of the other states had

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<sup>71</sup>The State-FIFRA Issues Research and Evaluation Group is a network of state officials interested in federal/state "co-regulation" of pesticides under FIFRA. It was established by the Association of American Pesticide Control Officials with financial support from EPA.

<sup>72</sup>The council is a network of tribal representatives and intertribal consortia that serve as a tribal technical resource, program development and policy dialogue group focused on pesticide issues and concerns.

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protection plans in some stage of development. In addition, EPA provided funding for a November 2015 training program to address tribal pollinator protection plans. Stakeholders we interviewed who commented on this topic generally supported EPA's efforts to encourage pollinator protection plans. Stakeholders' views on protection plans are summarized in appendix II.

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### EPA Has Revised Its Guidance for Assessing Risks to Bees Posed by New and Existing Pesticides, but Limitations Remain

In June 2014, EPA issued guidance advising the agency's staff to consider requiring pesticide registrants to conduct additional studies on the risks that new or existing pesticides may pose to bees and bee colonies for pesticides going through the registration or registration review processes.<sup>73</sup> The 2014 guidance formalized interim guidance issued in 2011.<sup>74</sup> EPA summarized the need for the risk assessment guidance in a 2012 White Paper to the FIFRA Scientific Advisory Panel that noted that the lack of a clear, comprehensive and quantitative process for evaluating pesticide exposure and subsequent risk to bees from different routes of exposure was a major limitation.<sup>75</sup> The guidance may result in registrants conducting additional studies on the toxicity of new and existing pesticides on honey bees. It also allows for several methods of characterizing pesticide risk. However, EPA's 2014 risk assessment guidance relies largely on honey bees as a surrogate for other bee species. In addition, the guidance does not call for EPA to assess the risks that pesticide mixtures may pose to bees.

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<sup>73</sup>*Guidance for Assessing Pesticide Risks to Bees*, co-authored by the Office of Pesticide Programs, United States Environmental Protection Agency, Washington, D.C.; the Health Canada Pest Management Regulatory Agency, Ottawa, ON, Canada; and the California Department of Pesticide Regulation, Sacramento, CA, June 19, 2014.

<sup>74</sup>The Director of EPA's Environmental Fate and Effects Division issued a memorandum to staff titled *Interim Guidance on Honey Bee Data Requirements* in October 2011. According to EPA officials, the agency used the interim guidance until it issued the final guidance in June 2014.

<sup>75</sup>Environmental Protection Agency, Health Canada Pest Management Regulatory Agency, and California Department of Pesticide Regulation, *White Paper in Support of the Proposed Risk Assessment Process for Bees: Submitted to the FIFRA Scientific Advisory Panel for Review and Comment*, September 2012. The FIFRA Scientific Advisory Panel is composed of biologists, statisticians, toxicologists, and other experts who provide independent scientific advice to EPA on a wide range of health and safety issues related to pesticides.

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EPA's Risk Assessment  
Guidance Potentially Calls for  
More Study of the Effects of  
New and Existing Pesticides  
on Honey Bees

EPA's June 2014 guidance calls for agency staff to consider requiring pesticide applicants or registrants to conduct additional studies on the toxicity of their pesticides to honey bees. The guidance applies to EPA's review of new pesticide registration applications and its ongoing review of existing registrations. EPA has used, and continues to use, a three-tiered approach for assessing the risks that pesticides may pose to bees (and other organisms). That is, the agency may require additional studies—in Tiers II and III—from pesticide applicants or registrants, depending on the results of any Tier I studies that it required. Therefore, under the June 2014 guidance, EPA staff are to consider a range of studies that examine different life stages of honey bees (adult and larval), different types of toxicity (acute and chronic), and different types of exposure to pesticides (contact and oral). Studies may be conducted in laboratories on individual bees (Tier I), as "semi-field" tests of small colonies (Tier II), or as field tests of whole colonies (Tier III). EPA may also consider other lines of evidence, including open scientific literature and incident reports.

Another aspect of assessing the risk of pesticides is deciding which chemicals within a pesticide product are to be studied. EPA's June 2014 guidance addresses this issue but leaves it to the discretion of agency staff. Specifically, EPA's June 2014 guidance states that toxicity data using the end-use product may be needed if data suggest that a typical end-use product is potentially more toxic than the active ingredient, and bees may come directly in contact with the product.<sup>76</sup> The guidance also calls for agency staff to consider the effects that systemic pesticides applied to seeds or in the soil may have on honey bees. Systemic pesticides applied to plants and soil can move through the plant to other plant tissues, potentially contributing to quantities of pesticide residues in pollen and nectar.

EPA regulations identify three honey bee studies as required, or conditionally required, and EPA's 2014 guidance suggests additional bee toxicity studies that agency staff might consider requiring. EPA staff we interviewed acknowledged that additional steps are needed to establish

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<sup>76</sup>The end-use product may comprise the active ingredient and "inert ingredients" that help make the active ingredient more effective. The active ingredient is the chemical or substance component of a pesticide product that can kill, repel, attract, mitigate, or control a pest or that acts as a plant growth regulator, desiccant, or nitrogen stabilizer. Some inert ingredients are also toxic to organisms. Therefore, the toxicity of the end-use product may be greater than the active ingredient alone.

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EPA's Risk Assessment  
Guidance Allows for Tiered  
Studies in Making Registration  
Decisions for New Pesticides  
and New Uses for Existing  
Pesticides

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study guidelines, but said that the agency has the authority under FIFRA to require and review any studies that it deems necessary to determine whether a pesticide will have unreasonable adverse effects. In addition, as of October 2015, EPA had not yet issued guidelines for the new types of studies that registrants may be required to submit. However, in July 2015, EPA announced on its website that it was considering a proposal within 12 months that would update and codify the data requirements needed to characterize the potential risks of pesticides to bees and other pollinators. In the meantime, registrants may conduct three of the additional studies—acute adult oral toxicity, acute larval toxicity, and semi-field testing with whole colonies—using guidelines developed by the Organization for Economic Cooperation and Development (OECD).<sup>77</sup> EPA officials told us that, as of October 2015, formal guidelines did not exist for chronic toxicity testing with adult bees and chronic toxicity testing with bee larvae but said that EPA is contributing to international efforts to develop formal guidelines, including draft guidelines on chronic toxicity with bee larvae. In addition, the task force's strategy stated that standardized guidelines may not be developed for field studies (Tier III) because "these studies are intended to address specific uncertainties identified in lower tier tests." Instead, according to agency officials, EPA will have to agree on specific Tier III protocols proposed by the pesticide applicant or registrant for particular pesticides.<sup>78</sup>

EPA's June 2014 risk assessment guidance for honey bees allows the agency to use tiered studies in reviewing registration applications for new pesticides and new uses for existing pesticides. EPA's review of registration applications for four pesticides—cyantraniliprole, oxalic acid, sulfoxaflor, and tolfenpyrad—provides examples of how the agency's use of its 2011 interim and 2014 final guidance and its call for bee-related studies can vary. Because EPA's risk assessment approach for this guidance is a tiered one, the agency staff uses its discretion when requiring registrants to conduct toxicity studies. For example, EPA

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<sup>77</sup>The mission of the OECD is to promote policies that will improve the economic and social well-being of people around the world. The OECD provides a forum in which governments can work together to share experiences and seek solutions to common problems.

<sup>78</sup>In this context, according to EPA officials, a protocol is a test method developed by a pesticide applicant or registrant. The protocol should follow guidelines from EPA or the OECD if guidelines are available. If guidelines are not available, EPA would review the protocol to determine whether it meets the agency's needs.

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approved oxalic acid for a new use as a miticide to combat *Varroa* mites in bee hives without requiring its own Tier II or Tier III studies. According to EPA staff, the agency relied on existing data from Canada that shows the pesticide has low acute toxicity and is effective at killing *Varroa* mites without harming bee colonies. For the other three pesticides, which were registered before the 2014 final guidance was issued, EPA reviewed varying numbers and types of studies but did not require all of the types of studies described in the new risk assessment guidance. However, EPA decided, on the basis of the studies that were done, to place restrictions on the pesticides' use in order to reduce bees' exposure. For example, EPA did not require Tier III studies for sulfoxaflor but used the results of Tier I and Tier II studies as the basis for reducing the amount of the insecticide that was allowed to be applied per acre under the pesticide's 2013 registration.<sup>79</sup> In addition, cyantraniliprole and tolfenpyrad are among the acutely toxic pesticides covered by EPA's May 2015 proposal to make label changes restricting the use of acutely toxic pesticides.

A finding from study results that a pesticide is toxic to bees (or other organisms) does not necessarily mean that EPA will disapprove an application for registration. Under FIFRA, throughout the tiered process, EPA considers whether mitigation measures (e.g., changes to application rates, the timing of applications, or the number of applications) are sufficient to reduce exposure to a level at which risk estimates are below levels for concern, while also taking the benefits from using the pesticide into consideration.

### EPA's 2014 Risk Assessment Guidance Relies Largely on Honey Bees as a Surrogate for Other Bee Species

While EPA's June 2014 pesticide risk assessment approach provides for the inclusion of data on additional bee species where available, it relies primarily upon data from honey bees as a surrogate for all bee species. However, other bee species may be affected differently by pesticides. EPA acknowledges in its guidance that there are limitations to using honey bees as surrogates but maintains that honey bees can provide information relevant to other species, and that adequate, standardized

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<sup>79</sup>In 2013, commercial beekeeping organizations filed a lawsuit against EPA concerning the agency's decision to register sulfoxaflor. In September 2015, the United States Court of Appeals for the Ninth Circuit vacated EPA's unconditional registration of sulfoxaflor and remanded for EPA to obtain further studies and data regarding the effects of sulfoxaflor on bees. On November 12, 2015, EPA issued a cancellation order for all previously registered sulfoxaflor products. In comments on a draft of this report, EPA said that the registrant is conducting additional studies to address uncertainties regarding the effects of sulfoxaflor on bees.

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tests are not yet available for other species. EPA is involved in international efforts to develop standardized tests for other bee species and has been directed by the task force's strategy with researching risk assessment tools for nonhoney bee species. However, EPA does not have a schedule for expanding the risk assessment process to other bee species. Stakeholders we interviewed from farming, commercial beekeeping, university, and conservation/environmental groups said EPA should expand its risk assessment process to include testing the effects of pesticides on pollinators other than the honey bee, including other commercial, or managed, and wild, native bees. Several of these stakeholders specified that EPA should develop testing models and guidelines for other types of bees, such as solitary and bumble bees.

EPA's September 2012 White Paper attributed the agency's focus on honey bees to two factors: (1) honey bees are considered the most important pollinator in North America from a commercial and ecological perspective and (2) standardized tests on the effects of chemicals are more developed for honey bees than for other managed bee species, such as the alfalfa leafcutting and orchard mason bees. However, the White Paper also noted that there are an estimated 4,000 species of wild, native bees in North America and more than 20,000 worldwide. These wild, native bees also provide important pollination services. Other managed and wild, native bee species may be exposed to pesticides through different routes, at different rates, or for different durations than honey bees, all of which may influence the effects of pesticides. The White Paper concluded that there was a clear need for a process to assess risks to species other than honey bees, owing to potential differences in sensitivity and exposure compared to honey bees. While noting the importance of assessing risks to diverse bee species, the White Paper also cited a 2012 European Food Safety Authority conclusion that published laboratory, semi-field, and open field test methods for other species (i.e., bumble bees, orchard mason bees, leafcutting bees, and alkali bees) needed further development.<sup>80</sup>

In its December 2012 review of EPA's White Paper, the FIFRA Scientific Advisory Panel recommended that EPA require testing on at least one

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<sup>80</sup>EFSA Panel on Plant Protection Products and their Residues (PPR), *Scientific Opinion on the Science Behind the Development of a Risk Assessment of Plant Protection Products on Bees (Apis mellifera, Bombus spp. and Solitary Bees)*. May 2012.

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additional species to address the goal of protecting diversity.<sup>81</sup> The FIFRA panel stated that alfalfa leafcutting bee and orchard mason bees are the easiest to include for Tier I testing, adding that these bees are commercially available in large numbers and would be fairly easy to use for higher-tiered tests. In addition, the panel noted that bumble bees are also available commercially, and considerable research is available on how to raise them, so they would be useful for Tier II tests, although with limitations. EPA's June 2014 risk assessment guidance stated that, as the science evolves, methods and studies using other bee species may be considered and incorporated into risk assessments.

The task force's strategy stated that uncertainty is created by relying on honey bees as a surrogate and stated the agency was working with regulatory counterparts through the OECD to ensure the development of standardized testing methods to address this uncertainty. In that regard, the task force's research action plan directs EPA to develop appropriate assessment tools for sublethal effects of pesticides, adjuvants,<sup>82</sup> and combinations of pesticides on the fitness, development, and survival of managed and wild pollinators (i.e., honey bees and other bees). The task force's strategy states that a metric for progress in meeting the strategy's directives will be the extent to which standardized guidelines are developed and implemented for evaluating potential risks to bees other than honey bees. According to the strategy, these studies will be critical for determining the extent to which honey bees serve as reasonable surrogates for other species of bees. However, the strategy and the research action plan do not identify how or when EPA is to ensure that adequate test protocols are incorporated into the risk assessment process. According to EPA officials, it would not be reasonable for the strategy to dictate a timeline or for EPA to commit to one given the absence of appropriations to support the development of test guidelines. Instead, these officials said that EPA is working with the OECD and other international bodies to develop test guidelines for other species of bees.

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<sup>81</sup>FIFRA Scientific Advisory Panel, *A Set of Scientific Issues Being Considered by the Environmental Protection Agency Regarding Pollinator Risk Assessment Framework September 11–14, 2012*.

<sup>82</sup>An adjuvant is generally broadly defined as any substance separately added to a pesticide product (typically as part of a spray tank mixture) that will improve the performance of the pesticide product. Since pesticide adjuvant products don't make pesticidal claims, they are not pesticides, and the components of adjuvants are, therefore, not pesticide inert ingredients.



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According to OECD documents, progress has been made in developing guidelines to assess the acute contact and oral toxicity of pesticides to individual bumble bees. The documents state that the results of validation testing for the guidelines (known as ring tests) are expected to be reported by late 2015 or early 2016. However, it is not clear when EPA could incorporate them into its risk assessment process, and guidelines for other bee species would take additional time to develop. Regardless, EPA has the authority under FIFRA to require pesticide registrants to submit data on the toxicity of pesticides on other bee species using methods that meet the agency's approval. By developing a plan for obtaining data from pesticide registrants on the effects of pesticides on nonhoney bee species, including other managed or wild, native bees, into its risk assessment process, EPA could increase its confidence that it is reducing the risk of unreasonable harm to these important pollinators, consistent with the task force's strategy and research action plan.

EPA's June 2014 Guidance Does Not Call for the Agency to Assess the Risks That Pesticide Mixtures May Pose to Bees

EPA's June 2014 risk assessment guidance calls for the agency to assess the risks that individual pesticides may pose to bees but not for the assessment of the risks from combinations of pesticide products or combinations of pesticide products with other chemicals. Farmers sometimes mix pesticide products for a single application to reduce the number of times they have to spray their fields. These combinations of pesticide products are known as tank mixtures. Beekeepers have raised concern that these mixtures of pesticide products may have synergistic effects on bees, meaning that the effect of the combination is greater than the sum of the effects of the individual pesticides. The Pollinator Stewardship Council reported on its website in 2014 that beekeepers attributed bee kill incidents to pesticides that acted in combination with each other to increase their collective toxicity. In addition, farmers may mix pesticide products with adjuvants, or chemicals to enhance the pesticides' effectiveness. University researchers have also reported that combining certain pesticide products with other products can synergistically increase the overall toxicity to bees.<sup>83</sup> Stakeholders we interviewed from commercial bee groups, universities, and conservation/ environmental groups suggested that EPA require companies to conduct

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<sup>83</sup>See RM Johnson, L Dahlgren , BD Siegfried, and MD Ellis (2013) *Acaricide, Fungicide and Drug Interactions in Honey Bees (Apis mellifera)*. PLoS ONE 8(1): e54092. doi:10.1371/journal.pone.0054092; F Sanchez-Bayo, K Goka (2014) *Pesticide Residues and Bees – A Risk Assessment*. PLoS ONE 9(4): e94482. doi:10.1371/journal.pone.0094482.

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toxicity studies on pesticide tank mixtures as part of its risk assessment process. According to agency officials, EPA has taken some steps to expand the scope of its risk assessment to include mixtures of pesticides, but challenges remain, as discussed below.

EPA registers an individual pesticide after assessing the risks the pesticide poses to human health or the environment when used according to its directions for use.<sup>84</sup> EPA also assesses the risks posed by combinations of pesticides that the applicant intends to be used as a registered combination.<sup>85</sup> Otherwise, EPA does not assess the risks of tank mixtures of pesticides or combinations of pesticides and other chemicals such as adjuvants that farmers or others may use. According to EPA officials, the use restrictions that apply to tank mixtures of pesticides are, instead, based on the most restrictive elements of the individual pesticides' labels.

In EPA's September 2012 White Paper, the agency stated that "with respect to mixtures, while multiple stressors and the interactive effects of pesticides and/or other environmental stressors are important issues, they will not be examined at this time." However, the task force's strategy recognized the risks that pesticide mixtures may pose and called for EPA to develop appropriate tools to assess the sublethal effects of pesticides, adjuvants, and combinations of pesticides with other products on the fitness, development, and survival of managed and wild pollinators.

Senior EPA officials told us in October 2015 that they agreed that tank mixtures of registered pesticides pose potential risks to bees. However, they said that there was no reliable process for assessing mixtures and that, given the number of possible permutations that may occur in tank mixing, it was difficult to imagine how EPA could reasonably commit to such an effort. EPA officials also said that the use of tank mixes may change over time and by location as farmers respond to different pest outbreaks, and that the agency does not know how it would identify commonly used mixtures. However, according to stakeholders we interviewed, sources for data on commonly used or recommended

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<sup>84</sup>A registrant may use a registered pesticide in multiple products. Each product would have its own label with specific use restrictions.

<sup>85</sup>Pesticide registrants may also get approval for label language stating that a pesticide should not be mixed with another pesticide.

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mixtures are available. These sources include the California Department of Pesticide Regulation—which has an extensive data base on pesticide use—the pesticide industry, farmers, pesticide application companies, and extension agents.

At the same time, EPA officials noted that the agency is working with the Fish and Wildlife Service and the National Marine Fisheries Service on assessing the risks of pesticides to threatened and endangered species such as salmon, including the risk posed by mixtures of pesticides. They said the agencies' effort could eventually be relevant to EPA's guidance for assessing pesticide risks to bees.<sup>86</sup> EPA and the other agencies subsequently developed joint interim scientific approaches for assessing the risks of pesticides to threatened and endangered species.<sup>87</sup> With respect to pesticide mixtures, the agencies' document on interim approaches stated that risks associated with pesticide mixtures will largely be considered qualitatively rather than quantitatively. A related agency document states that long-term future work includes establishing a quantitative approach for assessing risks of mixtures but provides no time frames for doing so.<sup>88</sup> We acknowledge that EPA's work with other agencies on pesticide risks to threatened and endangered species may eventually contribute to its risk assessments for bees, but the effects of that work remain to be seen. By identifying the pesticide mixtures that farmers and pesticide applicators most commonly use on agricultural crops, EPA would have greater assurance that it could assess those mixtures to determine whether they pose greater risks than the sum of the risks posed by the individual pesticides.

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<sup>86</sup>To assist their effort to address threatened and endangered species, the agencies requested advice from a National Research Council committee of experts. In an April 2013 report (National Research Council, *Assessing Risks to Endangered and Threatened Species from Pesticides*, April 2013), the committee noted the complexity of assessing the risks of pesticide mixtures but concluded that quantitative assessment of chemical joint action is warranted if adequate data are available on the exposures to and toxicities of the chemicals. The committee also said that challenges in assessing risks from mixtures include the lack of exposure data and an understanding of the potential for interactions among mixture components.

<sup>87</sup>*Interim Approaches for National-Level Pesticide Endangered Species Act Assessments Based on the Recommendations of the National Academy of Sciences April 2013 Report.*

<sup>88</sup>*Interagency Approach for Implementation of National Academy of Sciences Report: Assessing Risks to Endangered and Threatened Species from Pesticides*, Powerpoint slides dated November 15, 2013.

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According to senior EPA officials, if the agency has information about certain combinations being used regularly, it could require that pesticide registrants provide testing data on those combinations. If an assessment of commonly-used pesticide mixtures found synergistic effects on bees, FIFRA authorizes EPA to take regulatory actions to reduce risks, such as requiring label language warning of those effects.

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### Applying EPA's New Risk Assessment Guidance Will Likely Extend the Agency's Reviews of Registered Pesticides, and EPA Has Not Revised Review Schedules

Amendments to FIFRA require that EPA complete its reviews of all pesticide active ingredients registered as of October 1, 2007, by October 2022. Applying EPA's new risk assessment guidance to its review of registered pesticides will add time to the posted review schedules for some individual pesticides, and EPA has not revised these schedules.<sup>89</sup> As discussed, EPA's revised risk assessment guidance for bees calls for the agency to consider requiring registrants to conduct additional studies on their pesticide's effect on bees. According to EPA documents and officials, the agency is now applying the new guidance to registered pesticides that are in the review process, as well as to new pesticides. Deciding what studies are needed, requesting the data from registrants, waiting for the studies to be conducted, and analyzing the study data will add time to EPA's review of some pesticides' risks to bees. The director of EPA's Pesticide Re-Evaluation Division and other senior officials told us in April 2015, and confirmed in October 2015, that the agency was in the process of deciding what additional bee studies, if any, will be needed for specific individual pesticides. They could not estimate how long it will take to make those decisions but said a large number of pesticides for which EPA had begun a registration review prior to issuing its risk assessment guidance in June 2014 could require data on bees. The number of pesticides affected by the new risk assessment guidance is, therefore, likely to be substantial, according to EPA officials. In its annual PRIA implementation report, EPA reported to Congress in March 2015 that by September 30, 2014, it had begun the review process for 528 pesticide cases and prepared final work plans for 491 of those cases. The final work plans identify the studies the agency is requiring the registrant to conduct and show the agency's estimated schedule for completing a registration review. Of the 491 cases with final work plans, EPA had issued registration review decisions for 105 cases by the end of fiscal

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<sup>89</sup>EPA maintains dockets on a federal website at [www.Regulations.gov](http://www.Regulations.gov) that contain information on the agency's review of pesticide registrations. Included in the dockets are EPA's work plans for completing the registration reviews.

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year 2014. According to EPA officials, as of September 30, 2015, the agency had increased the number of reviews begun to 612 pesticide cases, had prepared final work plans for 580 pesticides cases, and had issued 155 interim and final registration review decisions.<sup>90</sup>

According to the EPA division director, if EPA determines through registration review that additional data are necessary to make the necessary findings, the agency must obtain approval from the Office of Management and Budget (OMB) to request the data from registrants that use a particular active ingredient in their products. He added that, if EPA decides that registrants need to do additional studies on bees, it will need to obtain another approval from OMB for the new data. Once OMB approves the request, the required risk assessment studies on bees may take registrants from one to several years to conduct. The division director said that EPA was concerned that the number of pesticides needing new bee test data could overwhelm the supply of qualified testing laboratories, which could delay the start and completion of those studies. In its written comments on a draft of this report, EPA said that it had more recently learned that laboratories are building capacity to conduct these studies. However, the conduct of honey bee studies is confined to a limited window within the year, typically from April through August.

The final work plans for most of the pesticide cases for which EPA had begun registration review were developed and posted to the [www.Regulations.gov](http://www.Regulations.gov) website before EPA adopted its revised risk assessment guidance for bees in June 2014. According to EPA officials, those work plans may therefore not reflect the types of studies that are now called for by the new guidelines or the estimated schedules for completing the registration reviews. Work plans that EPA posted after the June 2014 risk assessment guidance, on the other hand, may better reflect the types of studies that are called for by the new guidance.

To examine the effect that EPA's revised risk assessment guidance has had on its review of individual pesticide registrations, we selected eight

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<sup>90</sup>The agency may issue, when it determines it to be appropriate, an interim registration review decision before completing a registration review. Among other things, the interim registration review decision may require new risk mitigation measures, impose interim risk mitigation measures, identify data or information required to complete the review, and include schedules for submitting the required data, conducting the new risk assessment, and completing the registration review.

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registered pesticides associated with bee kill incidents reported in EPA's EIS database.<sup>91</sup> The work plans for these pesticides (amitraz, carbaryl, chlorpyrifos, coumaphos, malathion, and three neonicotinoid pesticides—clothianidin, imidacloprid, and thiamethoxam)—could provide information on how EPA's new risk assessment process will affect registration review, although we found the full effect is not yet clear. The director of the Pesticide Re-Evaluation Division explained that the work plans EPA has posted at [www.Regulations.gov](http://www.Regulations.gov) for amitraz, carbaryl, chlorpyrifos, coumaphos, and malathion are out of date because EPA has not yet decided what additional data on the effects of the pesticides on bees the agency will ask registrants to submit. However, EPA staff told us that the work plans for the three neonicotinoid pesticides—which predate the June 2014 risk assessment guidance—more closely reflect the guidance and call for additional studies on bees.<sup>92</sup> EPA staff said that they were aware of the need for more bee studies for those pesticides as the agency developed its 2014 guidance.

While the new guidance is likely to affect many pesticide reviews, EPA officials told us that the agency does not plan to revise the review schedules in work plans that have already been posted. The officials said that doing so would place a significant burden on agency staff and detract from their ability to conduct registration reviews. Instead, EPA officials said that the agency would annually announce for which pesticides it expected to have preliminary risk assessments available for public review in that year. In keeping with that plan, the May 2015 task force's strategy included a list of 58 registration review preliminary risk assessments that EPA said would be open for public comments during 2015. Unlike the posted work plans for pesticides undergoing registration review, the

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<sup>91</sup>We selected the 10 pesticides shown by the EIS data base to be associated with the largest number of bee kill incidents, weighted by EPA's certainty index. However, 2 of the pesticides, parathion and methyl parathion, have been cancelled by their registrants, and, therefore, are no longer subject to EPA's registration review process. See appendix I for more detail on our selection methodology.

<sup>92</sup>There are three other registered or formerly registered neonicotinoid pesticides that we did not examine in detail because, according to EPA's EIS database, they were not associated with a significant number of bee kill incidents. Two pesticides—dinotefuran and acetamiprid—are in the midst of registration review. According to EPA's website, the agency plans to issue a preliminary risk assessment and final risk assessment for dinotefuran in 2016 and 2017, respectively. Study data will be generated for acetamiprid through 2017, and EPA plans to complete the review process by 2019. The registration for the remaining neonicotinoid—thiacloprid—was voluntarily cancelled by the registrant, and EPA closed the registration review case in November 2014.

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announcement in the strategy did not estimate when the reviews of the 58 pesticides would be complete or identify what studies EPA has determined will be required. We understand that it may be challenging for agency staff to revise the review schedules in work plans that have already been posted. However, given that EPA is working to determine what studies will be required, it may soon be able to determine the studies it would require of registrants. By disclosing in its annual PRIA implementation reports which registration reviews have potentially inaccurate schedules and when it expected those reviews to be completed, EPA could provide Congress and the public with accurate information about the schedules for completing the registration reviews, thereby increasing understanding of EPA's progress toward meeting the October 2022 deadline for completing all registration reviews.

As required by FIFRA as amended by PRIA and subsequent legislation, EPA's PRIA implementation reports contain data on the number of cases opened and closed in a particular fiscal year and cumulatively since the start of registration review in 2007. EPA has reported on its website that it expects to open 70 or more new registration review dockets annually through fiscal year 2017. Although the reports do not estimate the number of reviews EPA expects to close each year as it moves toward the 2022 deadline, the agency wrote in its fiscal year 2014 PRIA implementation report that it continued to open dockets for new registration review cases at the pace that must be maintained in order to finish reviews in 2022. EPA has estimated that the average time it will take to complete a registration review is about 6 years and that the agency has completed an average of less than 20 per year. However, the new risk assessment guidance for bees may increase the average time needed for reviews, raising questions about EPA's ability to complete its registration reviews by 2022. EPA officials said that they are planning to assign additional agency staff to work on these registration reviews.

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## Conclusions

USDA and EPA have taken numerous actions to protect the health of honey bees and other species of bees, thereby supporting agriculture and the environment. Even with these efforts, honey beekeepers continue to report rates of colony losses that they say are not economically sustainable. Although data on the size of nonhoney bee populations (other managed bees and wild, native bees) are lacking, there is concern that these bee species also need additional protection. Finding solutions to address the wide range of factors that may affect bee health, including pests, disease, reduced habitat and forage, and pesticide exposure, will

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be a complex undertaking that may take many years and require advances in science and changes in agricultural and land use practices.

Monitoring honey bees and other bee species is critical to understanding their population status and threats to their health. The task force's research action plan on bees and other pollinators identified monitoring of wild, native bees as a priority and directed agencies in USDA and the Department of the Interior to take leading and supporting roles. However, the research action plan did not establish a mechanism, such as a monitoring plan, that would establish participating agencies' roles and responsibilities, establish common outcomes and goals, and obtain input from states and other stakeholders on native bees. By working with other key agency stakeholders, USDA can help agencies understand their respective roles, focus on the same goals and outcomes, and better solicit input from external stakeholders.

The task force's strategy also includes a plan for extensive research on issues important to honey bees; other managed bees; wild, native bees; and other pollinators. USDA's ARS and NIFA have funded and continue to fund research on these three categories of bees. While the ability to identify research projects by bee category is key to tracking projects conducted to implement the task force's research action plan, USDA's CRIS database does not currently reflect these categories. This limitation hinders users' ability to search for or track completed and ongoing bee research. Updating the CRIS database to include the three bee categories would increase the accessibility and availability of information about USDA-funded research on all bees.

In addition, the task force's strategy established a governmentwide goal of restoring and enhancing 7 million acres of habitat for bees and other pollinators. USDA's NRCS and FSA are supporting efforts to improve habitat to help meet the strategy's goal. It is not yet clear, however, how the agencies will determine which acres count toward this goal because USDA cannot currently track all acres on which conservation practices have restored or enhanced bee habitat as part of the effort to achieve the strategy's goal. Without an improved method, USDA cannot accurately measure its contribution to the strategy's goal. In addition, NRCS, which provides technical assistance to landowners implementing conservation practices, has conducted limited evaluation of the effectiveness of those efforts. NRCS's *National Planning Procedures Handbook* calls for the agency to evaluate its conservation practices, including the technical assistance provided to landowners. According to one evaluation, agency staff need additional expertise to effectively advise landowners on how to



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conserve pollinator habitat. However, NRCS has not evaluated which locations have gaps or identified methods for filling the gaps. Such methods could include providing additional training or time to conduct technical assistance through which staff can learn which practices are working and which are not. By increasing the evaluation of its habitat conservation efforts to include identifying gaps in expertise and technical assistance, USDA could better ensure the effectiveness of its efforts to restore and enhance bee habitat plantings across the nation.

Moreover, EPA has expanded its assessment of pesticides for their risks to honey bees. EPA generally uses data on pesticides' risks to honey bees as a surrogate for risks to nonhoney bee species but stated that having data on those species would help meet the goal of protecting bee diversity. The task force's research action plan calls for EPA to develop tools for assessing risks to a variety of bee species, including nonhoney bee species, such as other managed or wild, native bees. EPA is collaborating with international counterparts to develop standardized guidelines for how to study the effects of pesticides on other bee species. FIFRA authorizes EPA to require pesticide registrants to submit data from tests on nonhoney bee species using methods that meet EPA's approval. By developing a plan for obtaining data from pesticide registrants on pesticides' effects on nonhoney bee species until the standardized guidelines are developed, EPA could increase its confidence that it is reducing the risk of unreasonable harm to these important pollinators.

Furthermore, EPA does not assess the risks that mixtures of pesticides and other chemicals may pose to bees. Depending on the chemicals involved, a mixture may pose a greater risk to bees than the sum of the risks from exposure to individual pesticides. The task force's research action plan generally called for research on the effects mixtures of pesticides can have on bees and, in particular, directed EPA to develop appropriate assessment tools for sublethal effects of pesticides, adjuvants, and combinations of pesticides with other products on the health of managed and wild pollinators. However, EPA does not have data on commonly used mixtures and does not know how it would identify them. By identifying the mixtures that farmers and pesticide applicators most commonly use on agricultural crops, EPA would have greater assurance that it could assess those mixtures to determine whether they pose greater risks than the sum of the risks posed by the individual pesticides and, if appropriate, take regulatory action.

As directed by FIFRA, EPA began a review of all pesticide active ingredients registered as of October 1, 2007, in fiscal year 2007 and is

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required to complete it by October 2022. EPA's review has been affected by the changes to its risk assessment process that call for pesticide registrants to submit additional bee-related data for some pesticides. As a result, the agency's posted schedules for reviewing the registration of pesticides may be inaccurate because the schedules do not reflect requests for additional data. However, EPA has not posted revised schedules. Accurate information about the agency's estimated schedule would help Congress and the public better understand EPA's progress toward meeting the October 2022 deadline for completing all registration reviews.

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## Recommendations for Executive Action

We are making four recommendations to the Secretary of Agriculture and three recommendations to the Administrator of EPA.

To improve the effectiveness of federal efforts to monitor wild, native bee populations, we recommend that the Secretary of Agriculture, as a co-chair of the White House Pollinator Health Task Force, coordinate with other Task Force agencies that have monitoring responsibilities to develop a mechanism, such as a federal monitoring plan, that would (1) establish roles and responsibilities of lead and support agencies, (2) establish shared outcomes and goals, and (3) obtain input from relevant stakeholders, such as states.

To increase the accessibility and availability of information about USDA-funded research and outreach on bees, we recommend that the Secretary of Agriculture update the categories of bees in the Current Research Information System to reflect the categories of bees identified in the White House Pollinator Health Task Force's research action plan.

To measure their contribution to the White House Pollinator Health Task Force strategy's goal to restore and enhance 7 million acres of pollinator habitat, we recommend that the Secretary of Agriculture direct the Administrators of FSA and NRCS to develop an improved method, within available resources, to track conservation program acres that contribute to the goal.

To better ensure the effectiveness of USDA's bee habitat conservation efforts, we recommend that the Secretary of Agriculture direct the Administrators of FSA and NRCS to, within available resources, increase evaluation of the effectiveness of their efforts to restore and enhance bee habitat plantings across the nation, including identifying gaps in expertise and technical assistance funding available to field offices.

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To better ensure that EPA is reducing the risk of unreasonable harm to important pollinators, we recommend that the Administrator of EPA direct the Office of Pesticide Programs to develop a plan for obtaining data from pesticide registrants on the effects of pesticides on nonhoney bee species, including other managed or wild, native bees.

To help comply with the directive in the White House Pollinator Health Task Force's strategy, we recommend that the Administrator of EPA direct the Office of Pesticide Programs to identify the pesticide tank mixtures that farmers and pesticide applicators most commonly use on agricultural crops to help determine whether those mixtures pose greater risks than the sum of the risks posed by the individual pesticides.

To provide Congress and the public with accurate information about the schedules for completing the registration reviews for existing pesticides required under FIFRA, we recommend that the Administrator of EPA disclose in its PRIA implementation reports, or through another method of its choosing, which registration reviews have potentially inaccurate schedules and when it expects those reviews to be completed.

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## Agency Comments and Our Evaluation

We provided a draft of this report to USDA and EPA for review and comment. USDA and EPA provided written comments on the draft, which are presented in appendixes IV and V, respectively. In its written comments, USDA said that it agreed, in large part, with the four recommendations relevant to the department in the draft report and that progress with regard to the recommendations would improve protection for pollinators, especially bees. In its written comments, EPA said that it agreed with the three recommendations relevant to the agency in the draft report and that it has actions under way to implement the three recommendations.

In its written comments, USDA described actions it has taken or could take to implement our first recommendation that the Secretary of Agriculture, as a co-chair of the White House Pollinator Health Task Force, coordinate with other task force agencies that have monitoring responsibilities to develop a mechanism, such as a federal monitoring plan, that would (1) establish roles and responsibilities of lead and support agencies, (2) establish shared outcomes and goals, and (3) obtain input from relevant stakeholders, such as states. USDA noted that while it would be impossible to monitor all of the approximately 4,000 species of bees in North America, it would be informative for agencies to survey changes in the distributions of a common set of sentinel, or

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indicator, bee species. The agency also described some of the monitoring methods that it plans to use or that could be used by USDA, the Department of the Interior, and other collaborators. In doing so, USDA noted that identifying native bee species can be very difficult (even to those trained in biology and museum curators) and that possible remedies will be explored, including the development of a universal field guide or apps that would facilitate bee identification efforts.

USDA also described steps that it plans to take to implement our second recommendation that the Secretary of Agriculture update the categories of bees in CRIS to reflect categories of bees identified in the White House Task Force's research action plan. USDA states that the discrepancy between the government-wide effort and current classifications needs to be reconciled to capture efforts of research, education, and extension projects as they work to address threats to bee health. While USDA states that the CRIS categories can be changed relatively quickly, it also states that the efficacy of the changes varies, depending on whether they are made for historical project data or for future project reports. USDA describes the additional staff time needed to analyze and recode projects manually in CRIS and that adding new classifications would affect current projects and would require analysis to determine if changes will affect trend reporting of the budget. USDA also states that a strategy will be needed to increase awareness of the new classifications for project directors and other scientists who may choose to change to the more specific bee classifications for their projects. The agency then describes the process by which changes are made to research classifications in CRIS, saying that if the CRIS Classification Board approves changes to CRIS when it meets in the spring of 2016, NIFA would address relevant changes at that time.

USDA generally agreed with our third recommendation that the Secretary of Agriculture direct the Administrators of FSA and NRCS to develop an improved method, within available resources, to track conservation program acres that contribute to the goal of restoring and enhancing habitat for pollinators. USDA said that since November 2015, FSA has had a method for estimating acres of pollinator habitat associated with Conservation Reserve Program practices. In addition, according to USDA, NRCS is exploring options to develop a method for tracking acres on which conservation practices are planned and applied to benefit pollinators.

USDA generally agreed with our fourth recommendation that the Secretary of Agriculture direct the Administrators of FSA and NRCS to,

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within available resources, increase evaluation of the effectiveness of their efforts to restore and enhance bee habitat plantings across the nation, including gaps in expertise and technical assistance funding available to field offices. USDA said that it would expand and deepen its studies on the impact of conservation cover on honey bee and other pollinator health, diversity, and abundance as its budget allows.

EPA agreed with our first recommendation that the Office of Pesticide Programs develop a plan for obtaining data from pesticide registrants on the effects of pesticides on nonhoney bee species, including other managed or wild, native bees. In addition, EPA described actions that it is taking in collaboration with other parties to develop methods for testing the effects of pesticides on nonhoney bee species. We also noted many of these actions in the report.

EPA agreed with our second recommendation that the Office of Pesticide Programs identify pesticide mixtures that farmers and pesticide applicators most commonly use on agricultural crops to help determine whether those mixtures pose greater risks than the sum of the risks posed by the individual pesticides. EPA noted that there is opportunity to identify some commonly used tank mixtures. At the same time, EPA commented on our use of the term “unregistered mixtures.” In our draft report, we intended for the term “unregistered mixtures” to mean combinations of registered pesticides that EPA has not registered for use in combination. However, we agree with EPA that the term “unregistered mixtures” might cause confusion and revised the draft, replacing that term with the term “tank mixtures.”

EPA agreed with our third recommendation that the agency provide Congress and the public with accurate information about the schedules for completing the registration reviews for existing pesticides required under FIFRA. However, rather than agreeing to disclose this information in its PRIA implementation reports, EPA committed to creating a public website containing this information by April 2016. We agree that a public website could be a suitable method for accomplishing the intent of our recommendation.

USDA and EPA also provided technical comments, which we incorporated as appropriate.

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As agreed with your offices, unless you publicly announce the contents of this report earlier, we plan no further distribution until 30 days from the

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report date. At that time, we will send copies to the appropriate congressional committees, the Secretary of Agriculture, the Administrator of EPA, and other interested parties. In addition, the report will be available at no charge on the GAO website at <http://www.gao.gov>.

If you or your staff members have any questions about this report, please contact me at (202) 512-3841 or [morriss@gao.gov](mailto:morriss@gao.gov). Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made key contributions to this report are listed in appendix VI.

A handwritten signature in black ink that reads "Steve D. Morris". The signature is written in a cursive, slightly slanted style.

Steve D. Morris  
Director, Natural Resources and Environment

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# Appendix I: Objectives, Scope, and Methodology

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This report examines (1) the bee-related monitoring, research and information dissemination, and conservation efforts of selected U.S. Department of Agriculture (USDA) agencies and (2) the Environmental Protection Agency's (EPA) efforts to protect bees through its regulation of pesticides.

To examine USDA's monitoring, research and outreach, and conservation efforts with respect to bees, we focused on the National Agricultural Statistics Service (NASS), which surveys honey beekeepers; the Agricultural Research Service (ARS) and National Institute of Food and Agriculture (NIFA), which are the two largest USDA research agencies; and the Natural Resources Conservation Service (NRCS) and Farm Service Agency (FSA), which oversee conservation programs. To examine bee monitoring activities, we analyzed the methodology that NASS and the Bee Informed Partnership are using for their monitoring efforts related to their surveys of honey bee colony losses.<sup>1</sup> We also reviewed the White House Task Force plans for wild, native bee monitoring by a variety of federal agencies to determine whether a means of federal coordination had been established. We also reviewed our prior body of work on interagency collaboration, as agencies within USDA carry out work related to bee monitoring in conjunction with other agencies; from that work, we selected practices that were related to challenges that we or agency officials identified and used the practices to assess interagency collaboration at USDA concerning bee monitoring.<sup>2</sup> In addition, we reviewed ARS and NIFA documents related to monitoring projects and interviewed ARS and U.S. Geological Survey<sup>3</sup> officials and university researchers participating in monitoring projects.

To examine bee-related research and outreach, we analyzed USDA project funding data for ARS and NIFA for fiscal years 2008 through 2015 and for fiscal years 2008 through 2014, respectively, to identify the types of bees addressed by the projects. We selected fiscal year 2008 as the

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<sup>1</sup>The Bee Informed Partnership is a collaboration of efforts across the country from research laboratories and universities in agriculture and science. It is supported by USDA's National Institute of Food and Agriculture.

<sup>2</sup>[GAO-06-15](#); [GAO-12-1022](#); and [GAO-14-220](#).

<sup>3</sup>The U.S. Geological Survey is an agency within the Department of the Interior that provides scientific information on, among other things, the health of the U.S. environment and ecosystems.

starting point to reflect 2008 Farm Bill initiatives; data from fiscal years 2015 and 2014 were the most recent data available for ARS and NIFA, respectively. We evaluated the reliability of these data by comparing agency-provided data with data found in USDA's website for its Current Research Information System (CRIS) and reviewing the agencies' management controls to ensure the data's reliability. We determined that the data are sufficiently reliable for the purposes of this report. We also reviewed how ARS and NIFA categorize research data in USDA's CRIS database and compared the CRIS categories to those used in the task force strategy and research action plan. We interviewed ARS and NIFA officials in headquarters and in three bee laboratories regarding research and outreach projects being conducted and the usefulness of the CRIS bee categories.

To examine bee-related activities in two key USDA agencies with conservation programs, we collected data from NRCS and FSA on bee habitat acres established in 2014 and 2015 for two honey bee initiatives and associated agency funding. We evaluated the reliability of these data by reviewing the agencies' management controls for the systems maintaining the data to ensure the data were sufficiently reliable for the purposes of this report. We also reviewed NRCS and FSA guidance and other documents on bee habitat, as well as evaluations of the NRCS technical assistance efforts. In particular, we reviewed an evaluation by the Pollinator Partnership of NRCS's technical assistance efforts and examined the agency's response to conclusions about the level of bee habitat conservation expertise within the agency.<sup>4</sup> We interviewed FSA and NRCS officials to discuss strengths and weaknesses of their pollinator habitat efforts, particularly related to evaluation and technical assistance.

To examine EPA's efforts to protect bees, we gathered information on its regulation of pesticides under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). In particular, we obtained documents from, and conducted interviews with, officials in EPA's Office of Pesticide Programs (OPP). OPP carries out EPA's responsibilities for regulating the manufacture and use of all pesticides (including insecticides, herbicides,

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<sup>4</sup>Pollinator Partnership, *Assessing the Effectiveness of NRCS Pollinator Programs*, December 30, 2014. The mission of the Pollinator Partnership, a nonprofit organization, is to promote the health of pollinators critical to food and ecosystems through conservation, education, and research.



rodenticides, disinfectants, sanitizers, and more) in the United States. Specifically, we reviewed EPA's decisions in 2014 to modify the labels of pesticide products containing neonicotinoid active ingredients. We also reviewed EPA's 2015 proposal to modify the labels of pesticides the agency has determined to be acutely toxic to bees. We also gathered information about pesticides that have been associated with bee kill incidents from 1974 through 2014, as indicated by reports in EPA's Ecological Incident Information System (EIIS). To assess the reliability of the EIIS data, we discussed with EPA officials the methods by which the agency collects and assesses the EIIS data and determined that, while they had limitations, they were sufficiently reliable for the purpose of identifying pesticides potentially associated with bee kills. Furthermore, we reviewed documents and interviewed agency officials regarding EPA's efforts to encourage states to develop voluntary "managed pollinator protection plans."

In addition, we reviewed the agency's 2011 interim and 2014 final guidance for assessing the risks that pesticides pose to bees and examined how the agency has applied the new guidance to particular pesticides.<sup>5</sup> We also reviewed an EPA "White Paper" on risk assessment the agency submitted to the FIFRA Scientific Advisory Panel for comment, as well as the panel response.<sup>6</sup> To learn more about how the agency has used its 2014 risk assessment guidance when reviewing the registration of existing pesticides, we selected 10 pesticides shown by EPA's EIIS database to be associated with bee kills. When EPA receives reports of bee kill incidents, according to agency officials, it considers the evidence provided and categorizes the likelihood that a specific pesticide was associated with the bee kill as highly probable, probable, possible, unlikely, or unrelated. We assigned to those certainties a score of 4, 3, 2, 1, or 0, respectively, and multiplied the number of incidents for each

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<sup>5</sup>The director of EPA's Environmental Fate and Effects Division issued a memorandum to staff titled *Interim Guidance on Honey Bee Data Requirements* in October 2011. In June 2014, EPA issued *Guidance for Assessing Pesticide Risks to Bees*, co-authored by the Office of Pesticide Programs, United States Environmental Protection Agency, Washington, D.C.; the Health Canada Pest Management Regulatory Agency, Ottawa, ON, Canada; and the California Department of Pesticide Regulation, Sacramento, CA, June 19, 2014.

<sup>6</sup>EPA, *White Paper in Support of the Proposed Risk Assessment Process for Bees*, September 11, 2012 and FIFRA Scientific Advisory Panel, *A Set of Scientific Issues Being Considered by the Environmental Protection Agency Regarding Pollinator Risk Assessment Framework September 11 – 14, 2012*.

pesticide by the certainty score. Using the product of those calculations, we identified the 10 pesticides associated with the largest number of bee kill incidents and weighted by EPA's degree of certainty. The 10 pesticides, in alphabetical order, are amitraz, carbaryl, chlorpyrifos, clothianidin, coumaphos, imidacloprid, malathion, methyl parathion, parathion, and thiamethoxam. However, 2 of the pesticides, parathion and methyl parathion, have been cancelled by their registrants and, therefore, are no longer subject to EPA's registration review process. For the remaining 8 pesticides, we reviewed EPA's final work plans and other documents related to the agency's registration review process and interviewed agency officials to determine what effect the new risk assessment guidance had on the registration review process.

We reviewed data and interviewed agency officials about the status of EPA's pesticide registration and registration review programs. The data included the number of pesticide "cases" for which EPA had started the registration review process from the beginning of fiscal year 2007 through the end of fiscal year 2015, the number of cases with final work plans completed, and the number of case reviews that EPA has completed. We selected these time frames because EPA began the registration review process required by FIFRA in fiscal year 2007, and the most recent data available from the agency were through the end of fiscal year 2015. To assess the reliability of the data on registration reviews provided directly to us by EPA's OPP, we compared them to data in EPA implementation reports to Congress required by FIFRA and found them sufficiently reliable for our reporting purposes.

To address both objectives, we gathered stakeholders' views on what efforts, if any, USDA and EPA could take to protect bee health. Specifically, we interviewed stakeholders from the following types of organizations or entities: general farming, including conventional and organic farming; commodity farmers whose crops are pollinated by managed bees; commercial beekeepers; pesticide manufacturers; state governments; universities; and conservation/environmental protection. We developed a list of candidate stakeholders by asking for suggestions from knowledgeable federal officials and others knowledgeable about bee health and through our review of relevant literature. USDA and EPA officials reviewed our list of candidate stakeholders and made suggestions. We also obtained advice from a member of the National Academy of Sciences with extensive experience on bee and pollinator research about how to achieve a balanced list of stakeholders with varied expertise and knowledge. Appendix II presents a summary of stakeholders' views on USDA and EPA efforts to protect bees.

We conducted 35 interviews with stakeholders. A total of 50 individuals participated in the interviews because, in some instances, more than one person represented a stakeholder organization. See appendix III for the names of the individuals we interviewed, their title, affiliation, and type of stakeholder organization.

To ensure we asked consistent questions among all the identified stakeholders, we developed an interview instrument that included questions about the stakeholders' expertise and experience regarding bees, their knowledge of relevant USDA and EPA activities to protect bee health, and their views on suggestions for efforts, if any, (1) USDA's ARS, NIFA, or NRCS should make with regard to bee-related research and information dissemination; (2) other USDA agencies should make to protect bee health; or (3) EPA should make to protect bee health. With the exception of the university research scientists, the stakeholders represented their organizations' views. After completing the interviews, we conducted a content analysis of the stakeholders' responses, whereby we organized their comments into relevant categories. Because we used a nonprobability sample of stakeholders, their views cannot be generalized to all such stakeholder organizations but can be illustrative. In addition, the views expressed by the stakeholders do not represent the views of GAO. Further, we did not assess the validity of the stakeholders' views on what efforts USDA and EPA should make to protect bee health.

We conducted this performance audit from October 2014 to February 2016 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

# Appendix II: Stakeholders' Views on Efforts USDA and EPA Should Make to Further Protect Bees

This appendix presents stakeholders' views regarding suggested efforts the U.S. Department of Agriculture (USDA) and Environmental Protection Agency (EPA) should make to further protect bee health. Stakeholders provided these views in interviews. Specifically, we interviewed a nonprobability sample of stakeholders from 35 of the following types of organizations or entities: general farming, including conventional and organic farming; commodity farmers whose crops are pollinated by managed bees; commercial beekeeping; pesticide manufacturing; state government; university research; and conservation/environmental protection.

In our interviews, we asked stakeholders for their familiarity with agency efforts to protect bee health as well as for their views on suggestions for any efforts the agencies should make to further protect bee health. The information in table 1 provides a summary of stakeholders' views on commonly-cited topics and indicates the types of stakeholder groups that expressed those views.

**Table 1: Stakeholders' Views on Efforts U.S. Department of Agriculture (USDA) and Environmental Protection Agency (EPA) Should Make to Further Protect Bees**

Stakeholders' Views on USDA Efforts to Further Protect Bees
Stakeholders' Views on USDA's Research and Outreach on Bees
<p>Stakeholders suggested that USDA generally, or the Agricultural Research Service (ARS) and National Institute of Food and Agriculture (NIFA), specifically, should increase research on:</p> <ul style="list-style-type: none"> <li>• Bees and the health of bees generally (general farming, pesticide manufacturing, and university research stakeholders).</li> <li>• <i>Varroa</i> mites and tools, such as miticides, to reduce the impact of the mites on honey bees (general farming, commercial beekeeping, pesticide manufacturing and state organization stakeholders).</li> <li>• Issues related to the effects of pesticides on bees, including: the effects from entire pesticide products, fungicides, inert ingredients, adjuvants, multiple pesticides from different crops and locations, treated seeds, and tank mixes; the sublethal and synergistic effects of pesticides; the effects on different life stages of bees, native bees, individual bees, and the entire colony over its life span; and the effects of pesticide concentrations in surface water (general farming, commercial beekeeping, state organization, university research, and conservation/environmental stakeholders). In contrast, USDA should conduct less research on the connection between pesticides and bee decline (pesticide manufacturing stakeholder).</li> <li>• The development of Integrated Pest Management (IPM) and Integrated Pest and Pollinator Management for different cropping systems (state organization, university research and conservation/environmental stakeholders).</li> <li>• Forage and nutrition, including research to (1) identify which plants work best in different locations and are most attractive and nutritious for bees and other pollinators; (2) identify how to establish and maintain habitat; and (3) develop decision tools to inform USDA and growers of the costs and benefits of forage options (general farming, commodity farming, commercial beekeeping, university research, and conservation/environmental stakeholders).</li> <li>• Monitoring wild, native bees. USDA should take additional actions to monitor wild, native bees because current monitoring is insufficient and will not facilitate provision of long-term trends in populations (pesticide manufacturing, university research, and conservation/environmental stakeholders).</li> <li>• Bee genetics and breeding (general farming, pesticide manufacturing, state organization, and university research stakeholders).</li> <li>• Bee diseases, such as those that may be transmitted by commercial bumble bees to native bumble bees (conservation/environmental stakeholder).</li> </ul>

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**Appendix II: Stakeholders' Views on Efforts  
USDA and EPA Should Make to Further Protect  
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Stakeholders specifically suggested that ARS should:

- Classify honey bees as livestock and move them into NIFA animal and plant research groups—which receive more funding than insect research, so that honey bee grants would not detract from other insect research (university research stakeholder).
- Have a specific line item in its budget for pollinator research (university research stakeholder).

Stakeholders specifically suggested that NIFA should:

- Direct more competitive research funding to cooperative research efforts, as opposed to individual efforts (university research stakeholders).
- Streamline its paperwork requirements for competitive grants and provide scientists with more time to prepare proposals (university research stakeholder).
- Improve the organization and search functions of its website to help scientists more easily find funding opportunities related to bees (university research stakeholder).
- Discontinue funding to land-grant universities that develop or recommend tank mixtures that harm bees (commercial beekeeping stakeholder).

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**Stakeholders' Views on USDA's Habitat Management/Conservation Programs**

Stakeholders specifically suggested that USDA should:

- Provide funding for improved monitoring of the effectiveness of habitat planting (conservation/environmental stakeholder).
- Expand its conservation programs to benefit bees and other pollinators by (1) increasing funding for the Conservation Reserve Program (CRP) and Environmental Quality Improvement Program (EQIP); (2) increasing participation by farmers who use Integrated Pest Management (IPM) or organic practices; and (3) including states outside the five Midwestern states (Michigan, Minnesota, North Dakota, South Dakota, and Wisconsin) where the Natural Resource Conservation Service (NRCS) and Farm Service Agency have initiated honey bee habitat conservation efforts (general farming, commercial beekeeping, pesticide manufacturing, university research, and conservation/environmental stakeholders).
- Move funds from the crop insurance program to the CRP, for example, to stop the federal government from subsidizing the production of corn and soybeans on marginal lands (commercial beekeeping and university research stakeholders).
- Address the fact that federal biofuels and bioenergy subsidies encourage converting marginal lands, grasslands, and native prairies from pollinator-beneficial ecosystems into lands that produce monoculture crops (university research and conservation/environmental stakeholders).
- Have a pollinator habitat expert for native bees for each of the about 30 states that has a significant need for pollinator habitat (university research stakeholder).
- Increase funding for NRCS Plant Materials Centers so that they would have sufficient staff and facilities to increase conservation research and field demonstrations in their areas<sup>a</sup> (conservation/environmental stakeholder).
- Increase its emphasis on forage for honey bees (commercial beekeeping, state organization, university research, and conservation/environmental stakeholders).
- Obtain more input from beekeepers regarding forage used in conservation programs (commercial beekeeping stakeholder).

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**Stakeholders' Views on USDA Training and Expertise**

Stakeholders specifically suggested that USDA should:

- Hire and retain high-caliber research leaders at ARS laboratories (university research stakeholder).
  - Appoint someone to fill the role of a national extension agent for bees (university research stakeholder).
  - Provide more training to NRCS staff on how to promote the benefits of organic farming and IPM (general farming stakeholders).
  - Hire and train more NRCS staff to help landowners take advantage of available funding to help pollinators (university research and conservation/environmental stakeholders).
  - Improve the training and increase the hiring of NRCS staff throughout the states to ensure conservation plantings benefit bees (university research and conservation/environmental stakeholders).
  - Have NRCS ensure that each of the approximately 30 states with a significant need for pollinator habitat has a native bee expert (university research stakeholder).
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**Appendix II: Stakeholders' Views on Efforts  
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**Stakeholders' Views on Efforts by Other USDA Agencies**

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Stakeholders specifically suggested that USDA should:

- Take more action to promote IPM (state organization and conservation/environmental stakeholder).
- Ensure that farmers have access to nontreated seeds in case they want to use them. Toward that end, the Economic Research Service should examine current market conditions regarding the availability of nontreated seeds (conservation/environmental stakeholder).
- Review the methods the Agricultural Marketing Service's laboratory uses to test bee samples for pesticides. The stakeholder said they sent 100 bees contaminated with a large amount of an insecticide for testing, but the laboratory did not detect the insecticide (commercial beekeeping stakeholder).
- Permanently fund the national honey bee disease survey conducted by the Animal and Plant Health Inspection Service (APHIS) in coordination with ARS (state organization stakeholder).
- Require (through APHIS) that managed bumble bee colonies be certified as free of parasites and diseases harmful to wild bumble bees prior to being sold, imported, or moved between states (conservation/environmental stakeholder).
- Prohibit (through APHIS) the release of managed, nonnative bumble bee species outside of their native ranges (conservation/environmental stakeholder).
- Require (through APHIS) that all companies supplying native, bumble bees produce them within their native ranges (conservation/environmental stakeholder).
- Fund the National Agricultural Statistics Service to increase its monitoring of pesticide use (conservation/environmental stakeholder).

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**Stakeholders' Views on EPA Efforts to Further Protect Bees**

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**Stakeholders' Views on EPA's Bee Kill Incident Data**

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Stakeholders specifically suggested that EPA should:

- Automatically forward bee kill reports that are sent to EPA's beekill@epa.gov e-mail address to the relevant state department of agriculture and state apiarist<sup>b</sup> (state organization stakeholder).
  - Ensure that state agencies do an adequate job of investigating and enforcing label requirements in response to reports of bee kills (commercial beekeeping stakeholder).
  - Require states to conduct more investigations of bee kill incidents and to do so more quickly (conservation/environmental stakeholder).
  - Work with USDA to help the states investigate bee kills by improving state access to laboratory resources and technical expertise (state organization stakeholder).
  - Train state apiarists on how to investigate bee kills associated with pesticides and work with states to conduct more timely investigations (state organization stakeholder).
  - Provide more funding to the states to carry out bee kill incident investigations and reporting (university research stakeholder).
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**Appendix II: Stakeholders' Views on Efforts  
USDA and EPA Should Make to Further Protect  
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**Stakeholders' Views on EPA's Pesticide Regulation, Registration, and Registration Review**

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Stakeholders suggested EPA take several actions related to the agency's regulation of pesticide labels:

- Ensure that labels for registered pesticides contain appropriate language warning about the effects of the pesticide on species of bees other than honey bees. For example, some fungicides should have label warnings about their potential effect on orchard mason bees (commercial beekeeping stakeholder).
- Provide better warnings on labels for pesticides used by homeowners (university research stakeholder).
- Require that registrants disclose all ingredients—both active and inert—on pesticide labels (university research stakeholder).
- Ensure that the wording in products' bee advisory box is consistent with the environmental warning statement elsewhere on the products' labels (commodity farming stakeholder).
- Modify the bee icon in the bee advisory box so that it does not appear to be a healthy bee (university research stakeholder).
- Make the directions for use on pesticide labels consistent for crops pollinated by managed bees and crops not pollinated by managed bees (commercial beekeeping stakeholder).
- Expand the scope of label changes for neonicotinoid pesticides to include seed treatment applications (Conservation/environmental stakeholders).
- Develop clear labels for which pesticide mixtures are allowed (commercial beekeeping stakeholder).

Stakeholders suggested EPA take several actions related to how the agency assesses the risks that pesticides pose to bees:

- Expand the risk assessment process to include testing the effects of pesticides on pollinators other than honey bees, including other commercial and native bees (general farming, commercial beekeeping, university research, and conservation/environmental stakeholders).
- Require companies to conduct toxicity studies on pesticide mixtures (commercial beekeeping, university research, and conservation/environmental stakeholders).
- Focus attention on commonly used pesticide mixtures, including mixtures promoted by pesticide manufacturers, companies that apply pesticides, and extension agents, and mixtures found in bee hives (commercial beekeeping, university research, and conservation/environmental stakeholders).
- Require pesticide registrants to test entire pesticide formulations—all inert ingredients, as well as active ingredients in the product—in the risk assessment process (commercial beekeeping, university research, and conservation/environmental stakeholders).

Stakeholders suggested EPA take several actions related to the agency's monitoring of pesticide use:

- Develop or expand upon the public reporting of pesticide use (commercial beekeeping, university research, and conservation/environmental stakeholders).
- Collect data on the use of seeds treated with pesticides (commercial beekeeping, university research, and conservation/environmental stakeholders).
- Monitor the environment to determine which pesticides bees are exposed to (university research stakeholders).

Stakeholders suggested EPA take several actions related to the agency's oversight of seeds treated with pesticides:

- Revise the definition of a pesticide under FIFRA to include seeds that are treated with pesticides<sup>c</sup> (conservation/environmental stakeholders).
  - Take additional steps to address situations in which a pesticide applied to seeds is dislodged in the form of dust (commercial beekeeping and conservation/environmental stakeholders).
  - Ensure that farmers have access to seeds that are not treated with pesticides (conservation/environmental stakeholder).
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**Appendix II: Stakeholders' Views on Efforts  
USDA and EPA Should Make to Further Protect  
Bees**

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**Stakeholders' Views on EPA Research**

Stakeholders suggested EPA conduct additional research on:

- The effect that combinations of multiple pesticides can have on bees (commodity farming and university research stakeholders).
- The chronic effects that pesticides can have on bees (university research stakeholders).
- The effect of pesticides on the larval stage of bees' life cycle (university research stakeholders).
- The economic benefits of pesticide use, including seeds treated with systemic pesticides (conservation/environmental stakeholders).

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**Stakeholders' Views on EPA Outreach**

Stakeholders suggested EPA conduct additional outreach related to:

- Promoting pesticide use practices that benefit bees through additional training for farmers, pesticide application companies, and homeowners (general farming, state organization, and conservation/environmental stakeholders).
- Providing easily accessible fact sheets on pesticides (university research stakeholder).
- Providing information to the public and beekeepers about the risk associated with using pesticides in hives to combat *Varroa* mites (pesticide industry and state organization stakeholders).
- Providing training to Pest Control Advisors on the risks that pesticides pose to bees. Advisors need to know more about how to protect beneficial insects—including bees—and not just how to kill harmful insects (commercial beekeeping stakeholder).
- Promoting communication between commercial beekeepers and farmers (pesticide manufacturing stakeholder).

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**Stakeholders' Views on Agency Coordination**

**Stakeholders' Views on Federal-State Coordination**

Stakeholders suggested:

- USDA needs to provide better advice to state and county weed abatement programs on the impact of weed abatement on beneficial pollinator plants and bees (commercial beekeeping stakeholder).
- USDA should work with states to establish a more uniform framework for regulating the movement of nonhoney bees. Specifically, APHIS and states should facilitate permitting for moving these bees (commercial beekeeping stakeholder).
- USDA should provide training to state apiarists on methods for diagnosing threats to bee health (state organization stakeholder).
- USDA and EPA should work together to help the states investigate bee kills by improving state access to laboratory resources and technical expertise (state organization stakeholder).
- EPA should continue to: engage in all managed pollinator protection plan discussions; help develop protection plan guidance; evaluate state pollinator protection plans; and give the states flexibility to find local solutions regarding pesticide regulatory decisions (state organization stakeholder).
- Managed pollinator protection plans should include county extension agents, funded in part by USDA's NIFA, as key players for disseminating best management practice information and facilitating communication between beekeepers and farmers (state organization stakeholder).

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**Stakeholders' Views on Intra-Agency Coordination**

Stakeholders suggested:

- USDA should initiate a multistakeholder campaign to protect bees across a range of USDA agencies, similar to their International Year of Soils campaign for healthy soils (general farming stakeholder).
  - NRCS should include APHIS's invasive species advisory group in determinations of whether a plant that may be planted as bee forage is invasive or not (commodity farming stakeholder).
  - ARS and NIFA should more closely coordinate their bee-related research to avoid duplication. Coordination could include a formal agreement that spells out how they communicate with each other about their pollinator research plans if one does not already exist (commodity farming, commercial beekeeping, and university research stakeholders).
  - NIFA should allow ARS scientists to be principal investigators on and to collaborate with university researchers that have received NIFA competitive grants (university research stakeholder).
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**Appendix II: Stakeholders' Views on Efforts  
USDA and EPA Should Make to Further Protect  
Bees**

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**Stakeholders' Views on Inter-Agency Coordination**

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Stakeholders suggested:

- USDA and other agencies, such as the Department of the Interior's U.S. Geological Survey, should coordinate federal monitoring efforts (university research and conservation/environmental stakeholders). Without such a coordinated policy, agencies will not know which species are declining, endangered, or extinct (university research stakeholder).
- ARS and NIFA should ensure research they fund or conduct will be useful to EPA regulators in making regulatory decisions (commodity farming stakeholder).
- EPA should coordinate with ARS, and potentially other organizations and private companies, to develop the tests that EPA needs to assess bee toxicity (commodity farming stakeholder).
- USDA should be the lead agency in the honey bee health issue area, because bees are part of agriculture (commodity farming stakeholder).
- EPA and USDA should work together to develop a real-time database of pesticide spraying (commercial beekeeping stakeholder).
- ARS labs should be involved in the pesticide registration process administered by EPA. In particular, ARS labs should help provide third-party, objective verification of the toxicity of pesticides to bees. ARS should be involved in validating the claims made by the manufacturers and in commenting on EPA regulations and guidance (commercial beekeeping stakeholders).
- USDA and EPA should consider establishing a USDA laboratory that would not only conduct pesticide analysis, but also examine the effect of diseases, insect pests, and general nutrition in determining the cause of bee kill incidents (state agency stakeholder).
- EPA should work with USDA's ARS every 5 to 10 years to assess the state of research on pesticides and bee health (university research stakeholder).
- A national effort should be initiated to coordinate and encourage planting as well as better management of wildflowers on field margins, highway rights of way, power line cutouts, and other similar areas (university research stakeholder).

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**Stakeholders' Views on the Role of Congress in Protecting Bee Health**

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Stakeholders suggested:

- Congress should understand the benefits that the extension service can provide to farmers (general farming stakeholder).
  - USDA and Congress should continue to support Farm Bill funding that pays for state-led honey bee research and monitoring (state organization stakeholder).
  - The Department of Energy, the White House, and Congress should develop biofuel policies that include a high degree of sustainability, so that land pollinators use for their habitat is not lost. NRCS's role could be helping ensure that the forage crops are well-placed in the landscape and well-maintained (university research stakeholder).
  - Farm Bill policies and crop insurance statutory provisions should be changed to avoid planting in marginal lands that would benefit pollinators and other wildlife (conservation/environmental stakeholder).
  - Congress should promote IPM and encourage the chemical industry to offer IPM education to farmers (conservation/environmental stakeholder).
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**Appendix II: Stakeholders' Views on Efforts  
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**Stakeholders' Views on Federal-Nongovernmental Coordination**

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Stakeholders suggested:

- Chemical companies should be involved in public-private partnerships on research to maintain and improve bee health (general farming stakeholder).
- Before USDA or other federal agencies, states, and counties decide what plants are weeds, they should consult the beekeeping industry (commercial beekeeping stakeholder).
- Research leaders at ARS laboratories need to work more closely with nongovernmental researchers at universities and in industry, instead of working in isolation (commercial beekeeping stakeholder).
- USDA and ARS should increase coordination related to bee research with universities and others (commercial beekeeping, university research, and pesticide manufacturing stakeholders).
- ARS should improve communication with stakeholders, particularly beekeepers, prior to making significant personnel changes affecting stakeholders (general farming and university research stakeholders).
- NIFA should help encourage collaboration between ARS and universities by establishing an institute to bring ARS and university researchers together and to integrate research in genomics, applied bee health, and systems biology (university research stakeholder).
- The Bee Informed Partnership, under NIFA's direction, should involve EPA and industry scientists, in addition to other nongovernmental organizations, more closely in its analysis of its findings on the presence of pesticides in bee hives (pesticide manufacturing stakeholder).
- In addition to research, USDA should promote existing opportunities for public-private partnerships among the different organizations working in this area (general farming, pesticide manufacturing stakeholder).
- EPA should work with USDA and the agricultural community to facilitate a transition to more IPM-based, sustainable agricultural systems that leave room for bees and other wildlife (conservation/environmental stakeholder).
- USDA should engage beekeeping representatives, as well as scientists and other credible stakeholders in supporting the beekeeping industry on forage and nutrition issues (conservation/environmental stakeholder).
- USDA should seek out and leverage private sector and nongovernmental organization partners to leverage limited Conservation Reserve Program funds for incentives and outreach (conservation/environmental stakeholder).

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**Stakeholders' Views on U.S.-International Coordination**

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Stakeholders suggested:

- To help improve its guidelines for assessing pesticide risks to bees, EPA should collaborate more with European experts on how to protect honey bees, bumble bees, and solitary bees and also examine and follow the more protective European approach to risk assessment (commercial beekeeping stakeholder).

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Sources: GAO analysis of stakeholders' views. | GAO-16-220

<sup>a</sup>According to the NRCS website, the agency's Plant Materials Centers, which are based in ecologically distinct service areas, work with plant materials specialists to seek out and test plants and plant technologies that restore and sustain healthy natural ecosystems; conserve and enhance critical wildlife habitat; mitigate diverse environmental and natural resource concerns; provide economic and socially acceptable solutions; and support a safer human environment. These centers evaluate plants for conservation traits and make these materials available to commercial growers who provide plant materials to the public. The centers also develop innovative techniques for land managers to use in managing a variety of conservation plants.

<sup>b</sup>A collection of bee hives is called an apiary, and an apiarist is someone who keeps bee hives. A state apiarist is responsible for regulating bee hives according to the laws of that state.

<sup>c</sup>EPA's interpretation of FIFRA as set forth in its implementing regulations at 40 C.F.R. 152.25(a) is that the agency does not regulate seeds that are treated with registered pesticides and that meet the requirements of the treated article exemption. EPA considers the seeds to be "treated articles" that are exempt from FIFRA regulation. However, the pesticide active ingredients that are used to treat seeds are regulated under FIFRA and, according to EPA officials, the agency assesses the risks and benefits that may be associated with using the pesticide as a seed treatment.

# Appendix III: Bee Health Stakeholders We Interviewed

Name of stakeholder	Title	Affiliation	Type of organization
Laurie Davies Adams	Executive Director	Pollinator Partnership	Conservation or environmental protection
Brett Adee	Representative to the National Honey Bee Advisory Board	American Honey Producers Association	Commercial beekeeping
Matthew Allan	Pollination Specialist	Pacific Pollination, LLC	Commercial beekeeping
Scott Hoffman Black	Executive Director	Xerces Society	Conservation or environmental protection
Daniel A. Botts	Chairman of the Technical Committee/Vice President, Industry Resources	Minor Crop Farmer Alliance/Florida Fruit & Vegetable Association	Commodity farming
Gene Brandi	Vice President	American Beekeeping Federation	Commercial beekeeping
Mary Byrne	Plant Ecologist	Pollinator Partnership	Conservation or environmental protection
Dan Campbell	Stewardship and Regulatory Policy Team Leader	Syngenta Crop Protection, LLC	Pesticide manufacturing
Aimee Code	Pesticide Program Coordinator	Xerces Society	Conservation or environmental protection
Darren Cox	President	American Honey Producers Association	Commercial beekeeping
Robert Curtis	Associate Director of Agricultural Affairs	Almond Board of California	Commodity farming
Tom Driscoll	Government Relations Representative	National Farmers Union	General farming
Mark Dykes	President	Apiary Inspectors of America	State government
Jay Feldman	Executive Director	Beyond Pesticides	Conservation or environmental protection
Michelle Flenniken, PhD	Assistant Professor of Plant Sciences and Plant Pathology	Montana State University	University research
David Fischer, PhD	Director of Pollinator Safety	Bayer CropScience	Pesticide manufacturing
Jim Frazier, PhD	Professor Emeritus of Entomology	Pennsylvania State University	University research
Chandler Goule	Senior Vice President of Programs	National Farmers Union	General farming
Jim Gray	Chair	State-FIFRA Issues Research and Evaluation Group	State government
Thomas Green, PhD	Executive Director and Board Member	The IPM Institute of North America, Inc.	General farming
Nichelle Harriott	Science and Regulatory Director	Beyond Pesticides	Conservation or environmental protection
Jeff Harris, PhD	Assistant Extension/Research Professor of Entomology	Mississippi State University	University research
Jerry Hayes	Commercial Director of Beeologics	Monsanto Company	Pesticide manufacturing
Christi Heintz	Executive Director	Project Apis m.	Commercial beekeeping

**Appendix III: Bee Health Stakeholders We Interviewed**

<b>Name of stakeholder</b>	<b>Title</b>	<b>Affiliation</b>	<b>Type of organization</b>
Dudley Hoskins	Public Policy Counsel	National Association of State Departments of Agriculture	State government
Rufus Isaacs, PhD	Professor and Extension Specialist in Entomology	Michigan State University	University research
Reed Johnson, PhD	Assistant Professor of Entomology	The Ohio State University	University research
Aaron Kinsman	Media Relations Specialist	Rodale Institute	General farming
Claire Kremen, PhD	Professor of Arthropod Biodiversity	University of California-Berkeley	University research
Gabriele Ludwig, PhD	Associate Director of Environmental Affairs	Almond Board of California	Commodity farming
Rene Ruiter	North American Business Unit Manager	Koppert Biological Systems	Commercial beekeeping
Gene Robinson, PhD	Director, Institute for Genomic Biology	University of Illinois	University research
Jennifer Sass, PhD	Senior Scientist	Natural Resources Defense Council	Conservation or environmental protection
Caydee Savinelli, PhD	Pollinator and IPM Stewardship Team Lead	Syngenta Crop Protection, LLC	Pesticide manufacturing
Paul Schlegel	Director	American Farm Bureau Federation	General farming
Michael Schmaeling	Facilities Team Member and Honey Bee Conservancy Manager	Rodale Institute	General farming
Mark Seetin	Director of Regulatory and Industry Affairs	U.S. Apple Association	Commodity farming
Steve Sheppard, PhD	Chair of Entomology Department	Washington State University	University research
Mark Smallwood	Executive Director	Rodale Institute	General farming
Marla Spivak, PhD	Extension Entomologist	University of Minnesota	University research
David Tarcy, PhD	Professor and Extension Apiculturist	North Carolina State University	University research
Tim Tucker	President	American Beekeeping Federation	Commercial beekeeping
Tom Van Arsdall	Director of Public Affairs	Pollinator Partnership	Conservation or environmental protection
Dennis van Engelsdorp, PhD	Assistant Professor of Entomology	University of Maryland	University research
Mace Vaughan	Pollinator Program Co-Director	Xerces Society	Conservation or environmental protection
Mark Wagoner	Board Member and Past President	Western Alfalfa Seed Growers Association	Commodity farming
Gordon Wardell, PhD	Board Chairman	Project Apis m.	Commercial beekeeping
Neil Williams, PhD	Associate Professor of Entomology	University of California-Davis	University research

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**Appendix III: Bee Health Stakeholders We Interviewed**

<b>Name of stakeholder</b>	<b>Title</b>	<b>Affiliation</b>	<b>Type of organization</b>
Victoria Wojcik, PhD	Research Director	Pollinator Partnership	Conservation or environmental protection
Bob Young	Chief Economist and Deputy Executive Director, Public Policy	American Farm Bureau Federation	General farming

Source: GAO. | GAO-16-220

# Appendix IV: Comments from the Department of Agriculture



United States  
Department of  
Agriculture

Research  
Education  
Economics

Office  
of the Under  
Secretary

Room 214W  
Jamie L. Whitten Building  
Washington, DC 20250-0110

JAN 29 2016

Mr. Steve D. Morris  
Director, Natural Resources and Environment  
United States Government Accountability Office  
441 G Street NW.  
Washington, D.C. 20548

Dear Mr. Morris:

The United States Department of Agriculture (USDA) appreciates the opportunity to review and provide comments on the draft Government Accountability Office (GAO) report to Congressional requesters GAO-16-220, "Bee Health: USDA and EPA Should Take Additional Actions to Address Threats to Bee Populations" (January 2016).

The report was reviewed by the following USDA agencies: Animal and Plant Health Inspection Service (APHIS), Agricultural Research Service (ARS), Economic Research Service (ERS), Farm Service Agency (FSA), National Agricultural Statistics Service (NASS), National Institute of Food and Agriculture (NIFA), Natural Resources Conservation Service (NRCS), ARS Office of Pest Management Policy, Risk Management Agency, and U.S. Forest Service (USFS). In general, these agencies concluded that the report is well written, concise, and synthesizes a number of pollinator-linked programs across the Federal Government. The conclusions are well-researched and well-reasoned. The body of the text supports the recommendations and improvements to the previous draft are noted.

The report has four Recommendations for Executive Action that are addressed to USDA agencies, summarized as:

- 1) Monitoring Native Bees: For all USDA agencies (especially ARS, NIFA, NASS, and USFS, in collaboration with Department of Interior (DOI) agencies such as U.S. Geological Survey (USGS), National Park Service, and U.S. Fish and Wildlife Service), develop a federal monitoring plan for native bees;
- 2) Current Research Information System (CRIS) Coding for Bee Research: For NIFA and ARS, change current bee coding in CRIS to reflect the categories of bees identified in the White House Task Force research plan;
- 3) Tracking Pollinator Habitat Acres: For FSA and NRCS, develop an approved method, within available resources, to track conservation program acres to contribute to the goal of restoring and enhancing 7 million acres of pollinator habitat; and,
- 4) Pollinator Restoration: For FSA and NRCS, and within available resources, increase evaluation of the effectiveness of agency efforts to restore and enhance bee habitat planting.

The USDA agrees, in large part, with all of these recommendations, and that progress in these areas would improve protection for pollinators, especially bees. Significant progress on

Mr. Steve D. Morris  
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recommendations 1, 3, and 4 will require additional resources. However, some progress on all recommendations can be made by better coordination of existing resources.

**GAO Recommendation: Monitoring Native Bees**

To improve the effectiveness of federal efforts to monitor wild, native bee populations, we recommend that the Secretary of Agriculture, as a Co-chair of the White House Task Force on Pollinators, coordinate with other Task Force agencies that have monitoring responsibilities to develop a mechanism, such as a federal monitoring plan, that would (1) establish roles and responsibilities of lead and support agencies, (2) establish shared outcomes and goals, and (3) obtain input from relevant stakeholders, such as states.

**USDA Response: Monitoring Native Bees**

There are approximately 4,000 species of bees in North America. While it would be physically and fiscally impossible to monitor all of these species, it would nevertheless be informative for agencies to survey changes in the distributions of a common set of sentinel bee species. After development of a list of sentinel native bee species by USDA and DOI agencies, ARS plans on using fiscal year 2016 funding to determine the historical distribution of each of the selected species. The historic distributions will be determined using databases developed from pinned museum specimens of bees collected in past surveys. The agency and collaborators will then conduct on-the-ground surveys to determine if sentinel species occur where they are expected to occur, or if range contraction has occurred. Range contraction can be used as a measure of the health of bee populations. This has already been done by ARS and collaborators for some social bee species (i.e., bumble bees), and will be expanded to include solitary bee species. Furthermore, future surveys will be facilitated by improved bee taxonomy and the development of molecular barcoding, which will allow a greater set of bees to be identified and surveyed. Currently, many of the bees collected in general surveys cannot yet be identified to species.

Another option that will be explored is citizen science. There are several popular courses on bees, and clear interest by the public in bee conservation. However, even insect systematists find it difficult to identify bees to species, and those trained in biology often confuse wasps and even flies (e.g., hover flies) with bees – bees have bifurcating hairs and wasps do not, which requires a microscope to discern; museum curators often confuse bumble bee color morphs of a species as separate species. Although bird counts are very effective, there are usually only 100 to 200 bird species in an area, and birds generally have clear distinguishing features, including songs. Nevertheless, there has been some progress by USGS in training the public in bee collecting and curation, and in some cases, identification. Other current projects include Bumble Bee Watch conducted by the Xerces Society, the Great Sunflower Project (with Bee Observer Cards), the BeeSpotter (including BeeBlitz) effort at the University of Illinois, and the Great British Bee Count. Possible remedies will be explored, including development of a universal bee species field guide or apps that would help facilitate bee identification efforts. Development of new approaches such as computer integration of bee photographs [National Oceanic and Atmospheric Administration has a project on fish] and bee-DNA-on-a-chip barcoding would also offer hope for employing citizens in broad bee surveys.

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**GAO Recommendation: CRIS Coding for Bee Research**

To increase the accessibility and availability of information about USDA-funded research and outreach on bees, we recommend that the Secretary of Agriculture update the categories of bees in CRIS to reflect the categories of bees identified in the White House Task Force research plan.

**USDA Response: CRIS Coding for Bee Research**

NIFA and ARS agree that the White House Task Force's strategy and research action plan identifies research needs to fill knowledge gaps for honey bees; other managed bees; wild, native bees; and other pollinators. Current classifications capture honey bees, other pollinating insects, and the general subject of other honey bee and other pollinating insects. This discrepancy between the Government-wide effort and current classifications needs to be reconciled to capture efforts of research, education, and extension projects as they work to address threats to bee health. While the CRIS categories can be changed relatively quickly, the efficacy of the changes varies depending on whether these changes are made for historical project data or for future project reports. If historical projects are to be analyzed with new CRIS classifications, this would add additional staff time to analyze and recode projects manually in the system. In addition, adding new classifications would affect current projects, and would require analysis to determine if changes will affect trend reporting of the budget. In addition, a strategy will be needed to increase awareness of the new classifications for project directors and other scientists who may choose to change to the more specific bee classifications for their projects.

The CRIS Classification Board provides oversight and manages requests for changes to the CRIS system. The board facilitates accurate classification and retrieval of information to meet the needs of planning, budget, assessment and reporting for NIFA and NIFA's partners. The board ensures classifications are clearly defined and changes are justified. Classifications should remain useful to the management of research, education, and extension to provide the ability to track all agency dollars by category, but it is not intended to directly satisfy every reporting requirement. The classifications should be readily cross-referenced by other relevant agency and Government-wide systems, and allow for changes when there is a strong justification. Changes are submitted to the Board, with the approval of the appropriate Institute Deputy Director, through a standard procedure by a sponsor, typically a National Program Leader. Requests are reviewed and analyzed for potential impacts to current tracking and reporting efforts, and any other technical issues. If approved, the new classification changes are defined to update the classification manual, and carried out in the system. NIFA will follow up with the recommended changes when the Classification Board meets this spring, to analyze and implement the appropriate changes.

**GAO Recommendation: Tracking Pollinator Habitat Acres**

To measure their contribution to the task force strategy's goal to restore and enhance 7 million acres of pollinator habitat, we recommend that the Secretary of Agriculture direct the Administrators of FSA and NRCS to develop an improved method, within available resources, to track conservation program acres that contribute to the goal.



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**USDA Response: Tracking Pollinator Habitat Acres**

USDA generally agrees with this recommendation. Since November, FSA has established a process for estimating the acres of pollinator habitat associated with many existing Conservation Reserve Program (CRP) practices based on current practice descriptions. Agreements are being established to further estimate and assess pollinator habitat quality on CRP enrollments using on-site assessments. NRCS is currently exploring options to develop a feature in its conservation planning database to enable tracking of all acres on which conservation practices are planned and applied that will provide a benefit to pollinators, not just those acres from targeted pollinator initiatives, such as the NRCS Honey Bee Effort.

**GAO Recommendation: Pollinator Restoration**

To better ensure the effectiveness of USDA's bee habitat conservation efforts, we recommend that the Secretary of Agriculture direct the Administrators of FSA and NRCS to, within available resources, increase evaluation of the effectiveness of their efforts to restore and enhance bee habitat plantings across the Nation, including identifying gaps in expertise and technical assistance funding available to field offices.

**USDA Response: Pollinator Restoration**

USDA also generally agrees with this recommendation. We have continuing studies on the impacts of conservation cover on honey bee and other pollinator health, diversity, and abundance. We will expand and deepen this work in the future as the budget allows. NRCS will continue its efforts for improving the delivery of pollinator habitat in conservation programs.

Sincerely,



Catherine E. Woteki, Ph.D.  
Under Secretary  
Chief Scientist, USDA

# Appendix V: Comments from the Environmental Protection Agency



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
WASHINGTON, D.C. 20460

JAN 22 2016

OFFICE OF CHEMICAL SAFETY  
AND POLLUTION PREVENTION

Mr. Steve D. Morris, Director  
Natural Resources and Environment Division  
U.S. Government Accountability Office  
Washington, DC 20548

Dear Mr. Morris:

Thank you for the opportunity to review and comment on the U.S. Government Accountability Office's Draft Report entitled, "Bee Health - USDA and EPA should Take Additional Actions to Address Threats to Bee Populations" (GAO-16-220).

The U.S. Environmental Protection Agency appreciates the GAO's thoughtful efforts to examine the important issue of bee health. The EPA agrees with the three recommendations in the Draft Report, and as noted in the Report, the EPA already has significant actions underway to implement its recommendations.

While the current state of the science limits our understanding of the full effect of the multiple stressors, including pesticides, on pollinator health, the EPA has been collaborating with other Federal agencies and international organizations for years on these issues. As our knowledge has grown, the EPA has continuously incorporated the emerging science into our regulatory program to ensure the safety of all pollinators.

A critical part of the agency's commitment to bee health was first articulated in the recent "National Strategy to Promote the Health of Honey Bees and Other Pollinators," (May 2015) and associated Pollinator Research Action Plan. The National Strategy includes the following components:

- **Issuance of new toxicity study guidelines to more fully protect honey bees:** In June 2014, the EPA, working in collaboration with the Health Canada Pest Management Regulatory Agency and the California Department of Pesticide Regulation, released a harmonized guidance for assessing the risks posed by pesticides to bees<sup>1</sup>. The guidance describes a tiered process beginning with a conservative screen (Tier 1) that uses laboratory-based acute and chronic toxicity studies of individual adult and larval honey bees. These laboratory results are compared to exposure estimates to ascertain if there are potential risks to the bees. The guidance reflects the understanding that the honey bee colony represents a complex superorganism consisting of male and female bees at different stages of development, each with different functions within the colony and with differing routes of exposure to pesticides. Additional exposure study protocols are

<sup>1</sup> The guidance is available at: <http://www.epa.gov/pollinator-protection/pollinator-risk-assessment-guidance>.

designed to examine uptake and decline of residues in plants (particularly in nectar and pollen).

- **Re-evaluation of the neonicotinoid family of pesticides:** Bees exhibit a wide range of sensitivities to the different neonicotinoid compounds. Under the harmonized risk assessment process, the EPA has been working to ensure that there are sufficient data to characterize exposure and the effects of these compounds, both on individual bees and the whole-colony. In addition to laboratory-based studies on honey bee adults and larvae, the EPA is reviewing multiple field-based studies at the whole-colony level.
- **Analysis of neonicotinoid seed treatments:** The EPA conducted a draft economic analysis of the benefits of imidacloprid, clothianidin and thiamethoxam seed treatments for insect control in United States soybean production. The EPA's assessment of the benefits of neonicotinoids on soybeans is the first such assessment completed for the neonicotinoids. The EPA will perform additional benefits assessments as part of the registration review process in which the EPA will consider both risks and benefits for each of the neonicotinoids.
- **Assessment of other pesticides for their potential impacts on pollinators:** Building upon the risk framework and study protocol enhancements described above, the EPA will incorporate this new science into its regulatory decision-making process for all new active ingredients, as well during the review of active ingredients under the registration review program.
- **Restricting the use of pesticides that are acutely toxic to bees:** The EPA has improved label language and restrictions for pesticides that are acutely toxic to bees. In 2013, the EPA notified registrants of four neonicotinoid insecticides of the EPA's decision to reduce the potential acute exposure of bees to these pesticides. Subsequently the EPA imposed similar restrictions for some additional insecticides. The EPA is considering additional restrictions on a broader range of pesticide products to further reduce the likelihood of acute exposure and mortality to bees from the at-bloom application of acutely toxic compounds.
- **Working with state and tribes to issue pollinator protection plans:** Localized and more customized mitigation measures may best be achieved through state and tribes developing pollinator protection plans. These plans help address the need for improved communication between growers/applications and beekeepers with respect to pesticide applications. The plans articulate the means through which growers, applicators and beekeepers can quickly and effectively communicate about pesticide applications in proximately to managed colonies.
- **Reducing exposures during the planting of pesticide-treated seed:** Modern agricultural practices use precision pneumatic equipment to plant seeds. Bee kills have been reported from the drift of contaminated dust during the planting of pesticide-coated seed, predominantly from abrasion of the seed coating. The EPA has been working with the American Seed Trade Association, equipment manufacturers and pesticide registrants to explore additional mitigation measures, including broader adoption of best management practices, to further reduce the emissions of these pesticide residues during the planting process.
- **Evaluating and mitigating pesticide impacts on monarch butterflies:** The EPA has determined that the protection of milkweed is consistent with the agency's responsibilities under the Federal Insecticide, Fungicide and Rodenticide Act and that the

EPA will take actions, as part of its regulatory decisions and voluntary programs, to establish practices and requirements to protect critical milkweed resources. The efforts to conserve milkweed species from the effects of herbicides may encompass a number of pesticidal compounds. Therefore, in contrast to a typical quantitative single-chemical analysis approach, the EPA will rely upon both qualitative and quantitative analyses to weigh risks and benefits and identify actions to conserve the milkweed plant where it is important to monarch butterflies. While this effort is primarily focused on protection of monarch butterflies, because milkweed provides nutritional resources for honey bees, this endeavor can also contribute to honey bee protection efforts.

- **Issuing guidance for bee incident report inspections:** Bee mortality incidents are reported through tips or complaints to the EPA (<http://www2.epa.gov/pollinator-protection/report-beekills>), state, or tribal pesticide programs. The EPA considers this incident report data as a means to identify patterns of bee kills associated with the use of specific pesticides or active ingredients, and to thereby inform pesticide regulatory decisions.
- **Expediting review of new Varroa mite control products:** Many researchers believe that honey bee health has been significantly compromised by hive pests. In particular, the Varroa mite (*Varroa destructor*) is seen as a significant parasite and challenge to maintaining healthy honey bee colonies. In 2014, the EPA approved all of the requested emergency exemption applications it received from state agencies for a product that is designed to help manage the mite, and to increase the available options for combating resistance development in mite populations. The EPA recently registered a Varroa control product, oxalic acid, which is also registered in Canada. In addition, in September 2015, the EPA registered a new biochemical miticide, Potassium Salts of Hops Beta Acids, which provides another tool for beekeepers to use in controlling Varroa mites. The EPA is working with the regulated community, other Federal agencies and the private sector to identify products that may be effective in-hive pest control measures. The EPA is committed to expediting the evaluation for any new pesticide products that may be used to help manage colony pests.

**The EPA's Response to GAO's Recommendations for Executive Action:**

1. GAO Recommendation: To better ensure that EPA is reducing the risk of unreasonable harm to important pollinators, we recommend that the Administrator of EPA direct the Office of Pesticide Programs to develop a plan for obtaining data from pesticide registrants on the effects of pesticides on non-honey bee species, including other managed or wild, native bees.

The EPA has a multifaceted approach to addressing the potential threats to pollinators, including non-*Apis* bees. The EPA has been working with our regulatory counterparts in the Organization for Economic Cooperation and Development and with the international research community to develop new test methods to assess the effects of pesticides on pollinators other than honey bees. Currently, there are still several challenges to assessing some of the other bee species such as wild bees. To simply require non-*Apis* bee studies in the absence of draft protocols can lead to inconsistencies in both how such studies are conducted and evaluated. Nonetheless, over the past several years, the EPA has made tremendous headway and developed a plan that includes

scientific papers and international collaborations. In addition, the EPA anticipates pollinator research continuing for the foreseeable future. An overview of the EPA's plan includes the following components:

- Testing by multiple labs (*i.e.*, ring testing) is currently underway to evaluate draft protocols for testing non-*Apis* bees, such as bumble bees (*Bombus spp*) and blue orchard bees (*Osmia lignaria*), and the EPA has participated in symposia<sup>2</sup> where this research is under review. Consistent with the recommendations from the FIFRA Scientific Advisory Panel, both *Bombus* and *Osmia* represent non-*Apis* bees which are commercially available, as they are used to provide pollination services in agriculture. Based on the EPA's understanding of the status of current research efforts, the EPA anticipates that suitable protocols will be available for acute toxicity testing of *Bombus* in 2016, and hopes to work with our regulatory counterparts in the OECD to advance these protocols into formal OECD test guidelines. Similar test methods for *Osmia* may be available in 2017. In the meantime, consistent with the 2014 risk assessment guidance, the EPA will continue to evaluate data to determine whether criteria can be developed for triggering more refined testing with non-*Apis* species.
  - In addition to efforts with the OECD, the EPA's Office of Pesticide Programs and the EPA's Office of Research and Development are collaborating with the U.S. Department of Agriculture's Agricultural Research Service to advance protocols for testing non-*Apis* bees. The EPA is working with USDA researchers at the Logan, Utah, facility, which specializes in working with non-*Apis* bees, to develop a protocol for rearing bumble bees under laboratory conditions, and to develop a suitable synthetic diet which can be used for more standardized testing. Similar efforts are planned for *Osmia* and with alfalfa leaf cutter bees (*Megachile rotundata*).
2. GAO Recommendation: To help comply with the directive in the task force's strategy, we recommend that the Administrator of EPA direct the Office of Pesticide Programs to identify the unregistered pesticide mixtures that farmers and pesticide applicators most commonly use on agricultural crops to help determine whether those mixtures pose greater risks than the sum of the risks posed by the individual pesticides.

The EPA agrees that there is opportunity to identify some commonly used tank mixtures. As an aside, the EPA would like to point out that the terminology used to describe mixtures varies throughout the report. The GAO appears to include individual active formulations (active and inerts), co-formulations (multiple actives and inerts), and tank mixes (multiple formulations/inerts/adjuvants/surfactants) under the guise of "unregistered mixtures". Assessing mixtures (*i.e.*, tank mixes of actives/inerts/adjuvants/surfactants), especially those involving different modes of action, can be challenging, and determining the specific combination to test

<sup>2</sup> USEPA. 2012. White Paper in Support of the Proposed Risk Assessment Process for Bees. Submitted to the FIFRA Scientific Advisory Panel for Review and Comment September 11 – 14, 2012. Office of Chemical Safety and Pollution Prevention Office of Pesticide Programs Environmental Fate and Effects Division, Environmental Protection Agency, Washington DC; Environmental Assessment Directorate, Pest Management Regulatory Agency, Health Canada, Ottawa, CN; California Department of Pesticide Regulation <http://cues.cfans.umn.edu/old/pollinators/pdf-EPA/EAP-SAP-whitepaper.pdf> (last accessed 01/15/2016).

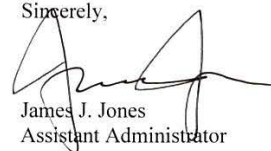
with respect to tank mixtures could be difficult to identify at the national level. There may be an opportunity however, for the EPA to utilize California Pesticide Use Reporting data to identify chemicals that are used in particularly vulnerable scenarios (*e.g.*, almonds, blueberries, cherries during pollination services) in California. By November 2017, the EPA will conduct a case study of honey bees in almond crops and determine the most commonly used tank mixtures for this scenario.

3. GAO Recommendation: To provide Congress and the public with accurate information about the schedules for completing the registration reviews for existing pesticides required under FIFRA, we recommend that the Administrator of EPA disclose in its PRIA implementation reports which registration reviews have potentially inaccurate schedules and when it expects those reviews to be completed.

The EPA is committed to providing transparent and accurate information to the public on the status of all registration review cases and especially those affecting the health of bees. To that end, the EPA will make available on a website its schedule for re-evaluating existing pesticides under registration review, and will update it on an annual basis. The website is planned to be made available for public access by April 2016.

Overall, we are pleased that the GAO Draft Report recognizes the EPA's continuing efforts to improve the protection of bees. The EPA also submitted to the GAO a separate document with specific technical comments on the Draft Report. If you have questions on this response, please contact Janet Weiner, the EPA's Office of Chemical Safety and Pollution Prevention Audit Liaison, at [weiner.janet@epa.gov](mailto:weiner.janet@epa.gov).

Sincerely,



James J. Jones  
Assistant Administrator

cc: Ann Johnson, Assistant Director, Natural Resources and Environment  
Bobbie Trent, OCFO GAO Liaison  
Janet Weiner, OCSPP Audit Liaison

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# Appendix VI: GAO Contact and Staff Acknowledgments

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## GAO Contact

Steve D. Morris, (202) 512-3841 or [Morriss@gao.gov](mailto:Morriss@gao.gov)

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## Staff Acknowledgments

In addition to the individual named above, Anne K. Johnson, (Assistant Director), Kevin Bray, Ross Campbell, John Delicath, Ashley Hess, Meredith Lilley, Beverly Peterson, and Leigh White made key contributions to this report. Barbara El Osta, Karen Howard, Ying Long, Perry Lusk, Jr, Anne Rhodes-Kline, Dan Royer, Kiki Theodoropoulos, and Walter Vance also made important contributions to this report.

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