HEARING TO REVIEW THE STATUS OF POLLINATOR HEALTH INCLUDING COLONY COLLAPSE DISORDER

HEARING

BEFORE THE

SUBCOMMITTEE ON
HORTICULTURE AND ORGANIC AGRICULTURE

OF THE

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HEARING TO REVIEW THE STATUS OF POLLINATOR HEALTH INCLUDING COLONY COLLAPSE DISORDER

THURSDAY, JUNE 26, 2008

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON HORTICULTURE AND ORGANIC AGRICULTURE,
COMMITTEE ON AGRICULTURE,
Washington, D.C.

The Subcommittee met, pursuant to call, at 10:05 a.m., in Room 1300 of the Longworth House Office Building, Hon. Dennis Cardoza [Chairman of the Subcommittee] presiding.

Members present: Representatives Cardoza, Etheridge, Barrow, Gillibrand, Peterson (*ex officio*), Neugebauer, Foxx, and Latta.

Staff present: Alejandra Gonzalez-Arias, Keith Jones, Scott Kuschmider, Sharon Rusnak, John Goldberg, and Jamie Weyer.

OPENING STATEMENT OF HON. DENNIS A. CARDOZA, A REPRESENTATIVE IN CONGRESS FROM CALIFORNIA

The CHAIRMAN. This hearing of the Subcommittee on Horticulture and Organic Agriculture to review the status of pollinator health including Colony Collapse Disorder will now come to order.

I would like to welcome you all here today. We will have opening statements as our first order of business. During that time I would like to ask all the panelists that will be appearing in our first panel to come forward. Chairman Peterson and Ranking Member Goodlatte may arrive throughout the hearing at some point and I would just like to recognize my Ranking Member and good friend, Mr. Neugebauer of Texas, who will be here in the hearing today representing the Republican side of the aisle. We will have opening statements by myself and Mr. Neugebauer and then we will request that other Members submit their opening statements for the record as well as witnesses will do so with their testimony.

Nearly 2 years ago now, a number of farmers in my district brought to my attention the difficulty they were having when they were procuring honey bees for their annual pollination of crops. At first many people, myself included, assumed that the rapid decline in the pollinator population was an aberration, just a fluke perhaps. However, in some regions across the country, beekeepers were reporting 30 to 90 percent losses in their honey bee colonies. Perhaps even more intriguing, the bees seemed to simply disappear, which is extremely uncharacteristic for these insects. In February of last year, top agriculture researchers in conjunction

with USDA termed this massive decline in honey bees as Colony Collapse Disorder and set out to pinpoint the cause of this problem. Unfortunately, it turns out that bees are extremely complex and highly sensitive insects. Their behavior patterns can be radically affected by slight changes in climate or weather and when exposed to small amounts of certain pathogens, including pesticides, making it enormously difficult to pinpoint the exact cause of their decline.

In March of 2007, I along with my Ranking Member, Mr. Neugebauer, convened the first ever hearing on bees and Colony Collapse Disorder. We heard from a number of experts in the field ranging from researchers to beekeepers to farmers about the possible causes of this decline and potentially devastating effects on American agriculture. Not much was known a year ago other than there were a number of potential causes including pathogens, parasites, environmental and management stress issues, as well as potential nutrition problems. But the hearing did highlight the intense need for a dedicated Federal funding stream to further study and investigate CCD and to support the continued longevity of domestic pollinators.

We have made notable progress towards this goal in the recent farm bill. USDA will now encourage pollinator habitat development in all conservation programs, thanks to the farm bill. Specifically within the EQIP program, the Secretary is now authorized to give greater priority to conservation practices that promote pollinator habitat.

Additionally, millions of dollars were authorized to conduct research on the various factors that may be contributing to the health of honey bees and other pollinators including pathogens and pest surveillance. The farm bill will also provide for an increase in the capacity and infrastructure of USDA's current colony collapse prevention efforts and requires annual reports to the House and Senate Agriculture Committees detailing the progress the Department has made in addressing colony losses. Finally, mandatory funding will now be made available under the Specialty Crop Research Initiative for Honey Bee Health as it pertains to the specialty crop industry.

Many of these provisions are directed specifically at Colony Collapse Disorder but it is important to recognize the plight of America's beekeepers and honey producers. Many beekeepers in my district have been financially and emotionally devastated by the rapid loss of their bee colonies. In the 2008 Farm Bill, it has also officially made honey and honey bee losses eligible for disaster assistance. But all these provisions are really stopgap measures. The industry really needs answers and solutions. Our last hearing prompted the USDA to develop an action plan for CCD. While I am impressed with the progress thus far, especially in identifying the recent occurrence of Israeli acute paralysis virus in damaged colonies, I remain very concerned of the lack of concrete findings and a final answer.

I hope our panelists today can shed some light on what may be preventing swift action to stop the continuing decline of bee colonies. The importance of bees and other pollinators cannot be underestimated. Nearly 130 different crops totaling over $15 billion in

farm gate value depend on pollinators to grow. In fact, in California, in my district particularly, our top agricultural products such as almonds, walnuts, cherries, melons and countless others are totally dependent on annual pollination efforts from local honey bees. Simply put, if there are no bees, there is no way for our nation's farmers to continue to grow the high-quality nutritious food our country relies on. This is a crisis we cannot afford to ignore.

[The prepared statement of Mr. Cardoza follows:]

PREPARED STATEMENT OF HON. DENNIS A. CARDOZA, A REPRESENTATIVE IN CONGRESS FROM CALIFORNIA

Nearly two years ago now a number of farmers in my district brought to my attention the difficulty they were having when procuring honeybees for the annual pollination of their crops. At first, many people—myself included–assumed that the rapid decline in the pollinator population was an aberration–just a fluke perhaps. However, in some regions across the country beekeepers were reporting 30–90% losses in their honeybee colonies. But perhaps even more intriguing, the bees seemed to simply disappear.

In February of last year, top Apiculture researchers, in conjunction with USDA, termed this massive decline in honeybees as "Colony Collapse Disorder" and set out to pinpoint the cause of this problem. Unfortunately, it turns out that bees are extremely complex and highly sensitive insects. Their behavior patterns can be radically affected by slight changes in the climate or weather and when exposed to small amounts of certain pathogens and pesticides.

In March of 2007, I—along with my Ranking Member Mr. Neugebauer—convened the first ever hearing on bees and Colony Collapse Disorder. We heard from a number of experts in the field ranging from researchers to beekeepers to farmers about the possible causes and potential devastating effects on American agriculture.

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But all of these provisions are really stop-gap measures. What the industry really needs are answers and solutions. Our last hearing prompted USDA to develop an action plan for Colony Collapse Disorder. While I am impressed with the progress thus far—especially in identifying the occurrence of the Israeli acute paralysis virus in damaged colonies, I remain very concerned about the lack of concrete findings. I hope our panelists today can shed some light on what may be preventing swift action to stop the continuing decline of bee colonies.

The importance of bees and other pollinators can NOT be underestimated. Nearly 130 different crops—totally over $15 billion in farm gate value—depend on pollination to grow. In fact, in California, and in my district particularly, our top agricultural products such as almonds, walnut, cherries, melons and countless others are totally dependent on annual pollination efforts from local honey bees. Simply put, if there are no bees, there is no way for our nation's farmers to continue to grow the high quality, nutritious foods our country relies on.

The CHAIRMAN. With that, I would like to turn this opening statement over to my Ranking Member, Mr. Neugebauer.

OPENING STATEMENT OF HON. RANDY NEUGEBAUER, A REPRESENTATIVE IN CONGRESS FROM TEXAS

Mr. NEUGEBAUER. Thank you, Mr. Chairman, for calling this hearing today to provide the Horticulture and Organic Agriculture Subcommittee with an update on pollinator health and any progress being made to find the cause of the solution to the Colony Collapse Disorder.

When this Subcommittee met about this issue last March, we heard about new research and initiatives aimed at solving the mystery behind the cause and solution of CCD. I look forward to hearing an update about these programs and any development or advancements in this issue and about any new research projects that have begun since that hearing.

I was honored to serve on the conference committee for the recently passed farm bill and am proud we were able to include several provisions that address pollination, especially CCD. The new Specialty Crop Research Initiative provides $230 million in mandatory funding for research and extension, which includes research threads to pollinators. As we speak, USDA is working to write the rules to implement these programs, and I hope that the steps taken in the farm bill will serve the needs of the pollinators and help protect this very important aspect of agriculture.

While USDA is a very important component in combating CCD, it is also critical that the private sector stakeholders become active on this issue. I am encouraged to learn that some proactive groups have already taken an active role in finding a solution to CCD, and I look forward to learning more about how the private sector and the government entities can work together to find cause and treatment for CCD and in doing so ensure the longevity of bees that pollinate crops for food, fiber, beverage, condiments, species and medicines that we consume and use on a daily basis. I appreciate the efforts of the several agencies of the Department of Agriculture that have taken a lead in research and dissemination of information regarding Colony Collapse Disorder, and I encourage USDA and its university and state partners to work closely with the bee industry in an effort to work together to coordinate research and disseminate the findings.

I look forward to learning more from researchers, beekeepers, farmers and industry leaders here today. While you may not yet understand the cause of the colony losses, you do understand the importance of honey bee pollination in agriculture and the Subcommittee benefits from your expertise.

With that, I yield back my time, Mr. Chairman.

The CHAIRMAN. Well, thank you, Mr. Neugebauer. Thank you for your work with us on the farm bill. You did a fabulous job and it is my pleasure to work with you on a regular basis on this Committee.

I want to welcome our first panel today, and as such, we have one of our Members who has a constituent on this panel, and I am going to turn it over to Mr. Barrow to introduce his constituent and

then I will recognize the rest of the panel. So Mr. Barrow, the floor is yours to recognize your constituent.

Mr. BARROW. Well, I thank the chair, and it is a point of personal privilege to introduce Dr. Keith Delaplane, Professor of Entomology at the University of Georgia. A technicality, Mr. Chairman, he is no longer a constituent. My district no longer includes the physical territory that houses the home offices and campus of the University of Georgia, but coming from the State of Georgia, I think it is fair to say that all of us represent the University of Georgia to some extent or another. In fact, I wish Brother Costa was here today so I could congratulate him on his Bulldogs beating our Bulldogs yesterday in the College Championship World Series.

It is a point of personal pride to me to introduce this national champion in his field, Dr. Delaplane, who is here basically to present the model that the University of Georgia has developed in response to the USDA's RFP, which is the most complex and robust proposal to me. It is why he has been selected totally on the merits and without regard to this Member. Dr. Delaplane, you can no longer vote for me, but I want you to know, I can vote for you and I want to thank you very much for what you do and thank you for your leadership in this endeavor, and Mr. Chairman, thank you for the privilege. I have to leave now to go to a hearing of my Committee on Energy and Air Quality, so please accept my apologies for not being able to stay but, Dr. Delaplane, thank you for being here. Thank you, Mr. Chairman.

The CHAIRMAN. Thank you, Mr. Barrow, and we all represent the University of Georgia. They are a fine institution. I am particularly proud that our Bulldogs beat your Bulldogs yesterday because—

Mr. BARROW. I am going to have to teach you all how to say "dogs." It is a two syllable word with a little more emphasis, but you are coming along pretty good.

The CHAIRMAN. I will probably have to do that since my son just enrolled this week in Southern High football in Maryland, where they also are the Bulldogs, and so I will try and get that down and I will keep practicing with you. Thank you, Mr. Barrow, and we will make sure that we get you the testimony of your witness and all the rest of them.

Mr. BARROW. Thank you, Mr. Chairman.

The CHAIRMAN. Ms. Foxx, I will be happy to yield to you for an opening statement at this time, a short opening statement. It is outside the parameters of what we laid out, but I would be happy to accommodate you.

OPENING STATEMENT OF HON. VIRGINIA FOXX, A REPRESENTATIVE IN CONGRESS FROM NORTH CAROLINA

Ms. FOXX. I appreciate it, Mr. Chairman. The thing I want to say is that I think I am probably the only former beekeeper on the panel. My husband and I have been farmers all of our lives, and we lost our bees. Actually I know why people are losing their bees. We lost ours, too. We had nine hives and so I have experience as a beekeeper, and I have just extraordinarily strong feelings about this issue. I have made several speeches on the floor about it, in fact, when I first came to the Congress alerting people, so I want to thank all of you for this. I have votes at 10:30 in the Education

Committee and so I am going to have to leave, but I just want the members of the panel and the Members of the Committee to know of my strong interest in this issue, both from my knowledge of the problem as well as my personal experience.

I thank you very much for that indulgence, Mr. Chairman.

The CHAIRMAN. Ms. Foxx, you are very welcome, and I didn't realize that you had had this experience but certainly it is very valuable to the Committee, and we will make sure we consult you as we go forward on this. Thank you.

At this time I would like to introduce the other members of our panel, and we are very delighted today to have Dr. Edward Knipling, Ph.D. and administrator with the ARS, U.S. Department of Agriculture here in Washington, D.C. Thank you, Doctor, for being here with us today. Mr. Delaplane has already been introduced by Mr. Barrow. We have Ms. Maryann Frazier, senior extension associate with the Pennsylvania State University at University Park, Pennsylvania. I would like to welcome all three of our first panelists.

Dr. Knipling, please begin when you are ready, and let me just read this following statement before you do begin. The Chair would like to remind all Members that they are recognized for questioning in order of seniority. Members who are here at the start of the hearing will be recognized first. After that, Members will be recognized in order of arrival, and I appreciate the Members' understanding. Dr. Knipling.

STATEMENT OF EDWARD B. KNIPLING, PH.D., ADMINISTRATOR, AGRICULTURAL RESEARCH SERVICE, U.S. DEPARTMENT OF AGRICULTURE, WASHINGTON, D.C.

Dr. KNIPLING. Thank you, Mr. Chairman and Members of the Committee. I am Edward Knipling, Administrator of the Agricultural Research Service, which is the intramural research agency of the Department of Agriculture, and thank you for this opportunity to appear before the Subcommittee today to present testimony on USDA's efforts to improve pollinator health and address the problem of Colony Collapse Disorder.

Mr. Chairman, you and others have already characterized the CCD problem very well and the importance of honey bees and other pollinators. Thus, I will only add at this point that the 2008 spring survey results following last winter indicate that bee colony losses across the United States were an average of about 36 percent compared to about 31 percent the year before in 2007. These levels are about twice what were experienced by beekeepers previously in so-called normal or typical years and winters, and the additional losses of about 15 to 20 percent over normal are being attributed to the CCD malady.

Numerous factors have been suggested as possible causes of this problem. These include increased pressure from viruses and other pathogens, parasites, environmental stresses, poor nutrition, transport stresses and pesticides, among other possible causes.

My comments today will focus principally on the progress of research and planned activities by ARS and our sister agency, the Cooperative, State, Research, Education and Extension Service.

Although scientists have not yet identified definitively the cause of CCD or a solution to the problem, they have greatly increased our understanding of the nature of the disorder and its potential contributing factors. For example, research suggests that CCD follows the weakening of a colony due to various stresses to the point that the colony cannot rear a replacement brood in the spring. Studies on the immune system response of bees support the hypothesis that CCD is caused by an interaction of multiple factors stressing the colony rather than any one single cause.

Along these lines in 2007, researchers identified a virus known as the Israeli acute paralysis virus, which appears to have a high degree of association with CCD, and further studies suggest that a parasite, the Varroa mite, may be spreading the virus to other bees. Researchers later observed high levels of a different but potentially related virus in CCD samples.

Other studies have shown that affected colonies tend to have elevated levels of other pathogens not commonly found in bee colonies. Specifically, investigations have identified a pathogen known as *Nosema ceranae* that infects bees in significantly different ways than does *Nosema apis*, a species long present in the United States.

Research has also focused on determining whether pesticides, which remain a top concern among beekeepers, are associated with CCD. This research has yet to confirm such as association but these studies are continuing.

Research has also been directed to beekeeping management practices, and progress in this area has been significant. A new protein supplement diet has been developed and shown to improve colony strength and protect against colony decline. This research has also shown that supplemental diets significantly improve the strength of colonies infected with Varroa mites. Other research has provided the first documented evidence of stress effects of long-distance transport of bee colonies for pollination services.

In 2006, the honey bee genome was sequenced prior to recognition of the CCD problem, and this genetic information is now proving very timely and valuable to researchers to detect and interpret immune response disorders in CCD-affected bees. Additional genomic sequencing research is underway on the suspected viruses and *Nosema* pathogens I mentioned earlier, and comparative analysis of these genomes will be important to understand the potential role in CCD and may lead to control measures.

I will now comment on the USDA research capacity and funding resources. ARS honey bee research is principally carried out at four laboratories located in Louisiana, Maryland, Arizona and Texas. This collective national honey bee program is supported by an annual base budget of $7.7 million of which 80 percent has been oriented since 2006 toward the CCD problem and its probable causes. In addition to this base funded research, $200,000 was provided to ARS scientists last year to sequence the genomes of the major microbial pathogens suspected of having a role in CCD.

Beginning this year in 2008, ARS has initiated what we are calling the Areawide Project on Honey Bee Health. The objectives of this 5-year project are to investigate the effects of migratory beekeeping including nutrition and the use of supplemental protein diets on honey bee health as well as developing more resistant bee

lines and better control methods for honey bee pests. This project is being carried out by all four ARS laboratories in cooperation with commercial beekeepers and university partners and with base funding that is available for ARS pest management research. This first year support is $670,000, and funding for the subsequent 4 years will be about $1 million per year.

The President's Fiscal Year 2009 budget proposals for ARS requests $780,000 in new funding to enhance base program support for honey bee health and CCD research.

CSREES, as the USDA extramural funding agency, is supporting university research at significant levels. Already, funds have been committed for five independent research and extension projects related to honey bee genetics and diseases and pesticide effects. Additionally, CSREES has recently completed panel review of proposals for a sizable competitive grant for multi-institutional honey bee health research and expects to make a $4.1 million, 4-year award next month in July. Overall, CSREES funding for CCD and bee health-related research has risen from about $500,000 in Fiscal Year 2006 to over $1 million in 2007, and funding this year is expected to exceed $2.5 million. The President's Fiscal Year 2009 budget also proposes to include an increase in the line item for critical issues and plant and animal diseases of about $1.7 million, which will be expected to provide additional resources for honey bee health.

As the Chairman has already noted, the newly enacted 2008 Farm Bill provides $30 million in mandatory funding this fiscal year to be awarded competitively by CSREES for specialty crop research, and the formal request for applications is expected to be issued next month in July. A considerable number of proposals related to honey bee health for specialty crops are expected.

Subject to future appropriations, the new farm bill also authorizes up to $20 million per year for the Fiscal Years 2008 through 2012 for honey bee and other pollinator research extension and surveillance.

Before closing, I will now briefly comment on the capabilities and activities of other USDA agencies relative to CCD. The Animal and Plant Health Inspection Service proposes to initiate the authorized national honey bee health and pest survey to obtain data and determine trends on the extent and possible causes of CCD. The Agricultural Marketing Service provides a capability on a user-fee basis for pesticide testing of agricultural samples, and AMS has already tested a number of honey bee samples, but the data obtained to date do not appear to associate pesticides conclusively in any way with CCD. The Natural Resources Conservation Service provides leadership and assistance in establishing conservation areas and other pollinator protection habitats which will be important for CCD mitigation.

In summary, Mr. Chairman, even though research to date has not produced a definitive finding on the cause or a solution to the CCD problem, the research is making important progress toward our understanding of the disorder, and these efforts are continuing at an accelerating pace. USDA very much appreciates Congress' interest in this issue, and I thank you once again for the opportunity to appear before you. We very much value also all of the coopera-

tion and partnerships we have with universities, the beekeeping industry, non-government organizations and the like.

Thank you, Mr. Chairman. I would be pleased to address any questions that you have at a later time.

[The prepared statement of Dr. Knipling follows:]

PREPARED STATEMENT OF EDWARD B. KNIPLING, PH.D., ADMINISTRATOR, AGRICULTURAL RESEARCH SERVICE, U.S. DEPARTMENT OF AGRICULTURE, WASHINGTON, D.C.

Mr. Chairman and Members of the Committee, I am Edward Knipling, Administrator of the Agricultural Research Service (ARS), which is the intramural scientific research agency of the Department of Agriculture (USDA).

Thank you for the opportunity to appear before the Subcommittee today to present testimony on USDA's efforts to improve pollinator health and address the problem of colony collapse disorder, known as CCD.

Background on CCD

As the members of the Subcommittee know, CCD is characterized by the sudden decline of a honey bee colony and absence of dead bees. Typically, all but a few bees disappear from a given colony's population for no apparent reason. These unexplained losses were first reported in the fall of 2006, with further investigations indicating that the problem may have been occurring since at least 2005. Given the critical role played by honey bees and other pollinators in plant reproduction, resulting in $15 billion in added crop value to at least 30 percent of our Nation's crops, CCD poses a significant threat to the U.S. beekeeping industry, food and honey production, and ecosystem health.

In 2007, bee colony losses to CCD and other stressors were reported to be 31 percent. Surveys to date in the 2008 season indicate losses of about 36 percent, which is about twice the percentage of losses sustained during a typical winter. Although beekeepers are still meeting their pollination service contracts, the costs for pollination of some crops such as almonds have more than doubled over the past few years. Fortunately, the cost increases for other crops during off-peak pollination periods have not been as dramatic.

Numerous factors have been suggested as possible causes of the CCD malady. These include viruses and other pathogens, parasites, environmental stresses, poor nutrition, transport stresses, and pesticides among others.

USDA Leadership Efforts

Upon hearing reports of CCD in the fall of 2006, USDA began to mobilize resources and bring university partners, honey and pollination industry leaders, and other stakeholders together to approach the problem. Working teams were formed to begin preliminary investigations into CCD. These groups also met formally in February and April 2007 to develop a comprehensive CCD Action Plan, which resulted in a framework approach to solve the problem and identify available resources to address research needs. The goals and objectives of the plan are centered around four main components: survey and data collection; sample analysis; hypothesis-driven research; and mitigation and preventative measures.

Research

My comments today will focus principally on the progress of research to date and ongoing and planned activities by ARS and our sister agency the Cooperative State Research, Education, and Extension Service (CSREES). CSREES is the primary extramural research funding agency of USDA for universities, agricultural experiment stations, and cooperative extension services across the Nation.

Although ARS and university scientists have not yet identified the cause of CCD or a solution to the problem, they have greatly increased our understanding of the nature of the disorder and its potential contributing factors.

For example, research suggests that CCD follows the weakening of a colony due to various stresses to the point that the colony cannot rear replacement brood in the spring. Studies on the immune system response of bees support the hypothesis that CCD is caused by an interaction of multiple factors stressing the colony rather than by any one single cause.

Along these lines, in 2007 researchers identified a virus, known as the Israeli acute paralysis virus (IAPV), which appears to have a high degree of association with CCD. Further studies suggest that a parasite, the varroa mite, may be spreading the virus to other bees. Researchers later observed high levels of a different, but

potentially related virus in CCD samples that is associated with IAPV. Although additional work is needed to confirm a link between these viruses and CCD, this research provides a basis for identifying important markers for the disorder.

Additional studies have shown that CCD-affected colonies tend to have elevated levels of other pathogens not commonly found in bee colonies. Specifically, investigations have identified a pathogen known as *Nosema ceranae* that infects bees in significantly different ways than does *Nosema apis,* a species long present in the United States.

Research has also focused on determining whether pesticides, which remain a top concern among beekeepers, are associated with CCD. This research has yet to confirm such an association, but research will continue to analyze bee samples for pesticide exposure to definitively confirm or refute an alleged correlation.

In addition to pathogens, parasites, and pesticides, research has also been directed to beekeeping management practices, which are critical to honey bee health. Progress in this area has been significant. A new protein supplement diet has been developed and shown to improve colony strength and protect against colony decline. This research has also shown that supplemental diets significantly improve colony strength in colonies infested with varroa mites. Other research has provided the first documented evidence of stress effects of long distance transport of bee colonies for pollination services. These studies will help establish critically-needed management strategies and guidelines for beekeepers to improve the health and strength of their bees as a protection against CCD.

In early 2006, the entire honey bee genome was sequenced prior to recognition of the CCD problem. This genetic information is now proving timely and invaluable to researchers to detect and interpret immune response disorders in CCD affected bees. Additional genomic sequencing research is underway on the suspected viruses and *Nosema* pathogens previously mentioned. Bioinformatic analyses and comparisons of these genomes will be important to understand their role in CCD and may lead to control measures.

Research Capacity

ARS honey bee research is principally carried out at four bee laboratories located in Baton Rouge, Louisiana; Beltsville, Maryland; Tucson, Arizona; and Weslaco, Texas. We also conduct alternative pollinator research at Logan, Utah. The collective national honey bee research by ARS is supported by an annual base budget of $7.7 million, of which 80 percent has been oriented since 2006 toward the CCD problem and its probable causes. This research also includes breeding efforts to improve honey bee resistance to varroa mites and other pests.

In addition to this base funded research, $200,000 was provided to ARS scientists in 2007 to sequence the genomes of the major microbial pathogens suspected of having a role in CCD.

Beginning this year in 2008, ARS has initiated what we are calling the Areawide Project on Honey Bee Health. The objectives of this 5-year project are to investigate the effects of migratory beekeeping, including nutrition and use of supplemental protein diets, on honey bee health, as well as developing more resistant bee lines and better control methods for honey bee pests. This project is being carried out by all four ARS bee laboratories in cooperation with commercial beekeepers and university partners. Base funding is available from ARS pest management research. First year support is $670,000. Funding for subsequent years will be based upon available appropriations.

The President's fiscal year 2009 budget proposal for ARS requests $780,000 in new funding to enhance base program support for honey bee health and CCD research. ARS also proposes to consolidate some of its existing base program activity on honey bee research in order to achieve a stronger critical mass of scientific effort and focus on the CCD problem.

CSREES, as the USDA extramural funding agency, is also supporting CCD research at significant levels. Already funds have been committed for five independent research and extension projects relating to honey bee genetics and diseases, and pesticides effects. Additionally, CSREES has completed panel reviews of proposals for a sizeable competitive grant for multi-institutional honey bee health research and expects to make a $4.1 million, 4-year award in July 2008. Approximately $1.025 million will be provided each year. Overall, CSREES funding for CCD and bee health related research has risen from $538,000 in fiscal year (FY) 2006 to over $1,000,000 in FY 2007, and funding will exceed $2.5 million in FY 2008. The President's fiscal year 2009 budget proposal for CSREES also includes an increase of $1,743,000 for the Critical Issues in Plant and Animal Diseases line item which was used extensively to mount the agency's initial response to the CCD crisis.

As this Subcommittee knows, the newly enacted 2008 Farm Bill provides $30 million in mandatory funding this fiscal year, to be awarded competitively by CSREES, for specialty crop research. CSREES plans to issue the formal Request for Applications in July 2008. Because honey bee pollination is important for many fruit, nut, and vegetable crops, some proposals for honey bee health research related to the CCD problem are anticipated to be received.

Subject to future appropriations, the new Farm Bill also authorizes up to $20 million per year for the fiscal years 2008 through 2012 for honey bee and other pollinator research, extension, and surveillance.

Other USDA Agencies

I would now like to briefly comment on the capabilities and activities of other USDA agencies relevant to CCD. The Animal and Plant Health Inspection Service (APHIS) proposes to initiate the authorized national honey bee health and pest survey to obtain data and determine trends on the extent and possible causes of CCD. The Agricultural Marketing Service (AMS) provides a capability on a user fee basis for pesticide testing of agricultural samples. AMS has already tested a limited number of dead honey bee samples, but the data obtained to date do not appear to associate pesticides with CCD. The Natural Resources Conservation Service (NRCS) facilitates the USDA Pollinator Protection Committee, an 11-agency committee that provides leadership in pollinator protection endeavors, including CCD mitigation. Among other activities, in 2007 NRCS entered agreements with several national pollinator protection efforts to assist at the national, regional, state, and local levels to build awareness of and better address the nesting and foraging needs of wild and managed pollinators, which may serve as alternatives to honey bees.

Closing

Even though research to date has not produced a definitive finding on the cause of or solution to the CCD problem, the research is making important progress toward our understanding of the disorder. These efforts are continuing across the Nation. USDA appreciates Congress' recognition of the significance of colony collapse disorder and thanks you for your support and the opportunity to testify before you today. USDA also values our partnerships with universities, industry, and other stakeholders in the collective efforts to safeguard honey bees, the beekeeping industry, and U.S. agriculture. Mr. Chairman, this concludes my remarks. I would be pleased to answer any questions at this time.

The CHAIRMAN. Thank you, Dr. Knipling. We will indeed have the panel ask you a series of questions after our other witnesses have had their opportunity to testify.

I wanted to inform the audience and the panel and the Members of the Committee that we just got word from the Agriculture Appropriations Subcommittee that their Fiscal Year 2009 appropriation that will be coming out of that Subcommittee will be $780,000 for specific work on the items that you mentioned in your testimony and $10 million to your Department in order to conduct general bee research. So that is what the Subcommittee is working on, as we speak, and their hearing is still ongoing, and as further updates become known, we will pass that on too.

I wanted to also take a moment to digress from our testimony and just recognize the Chairman of the full Committee, Mr. Peterson, who is here with us and has joined us briefly. He is working on some other very important matters today with regard to gas prices and he is going to have to excuse himself, but while I have him here, this is the first hearing that we have had post farm bill and I just wanted to thank the Chairman for the unbelievably outstanding work that you did getting that bill passed to completion. You have had unbelievable burdens getting that bill passed but the country is better off for its passage, and thank you on behalf of everybody on the Committee for the work you did. Mr. Peterson, if you have any statements, I would like to recognize you now.

OPENING STATEMENT OF HON. COLLIN C. PETERSON, A REPRESENTATIVE IN CONGRESS FROM MINNESOTA

Mr. PETERSON. I thank the Chairman for the work he did and the Ranking Member and all the Members of this Subcommittee and our Committee. It wasn't just me, it was a team effort, and in the end I think the bill isn't perfect but we were able to accommodate concerns from all parts of the country, from all aspects of agriculture, and as it relates to honey bees, which I have some history with too. I used to have clients back when I was in the CPA business that were in the honey bee business and witnessed firsthand the trials and tribulations that those people went through from year to year, and so we were pleased to be able to raise the loan rates for honey to do some of the research aspects, to make changes in conservation, which will further support honey bees and a lot of those efforts and credit goes to Mr. Cardoza and the Subcommittee for focusing on this and to continue on this.

So I have a statement. I ask that it be made part of the record, and thank you all for your leadership and we will keep our eye on this situation and hopefully we will come up with the right outcome. Thank you.

[The prepared statement of Mr. Peterson follows:]

PREPARED STATEMENT OF HON. COLLIN C. PETERSON, A REPRESENTATIVE IN CONGRESS FROM MINNESOTA

Thank you, Chairman Cardoza, for calling this hearing today and for the great leadership you have shown as Chairman of the Horticulture and Organic Agriculture Subcommittee, and for highlighting a health issue that is crucial not just to beekeepers and producers, but to every American who enjoys a balanced diet.

In March of last year, this Subcommittee held the first ever Congressional hearing that focused exclusively on the honey bee industry and their vital role as pollinators to the nation's food supply.

The hearing focused on Colony Collapse Disorder, an epidemic that is killing honey bees at a rapid rate nationwide. Despite a host of theories, some credible and some not, the cause of CCD has yet to be determined. It continues to be of great concern for beekeepers and farmers who rely on bees to pollinate their crops.

I'm proud of the work that this Committee did in writing and passing the farm bill to recognize the threat of CCD and how important pollinators are to agriculture. The farm bill that was passed and signed into law over the President's veto ensures that all Americans have access to a safe, secure and inexpensive food supply.

That supply depends in large part to the presence and health of honey bees, who are the most economically valuable pollinators of farm crops in the world, with an estimated value in the tens of billions of dollars. They contribute to the production of fruits, vegetables, nuts, forage crops, and, of course, honey, accounting for almost one third of all crop cash receipts in the United States.

Bee pollination roughly accounts for one third of the American diet. And pollinators are crucial to the growing value-added market for fruits and vegetables like organic products and local food networks, which are also prioritized in the farm bill.

Recognizing the valuable role that pollinators play in our farm economy, the farm bill has provisions across several of the bill's fifteen titles to support beekeepers and Colony Collapse Disorder research. Language in the farm bill research title prioritizes the identification of causes and solutions for CCD, while expanding USDA's infrastructure to be able to address CCD research for the long term. It extends the honey marketing loan, which helps keep market prices stable.

Conservation provisions in the bill will encourage habitat development and protection for native and managed pollinators, ensuring that technical assistance includes applicable standards. And provisions affecting bees and pollinators were also added to the farm bill's crop insurance and disaster assistance sections.

Despite some good signs, there are still vital concerns about CCD and the future of pollinators. We are here to learn from researchers in the field, beekeepers, and the producers who depend on pollinators for the health of their crops, about the

challenges they still face after that March 2007 hearing. I welcome today's witnesses, I look forward to their testimony, and I yield back my time.

The CHAIRMAN. Thank you, Mr. Chairman. Thank you again for your hard work.

Now I would like to recognize Mr. Keith Delaplane, Professor of the Department of Entomology at the University of Georgia in Athens. Sir, the floor is yours.

STATEMENT OF KEITH S. DELAPLANE, PH.D., PROFESSOR, DEPARTMENT OF ENTOMOLOGY, UNIVERSITY OF GEORGIA, ATHENS, GA

Dr. DELAPLANE. Thank you. Chairman Cardoza and Members of the Subcommittee, it is a pleasure and an honor to present to you a summary of some of the research being planned in response to pollinator decline. I am project director of a $4.1 million proposal to the USDA CSREES NRI competitive grants program targeted for managed pollinators. The proposal falls under the category of a Coordinated Agricultural Project, or CAP, and CAP proposals must address problems of national concern in a coordinated program of research and knowledge delivery. By inviting CAP proposals in managed pollinators in 2008, CSREES has rightly prioritized pollinator decline as a matter of public interest, and we are pleased to be informed that our proposal has been recommended for funding by the review panel.

The team comprising our CAP project represents 17 institutions including 14 land-grant universities, one 1980 school, one ARS lab and one state lab, and the following are specific objectives. First, to determine and mitigate causes of CCD. This will include studying the interactive effects of disease agents and environmental factors on honey bee health. Second, to incorporate genetic traits that help honeybees resist pathogens and parasitic mites and to increase genetic diversity of commercial stocks. Third, to improve conservation and management of non-*Apis* pollinators by identifying new or emerging pathogens and parasites, abiotic stresses and practices that optimize their pollinating efficiency. Fourth, to deliver research knowledge to client groups by developing a technology transfer program for queen breeders and literature on best management and conservation practice for managed pollinators and queen breeders.

In forming these objectives, we placed priority on identifying causes of pollinator decline. At this time, CCD cannot be assigned rigorously to any one definitive cause. However, pollinator decline has been the focus of worldwide research for decades, and we do have good starting points in our search for a definitive cause. There is evidence, for instance, that new or emerging bee viruses and pathogenic microsporidia contribute to honey bee morbidity, and in our proposal we have chosen to focus on four: Israeli acute paralysis virus, deformed wing virus, *Nosema ceranae* and *Nosema apis*. It is likely that these viruses and microsporidia interact negatively with other more familiar honey bee problems such as Varroa mites, tracheal mites, pesticides, both in hive and out, and stresses associated with migratory beekeeping. Similar to experiments on honey bees, another set of studies will tease apart the risks to non-honey bees from pathogens and field-exposed pesticides.

A similar priority has been placed on mitigating pollinator decline and optimizing bee management. For instance, one of our native pollinators, the bumble bee, *Bombus impatiens,* will be the focus of experiments to identify management practices that optimize its pollinator performance in the field. We have also placed high priority on advancing the powerful advantages of genetic host resistance. There is rich literature on classical bee genetics augmented with new advances in genomics that place within our reach the prospect of identifying genes responsible for honey bee resistance, genetically marking individuals that carry those genes and selectively propagating them.

The knowledge delivery mandate will be met in large part by the extension activities of our team. However, it will also be addressed more deliberately by creating a new literature on best management practices for honey bee managers and non-honey bee managers and queen breeders. The vehicle for delivering these publications will be the web-based platform extension. We will share this platform with our sister group, the ARS Areawide Project, which has been already alluded to this morning.

In summary, Mr. Chairman, it is my wish to affirm this Subcommittee and CSREES for their vision in prioritizing pollinator decline as a fundable problem in 2008. I have showcased the NRI CAP program as a model for addressing problems of national concern. In developing our CAP project, we have emphasized candidate disorders for which there is strong evidence that they contribute significantly to bee decline. It remains to test these candidate factors alone and in combination to discover the chief causes of bee decline. Our mitigation efforts will focus on genetic host resistance and developing best management practices based on research flowing from our CAP and from the ARS Areawide Project.

Rarely has the opportunity been better for American bee scientists to work together across university and Federal boundaries on a problem of such magnitude and national significance. It is to be hoped that Federal assistance will be sustained in a strategic and long-term manner, permitting bee science to mature and engender healthier bee populations across the United States.

Thank you, Mr. Chairman.

[The prepared statement of Dr. Delaplane follows:]

PREPARED STATEMENT OF KEITH S. DELAPLANE, PH.D., PROFESSOR OF ENTOMOLOGY, UNIVERSITY OF GEORGIA, ATHENS, GA

Chairman Cardoza and Members of the Subcommittee, it is a pleasure and honor to present to you a summary of some of the research being planned in response to pollinator decline. I am a professor of entomology at the University of Georgia, and my research specialty is pollination and honey bee management. I am also Project Director of a $4.1 million proposal to the USDA CSREES NRI competitive grants program targeted for Managed Pollinators. This proposal falls under the category of a Coordinated Agricultural Project, or CAP. CAP proposals must address assigned problems of national concern in a coordinated program of research and knowledge delivery. CAP proposals must address the problem with linkages that are multi-institutional and multi-disciplinary and relatively lengthy, in our case 4 years. CAP proposals must identify and eliminate redundancies and design research that builds naturally and progressively upon earlier discoveries. The knowledge delivery component is integral, designed, deliberate, and outcome-oriented. The CAP model has proven an effective means of addressing national-scale problems such as Porcine Reproductive and Respiratory Syndrome and Avian Influenza. By inviting CAP proposals in Managed Pollinators in 2008, the CSREES NRI competitive grants pro-

gram has rightly prioritized pollinator decline as a matter of public interest. We're pleased to be informed that our proposal was recommended for funding by the review panel.

The team comprising our CAP project represents 17 institutions including 14 land-grant universities, one 1890 school, one ARS lab, and one state lab. Eleven of the 19 team members have whole or partial appointments in agricultural extension. Thus, the CAP knowledge delivery component is integral to the makeup of the team.

Here are the objectives of our project:

1. Determine and mitigate causes of CCD: study the interactive effects of disease agents (pathogens, parasites) and environmental factors (pesticides, nutrition) on honey bee health.

2. Incorporate traits that help honey bees resist pathogens and parasitic mites and increase genetic diversity of commercially available stocks.

3. Improve conservation and management of non-*Apis* pollinators by identifying new or emerging pathogens and parasites, abiotic stresses, and practices that optimize their pollinating efficacy.

4. Deliver research knowledge to client groups by developing a technology transfer program for queen breeders and a literature on Best Management and Conservation Practices for managed pollinators and queen breeders as an eXtension Community of Practice.

In forming our objectives, priority was placed on identifying causes of pollinator decline. At this time, honey bee Colony Collapse Disorder (CCD) cannot be rigorously assigned to any definitive causes. However, bee morbidity and pollinator decline have been the focus of worldwide research for decades, and we have good starting points in our search for definitive causes. There is strong evidence that new or emerging bee viruses contribute significantly to honey bee morbidity. In our proposal we have chosen to focus on two: Israeli Acute Paralysis Virus and Deformed Wing Virus. Similarly, there is strong and recent evidence for bee morbidity from *Nosema ceranae,* a single-celled microsporidian pathogen recently introduced into Europe and North America, presumably from southeast Asia. It is likely that viruses and microsporidia, whether new to our continent or latent, interact negatively with more familiar honey bee problems such as parasitic Varroa mites and tracheal mites, pesticides both in-hive and out-, and stresses associated with intense migratory commercial beekeeping practices. Similar to these experiments on honey bees, another set of studies will tease apart the risks to non-honey bees from pathogens and field-exposed pesticides. At this stage in our understanding of bee decline, it is necessary to include numerous interaction experiments to discover the major contributors of bee morbidity and the extent to which they act singly or in synergy.

In forming our objectives, a similar priority was placed on mitigating causes of pollinator decline and optimizing bee management. These objectives include research, but also represent our heaviest investments in knowledge delivery. In the interest of minimizing our reliance on chemical remedies, we have placed a high priority on advancing the powerful advantages of genetic host resistance. There is a rich literature on classical bee genetics, augmented with new advances in genomics that place within our reach the prospect of identifying genes responsible for honey bee resistance to disorders, genetically marking individuals that carry those genes, and selectively propagating them. Our proposal includes research that moves us in this direction as well as initiatives for delivering improved stock to bee breeders and for training them in classical selection techniques. One of our native pollinators, the bumble bee *Bombus impatiens,* will be the focus of experiments to identify management practices that optimize its pollinator performance in the field.

The knowledge delivery mandate will be met in large part by the extension activities of our team members, most of whom have at least a partial extension appointment. However, the mandate will be addressed more deliberately by creating a new literature on Best Management Practices for honey bee managers, non-honey bee managers, and queen breeders. The primary vehicle for delivering these publications will be the web-based eXtension platform *http://about.extension.org/,* which on its homepage is described as ". . . an Internet-based collaborative environment where Land Grant University content providers exchange objective, research-based knowledge to solve real challenges in real time." The "content providers," or Communities of Practice, are each a delimited group of content specialists who use the eXtension platform to jointly write, edit, peer-review, and publish knowledge-based extension literature. Our CAP team has agreed to join forces with our sister group, the ARS Areawide Project, to form one Managed Pollinator Community of Practice. This combined website will be the chief conduit through which new knowledge from our re-

search flows to beekeepers and crop growers who need real answers to the problem of pollinator decline.

In summary, it is my wish to affirm this Subcommittee and CSREES for their vision in prioritizing pollinator decline as a fundable problem in 2008. I have showcased the NRI CAP program as a model for addressing problems of national concern through a synthesis of multi-disciplinary research and outcome-oriented knowledge delivery. In developing our CAP project, we have emphasized candidate disorders for which there is strong evidence that they contribute significantly to bee decline. It remains to test these candidate factors, alone and in interaction, to discover the chief causes of bee decline. Our mitigation efforts focus on genetic host resistance and developing Best Management Practices based on research flowing from our CAP and from the ARS Areawide Project.

Rarely has the opportunity been better for American bee scientists to work together across university and federal boundaries on a problem of such magnitude and national significance. It is to be hoped that federal assistance will be sustained in a strategic and long-term manner, permitting bee science to mature and engender healthier bee populations across the United States.

Key Personnel, Their Institutions, and Roles in the Managed Pollinator CAP

Co-Investigator	Role
Keith S. Delaplane, Univ GA, All years	Project Director; Exercise general oversight of the project and do Objectives 1.9 (Varroa IPM) and 4.3 (queen market).
Kate Aronstein, ARS, Weslaco, TX, All years	Objectives 1.1 (*Nosema*), 1.3 (stationary apiary), and 2.1 (ID genes). Dr. Aronstein will manage the Texas replicate of the stationary apiaries, collaborate with T. Webster and L. Solter on *Nosema ceranae* infection and analyze bee samples with qRT-PCR to estimate differences in immune response between infected and healthy bees. Microarrays will be done by C. Grozinger.
Anne Averill, Univ MA, All years	Executive Committee; Objectives 1.3 (non-*Apis* pathogens in stationary apiaries), 3.1 (non-*Apis* pathogens), 3.2 and 3.3 (non-*Apis* toxicology). Dr. Averill will study insecticide effects on non-*Apis* bees and coordinate flow of non-*Apis* deliverables to eXtension.
Nick Calderone, Cornell Univ, Years 1–3	Objective 2.2 (Genetic diversity). Dr. Calderone will study genetic variability of northern bee populations. Desirable germplasm will be sent to G. Hunt and to S. Sheppard for use in their research. Dr. Calderone will develop eXtension protocols for stock selection and conduct bee breeding workshops.
Diana Cox-Foster, PA State, All years	Objectives 1.2 (IAPV, DWV), 1.3 (*Apis* pathogens in stationary apiaries), 1.4 (diagnostics) and 1.5 (pathogen voucher collection). Dr. Cox-Foster will have lead roles in the diagnostic, curatorial, and diagnostic development aspects of these Objectives.
Robert Danka, ARS, Baton Rouge (non-funded)	Dr. Danka's lab will phenotype bees for Varroa-Sensitive Hygiene and conduct gene expression assays in collaboration with Hunt and Spivak in association with Objective 2.1 (ID genes).
Frank Drummond, Univ ME, All years	Objectives 1.3 (stationary apiary), 3.4 (*Bombus* management), and 3.5 (economics of non-*Apis*). Dr. Drummond will manage the Maine replicate of the stationary apiaries and do original studies on pollinating efficacy of *Bombus impatiens* and local-scale habitat restoration.
Brian Eitzer, CT Ag Exp Sta, All years	Conduct toxicology in Objectives 1.3 (*Apis* stationary apiaries) and 3.3 (non-*Apis*).
Marion Ellis, Univ NE, Years 1–2	Objective 1.6 (pesticide synergies and sub-lethals). Dr. Ellis will recruit and mentor the post-doc assigned to this work, supervise its execution, analyze data, complete reports, and channel relevant deliverables to eXtension. His budget will support the services of his colleague Dr. Blair Siegfried, Professor, Univ Nebraska.
Christina Grozinger, NC State Univ, Year 3	Objective 2.1 (ID genes). Dr. Grozinger will be responsible for microarray analyses of *Nosema*-infected bees collected by K. Aronstein and the *Nosema*-infected resistant and sensitive bees used in the QTL analysis by G. Hunt (Purdue).
Zachary Huang, MI State Univ, All years	Objective 1 (*Nosema*). Dr. Huang will cooperate with T. Webster, L. Solter, and K. Aronstein on aspects of *Nosema*-induced morbidity of honey bees.

Key Personnel, Their Institutions, and Roles in the Managed Pollinator CAP—Continued

Co-Investigator	Role
Greg Hunt, Purdue Univ, All years	Executive Committee; Objectives 1.4 (diagnostics) and 2.1 (ID genes). Dr. Hunt will develop probes for single-nucleotide polymorphisms (SNPs), determine SNP genotypes throughout the genome, map quantitative trait loci (QTL), and identify genes for resistance. In addition, Dr. Hunt will coordinate with M. Spivak and T. Webster to develop crosses for QTL mapping and with C. Grozinger to analyze gene expression. Dr. Hunt will direct deliverables from the genetics goal to eXtension.
Chris Mullin, PA State, Years 3–4	Objective 1.7 (pesticide metabolites). Dr. Mullin will provide project leadership for the sublethal behavioral bioassays. He will be assisted (non-funded) by M. Frazier who will supervise extension communications and by J.L. Frazier who will provide leadership on measures of chemosensory cells.
Nancy Ostiguy, PA State, All years	Executive Committee; Objectives 1.2 (IAPV, DWV) and 1.3 (stationary apiary). Dr. Ostiguy will manage the PA replicate of the stationary apiaries and be responsible for descriptive epidemiology of IAPV and DWV, provide overall guidance on the stationary colony project, and assist D. Cox-Foster with pathogen molecular biology. She will direct deliverables from the CCD goal to eXtension.
Steve Sheppard, WA State Univ, All years	Executive Committee; Objectives 1.3 (stationary apiary) and 2.2 (Genetic diversity). Dr. Sheppard will manage the WA replicate of the stationary apiaries, characterize genetic diversity in U.S. honey bee populations with emphasis on the western and southern U.S. and Australia. Comparisons will be made with previous U.S. collections of commercial stocks and a concurrent database from northern producers (N. Calderone).
J. Skinner, Univ TN, All years	Executive Committee; Objective 4.1 (establish eXtension Community of Practice). Dr. Skinner will set up a Managed Pollinator Community of Practice on eXtension, coordinate receipt of deliverables from co-investigators, and facilitate its delivery on the eXtension website.
Leellen Solter, IL Natural History Survey, Years 1–2	Objectives 1.1 (*Nosema*-induced bee morbidity), 1.2 (*Nosema* interactions with biotics and other stressors). Dr. Solter will take the lead on *Nosema* with experiments in collaboration with Drs. Huang, Ostiguy, Cox-Foster, Webster, and Aronstein.
Marla Spivak, Univ MN, All years	Executive Committee; Objectives 1.3 (stationary apiary), 2.1 (ID genes), and 4.2 (queen market). Dr. Spivak will manage the MN replicate of the stationary apiaries, assist G. Hunt and B. Danka in phenotyping VSH bees, and lead CA queen breeding workshops.
Kirk Visscher, Univ CA, All years	Objective 1.3 (stationary apiary). Dr. Visscher will manage the CA replicate of the stationary apiaries.
Tom Webster, KY State Univ, All years	Objectives 1.1 (*Nosema*), 1.4 (diagnostics), and 2.1 (ID genes). Dr. Webster will conduct comparative bioassays on the virulence of *Nosema apis* and *Nosema ceranae* and interactions with other stressors. Bees infected with *N. apis,* infected with *N. ceranae,* or not infected will be sent to K. Aronstein for immune assays.

The CHAIRMAN. Thank you, sir. I appreciate your testimony.

I would now like to recognize Ms. Maryann Frazier, Senior Extension Associate with the University of Pennsylvania at University Park, Pennsylvania. Welcome, and please proceed.

STATEMENT OF MARYANN T. FRAZIER, SENIOR EXTENSION ASSOCIATE, DEPARTMENT OF ENTOMOLOGY, THE PENNSYLVANIA STATE UNIVERSITY, UNIVERSITY PARK, PA

Ms. FRAZIER. Good morning. Chairman Cardoza and Members of the Subcommittee on Horticulture and Organic Agriculture, thank you for the opportunity to be here today and to bring you up to date on CCD, pollinator health and our land-grant universities' efforts to address this critical issue.

I want to thank this Committee for the critical research funding that has been allocated to the land-grant system to work on pollinator health and CCD to date. This includes over $300,000 in CSREES critical issues funding and the pending $4.1 million CAP grant. In addition, I want to acknowledge the extraordinary level of cooperation between several land-grant universities, state departments of agriculture and the USDA to address this critical problem.

However, I do believe the magnitude and timeliness of this response has not matched the scale and urgency needed to save an industry valued at $15 billion. A quote by one of our CCD working team colleagues helps put this situation into perspective: "How would our government respond if one out of every three cows was dying."

After facing almost 2 years of CCD ravaging the beekeeping pollinator industry, we would like to propose five additional action items that, if taken, could immediately move critical research forward and help our beekeepers survive this difficult time. These actions in turn would ensure ongoing pollination services to the fruit, nut, seed and vegetable industry, and thus provide an uninterrupted supply of reasonably priced fresh fruits and vegetables to consumers. These action items include reducing the cost of pesticide analytical services provided by the USDA Agricultural Marketing Service to both USDA and university researchers working on pollinator health, particularly the pesticide angle, creating a new USDA critical issues program to develop alternative control methods for Varroa mites, provide additional authorized funding aimed at understanding pollinator decline and improving pollinator health, providing direct financial assistance to beekeepers suffering from hive losses, and directing APHIS to immediately implement a national survey for honey bee diseases, and increased screening for diseases on imported bees.

Despite significant efforts over the past 18 months on the part of the USDA, state departments of agriculture and land-grant universities, we have yet to understand this most recent manifestation of pollinator die-off, CCD. Its cure and its cause remain unknown. Important funding to address this problem has been received from the beekeeping industry, in particular, the National Honey Board and beekeeping organizations, the Pennsylvania and Florida departments of agriculture, the Pennsylvania State University HATCH funds, USDA CSREES, Häagen-Dazs and many concerned public groups and individuals.

While the CCD team has not been able to identify, as you already heard, a single factor responsible for CCD, we feel that factors likely working together include pathogens, pesticides, poor nutrition and Varroa mites. These are stressing the bees and the beekeepers beyond their ability to cope. This scenario makes the situation far more complex and difficult to understand and to fix. However, current studies are underway to evaluate the pathogenicity of IAPV with additional field studies planned through the CAP, two long-term studies following 260 colonies in different migratory operations that is being conducted by a multi-institutional effort including Penn State, Pennsylvania Department of Agriculture, North Carolina State University and the USDA.

Over the past 18 months, our research group at Penn State has worked on the question of whether or not pesticides are responsible for CCD specifically and pollinator decline in general. This work would not be possible without the assistance of chemist Roger Simonds and the services of the USDA analytical lab in Gastonia, North Carolina, and of course, our other CCD working group members.

In 2007, we analyzed pollen, wax and bees for pesticide residues. In a total of 108 pollen samples analyzed, 46 different pesticides including 6 of their metabolites were identified. Up to 17 different pesticides were found in a single pollen sample. Samples contained on average five different pesticide residues. Only 3 of these 108 had no detectable pesticides. We fear this large number and multiple kinds of pesticides could result in potential toxic interactions for which there are no scientific data to date. Also, these chronic levels of pesticide need further investigation with regard to their potential interaction with other stressors like IAPV in order to determine their potential contribution to CCD. From February 2007 to the present, 60 percent of our available funds have gone to pay the USDA for pesticide analytical services. If this service could be provided at reduced cost, it would allow us to redirect our limited research dollars to understanding the impacts pesticides are having on bees and other pollinators.

For most of the last 20 years, U.S. beekeepers have had only two registered chemical miticides to combat the most significant honey bee pest in the world, the Varroa mite. There has been significantly little effort put into biological control alternatives. For our beekeeping industry to survive, we must have safe, alternative Varroa mite controls. This will only happen if significant new resources are focused in this direction. In an effort to keep their bees and their businesses alive and to meet their pollination contracts, our beekeepers have pushed themselves and their bees to the limits financially, emotionally and physically. Direct financial assistance is overdue and is critical to their survival or next year's agricultural pollination needs may not be met.

I thank you for this opportunity to provide you this testimony, and would be happy to answer any questions that you might have.

[The prepared statement of Ms. Frazier follows:]

PREPARED STATEMENT OF MARYANN T. FRAZIER, SENIOR EXTENSION ASSOCIATE, DEPARTMENT OF ENTOMOLOGY, THE PENNSYLVANIA STATE UNIVERSITY, UNIVERSITY PARK, PA

Introduction

Chairman Cardoza and Members of the Subcommittee on Horticulture and Organic Agriculture,

I would like to begin by thanking you for the opportunity to be here today and bring you up to date on CCD, pollinator health, and our land-grant universities' efforts to address these critical issues.

As the Senior Extension Associate at Penn State, specializing in apiculture for the past 20 years, I have had the opportunity to work closely with beekeepers as well as university and USDA researchers involved in honey bee research. I am also a beekeeper and am intimately involved in scientific research dealing with the health and productivity of honey bees and other pollinators. I believe this gives me a unique perspective and understanding of the challenges faced by both groups. I am also a founding member of the Mid-Atlantic Apiculture Research and Extension Consortium (MAAREC). This group, established in 1997, is focused on addressing

the pest management crisis facing the beekeeping industry in the Mid-Atlantic Region. I have worked in the regulatory arena as the assistant state apiary inspector in Maryland and as a beekeeping specialist in Africa and Central America. In addition I am one of the members of the CCD working team that formed in response to the latest threat to honey bee health.

I want to thank this Committee for the critical research funding allocated to work on honey bee health and CCD since this Committee first met in March 2007. This includes $321,932 in CSREES critical issues funding awarded to Penn State and the University of Georgia and the pending $4.1 million CAP grant that will fund work on pollinator health at several collaborating universities. However I believe the magnitude and timeliness of the response has not matched the scale and the urgency needed to save an industry valued at more than $14 billion. A quote by one of our CCD working team colleagues helps put the situation into perspective, "How would our government respond if one out of every three cows was dying?" While this Committee held it first timely hearing in March of 2007, the funding that has been allocated to date falls far short of the time sensitive and potentially catastrophic nature of this problem.

After facing almost two years of CCD ravaging the beekeeping and pollination industries, we would like to propose five additional "action items" that if taken, could immediately move critical research forward and help our beekeepers survive this difficult time. These actions would, in turn, help ensure on-going pollination services to the fruit, nut, seed and vegetable industries across the US and thus provide reasonably priced fresh fruits and vegetables to consumers with minimal interruption.

These actions include:

(1) Reducing the cost of pesticide analytical services provided by USDA Ag Marketing Services to USDA and University researchers working on pollinator health.

(2) Creating a new USDA critical issues program to develop alternative control methods for Varroa mites

(3) Providing additional funding aimed at understanding pollinator decline and improving pollinator health that includes native species of pollinators

(4) Providing direct financial assistance to beekeepers suffering from high losses

(5) Directing APHIS to immediately implement a national survey for honey bee diseases

Justification

Due to our current agricultural methods, including the establishment of large monocultures and the use of insecticides and herbicides, wild pollinators are largely absent from cropping systems that require insect pollination. For this reason, growers depend on beekeepers to move their honey bee colonies in and out of crops during bloom. The contribution of honey bees to agriculture production in the US is valued at $14 billion annually. However, according to the latest Apiary Inspectors of America and USDA/ARS survey, losses of managed colonies nationwide topped 36 percent in 2008, compared to a 31 percent loss during the same period last year. Despite significant efforts over the past year and a half on the part of USDA, state departments of agriculture, and land-grant university researchers to understand the most recent manifestations of pollinator die-offs, Colony Collapse Disorder, its cause and cure remain unknown.

Status and Progress to date

Government, industry and the private sector have mobilized to address this problem. Important timely funding to address this problem has been received from the beekeeping industry, in particular the National Honey Board and beekeeping organizations, the Pennsylvania and Florida Departments of Agriculture, The Pennsylvania State University (HATCH funds), USDA; CSRESS, Häagen-Dazs, and many concerned public groups and individuals. Two grants totaling $250,000 from Häagen-Dazs were made to Penn State and UC Davis. At Penn State, an additional 252 gifts from individuals, foundations and small businesses have been made totaling $52,884. Of these, 150 gifts totaling $7,300 were made as a direct result of the Häagen-Dazs web site. This creative effort to support research into pollinator decline and public education on the importance of pollinators is relatively new and additional funding is expected as a result of this unique effort initiated by Häagen-Dazs. However many of the research and education activities to date have relied on short-term and somewhat uncertain funding sources.

Critical ongoing research projects by the CCD working team include the potential role of IAPV as a major contributing factor causing CCD. The initial work identifying IAPV would not have been possible without the assistance of Dr. Ian Lipkin

and resources from a Northeast Biodefense grant from NIH awarded to Columbia University. Since this work is not directly related to human health, this significant contribution to CCD research has ended. Studies are underway to evaluate the pathogenicity of IAPV to honey bees in a controlled greenhouse; additional studies are planned for field studies through the CAP grant. A recent survey of bee colonies from 11 states has revealed that IAPV is more widely distributed than previously observed; however, it and other viruses are regarded as being major contributors to colony death.

Two long-term studies following 260 colonies in different migratory operations was initiated and conducted by a multi-institutional team including PSU, PDA, NCS and the USDA. Over the course of this experiment 3,702 samples were collected while the health of these colonies was assessed over time. Some of these samples are now being tested for levels of parasites, viruses, and pesticide residues. These long-term studies have also highlighted several other previously undescribed conditions in honey bee colonies that appear to have a negative impact on colony health, such as "entombed" pollen. Theses samples will also be an invaluable resource when we begin to test the predictive value of diagnostic tests which are presently in the final stages of development. For instance, based on the autopsies of several thousand bees, we hope to develop a CCD diagnostic test based on gross symptoms. When this diagnostic key is finalized it can be tested against samples in storage to validate the tests ability to predict disease outbreak. The USDA/ARS, PDA and PSU have also initiated studies to develop practical and effective ways for beekeepers to control parasitic infections, such as *Nosema* and Varroa mites.

Ongoing research into the role of pesticides in pollinator decline and CCD includes a study to track colonies heath and pesticide exposure in three Pennsylvania apple orchards, the use of gamma radiation to mitigate pesticide build-up in wax combs and foundation, lab bioassays on the synergistic effects of multiple pesticide residues and the potential impacts of pesticide adjuvants.

At present, the CCD team has not been able to identify a single cause for CCD. We are now performing a multi-factorial analysis on the data set resulting from the initial CCD sample collection. Over 180 analyses were preformed on a common set of colonies by more than seven different laboratories. We are hopeful that the multi-factorial analysis will highlight those factors, which, in combination, might explain CCD. Factors likely working together, including the recently identified IAPV plus the parasitic microsporidia and Kashmir Bee Virus, pesticides, poor nutrition, and varroa mites are stressing the bees (and the beekeepers) beyond their abilities to cope. This scenario makes the situation far more complex and difficult to understand and to "fix." However, the potential ramifications of not understanding the collapse of our biological systems, in this case, pollinators are huge and potentially disastrous on many levels, including the sustainability of our food supply as we know it.

The Potential Role of Pesticides

As the original member of the CCD working team charged with investigating the potential role of pesticides in CCD, I have, over the past 18 months worked closely with chemist and toxicologist, Dr. Chris Mullin, and physiologist Dr. Jim Frazier on the question of whether or not pesticides are contributing to pollinator decline in general and CCD specifically. This work would not be possible without the assistance of chemist Roger Simonds and the services of the USDA, Agricultural Marketing Service, National Science Laboratory in Gastonia NC and our CCD working team colleagues and their teams; especially Dennis vanEngelsdorp from the Pennsylvania Department of Agriculture/PSU and Dr. Jeff Pettis with the USDA/ARS in Beltsville MD.

Honey bee exposure to chemical pesticides has long been a concern of beekeepers and growers alike. Over one half of our 2.4 million colonies is utilized for crop pollination and typically employed on several different crops per season. These colonies are at risk of exposure to the pesticides used by growers to control pest insects, diseases and weeds. Beekeeper use of miticides within the beehive to control varroa mites is cause for concern due to their potential impacts on developing bees (especially queens) and contamination of hive products. In the past, pesticide poisoning of honey bees has been associated with lethal exposure and the obvious symptom of a pile of dead bees in front of the hive. We are becoming increasingly concerned that pesticides may affect bees at sublethal levels, not killing them outright, but rather impairing their behaviors and their abilities to fight off infections. For example, pesticides at sublethal levels have been shown to impair the learning abilities of honey bees and to suppress their immune systems. For these reasons, we believe that pesticide exposure may be one of the factors contributing to pollinator decline and to CCD.

In 2007 we analyzed pollen, wax and bees for pesticide residues. A significant number of samples analyzed were from operations impacted by CCD and control operations (not impacted by CCD) that were collected by members of the CCD working team as part of a larger CCD study. Additional samples were collected from honey bee colonies placed in specific Pennsylvania apple orchards (PSU field study) and a third source was pollen, wax or bees submitted by beekeepers who placed their bees in specific crops, or who were concerned about the declining health of their colonies.

In a total of 108 pollen samples analyzed, 46 different pesticides including six of their metabolites were identified. Up to 17 different pesticides were found in a single sample. Samples contained an average of 5 different pesticide residues each. Only three of the 108 pollen samples had no detectable pesticides. In a total of 88 wax samples analyzed, 20 different pesticides including two of their metabolites were identified. As was found in pollen, fluvalinate, coumaphos, chlorpyrifos, and the fungicide chlorthalonil, were the most commonly detected pesticides with fluvalinate and coumaphos detected in 100% of the samples.

Unprecedented amounts of fluvalinate (up to 204 ppm) at high frequencies have been detected in brood nest wax, and pollen (bee bread). Changes in the formulation of fluvalinate over time resulting in a significant increase in toxicity to honey bees, makes this a serious concern. The large numbers and multiple kinds of pesticides that have been found could result in potentially toxic interactions for which there are no scientific studies to date. European researchers have found similar pesticides and frequencies in hive matrices and express similar concerns. Also these chronic levels of pesticides in pollen and wax at potentially acute toxicity levels need further investigation with regard to their potential interactions with other stressors (*e.g.,* IAPV) and their potential contribution to CCD.

Closing Remarks

We know that pesticides are present in the food the bees are consuming, in the wax combs where they develop and live, and in the bees themselves. What we don't know is how these chemical residues are affecting the bees. From February 2007 to the present, $247,334 has been committed to our work on pesticide research. Of the $96,000 spent to date, $57,683 or 60% has been paid to the UDSA for pesticide residue analysis. If this service could be provided at a reduced cost, it would allow us to redirect our limited research dollars to understanding the impact pesticides are having on honey bees and other pollinators.

For most of the last 20 years US beekeepers have had essentially only two registered chemical miticides to combat the most significant honey bee pest in the world, the varroa mite. Granted three "soft" materials have been registered more recently, but these are of limited use for our large commercial beekeepers. These materials require specific time and temperatures to work and often give sporadic results not amenable to migratory operations. There has been little effort invested in finding biologically-based alternatives to pesticides, including the most promising, the development of bees resistant to mites. Thus, the varroa mite, known to transmit diseases, possibly including the newly identified IAPV, and to impair the honey bee immune system has been largely ignored by industry and researchers, thus beekeepers have been left to their own devices to try to control it. Additionally, the chemical miticides being used to control varroa mites, accumulate in the wax combs and pollen reserves and are possibly contributing to the bee's demise as much as they are controlling the mites. For the beekeeping industry to survive we must have safe, effective varroa mite control methods. This will only happen if significant new resources are focused in this direction.

While in the long run honey bees will most likely survive, our beekeepers may not. In an effort to keep their bees alive and their businesses afloat, and to meet critical pollination contracts they have pushed themselves to the limits financially, emotionally and physically during the past 18 months. Direct financial assistance is overdue, and is critical to their survival, or next years agricultural pollination needs will not be met. One immediate small step would be to exempt beekeepers from paying the sugar tariff on sugar used to feed their bees. I urge the Committee to consider these five suggestions for improving our efforts to find the cause or causes for CCD and save our pollination industry before it is too late.

I thank you for this opportunity to provide testimony and would be happy to answer any questions.

The CHAIRMAN. Thank you, Ms. Frazier. Your testimony is compelling. I am sure that Members will have significant questions.

I am going to open it up for questions at this time and I will begin the questioning with Dr. Knipling. In your testimony, you

state that one area of research focus has been on determining whether pesticides are associated with CCD and that you continue to analyze bee samples for their pesticide exposure. Can you give the Committee a sense of the universe of these samples under consideration and how many of these samples have been examined to date?

Dr. KNIPLING. Certainly, sample analysis is very critical to support of all of the efforts you have heard about and in fact much of the progress and our understanding of the directions that we need to take are based upon those sample analyses. There have been a considerable number of samples tested at considerable expense. They are expensive. I don't know the precise number—we could provide that for the record—but I think it is on the order of 4,000 to 5,000 samples and over $100,000 has been spent from various sources and from various projects. There are probably about that many remaining samples and these samples are bee samples, pollen samples, and wax samples. About ⅔ of the analyses that are required are for pathogens, the various pathogens we have heard about, and perhaps about ⅓ for pesticides. Certainly the additional resources that we now have and will be forthcoming will allow us to move forward on this.

We do know, however, that based on the samples that have already been analyzed, they have given us a very good sense of direction and helped us to establish and define hypothesis-driven research. Certainly, the priorities for sample analyses will be given to those samples coming from those research projects, as opposed to samples that have come from various sources unrelated to research projects. But we are well on track of this issue and we have the increasing resources to address the problem.

The CHAIRMAN. I would like to follow up on that. I understand from your testimony that these samples are being examined by AMS for pesticide residues. Can you describe the mechanism and/or the relationship between ARS and AMS in conducting the analysis of these samples? It has been reported to the Committee and it comes up in witness testimony today that samples are not being examined on a timely basis. You mentioned that half of them have not been examined yet. And I understand that AMS involvement in this analysis is on a fee-for-service basis. You just heard from Ms. Frazier that it is very expensive and is using a great deal of their resources. Can you discuss this in some great detail?

Dr. KNIPLING. Yes. The Agricultural Marketing Service facility in North Carolina operates a pesticide testing capability on a user-fee basis. That capability has been in existence for some time unrelated to this issue. AMS is responsible for the so-called pesticide data inventory for agricultural samples which they do on a user-fee basis. They do not have a mission responsibility with respect to this honey bee issue. The testing they have done has been based upon the resources that have been provided to them from the researchers, both the ARS researchers and the university researchers. There has been support from some of the other state-level organizations as well. The tests are expensive, depending on whether it is bees, pollen or wax, perhaps up to $200 per sample, and as the researchers can pay for those samples, they will be tested. With

the new additional resources, we see that considerable additional progress will be made in that area.

The CHAIRMAN. Dr. Knipling, the ARS CCD work plan coordinates the Federal strategy in response to this problem. In the March 2007 hearing, we heard from a number of witnesses who stress the need for increased data collection and accurate annual surveys of bee colonies and bee health. Can you describe for the Committee the activities that USDA has undertaken to increase the data associated with an accurate assessment of pollinator health? Your testimony seems to indicate that action on a national bee health survey is sometime in the future. Is USDA solely at the mercy of appropriators in paying these resources to conduct these surveys, and is there any other means that we can expedite this critical aspect of what we need to have happen in order to get to the bottom of this?

Dr. KNIPLING. The data we have to date, and some of the loss numbers I quoted earlier in my testimony, are based upon surveys that have been conducted by some of the ARS researchers in cooperation with the Apiary Inspectors of America. Those are the state department of agriculture-level organizations. And we are using research dollars to do this and they are using state-level resources as well. APHIS is planning, as indicated and as authorized in the new farm bill, to conduct a more systematic national survey of honey bee health and pests, and that is in process at this point. The planning for that survey, I understand, is in process.

The CHAIRMAN. When can we expect the results from that survey?

Dr. KNIPLING. The planning, of course, is just being initiated, and then I imagine it would take months, perhaps a full season, to get the additional data. But this is, as you said at the outset, a very difficult and complex issue and we are continuing to address all avenues as resources permit.

The CHAIRMAN. One of the things that I am wanting to discuss with you today, certainly we all realize that this is a big problem, and I am not in any way holding this hearing in an effort to beat you all up, but we have to find out and we have to hear from you very directly what are the necessary resources needed to be brought to bear on this problem in order to find out the information that we need to get to the bottom of this question. I am a little concerned that we are a year from the last hearing and we still don't know all of the requests that are needed to get to answers, and that is something that is of grave concern to me. Do you have a response that you would like to share?

Dr. KNIPLING. I would just acknowledge that we are very conscious of the concern and we are addressing it as vigorously as we can with the resources available to us.

The CHAIRMAN. That is my point, sir. We need to know if there are additional resources that need to be brought to bear. That is something that this Committee needs to be aware of, and we just heard from the appropriators today what the level of resources that they have allocated. Now, you have friends on this Committee who want to get to the bottom of this question. If you don't tell us what we need to do, then we can't be your advocates in making sure that the appropriators provide those dollars. Now, either the President

hasn't requested enough dollars or we have not provided them, but one way or another, we can't let this problem go on for lack of funding. So I just reiterate my request that you need to tell us what the impediments are so that we can get to the bottom of this.

Dr. KNIPLING. Well, we will certainly provide additional information for the record, and the new resources that were requested in the President's Fiscal Year 2009 budget and, as you acknowledged earlier, the House Subcommittee action will help us move in that direction.

The CHAIRMAN. Thank you.

Dr. Delaplane, both you and Dr. Knipling have raised the role of the Israeli acute paralysis virus as a marker for CCD. Your proposal has an IAPV component. What kind of research is needed to explore the possibility of a causal link? How long does research of this nature take? And Dr. Knipling, you are welcome to weigh in on this as well as Dr. Delaplane, if you could just comment on the resources issue if you see fit.

Mr. DELAPLANE. The situation with IAPV, as well as any of the disorders, to rigorously assign cause and effect would have to go through a step called Cox postulates which is a standard epidemiological method of trying to reproduce symptoms when the pathogen is artificially inserted into the host, let the pathogen reproduce in the host and then reinfect another generation of the host. This is the most rigorous way to pin down cause and effect, and the studies that we are proposing—which, I should say, will be led primarily by Dr. Diana Cox Foster at Penn State—involve this type of design work.

The CHAIRMAN. Thank you, sir.

Ms. Frazier, you state in your written testimony that there has been little effort or investment in finding biologically based controls for bee parasites. Can you expand on your statement and your call for significant new resources as we were just discussing with regard to biological-based materials?

Ms. FRAZIER. Sure, and I don't want to say that there have been no resources or no effort. Certainly there has been by the USDA and by researchers as well, university researchers as well, but I think you have to understand that the bee research community unfortunately is quite small. So, the number of us trying to address this problem along with the resources that we have had to tackle this huge problem of Varroa mites, and particularly trying to find biological alternatives to its control, has been very minimal compared to the size of the problem. If you are asking me what would it take, that is a difficult question. But certainly what we need is more people, more manpower to address this problem of alternatives, and I think one of the ways to do that is through critical issues funding through USDA CSREES to develop a critical issues project that would be devoted specifically to Varroa mite control alternatives. And I think that the research community as a whole, like the group that came together to design the CAP, could do the same for an effort made specifically to finding alternative controls for Varroa mites.

The CHAIRMAN. I have taken significant liberty about going over my time so far but I am going to take that liberty one more time. Ms. Frazier, you also advocate in your testimony the need for re-

duction in cost of the pesticide analysis service provided by USDA and AMS, which we discussed. You said in your testimony 108 pollen samples were analyzed. Do you know how many samples are waiting for analysis?

Ms. FRAZIER. Well, there are several different efforts that are ongoing. Some are just at Penn State. Some are collaborations between Penn State and USDA. Some are including the Department of Agriculture in Pennsylvania and Florida. Our best recollection is that there are about 2,000 samples, our best estimate is that there are about 2,000 samples that need to be analyzed, which would be a cost of well over $200,000. Again, the idea of trying to reduce that cost would be very significant to our research effort.

The CHAIRMAN. It seems like a significant problem. I just want to be sure, are those samples waiting solely due to the lack of funds?

Ms. FRAZIER. Yes.

The CHAIRMAN. Thank you.

Mr. Neugebauer had to go to a classified briefing that he was compelled to attend and has been excused from the hearing. In his place, Mr. Latta from Ohio has taken over the chores of Ranking Member here and we will now allow him to ask questions. Welcome, Mr. Latta, and please proceed with your questions.

Mr. LATTA. Thank you very much, Mr. Chairman. I appreciate that. I also would like to thank you for this hearing. Where I come from in northwest Ohio, this is a big issue, and I know firsthand from when my cousin had—I want to use the word "had"—bees, and I would help him on many occasions when we would bring the honey in to get it extracted. I know of many, many cases across our area where we have lost bee hives and also in my old Senate district along Lake Erie, some of the people I used to represent had 10,000 apple trees and it is very important up there along with apples and peaches and everything else to make sure that these hives remain active and we can get this problem solved.

Dr. Knipling, if I could ask a couple questions, the first being, is there any collaboration between Canada, the United States and Mexico to establish pollinator monitoring projects for all of North America?

Dr. KNIPLING. I am not aware of any specific collaboration of the type we have been talking about this morning. Certainly we do have collaborations generically with the research organizations in those countries, the national research organizations as well as many of the universities, but I could provide some additional information for the record.

Mr. LATTA. Thank you. Also, does the USDA regulate the interstate movement of honey bees and honey bee pests?

Dr. KNIPLING. It is my understanding that there are no such regulations except perhaps in the case of Hawaii, which does not have the Varroa mite on all of its islands, but again, I would seek some assistance from our APHIS partners and USDA and provide that information. They would have the responsibilities for those quarantine-type activities.

Mr. LATTA. Another question pretty much along the same lines is on the importation of honey bees into the United States and how do we justify allowing these importations?

Dr. KNIPLING. Once again, that would be a question I would seek input from APHIS on. Moving the honey bees is quite common. Other countries do provide breeding stock for the commercial bee industry. Also, sources of genetic resistance for our research efforts are important. The honey bee we have now was introduced from Europe many years ago, so we are very highly dependent in the United States on germ plasm resources from other countries under proper regulation and insurance that they are not carrying pests. But once again, I could provide information on the regulations in place regarding imports from other countries.

Mr. LATTA. Thank you very much, Mr. Chairman.

The CHAIRMAN. Thank you, sir.

Now I would like to recognize my colleague, Mr. Etheridge, Mr. Bobby Etheridge from North Carolina, and I just want to congratulate him on the work that he did with regard to the farm bill and getting it to goal, and the work he continues to do on the energy front through the Agriculture Committee. The Agriculture Committee is responsible for commodity trading and so we have a significant role in dealing with this current oil crisis, and Mr. Etheridge is a leader in making sure that the American people aren't shortchanged. So Mr. Etheridge, I recognize you and thank you for your work.

Mr. ETHERIDGE. Thank you, Mr. Chairman. Let me thank you for calling this hearing and let me say to our folks who are testifying and others who may follow, if you see me slip out, we are going to have a bill on the floor today, so I may be back and forth over there speaking. But let me thank you for being here.

My State of North Carolina has sort of changed its crop mix and we are putting a lot more fruits and vegetables out so this is an issue of importance to the people in North Carolina. I was telling the Chairman a little earlier, most of us who grew up on a farm, as I did, and just had a few fruits and vegetables, didn't think about it or realize that honey bees were really all that important. We thought they were a nuisance from time to time, especially if you got out in your garden and one of them stung you. But today we have a much greater appreciation as we have larger and larger fields where we produce a lot of fruits and vegetables that supply the world. One of the common observations that I picked up in this hearing is that we don't really know what is causing CCD, or at least we are not certain as to any one thing, and I guess since this problem has arisen relatively recently, is it possible there was some type of similar problem that we experienced back in the 1980s? As you remember, in the 1980s we had a mite problem. It took a while. We figured it out. And my question is, is it similar to that, or in your opinion, what can be done to maximize—I know we are working on it but it seems to me we ought to be able to maximize our Federal support at our university-based research to really focus on this problem. I know we took some action in the farm bill, as the Chairman indicated earlier, but it seems to me that that is where we can get the quickest return and the biggest bang for the buck to get this fixed. Whoever would like to answer, or all three of you.

Dr. KNIPLING. I will start. As has been pointed out, the honey bee science community is actually very small relative to other dis-

ciplines. We have at ARS approximately 15 scientists scattered among four different laboratories and university depth is often much more shallow than that———

Mr. ETHERIDGE. Do we know how many———

Dr. KNIPLING.—one or two persons.

Mr. ETHERIDGE. Do we know how many universities have some expertise?

Dr. KNIPLING. Perhaps my colleagues could help me on that. No, I don't know offhand. But let me just say that these new resources that we have available will help us bring in other disciplines, maybe not honey bee scientists but microbiologists, genomic scientists and so forth. So, we see a great opportunity to bring more expertise to this problem, and sometimes those outsiders have some insights and abilities to suggest some promising areas that we may have overlooked.

Dr. DELAPLANE. I might add that we have seen in this session a couple good examples, more industry involvement, some real innovative things with Häagen-Dazs and Burt's Bees, for instance, and these types of linkages should only be encouraged and increased. Specific areas like the Critical Issues Initiative with CSREES is a logical place to pump more dollars into this, and the CAP program of which I have written a proposal is also a good model for targeted issues like bee decline.

Ms. FRAZIER. Just in answer to your question about the number of researchers at universities, I don't know the exact number, but over the last few years researchers and extension specialists focused on bee or apiculture has dramatically declined. It is a small industry and unfortunately resources and personnel have just not gone in that direction. I do totally agree that what we also need is not necessarily researchers who are trained, for instance, in apiculture, but we need toxicologists and pathologists and physiologists. We need to bring that kind of expertise to bear on this problem. It is a very big and a very complex problem and unfortunately, for better or worse, researchers go where the funding is. So if we had significant resources, I think we would get that kind of expertise, researchers working on this kind of problem.

Mr. ETHERIDGE. I thank you. I think that is important.

Dr. Delaplane, you mentioned the importance of increasing the funding and all of you touched on that to combat the CCD and I agree that is important. I think we all agree on that one. But tell me what are universities studying to see what kind of things they are doing, asking individual landowners how they can help, what kind of information they have. It seems to me, as has just been stated, they have a lot of information. I wonder if we are really getting that information then to use because it seems to me the person who is at the end of that food chain, so to speak, would have pretty good information as to be able to assist the researchers.

Dr. DELAPLANE. We do, and we are certainly not starting at ground zero. Bee decline has been an interest for literally decades, and some aspects of this can be tracked back to the 1940s even with declining bee numbers. So this in some sense is not new so we do have a large information base to capitalize on with the current crisis. I guess that raises a question, what is the current crisis, and I think it is an acute expression of trends that we are al-

ready familiar with. We have been seeing declining bees and it is getting worse. So that is what is new. So I make that point just to emphasize that several university programs have been working on issues related to this. One thing that is really exciting about the present situation is the ability to coordinate all of this, and to sort of get all on one page and to avoid redundancies, and to use our resources more effectively, and I see that happening with some of these funding opportunities that we are seeing now.

Mr. ETHERIDGE. Ms. Frazier, let me ask you, and others may want to comment on this because it seems when something appears relatively quickly and we don't have a quick answer, I really wonder, is there any indication that this is regional, in regional parts of the country?

Ms. FRAZIER. No.

Mr. ETHERIDGE. Could it be affected by drought or change in weather patterns? Have you got enough research to indicate whether that could be an impact? I know in our part of the country we may be starting the third year of a drought, which———

Ms. FRAZIER. It certainly would be helpful if that was the case but unfortunately, it is not the case. This is very much nationwide. If you had to kind of characterize it in any one way, I would say unfortunately it does seem to be a problem mainly in our large commercial migratory operations. That is CCD. Overall pollinator decline, though, is across the board in terms of all beekeepers whether they be small, migratory or not. We have been seeing this decline of pollinators, as Keith just described, for years. But CCD does seem to be particularly a problem among our large commercial migratory beekeepers.

Mr. ETHERIDGE. Thank you.

I yield back, Mr. Chairman.

The CHAIRMAN. Thank you.

Just a follow-up on that last question. Does it continue to seem to be a worldwide problem or is there some improvement in other parts of the world?

Ms. FRAZIER. Pollinator decline is most certainly a worldwide problem. Whether or not it is CCD is a hard thing to discern at this point. In many parts of the world, they don't do a very good job at actually—I mean, certainly in Europe, they have a very good handle on declines, numbers of bees, numbers of bees that are dying for whatever reasons, but in many parts of the world like South America and Africa and so forth, this information is not collected and not documented. In Europe, certainly for a number of different reasons, they have had significant declines and not the least of which they blame—certainly their declines in the most recent one, for instance, in Germany—on pesticides.

The CHAIRMAN. Thank you.

Dr. Knipling, I want to thank this panel in general for their testimony and thank you, sir, specifically but also I am going to be wanting to follow up, this Committee is going to want to follow up with USDA and your agency with regard to adequate funding levels and that question. We are not going to let this just die with this hearing closing today. So I would encourage you to be in contact with my staff on the Committee because we are going to have a lot

of further questions and follow-up, and I don't want this to just sort of languish until next year.

Dr. KNIPLING. Yes, Mr. Chairman, and we will work with you and your staff and provide the requested information.

The CHAIRMAN. Thank you very much. With that, I would like to dismiss this panel, thank you for your testimony, and call up our second panel. As you are coming forward, I would just like to mention that it is anticipated that we are going to have a series of votes coming up. We could have up to nine votes, which would take a significant amount of time if in fact they are called. So we are going to have to try and move the hearing along as best we can. With the next panel coming forward, I would ask you to submit your written testimony and please summarize and give us your best summation, in as brief a fashion as possible, the salient points that you want to convey in live testimony to the Committee. So with that, I will call and introduce the next panel.

The staff has actually come up with a good suggestion, and what I would like to do is combine both panels two and three, so if we can all just shift over a bit, bring up some chairs. The staff is going to try and rearrange the name placards, and we will try and make one large panel of the next witnesses who are planning to testify. So staff, if you can take the other name placards down. Sorry for this rearranging, but this often happens in Congress. I have noted that you are not sitting in order, which I can't blame you for after all the moving around. I will call you up individually in the correct order that we had laid you out on the panel, because there is some rhyme and reason to why we have done it this way. I would like to begin by introducing our witnesses. First of all, I will introduce you all and then I will introduce you one by one.

We have with us today Mr. Steve Godlin, beekeeper from Visalia, California. Welcome. We have Dr. David Mendes, Vice President of the American Beekeeping Federation from North Fort Myers, Florida. We have Mr. Robert Edwards, producer from Whitakers, North Carolina, who is a constituent of Mr. Etheridge's and I believe he will want to introduce you when he comes back. We have Mr. Edward Flanagan, President and Chief Executive Officer of Jasper Wyman and Sons, Millbridge, Maine. We have with us as well Ms. Katty Pien, Brand Director, Häagen-Dazs Ice Cream, Oakland, California. Welcome very much. We have Mr. John Replogle, President and CEO of Burt's Bees, Durham, North Carolina. Welcome. And Ms. Laurie Davies Adams, Executive Director of the Pollinator Partnership in San Francisco, California. Welcome to you all.

Mr. Etheridge, we have combined panels two and three so that we can hopefully expedite. We have asked our witnesses to summarize their testimony, to submit their written testimony and just give us their salient points in their oral testimony.

We will now start out with Steve Godlin, beekeeper from Visalia. Steven, welcome. Thank you very much for being here with us today and the floor is yours.

STATEMENT OF STEVE GODLIN, BEEKEEPER, S.P. GODLIN APIARIES, VISALIA, CA

Mr. GODLIN. Thank you, Mr. Chairman, honorable Committee. My name is Steve Godlin. I am a commercial beekeeper from

Tulare County in California's Central Valley. I am here today to give you an update on the condition of our industry.

Before I do, I would like to say my old mentor, Hood Littlefield, was here 40 years ago and he is the guy that got me in business, and he always said Steve, take care of your bees and the bees will take care of you, and he was a great man and I hope to honor him here today.

The CHAIRMAN. It sounds like great advice, sir.

Mr. GODLIN. Our bees look good today. We have over 5,000 hives alive and well, and this is about where we were last year at this time. Things started to unravel in the middle of July. By the time October mercifully arrived, we were down to 2,500 hives and not the strongest hives at that. But like all good farmers, we took what money we made and dumped it back into the bees. We took a 50 percent hit and survived because we are fortunate to have our operation based in the best place in the world for bees, the heart of the almond industry. In case you haven't heard, cotton is no longer king in San Joaquin. Currently there are 660,000 acres producing and would be more if not for the water crisis in our state. This requires about 1.3 million hives of bees. The number of managed hives in California has dropped despite beekeepers' efforts to meet growers' demand. Bees are now being shipped into California from everywhere in the United States. Even Australia is trying to get in the game.

We have created the biggest experiment ever performed on the honey bee. Take bees from all over the continent and stick them in the valley to mingle and forage together with mites and diseases, an apparent list of viruses as long as your arm and see what happens. Or maybe this isn't what is wrong. Haven't we heard bees around the world are having a problem and beekeepers here in the United States who do not ship bees to California are losing hives as well.

We began to notice these losses in recent years. We have had rough years from time to time with higher than usual losses, but nothing has been on the levels we are facing right now, and this is why there has been all this attention on us. People now realize that that $15 billion worth of food that requires pollination to exist is a lot of pretty delicious stuff.

We appreciate this attention and have been encouraged by the legislative actions. At home, the bee lab at UC Davis is up and running again thanks to generous contributions by beekeepers, almond growers and companies like Häagen-Dazs Ice Cream, who donated $250,000 to honey bee research and is running a priceless "Save the Bee" ad campaign. We couldn't buy this.

Researchers across the country have been collaborating on projects in an attempt to find answers. Beekeepers themselves have put aside their differences and are working with the scientific and governmental communities, as well as each other, on an unprecedented level. I know the fact that our two national organizations had a shared conference this year speaks volumes to the importance of this issue.

I am here today to ask that you continue to fund honey bee research. There are some very important projects just getting up and started and we really haven't time to waste. I hope we are getting

there. The middle of July is looming and I am more than a little worried. We are providing our bees all the supplemental nutrition and fresh queens we can. We are treating for *Nosema ceranae* aggressively and hope for a better fall than this last one.

Of critical importance is bee pasture. Like any other animals, bees need forage. Recently there has been a lot of discussion about bee farms where forage is planted specifically for bees. CRP land in the Midwest is a perfect example of this but, as you all know, this is going away fast. Feedlot beekeeping is not working. I have seen areas in California where literally thousands of hives are gathered in a few square miles with disastrous results. It is a very unnatural situation for the bees when all they have to feed on is each other.

Finally, I would be remiss if I didn't talk about pesticides. Thirty to 40 percent of our honey and pollen sources are wild from the Sierras, the Mojave Desert and the coast range, all based on rainfall. All the rest comes from irrigated crops where we are guests, and a good guest doesn't complain about the smell on his food while he is eating at his host's table. It has been a very delicate task to make what little headway we have, thanks in part to public awareness and everyone's desire for a cleaner world. All farmers bear a tremendous burden to produce food safely and still make a profit.

I am proud to be a part of the greatest agricultural powerhouse in the world. I know that the honey bee industry is an odd, hard-to-fit gear in this machine and the average person needs to understand that food doesn't magically appear at our grocery stores who, by the way, need to step up and help with this education.

Thank you for your time. I am a producer. I believe hard work is a cure for everything and I know we all need to work smarter, not harder. Please be smart. Thank you and good luck to us all.

[The prepared statement of Mr. Godlin follows:]

PREPARED STATEMENT OF STEVE GODLIN, BEEKEEPER, S.P. GODLIN APIARIES, VISALIA, CA

Chairman Cardoza and Members of the Subcommittee:

My name is Steve Godlin; I am a commercial beekeeper from Tulare County in the middle of California's central valley by the western foothills of the Sierra Nevada. I am here today to give an update on the condition of the honey bee industry right now.

Our bees look good. We have over 5,000 hives alive and well in the field today. We are coming off a surprisingly good desert buckwheat honeyflow considering the dry spring we had. I am very encouraged by the honey prices and the pollination season ahead in 2009.

This is about where we were last year at this time. Things started to unravel in the middle of July. By the time October mercifully arrived we were down to 2,500 hives, and not the strongest hives at that. But like all good farmers, we took what money we made and dumped it back into bees.

We traveled to South Dakota and bought $100,000 worth of bees from another beekeeper and put them into our empty equipment and shipped three semi loads of bees across the country. We arranged to buy another semi load of bees from a man in Minnesota. We arranged to lease another 5,000 hives from beekeepers in North and South Dakota, Minnesota and Texas. We were up and running.

We took a fifty percent hit and survived because we are fortunate to have our operation based in the best place in the world for making money with bees, the heart of the almond industry. In case you haven't heard, cotton is no longer king in the San Joaquin. Almond acreage is at an all time high and is an economic juggernaut for California agriculture.

Currently there are 660,000 acres producing and would be more if not for the water crisis in our state. This requires about 1,300,000 hives of bees to pollinate them. The number of managed hives in California has dropped to around 400,000 hives despite beekeepers' efforts to meet growers' demands. Bees are now being shipped into California from everywhere in the U.S.; even Australia is trying to get in the game. Now I have to go to national bee conventions and defend my state as beekeepers from New York or Montana disparage us and call us a gutter for bees.

We have created the biggest experiment ever performed on the honey bee. Take bees from all over the continent and stick them in the valley to mingle and forage together with mites and diseases and apparently a list of viruses as long as your arm and see what happens. Or maybe this isn't what is wrong—haven't we been hearing that bees around the world are having a problem? And beekeepers here in the U.S., who do not ship bees to California are losing hives as well.

We began to notice these losses in recent years. We have had rough years from time to time with higher than usual losses, and in history there have been a few epidemics in the bee world. But nothing has been on the levels we are facing now. This is why there has been all this attention on us. People now realize that the $15 billion dollars worth of food that requires pollination to exist is a lot of pretty delicious stuff.

We appreciate this attention and have been encouraged by the legislations actions. At home, the Bee Lab at U.C. Davis is up and running again thanks to generous contributions by beekeepers, almond growers, and companies like Häagen-Daz Ice Cream who donated $250,000 to honey bee research and is running a priceless "save the bee" ad campaign.

Researchers across the country have been collaborating on projects in an attempt to find answers. Beekeepers themselves have put aside their differences and are working with the scientific and governmental communities as well as each other on an unprecedented level. I know the fact that our two national organizations had a shared conference this year speaks volumes to the importance of this issue.

I am here today to ask that you would vote to continue helping to fund honey bee research. There are some very important projects just getting up and started, and we really haven't time to waste, or money. We need results. We need a united effort by all and shared knowledge from a variety of fields.

I hope we are getting there; the middle of July is looming and I am more than a little worried. We are providing our bees all the supplemental nutrition and fresh queens we can. We are treating for *Nosema ceranae* aggressively and hope for a better fall than this last one.

Beekeeping is more challenging now than it has ever been and you dare not walk very far away from them if you expect them to survive. My old mentor always told me to "take care of the bees and they will take care of you." Well, Mr. Littlefield, I wish I knew what to do.

Of critical importance is bee pasture. Like any other animals, bees need forage. No farmer grows crops just for bees; they grow crops to make money. Recently there has been a lot of discussion about bee farms where forage is planted specifically for bees. CRP land in the Midwest is a perfect example of this, but as you all know this is going away fast with the pressure to grow more corn and soybeans. Feedlot beekeeping is not working. I have seen areas in California where literally thousands of hives are gathered in a few square miles with disastrous results. It is a very unnatural situation for the bees when all they have to feed on is each other.

Finally, I would be remiss if I didn't talk about pesticides. Thirty to forty percent of our honey and pollen sources are wild such as the Sierras, the Mojave and the coast range, all based on rainfall. All the rest comes from irrigated crops where we are guests, and a good guest doesn't complain about the smell on his food while he is eating at his host's table. It has been a very delicate task to make what little headway we have, and I would hope that progress is being made, thanks in part to public awareness and everyone's desire for a cleaner world. All farmers bear a tremendous responsibility and burden to produce food that is safe and still make a profit.

I am proud to be a part of the greatest agricultural powerhouse in the world and I know that the honey bee industry is a little, odd, hard-to-fit gear in the machine. We need help right now, and we need the average person to understand that food doesn't magically appear at our grocery stores, which, by the way, need to step up and help with this education.

Thank you for your time. I am a producer. I believe that hard work is the cure for everything, but I know we all need to work smarter not harder, please be smart.

Thank you and good luck to us all.

STEVE GODLIN,

S.P. Godlin Apiaries.

The CHAIRMAN. Thank you, Mr. Godlin. I will tell you that your testimony rings true to me. It is certainly the last part that you talked about, hard work. That was my daddy's answer to everything as well. Maybe because we come from the same part of the country, we have the same views on that.

I have just been informed that we are going to have a series of three votes between 11:30 and 11:45. We will continue taking testimony through that period of time. We will have to recess for those three votes and then I will come back and we will probably engage in questions at that time.

Next up, I would like to call Mr. David Mendes, Vice President of the American Beekeeping Federation from North Fort Myers, Florida. Welcome, sir. The floor is yours.

STATEMENT OF DAVID MENDES, VICE PRESIDENT, AMERICAN BEEKEEPING FEDERATION, INC., NORTH FORT MYERS, FL

Mr. MENDES. Chairman Cardoza and Members of the Subcommittee, thank you for the opportunity to address you and other Members of the Subcommittee who have continued to demonstrate your concern about honey bee Colony Collapse Disorder, or CCD. My name is David Mendes. I am representing the American Beekeeping Federation, a national beekeepers' association of about 1,100 members in all 50 states. I hope to speak for this organization and also to share with you my own personal observations as a beekeeper in the field. I will try to keep my comments brief.

I would like to be able to tell you that over the last 18 months we have figured out the cause of CCD, but that would not be an accurate statement. What I can tell you is that many beekeepers have a pretty good idea of what is hurting their bees. I hope to share with you my opinions on the problem and what we need to do about it. I need to emphasize the frustration and in many cases desperation felt by beekeepers that have watched large numbers of their bees die and felt helpless to do anything about it. Beekeepers are not very good at asking for help. We tend to be an independent and self-reliant bunch. But what is happening now is different than anything that we have seen before, and I am convinced that we will not solve this problem without a significant research effort.

So far there has been tremendous media coverage of CCD and a lot of talk about efforts to solve this problem, but actual research money spent in the field has been very little. I would encourage you to add up the dollars invested so far. You would be amazed to know how little money has been made available for such a big problem.

It is my opinion that CCD is more than just a beekeeping problem. There is something in the environment that is making our bees sick. It is generally accepted that honey bees can be used as indicators of environmental quality. The Defense Department has funded projects to use honey bees to locate land mines and biological agents that may be used in chemical warfare. I can direct you to people that are doing this research. It is amazing that a honey bee can detect such low levels of toxins even in the parts per billion range.

I participated in a project coordinated through Penn State to collect samples of bees, comb, pollen and honey from my hives from March 2007 to January 2008. Two other East Coast beekeepers were also involved. For each of us, 18 to 24 hives were selected and marked. The goal was to take samples out of each hive each time they were moved to a new location. In my case, hives were sampled seven times, twice in Florida in the spring, once in Maine on blueberry pollination, once in Massachusetts on cranberry pollination, and three more times in Florida through the fall and winter.

Samples were collected for analysis with the intent that some conclusions could be drawn to compare the conditions in the hive that result in survival or death of these hives. Varroa mite levels and *Nosema* spore counts were to be examined to either confirm or deny their role in hive mortality. One of the most interesting aspects of this study is the ability to do pollen analysis for pesticide, fungicide and herbicide levels inside the hive. Unfortunately, this type of testing is costly and only a few of the samples collected have been analyzed so far. The balance are in storage awaiting funding.

The information from the samples that have been run so far is absolutely amazing and certainly the type of data that beekeepers need to direct where they can safely keep their bees. My first samples from Florida citrus showed levels of imidacloprid and aldicarb inside the pollen that are much higher than expected. The samples taken while my bees were in Massachusetts for cranberries show levels of fungicide in the pollen as high as 7,000 parts per billion. It may be interesting for you to know that of the 18 hives that began this study in March 2007, only 4 of these hives were still alive 10 months later. Of these four hives, only one was of sufficient strength to pollinate almonds in California in February. My calculations show this to be a 95 percent loss on these test hives in 10 months.

I am here this morning to appeal to you that a first step in figuring out CCD is to develop a comprehensive program to look inside bee hives all across the nation to find out what types of substances our bees are exposed to. Beekeepers understand that something is making our bees sick, but in order to be taken seriously by regulatory officials who control the use of agricultural products, we need data to back up our opinions.

I personally contacted the pesticide regulatory department in Florida to discuss the levels of imidacloprid and aldicarb that my bees were exposed to in Florida citrus, and was politely told that nothing could be done to protect my bees without proper data collection to show that these products were performing differently than show in their original EPA certification. In effect, I was educated on how the regulatory system works. It is data and not opinion that is needed. This makes sense to me and that is why we need to get to work collecting this data.

I know that monitoring beehives and lab analysis of samples is expensive. The work that has been done so far has been paid for by the industry through our organizations and the National Honey Board with some supplemental funding by ARS. The institutions doing the CCD work, both government and universities, have had to divert money from other projects to cover these costs. Companies

such as Häagen-Dazs and Burt's Bees have been a tremendous help in providing some funding for some of this work.

Who should be shouldering this cost? Right now the beekeepers are getting hit with all the expense in the form of dead beehives. It would likely be appropriate for the manufacturers of pesticides, fungicides and herbicides to share in the cost of monitoring the distribution of their products in the environment. This should be included as a normal cost of selling ag chemicals. Honey bees could be a valuable tool to monitor how these products travel in the plants, water and soil that they are applied to.

I am sure that most of the people at this hearing are aware of recent actions in Germany to restrict the use of many systemic pesticides. This follows regulatory actions originally implemented in France to limit the use of these products until they can be clearly proven to be safe to honey bees and other beneficial insects. Our regulatory system in the United States is different than in Europe and it may require more data collection to challenge products that have already received EPA approval. I say that the effort to collect the data that either proves or disproves the safety of these products needs to be required now.

Much of the frustration felt by beekeepers is directed at the lack of any concrete actions to address the causes of CCD. A comprehensive program to sample hives all over the country would be a visible first step to get the ball rolling. If a person is sick, the first thing a doctor does is take their vital signs and run lab tests. This is the place to begin with CCD. The answers to this problem will only be discovered if we take the time to look inside our hives.

I appreciate the opportunity to speak to you this morning. I would be glad to offer much more detail or answer questions about any of our field observations. Thank you.

[The prepared statement of Mr. Mendes follows:]

PREPARED STATEMENT OF DAVID MENDES, VICE PRESIDENT, AMERICAN BEEKEEPING FEDERATION, INC., NORTH FORT MYERS, FL

Chairman Cardoza and Members of the Subcommittee:

Thank you for the opportunity to address you and the other members of the Subcommittee who have continued to demonstrate your concern about honey bee Colony Collapse Disorder (CCD). My name is David Mendes. I am representing the American Beekeeping Federation, a national beekeepers association of about 1,100 members in all 50 states. I hope to speak for this organization and also to share with you my own personal observations as a beekeeper in the field. I will try to keep my comments brief and will be happy to answer any questions that you or the Subcommittee may have.

I started keeping bees when I was in the seventh grade. By the time I was in high school, I was in the bee business with over 300 hives. Today I operate 7,000+ hives from a base in Florida, with annual migration up the East Coast to pollinate blueberries in Maine and cranberries in Massachusetts. This past February I sent 15 tractor-trailer loads of bees to California to pollinate almonds.

My experience with CCD started with a phone call from my good friend Dave Hackenberg in November 2006. I was attending the California State Beekeepers convention when Dave told me that something was very wrong with his bees. I flew back to Florida a few days later and met with Dave to look at the bees he was having problems with. Out of a load of over 400 hives he had brought to Florida from Pennsylvania in October, less than 40 were still alive a few weeks later. Hackenberg went on to discover that many of his other hives were also dying and by the end of the year almost 70% of his hives were dead. This episode was the opening chapter in the story of Colony Collapse Disorder. During that winter of 2006–2007 many other beekeepers experienced excessive hive mortality resulting in over 30% hive

loss nationwide. The winter of 2007–2008 has been worse with some reports of over 37% loss nationwide.

I would like to be able to tell you that over the last 18 months we have figured out the cause of CCD, but that would not be an accurate statement. What I can tell you is that many beekeepers have a pretty good idea of what is hurting their bees. I hope to share with you my opinions on the problem and what we need to do about it. I need to emphasize the frustration and in many cases desperation felt by beekeepers that have watched large numbers of their bees die and felt helpless to do anything about it. Beekeepers are not very good at asking for help. We tend to be an independent and self-reliant bunch. But what is happening now is different than anything that we have seen before, and I am convinced that we will not solve this problem without a significant research effort. So far, there has been tremendous media coverage of CCD and a lot of talk about efforts to "solve" this problem, but actual research money spent in the field has been very little. I would encourage you to add up the dollars invested so far. You would be amazed to know how little money has been made available for such a "big" problem.

It is my opinion that CCD is more than just a beekeeping problem. There is something in the environment that is making our bees "sick." It is generally accepted that honey bees can be used as indicators of environmental quality. The Defense Department has funded projects to use honey bees to locate land mines and biological agents that may be used in chemical warfare. I can direct you to people that are doing this research. It is amazing that a honey bee can detect such low levels of toxins even in the parts per billion range.

I participated in a project coordinated by Dennis VanEngelsdorp from the Pennsylvania Department of Agriculture to collect samples of bees, comb, pollen, and honey from my hives from March 2007 to January 2008. The purpose of this study was to monitor as many variables as possible in a small sample of hives to see if any patterns emerge that can identify factors causing hive mortality. Two other East Coast beekeepers were also involved. For each of us 18 to 24 hives were selected and marked. The goal was to take samples out of each hive each time they were moved to a new location. Sampling began while the bees were in Florida citrus groves and followed each beekeeper as they migrated up to the northern crops they would pollinate. In my case, hives were sampled 7 times, twice in Florida in the spring of 2007, once in Maine on blueberry pollination, once in Massachusetts on cranberry pollination, and three more times in Florida through the following fall and winter.

Samples were collected for analysis with the intent that some conclusions could be drawn to compare the conditions in the hive that result in survival or death of these hives. Varroa mite levels and *Nosema* spore counts were to be examined to either confirm or deny their role in hive mortality. One of the most interesting aspects of this study to me is the ability to do pollen analysis for pesticide, fungicide, and herbicide levels inside the hive. Unfortunately this type of testing is costly and only a few of the samples collected have been analyzed so far. The balance are in storage awaiting funding for the analyses.

The information from the samples that have been run is absolutely amazing and certainly the type of data that beekeepers need to direct where they can safely keep their bees. My first samples from Florida citrus showed levels of imidacloprid and aldicarb inside the pollen that are much higher than expected. The samples taken while my bees were in Massachusetts cranberries show levels of fungicide in the pollen as high as 7000 ppb. It may be interesting for you to know that of the 18 hives that began this study in March 2007, only 4 of these hives were still alive 10 months later in January 2008. Of these 4 hives only one was of sufficient strength to pollinate almonds in California in February. My calculations show this to be a 95% loss on these test hives in ten months.

I am here this morning to appeal to you that a first step in figuring out CCD is to develop a comprehensive program to look inside beehives all across the nation to find out what types of substances our bees are exposed to. Beekeepers understand that something is making our bees sick, but in order to be taken seriously by regulatory officials who control the use of agricultural products, we need data to back up our opinions. I personally contacted the pesticide regulatory department in Florida to discuss the levels of imidacloprid and aldicarb that my bees were exposed to in Florida citrus groves and was told that nothing could be done to protect my bees without proper data collection to show that these products were performing differently than shown in their original EPA certification. In effect, I was "educated" on how the regulatory system works. It is data and not opinion that is needed. This makes sense to me and that is why we need to "get to work" collecting this data.

I know that monitoring beehives and lab analysis of samples is expensive. The work that has been done thus has been paid for by the industry through our organi-

zations and the National Honey Board, with some supplemental funding by Agricultural Research Service. The institutions doing the CCD work, both government and universities, have had to divert money from other projects to cover these costs.

Who should be shouldering this cost? Right now the beekeepers are getting hit with all the expense in the form of dead beehives. It would likely be appropriate for the manufacturers of pesticides, fungicides, and herbicides share in the cost of monitoring the distribution of their products in the environment. This should be included as a normal cost of selling agricultural chemicals. Honey bees could be a valuable tool to monitor how these products travel in the plants, water and soil that they are applied to.

I am sure that most of the people at this hearing are aware of recent actions in Germany to restrict the use of many systemic pesticides. This follows regulatory actions originally implemented in France to limit the use of these products until they can be "clearly proven" to be safe to honey bees and other beneficial insects. Our regulatory system in the United States is different than in Europe, and it may require more data collection to challenge products that have already received EPA approval. I say that the effort to collect the data that either proves or disproves the safety of these products needs to be required now.

Much of the frustration felt by beekeepers is directed at the lack of any concrete actions to address the causes of CCD. A comprehensive program to sample hives all over the country would be a visible first step to get the ball rolling. If a person is sick, the first thing a doctor does is take their vital signs and run lab tests. This is the place to begin with CCD. The answers to this problem will only be discovered if we take the time to look inside our hives.

I appreciate the opportunity to speak to you this morning. I would be glad to offer much more detail or answer questions about any of our field observations.

Thank you,

DAVID MENDES.

The CHAIRMAN. Thank you, sir.

Next we have Mr. Etheridge's guest witness, so I would like to ask him to introduce his constituent from North Carolina.

Mr. ETHERIDGE. Thank you, Mr. Chairman. I will be brief because we want to get it in, but Mr. Edwards, glad to have you.

Mr. EDWARDS. Thank you.

Mr. ETHERIDGE. He is a large producer of multiple crops, cucumbers being the one he has great need for bees on, and a lot of cucumbers and a lot of vegetables are grown in our part of the state that weren't grown 10, 15 years ago. Welcome. We look forward to your testimony.

STATEMENT OF ROBERT D. EDWARDS, COTTON, CORN, SOYBEANS, PEANUTS, AND OTHER SPECIALTY CROPS PRODUCER, HALIFAX, NASH, AND EDGECOMB COUNTIES, NORTH CAROLINA, WHITAKERS, NC

Mr. EDWARDS. Thank you, Mr. Etheridge. Good morning. My name is Robert Edwards and I am a third-generation farmer from Whitakers, North Carolina. Along with my brother and father, we grow over 5,000 acres of cotton, corn, soybeans, peanuts, tobacco and cucumbers in Halifax, Nash and Edgecomb Counties, that is located in eastern North Carolina. Our farm is a family operation and I have grown up working on this land and look forward to continuing this operation for many years in the future.

For over 10 years, a vital part of our firm has been the 100 acres of cucumbers that we plant each year. I am sorry to have to report to this Committee, however, that due to the severe and sudden rise in the price of fuel, the ongoing and worsening problem of a lack of labor to harvest, and the recent and increasing problem of a lack of honey bees needed to pollinate these crops, we have been forced to reduce our acreage of cucumbers by 50 percent.

I am not alone in experiencing these problems. Not only do I grow cucumbers on my farm, I also work for a much larger cucumber operation, Carolina's Best, managing cucumber production producing hundreds of acres of cucumbers that supply the $36.2 million cucumber industry in North Carolina.

I emphasize again the economic pressures that all farmers are feeling with respect to labor availability and the rising cost of fuel, and I know that Congress is working to address these issues, but we are here today to discuss a problem that is just as harmful as those previously mentioned, that is, pollinator availability or honey bees. The simple fact is, no honey bees, no cucumbers. The cucumbers we grow today are highly pollinator intensive. There is a very short window for this fruit to be pollinated, which also requires a high number of bees to perform this task successfully, and I again emphasize if this pollination does not occur within that window of opportunity, there will be no cucumbers to harvest.

We have always rented honey bees from beehive operations located within the State of North Carolina. Over the past 3 years, however, we have seen a notable decrease in the availability of the hives for rent in North Carolina. The reason for this is that the hives produced in the southeastern part of the United States are being shipped all over the nation due to shortages of bees in other areas, thus increasing the cost we pay to rent hives. These longer shipping distances have also increased the cost. Three years ago, I was paying approximately $45 per hive. Today I am paying $68 for that same hive, and I don't know what the cost will be tomorrow.

In other states the story is even worse. In California, there is already concern about a shortage of bees to pollinate the almond crop. Growers are scrambling to reserve bees, and I have heard prices as high as $140 per hive.

Honey bees are truly unsung heroes in feeding our nation and the world. I tell my non-farmer friends that these bees are out there pollinating more than my cucumbers. They are critical for the growth of virtually everything in our food chain, because everything in this chain eats something that has been pollinated or ate something else that was pollinated by a honey bee.

Mr. Chairman, I am not a scientist, I am a farmer, and I know one thing for certain: no bees, no crops. As a farmer who relies on these bees, I am searching for solutions just like you. I think in the short term, possible solutions could be to give these beekeepers access to some of the same programs that we provide to the farmers. For example, my beekeeper that I use lost 40 percent of his bees last year. If I lost 40 percent of a crop without crop insurance, I wouldn't be here today, I would be probably picking up tin cans on the side of the road. But Congress is working to fix the H2–A problem to correct our labor crisis in the specialty crop industry and I am hopeful that at some point fuel prices will go back down. But Congress needs to understand that the problem of the lack of bees to pollinate the very foods we consume every day is a real and growing problem that needs to be studied, addressed and corrected. Bees are as important to our crops as the water and the sunshine.

I would like to thank you for your attention to this matter. If you have any questions, I will be glad to answer them.

[The prepared statement of Mr. Edwards follows:]

PREPARED STATEMENT OF ROBERT D. EDWARDS, COTTON, CORN, SOYBEANS, PEANUTS, AND OTHER SPECIALTY CROPS PRODUCER, HALIFAX, NASH, AND EDGECOMB COUNTIES, NORTH CAROLINA, WHITAKERS, NC

Good morning, my name is Robert Dowe Edwards, I am a third generation farmer from Whitakers, North Carolina. Along with my brother and father, we grow over 5,000 acres of cotton, corn, soybeans, peanuts, and other specialty crops such as cucumbers in Halifax, Nash, and Edgecomb Counties in Eastern North Carolina. Our farm is a family operation, I have grown up working this land, and look forward to continuing this operation for many years in the future.

For over ten years, a vital and profitable part of our farm, has been the 100 acres of cucumbers we plant each year. I am sorry to have to report to this Committee, however, that due to the severe and sudden rise in the price of fuel, the ongoing and worsening problem of a lack of labor to harvest these cucumbers, and the recent and increasing problem of a lack of honey bees needed to pollinate these crops, we have been forced to reduce our acreage of cucumbers by 50 percent.

I am not alone in experiencing these problems. Not only do I grow cucumbers on my farm, I also work as a grower for a much larger cucumber operation, Carolina's Best Farms, managing cucumber production operations in these counties, producing hundreds of acres of cucumbers that supply pickling cucumbers for the significant pickling and canning industry in the State of North Carolina.

I emphasize again the economic pressures that all farmers are feeling with respect to labor availability and the rising cost of fuel, and I hope that Congress is working to address these issues. But we are here today to discuss a problem that is just as harmful as those previously mentioned: pollinator availability, honeybees. The simple fact is, no honeybees, no cucumbers.

The hybrid Vlaspick pickle breed that I grow, specially bred and designed as a heavy fruit set variety designed for five to six pickings at harvest, is highly labor, irrigation, and time intensive. This breed is also highly pollinator intensive, there is a short window for this fruit to be pollinated, which also requires a high number of bees to perform this successfully. And again I emphasize, if this pollination does not occur within the window of opportunity, these will be no cucumbers to harvest.

Our decision to reduce our acreage of cucumber production is as directly related to the declining availability of honey bees for pollination of these crops. Our farm and the surrounding cucumber farms that I work with have until recently always rented honey bees for pollinators from bee hive operations located within the State of North Carolina. Over the past three years, however, we have seen a notable decrease in the availability of these hives for rent. The reason for this is that the bee hives produced in the Southeastern part of the United States are being shipped all over the country due to shortages of bees in other areas, this increases in the cost we pay to rent these bees. These longer shipping distances have also increased the cost of the hives. Three years ago I paid $45 per hive, today I am paying $68 to rent that same hive.

In other states the story is even worse. In California, there is already a concern about a shortage of bees to pollinate the almond crop, growers are scrambling to reserve bees, and the price their has risen to $140 per hive.

The lower number of hives for rent has also decreased the time these bees are available to sit on the field to be pollinated, making the window for pollination even smaller. This increases my pressure to increase irrigation to make sure the crop is ready for the time I will have these bees, and this in turn further increases my fuel costs.

For our purposes, our operation has always used one hive per acre to ensure adequate pollination. As I mentioned earlier, cucumbers are a difficult fruit to pollinate, this is a very sticky plant that requires a high number of bees due to the increased effort that is needed on the part of the bee. And as I tell my non-farmer friends, these bees are out there pollinating more than my cucumbers, they are critical for the growth of virtually everything in our food chain; because everything in this chain eats something that has been pollinated, or ate something else that was pollinated by a honey bee.

My great concern is that we are witnessing a serious and unexplained reduction in the availability of these bees. This sudden reduction in the number of bees has been explained to me as Colony Collapse Disorder, but the cause of this is not so clear.

Mr. Chairman, I am not a scientist, I am a farmer, and I know one thing for certain: no bees, no crops. As a farmer who relies on these bees I am searching for

solutions just like you are. I think in the short term, possible solutions could be to give these farmers some of the access to the programs that we provide to the farmers who rely on them. My bee supplier lost 40 percent of his hive last year, if I lost 40 percent of my crop and did not have crop insurance, I would go under. Congress should consider making crop insurance and low interest FSA loans available to these bee keepers, and to increase the amount of bees, possibly making them eligible for beginning farmer loans.

I did not reduce my acreage of cucumbers because of the cost of fuel, I was forced to reduce my acreage because I could not ensure that I would be able to rent enough bees to pollinate my crop. Congress can work to fix the H–2A problem, to correct our labor crisis in the specialty crop industry, and I am hopeful that at some point fuel prices will have to go back down. But Congress needs to understand that the problem of a lack of bees needed to pollinate the very foods we consume every day is a real and growing problem that needs to be studied, addressed, and corrected. Bees are as important to our crops as the water and the sunshine.

Again, I thank this Committee and Chairman Cardoza for his attention to this important matter. I would be happy to try to answer any questions the member of this Committee might have.

The CHAIRMAN. Thank you, Mr. Edwards. As usual, Mr. Etheridge has brought up one of his constituents that has given us very salient testimony. We have some folks from the media here today, and in the next few weeks and next few months, people are going to be asking why food prices are so high, and today you gave the testimony in advance to answer that question. There is a lack of pollination. You have had to cut down the number of acres that you have under production. Energy costs and input costs to produce that food is costing you more and you are going to have to pass that on, and then the transportation costs and all the rest to get that food to market is all going to be higher, and unfortunately, like you indicated, the consumer is going to be paying higher prices and bearing the brunt of all these input costs, and so you gave some very salient testimony today to that question.

Next up we are going to have Mr. Edward Flanagan, President and Chief Executive Officer of Jasper Wyman and Sons from Millbridge, Maine, and then as soon as you are done with your testimony, sir, we are going to recess for the duration of the votes. I would like to make the floor available to you at this time.

STATEMENT OF EDWARD R. FLANAGAN, PRESIDENT & CEO, JASPER WYMAN & SON, MILLBRIDGE, ME

Mr. FLANAGAN. Thank you, Chairman Cardoza. My name is Ed Flanagan. I am here today as the President and CEO of Jasper Wyman & Son, the largest U.S.-owned blueberry grower. We grow wild, or lowbush, blueberries in eastern Maine and we also have operations on Prince Edward Island and New Brunswick in the Canadian Maritimes. In Maine, combining what we grow on our land and what we buy from other growers, we process and market between 35 and 40 percent of the U.S. wild blueberry crop. But besides Wyman's, I am here to express the concern of all wild blueberry and cultivated blueberry growers who according to the USDA had farm gate value in 2007 of nearly $600 million. To echo my colleague here beside me, in our business too, it is simple: no bees, no blueberries.

You may not know that there are three fruits that are native to North America: concord grapes, cranberries and wild blueberries. Early Native Americans used wild blueberries for food, coloring and for medicinal remedies. What they knew then, the American con-

sumer has come to know in the last several years, thanks to well-grounded research from some of our best universities and laboratories, and that is that blueberries are one of the healthiest foods you can add to your diet. Wild blueberries can't be planted, not here, not in Chile, not in China. It is a root system that is indigenous to Maine and the Maritimes and more like a mineral resource than a crop in that way. Thus, it has always has strong, enduring export market demand. It is a small but important crop for America and it is a very important crop to the economy of eastern Maine.

That health news has led to some good years. In agriculture, it seems that supply and demand are almost never in balance. In the case of blueberries in recent years, demand has been ahead of supply. Farm gate earnings have been healthy and we have been able to absorb pollination costs that have more than doubled in the last 3 years. We know that supply will catch up with demand, prices will go down and we will need sharp control of our costs. Agriculture is one tough and honest way to make a living and we face our challenges head on, but we are very scared at the prospect of no pollinating bees in our fields. There is no alternative.

Wild blueberry fields, called barrens, are usually bordered by forestland and we have learned to live with nature and its perils and marvel at its complex interactions. For example, if we don't string electrified wire around the hives in the fields, the bears have a feast at our expense.

What scares us about Colony Collapse Disorder is what the beekeepers have observed, healthy bees refusing to go into the sick hives to rob the honey, the normal predators, hive beetles and moths, keeping their distance from an impacted hive, the practice of putting a healthy hive near a diseased one to repopulate the weak one but instead it is killing the healthy one. Something is very, very wrong.

A good wild blueberry crop needs three basic things to happen: a snow cover over the low growing plants in the winter to protect the buds from cold temperatures, good pollination in May, and then from June to August, a good mix of sun and rain. The wild blueberry crop blooms in May and it takes 2 to 3 weeks to get good pollination. The bees won't work if it is cold or windy, which it can be in Maine then, and we accept that neither the beekeepers nor Congress can do anything about that.

The CHAIRMAN. Sir, I am going to need to interrupt. I have been informed I have less than 3 minutes to get to the vote and so I am going to have to call a recess. If you would just mark a place in your testimony, we will reconvene the hearing as soon as I can possibly get back from the votes. At this time the Committee is in recess.

[Recess.]

The CHAIRMAN. If the witnesses and the guests would please retake their seats, we will get this hearing reconstituted here in just about 2 minutes.

If everyone is ready, we will continue the hearing. Mr. Flanagan, I want to apologize. I have never had to interrupt someone in the middle of their testimony before but the vote just crept up on us. I apologize for having to interrupt you and I would like if you can

remember exactly where you were in your testimony, I would like to give you the floor to continue from that point.

Mr. FLANAGAN. I can. Thank you very much.

Where I left off was, the wild blueberry crop blooms in May and it takes 2 to 3 weeks to get good pollination. The bees won't work if it is cold or windy, which it can be in Maine then, and we accept that neither the beekeepers nor Congress can do anything about that. We don't ask for your help often because really there isn't much you can do, but we do need it here.

If you have my testimony in front of you, you can see what a good blueberry crop in August looks like. Every single one of those berries owes its existence to the crazy, neurotic dancing of a honey bee from flower to flower. If there were no beekeeping industry to come to Maine, the amount of fruit pollinated by natural pollinators would not amount to enough to keep farming the land. We would either be out of this business all together or charging a price fivefold or tenfold what it is now just to go out and get what was there.

I don't know who or why anyone would oppose budgeting research funds for this critical problem. I urge you not to use Washington inertia as an excuse. I firmly believe that if it was the pesticide family of neonicotonoids, it may have been an unintended consequence of the chemical industry trying to replace directly toxic organophosphates with a more benign alternative. We need to put the blame game aside and get to the endpoint, which is knowledge.

Chairman Cardoza, I heard you inform us today that the labs were rebudgeted at $10 million and CCD research received an extra $800,000. The budget process here is a mystery to an out-of-towner like me but an extra 8 percent in funding is way short of what is needed.

Thank you very much.

[The prepared statement of Mr. Flanagan follows:]

PREPARED STATEMENT OF EDWARD R. FLANAGAN, PRESIDENT & CEO, JASPER WYMAN & SON, MILBRIDGE, ME

Chairman Cardoza, ranking member Neugebauer, and other members of the committee I want to thank you for recognizing the urgent, non-partisan, north to south and coast to coast problem that faces this nation's food supply if we don't solve the mystery that is endangering our pollinating bees.

My name is Ed Flanagan. I am here today as the President & CEO of Jasper Wyman & Son, the largest U.S. owned bluebery grower. We grow wild (or lowbush) blueberries in eastern Maine and we also have operations in Prince Edward Island and New Brunswick in the Canadian Maritimes. In Maine, combining what we grow on our land and what we buy from other growers, we process and market between 35-40% of the U.S. wild blueberry crop. But besides Wyman's I am here to express the concern of all wild blueberry and cultivated blueberry growers who according to the USDA had farm gate value in 2007 of nearly $600 million.

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That health news has led to some good years. In agriculture it seems that supply and demand are almost never in balance. In the case of blueberries in recent years demand has been ahead of supply. Farm gate earnings have been healthy and we have been able to absorb pollination costs that have more than doubled in the last three years. We know that supply will catch up with demand, prices will go down and we will need sharp control of our costs. Agriculture is one tough and honest way to make a living and we face our challenges head on but we are very scared at the prospect of no pollinating bees for our fields. There is no alternative.

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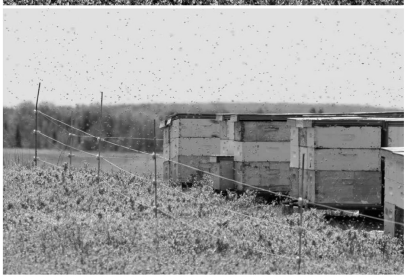
A good wild blueberry crop needs three basic things to happen. A snow cover over the low growing plants in the winter to protect the buds from cold temperatures, good pollination in May and then from June to August a good mix of sun and rain.
The wild blueberry crop blooms in May and it takes two-three weeks to get good pollination. The bees won't work if it is cold or windy which it can be in Maine then and we accept that neither the beekeepers nor Congress can do anything about that. We don't ask for your help often because there really isn't much you can do but we need it here.



If you have my testimony in front of you you can see what a good blueberry crop in August looks like. Every one of those berries owes its existence to the crazy, neurotic dancing of a honey bee from flower to flower. If there were no beekeeping industry to come to Maine the amount of fruit pollinated by natural pollinators would not amount to enough to keep farming the land. We would either be out of this business altogether or charging a price five fold or ten fold what it is now just to go out and get what was there.

Members of the committee, I don't know who or why anyone would oppose budgeting research funds for this critical problem. I urge you not to use Washington inertia as an excuse. I firmly believe that if it was the pesticide family of neonicotonoids it may have been an unintended consequence of the chemical industry trying to replace directly toxic organophosphates with a more benign alternative. We need to put the blame game aside and get to the end point which is knowledge.

I have never seen a problem in agriculture get more press coverage and more consumer awareness in a short time than this. There is need…there is momentum… and what we need now is political will. I hope you are the right people for that.

Thank you.

The CHAIRMAN. Thank you, sir. I would like to make a point. During this last series of votes, I talked to Mr. Alcee Hastings from Florida, who has been a true champion on behalf of getting to the bottom of this crisis. I also talked to Chairwoman Rosa DeLauro of the Appropriations Subcommittee on Agriculture, and both of them agreed with me and my previous statement that funding should not be an issue here, that we need to know exactly what funds are needed to bring to bear on this program and we will work diligently to make sure that all the funds necessary are used, that they are provided and used to get to the bottom of this. Now, I am going to reiterate that in no way should anyone leave here thinking that they should not request the total amount necessary to get to the bottom of this question, and Ms. DeLauro stands ready to be of assistance to us. We will go to the Speaker. We will go to Mr. Reid. We will go and shout off the top of the Washington Monument if necessary. We will find the funds for this problem, but we have to know exactly how much we need, and funds should not be an excuse for why we can't find the problem on this research. So I am just putting USDA on notice today that if next year or in 6 months we get back and we hear again that funds are a problem, there is going to be some hell to pay. So let us understand that all here together today.

Next up we have Ms. Katty Pien. I am sorry———

Ms. PIEN. It is Katty.

The CHAIRMAN. Brand Director from Häagen-Dazs Ice Cream, Oakland, California. My daddy used to butcher people's names and I have taken up in his footsteps on this as well, so I apologize. Thank you for being with us today.

STATEMENT OF KATTY PIEN, BRAND DIRECTOR, HÄAGEN-DAZS ICE CREAM, OAKLAND, CA

Ms. PIEN. Thank you. Good morning, Chairman Cardoza. My name is Katty Pien and I am the Brand Director for Häagen-Dazs Ice Cream, America's leading super-premium all-natural ice cream. I will comment today on how pollinators are an essential part of our business.

Thank you for the opportunity to testify about Colony Collapse Disorder and for the leadership you have shown in addressing it through the pollinator provisions of the farm bill. I would like to highlight some key points and ask that my full statement be submitted for the record.

Häagen-Dazs has a major stake in the health of America's honey bees. Pollination is essential for ingredients in more than 40 percent of Häagen-Dazs flavors. For example, to produce our vanilla Swiss almond and rocky road flavors, we use more than 1 million pounds of almonds every year. Should the CCD crisis continue, pollinated ingredients such as strawberries, cherries, blueberries, and almonds could all become scarce or too expensive to obtain, forcing us to evaluate whether we can continue to offer flavors that depend on pollinated ingredients because of higher production costs, which could lead to higher consumer prices.

Häagen-Dazs recognized that to preserve our variety of flavors, to help consumers and to be a responsible steward of the resources we use, we needed to take corporate action. Earlier this year we

introduced *Häagen-Dazs Loves Honey Bees,* a public education program. Among our efforts, we have launched a limited edition flavor, vanilla honey bee, to pay tribute to the hardworking honey bees. We pledged $250,000 to fund sustainable pollination and CCD research at Pennsylvania State University and the University of California Davis. We have developed print, television and in-store advertising campaigns drawing attention to this crisis. We have even launched a dedicated consumer education website, *helpthehoneybees.com.*

Despite these efforts, there is a long way to go. A recent survey commissioned by the Häagen-Dazs brand showed that more than half of Americans are not even aware of the honey bee crisis. Häagen-Dazs Ice Cream challenges other consumer products companies reliant on pollinators to join us in educating the public and helping efforts needed to save this essential natural resource.

Nevertheless, robust Federal action is needed. We urge Congress to fully implement and fund the pollinator provisions of the farm bill.

Mr. Chairman, thank you for your time today. I would be happy to answer any questions.

[The prepared statement of Ms. Pien folllows:]

PREPARED STATEMENT OF KATTY PIEN, BRAND DIRECTOR, HÄAGEN-DAZS® ICE CREAM, OAKLAND, CA

Chairman Cardoza, Ranking Member Neugebauer, and members of the Subcommittee, good morning.

My name is Katty Pien. I am the Brand Director for Häagen-Dazs® Ice Cream, America's leading super-premium all-natural ice cream. The Häagen-Dazs brand sells more than 70 flavors of ice cream, sorbet and frozen yogurt around the world. As you will learn, pollinators are an essential part of our business.

Thank you for the opportunity to testify on the very important issue of Colony Collapse Disorder, and for the leadership you have shown in addressing it through the pollinator provisions of the Farm Bill. Full funding and implementation of those provisions would be an excellent step in ensuring the survival of America's honey bees.

I'm here today to highlight the importance of pollinators to Häagen-Dazs Ice Cream; to explain the dangers posed to consumer products such as ours by CCD; to highlight our corporate reaction to the crisis; and to suggest next steps the federal government and the private sector might take to reduce the impact of the crisis on producers and consumers.

The Häagen-Dazs brand relies on the finest all-natural ingredients for its ice cream. Not surprisingly, pollination is essential for ingredients in more than 40 percent of Häagen-Dazs flavors. For example, to produce our popular Vanilla Swiss Almond and Rocky Road flavors, we use more than one million pounds of almonds every year. Almonds, as you know, Mr. Chairman, are 100 percent dependent on honey bees for pollination.

As you can see, the Häagen-Dazs brand has a major stake in the health of America's honeybees. Should the CCD crisis continue unchecked, pollinated ingredients such as strawberries, cherries and almonds could become scarce or too expensive to obtain, forcing us to evaluate whether we can continue offering popular flavors that depend on pollinated ingredients because of higher production costs.

That brings us to the looming specter of higher consumer prices. While CCD has not yet led to higher prices, we fear that's a likely result if the crisis remains unabated. Farmers and pollinators will either pass along their skyrocketing costs, or choose to exit a field that is less profitable, thereby reducing the supply of pollinated ingredients to companies such as Häagen-Dazs.

Mr. Chairman, a combination of private sector and government efforts can make sure that doesn't happen.

The Häagen-Dazs brand is doing its part. We recognized that to preserve our variety of flavors, to help consumers, and to be a responsible steward of the resources we use, we needed to take corporate action. Earlier this year, we introduced

Häagen-Dazs loves Honey Bees, a multi-faceted public education program. Among our efforts:

- A limited edition flavor, Vanilla Honey Bee, to draw attention to the crisis.
- A $250,000 pledge to fund sustainable pollination and CCD research at Pennsylvania State University and the University of California, Davis, partially funded by sales of Vanilla Honey Bee ice cream and our other bee-dependent flavors.
- A commitment to work with community groups to distribute 1 million bee-friendly flower seeds (more than 350,000 distributed so far).
- A Honey Bee Board of leading scientists and beekeepers to advise us on the issue.
- An online, downloadable honey bee education program for students and families, available at *www.helpthehoneybees.com.*
- Sponsorship of "The Vanishing of the Bees," a documentary that investigates the bee crisis.
- Print, television, in-store and online advertising campaigns drawing attention to the crisis, as well as information in retail stores.
- At Häagen-Dazs offices, we landscape with bee-friendly plants such as glory bushes, jasmine and rosemary.
- We give our employees free seeds and encourage them to plant bee-friendly gardens at home.

Despite those efforts, there's a long way to go. A recent survey commissioned by the Häagen-Dazs brand showed that more than half of Americans are not even aware of the honey bee crisis.

So Häagen-Dazs Ice Cream challenges other consumer-product companies reliant on pollinators to step up to the plate—to educate the public and help in efforts needed to save this essential natural resource. It only makes economic sense that companies which benefit from pollination should help ensure the survival of those species that allow us to commercially thrive. We applaud Burt's Bees for doing so, as well.

Nevertheless, there is no substitute for robust federal action in this area. The Häagen-Dazs brand stands with the Pollinator Partnership in urging Congress to fully fund and implement the pollinator protection provisions of the recently-passed farm bill.

Mr. Chairman, this concludes my oral presentation. I ask that my entire statement be submitted for the record. Thank you for your time today. I'd be happy to answer any questions.

The CHAIRMAN. Thank you for being here, and God bless your company for the work they do. Normally we don't have such a high-profile corporate involvement in Congressional hearings, but I will tell you that the work your company has done has been quite extraordinary.

Ms. PIEN. Thank you, Mr. Chairman.

The CHAIRMAN. Next up we have Mr. John———

Mr. REPLOGLE. Replogle.

The CHAIRMAN. Replogle—I am so sorry, but I can't get that one, my tongue doesn't seem to go that way—President and CEO of Burt's Bees, Durham, North Carolina, and the fact is that I can't say your name but I certainly know my children use your products on a regular basis, so thank you for being here and please proceed with your testimony.

STATEMENT OF JOHN REPLOGLE, PRESIDENT AND CEO, BURT'S BEES, DURHAM, NC

Mr. REPLOGLE. Mr. Chairman, thank you for the opportunity to testify about the status of research and other activities related to the health of the honey bees and to all pollinators. My name is John Replogle and I am the President and CEO of Burt's Bees based in Durham, North Carolina, a 400-person company invested

in the well-being of humans. More importantly, I am the father of four girls and I am vitally interested in their health and well-being.

Allow me to state the obvious: honey bees are important to Burt's Bees. Our roots are entangled with theirs. We share their name. Their image still adorns our logo, and to this day a majority of our products rely on their instinctive skills. The health and welfare of bees is very dear to us. While we rely on bee byproducts as well as ingredients pollinated by bees, our interest in the health of bees is also very closely linked with our commitment to the environment. We work with our suppliers to ensure our beeswax, honey and bee-pollinated ingredients are sourced with bee-friendly and sustainable sourcing methods. Our commitment to the finest natural ingredients and products is intrinsically tied to how we care for our environment. Even more important than our own product supply is the impact on our bees to the overall health of the ecosystem. Bees are responsible for pollinating a third of the fruits and vegetables we eat, and collectively they support a $15 billion cash crop as well as are the backbone to ingredients of a $50 billion personal care industry here in the United States.

Without being overstated, honey bee health is directly linked to our planet's health and every person's well-being. If we fail to take action now to mitigate the loss of honey bees, there will be broad implications on the foods we love, the plants that we depend on for many of our products and the well-being of our planet. Put bluntly, in 2008, honey bees are the proverbial canary in the coal mine. So go the bees, so goes the well-being of all Americans.

We applaud and support the efforts by the Congress and by the USDA to address Colony Collapse Disorder and other pollinator health issues through the historical inclusion of pollinators in the farm bill with both research and conservation. I would like to say thank you to you, Chairman, today for the Committee's pledge to fully fund the issue. I believe business along with government can powerfully join forces to have a positive impact on our changing environment. Therefore, Burt's Bees has taken action directly, given the gravity of this situation. We hope the government will continue to play a much more active role in partnering with business to find solutions to this acute issue.

While the causes for CCD are unknown, we do know that forces like habitat disruption, misuse of pesticides, invasive species and global warming create risks to honey bees. That is why Burt's Bees is taking a holistic approach to honey bee health. We have joined forces with the Pollinator Partnership to provide funding to support research projects through the new Honey Bee Health Improvement Project, which is guided by a task force of the North American Pollinator Protection Campaign, which is also focusing on four key areas: breeding stock improvement, best practices for commercial beekeeping, effects of pesticides and chemicals, and improving nutritional resources. We are very pleased with the progress and quality efforts of the task force and we have already committed to a second year in partnering with the Pollinator Partnership.

Second, Burt's Bees has launched a public service awareness campaign. Not enough Americans are aware of the issue today, and we believe when individuals become aware of the environmental

challenges and are given information about simple actions they can take, many will be inspired to take action.

Third, we are expanding our reach to make the issue known on every main street in America. We are doing this by launching a Help the Honey Bees beeswax lip balm with 5 percent of the proceeds going to directly fund the Pollinator Partnership. We will distribute over 2 million units to further engage consumers and to fund research.

In closing, we at Burt's Bees truly believe that by helping to save the bees, we save a lot more than the bees. We appreciate the time, attention and leadership you are devoting to the health of our pollinating partners. Thank you very much.

[The prepared statement of Mr. Replogle follows:]

PREPARED STATEMENT OF JOHN REPLOGLE, PRESIDENT AND CEO, BURT'S BEES, DURHAM, NC

Mr. Chairman and members of the Subcommittee, thank you for the opportunity to testify about the status of research and other activities related to the health of honeybees and all pollinators. My name is John Replogle, and I am President and CEO of Burt's Bees, which is headquartered in Durham, North Carolina. Burt's Bees is the leading Natural Personal Care brand, bringing Earth-friendly, natural personal care products to consumers for more than 20 years. Our mission, simply put, is 'to make people's lives better everyday, naturally.' We do this by creating the best natural personal care products with the finest natural ingredients to help individuals maximize their well-being and the well-being of the world around them. We operate our business with a commitment to *The Greater Good*—care for our products, our planet and our communities.

Why Burt's Bees is Involved in Pollinator Health Efforts:

Honeybees are important to Burt's Bees. Our roots are entangled with theirs. We share their name. Their image still adorns our logo. And, to this day, many of our products rely on their instinctive skills. Our co-founder, Burt Shavitz, was a beekeeper for over 20 years.

Indeed, bees are the foundation of Burt's Bees' business. The health and welfare of bees are very dear to us. Even though we get beeswax and honey in a completely bee-friendly way, we know we all can and must do more. More important than our own product supply, the impact of bees on our ecosystem is critical—they are responsible for ⅓ of the food we eat. It's another major indicator that demonstrates the importance of caring for our environment. If we fail to take action, there could be further negative impact on the fruits and vegetables that we eat as well as the biodiversity of the plants that we depend on for many of our products.

Burt's Bees is deeply concerned about the health of honeybees and other pollinators because of two of our core beliefs: natural ingredients work in harmony with the body; and we must protect and provide for the precious resources of our planet. Many of the natural ingredients in our personal care products are either directly produced by honeybees, such as beeswax and honey, or are derived from plants pollinated by honeybees, such as almond oil, sunflower oil, avocado butter and peach stone. To make certain that all our products meet the highest natural standards, we carefully craft them using time-tested, proven recipes with ingredients that are the best nature has to offer: beeswax, botanical and essential oils, herbs, flowers and minerals. These safe, effective ingredients have withstood the test of time. And because of that, we never use any ingredient that isn't proven safe and effective. This fine attention to quality is recognized by our consumers; for the past two years, college students around the country have recognized us as one of the *Top 10 Socially Responsible Companies* through the Alloy U awards.

Burt's Bees has a long-standing commitment to the environment, which is a central component of our mission. We are committed to leading innovation in our choices for packaging, using materials that are biodegradable, recycled and/or recyclable. We strive to operate our business with constant attention to minimizing our impact, including reducing our energy and water use and educating and inspiring our employees to change personal habits. For example, our company grew 26 percent in 2007 and, through the work of our dedicated team, was able to reduce our energy use by 2 percent. In 2008, the Carolina Recycling Association gave Burt's Bees an award for the Best Business Recycling Program, which was developed and

led by volunteer employees. This year, we also led the first annual Planet Earth Celebration in Raleigh, NC, attended by over 15,000 members of our community.

Burt's Bees got its start back in 1984 in Maine, when Roxanne Quimby and Burt Shavitz teamed up selling candles and lip balm made from the beeswax created as a by-product of Burt's honey business. At the very first craft fair, they sold $200 worth, and by the end of the first year, sales climbed to $20,000. As the company grew, they realized the need to relocate to best position for further growth and brought the company to North Carolina in 1993. Since then, company growth has been a testament to individuals living the 'American Dream,' with the company experiencing double-digit growth year over year, reaching $350 million in retail sales in 2007.

Actions to Support Honeybee Health:

Burt's Bees has chosen to take a holistic approach to supporting honeybee health. Colony Collapse Disorder, or CCD, has been the catalyst for increased research efforts, even though it is one of a myriad of challenges confronting honeybees, beekeepers, and growers who require pollination services as a vital stage in crop production. While the causes for Colony Collapse Disorder are unknown, we do know that forces such as habitat destruction, misuse of pesticides, invasive species and global warming create risks to honeybees.

Research is critical to providing the knowledge and science-based solutions needed to address CCD and a host of other challenges threatening the health and sustainability of honeybees and other pollinators. We commend the increasing efforts by the U.S. Department of Agriculture (USDA) to conduct and coordinate research on CCD and other challenges impacting honeybees and other pollinators, such as USDA's CCD research action plan launched last summer.

We also applaud this Subcommittee, the Agriculture Committee, and the Congress for enacting a new farm bill that for the first time includes pollinator-specific research and conservation provisions laying the groundwork for further action.

Burt's Bees urges the Congress to provide additional funding for pollinator research and conservation in the Fiscal Year 2009 appropriations. We also urge the research and conservation agencies at USDA to take maximum advantage of the new pollinator provisions in the farm bill in implementing their programs.

I believe business, along with government, can collaborate as a powerful force to positively impact our changing environment. At Burt's Bees, we feel a responsibility to take action directly, given the gravity of the situation. After considering options on how best to help, Burt's Bees joined forces last fall with the Pollinator Partnership. We are providing funding for research projects through the Pollinator Partnership's Honeybee Health Improvement Project, which is focusing on four critical areas:

1. Breeding stock improvements
2. Best practices for commercial beekeeping
3. Effects of pesticides and chemicals
4. Improving nutritional resources

The Honeybee Health Improvement Project is being managed by the Honeybee Health Improvement Task Force of the North American Pollinator Protection Campaign (NAPPC). NAPPC is a tri-national, public-private sector collaboration facilitated by the Pollinator Partnership. With a well-respected team of researchers guiding the project, we believe their work will go a long way in improving honeybee health and sustainability.

Additional information about the Task Force and research projects is provided in the testimony of the Pollinator Partnership as well as at *www.pollinator.org/honeybee_health.htm.*

As a bee-friendly company, we know the critical role bees play in our ecosystem. We are proud to support this Task Force and believe the research projects will yield outcomes that will help improve the health of bees and indeed benefit all of us who depend upon their industrious pollination labors.

Burt's Bees has been so pleased with the progress and quality of existing efforts that we have already committed to a second year in partnering with the Pollinator Partnership.

Increasing Public Awareness and Encouraging Consumers to Take Action:

Burt's Bees believes that when individual citizens become aware of environmental challenges and are given information about simple actions they can take to help, many will be inspired to take action. Individual actions can collectively make a difference.

Last year Burt's Bees produced a 60-second Public Service Announcement (PSA) (*http://www.burtsbees.com*) that describes the CCD problem and outlines basic actions our consumers can take to help, including purchasing locally grown organic foods and planting bee-pollinated flower seeds. Visitors to our website are encouraged to visit the Pollinator Partnership's website (*http://www.pollinator.org*) for more information.

The PSA launched last November, generating over 5 million impressions in its first few weeks. Through the PSA and our website, we distributed over 50,000 seed packets in just 8 weeks. That's millions of flowers planted around the country that represent forage for honeybees and other pollinators. We continue to educate consumers with the PSA this year on our website and as part of our 2008 Bee-utify Your World Mobile Tour, which will be visiting 30 cities around the United States. While we know flower seed packets aren't the cure, we hope they'll help broadcast the problem and educate consumers about the life-giving role that bees play in a healthy, balanced food chain.

This year, Burt's Bees is taking another step to increase public awareness and contribute funding to support pollinator protection efforts by launching a "Help the Honeybees" Beeswax Lip Balm, with 5 percent of proceeds directed to support the Pollinator Partnership's Honeybee Health Improvement Project. The lip balm package and supporting in-store displays publicize the issue, the need to take action and where to learn more about what can be done to help.

In closing, we at Burt's Bees truly believe that by helping to save the bees, we save a lot more than the bees. That is why we are motivated to support pollinator health research to increase public awareness and encourage individuals to take action.

We appreciate the time, attention and leadership you are devoting to the health of our pollinating partners.

The CHAIRMAN. Thank you, sir. I appreciate your testimony.

And finally, we have with us today Ms. Laurie Davies Adams, Executive Director of the Pollinator Partnership from San Francisco, California. Thank you for being here.

STATEMENT OF LAURIE DAVIES ADAMS, EXECUTIVE DIRECTOR, POLLINATOR PARTNERSHIP, SAN FRANCISCO, CA

Ms. DAVIES ADAMS. Thank you very much. Mr. Chairman, thank you for this opportunity to testify. I am Laurie Davies Adams and I am the Executive Director of the Pollinator Partnership, a nonprofit promoting sustainable agriculture and biodiversity through research, education, conservation, policy and partnerships, and our largest initiative is the management of the North American Pollinator Protection Campaign, or NAPPC, which is a public-private collaboration of over 125 North American stakeholders from industry, government, NGOs and science to be proactive in their support of the health of all pollinators. So, we concern ourselves not just with bees but with butterflies, beetles, bats, birds and more.

Now, you have heard that the critical role of animal pollinators in American agriculture is clear. It underscores the need, however, to have a continued focus on the totality of pollination systems. That includes managed and solitary bees but also other animals. The loss of habitat has been identified by the National Academy of Sciences as one of the irrefutable factors in the decline of pollinators. Pollinators suffer from real estate scarcity. Both commercial bees and natives face diminishing floral resources and nesting sites. The reason: development, pesticide misuse, invasive species, edge-to-edge farming. They have all contributed to the disappearance and fragmentation of habitat.

This week, National Pollinator Week, we introduce a program on our website, *pollinator.org,* called Selecting Plants for Pollinators, a series of ecoregional guides that are available free of charge to

farmers and ranchers, public land managers, professional home gardeners and home gardeners, and the general public to help solve the habitat problem. The guides are step-by-step instruction manuals with specific plant lists and bloom periods for each ecoregion, and to help people know their ecoregion, we have created a ZIP Code habitat locator and that we developed with the U.S. Geological Survey and NBII. It provides Google satellite data to determine the exact habitat and then connects to an ecoregional guide. The first six guides roll out this week, two more each month until September when we will complete all 35 next year at the end of 2009, and with your permission I will show you this right after my testimony.

Why have ecoregional guides? They provide the best science for critical pollinator habitat. All of our NALC partners, but most especially NRCS and CSREES, NACD and the Forest Service will help distribute links. Now, why is this so important to agriculture? These guides were developed on a model from Montana NRCS, a project developed by State Conservationist, Dave White, who pioneered WHIP and EQIP support for pollinator-friendly plantings. So our guides expand that opportunity across the country and specifically support the recent inclusion of pollinator plantings in the farm bill.

I think we can all feel proud of all of the work and all the testimony you have heard today and contributions by groups like NALC and by visionary companies like Burt's Bees and Häagen-Dazs and also by vast numbers of everyday citizens. This issue resonates with people more than any agricultural and conservation issue I can remember. It crosses every age, every demographic and every political stripe. People care about bees, but they also want to do something. America is awakening to the terrifying prospect that our pollinator and the agro- and ecosystems that they support are in jeopardy, but I also want to assure that you Americans are also expressing their eagerness to step forward to engage in positive result-producing actions. Thanks to the ecoregional guides, there is something important to contribute on the ground. It is just one step, but it is significant. You have heard today about problems that involve nutrition, that involve pesticides and foraging. This is a first step that we can do in every Congressional district in every state, in every city, on every farm, in every school. We can do it now. It is part of a comprehensive approach that we applaud this Committee for having.

We applaud your leadership and we hope that you will continue to push this as much as it deserves. Thank you very much.

[The prepared statement of Ms. Davies Adams follows:]

PREPARED STATEMENT OF LAURIE DAVIES ADAMS, EXECUTIVE DIRECTOR, POLLINATOR PARTNERSHIP, SAN FRANCISCO, CA

Mr. Chairman and Members of the Subcommittee, thank you for the opportunity to testify about the status of research and other activities related to the health of honeybees and other pollinators. My name is Laurie Davies Adams, and I am Executive Director of the Pollinator Partnership.

Interest of the Pollinator Partnership:

The Pollinator Partnership (P2)[1] is a nonprofit organization headquartered in San Francisco, California. P2's mission is to catalyze stewardship of biodiversity. P2 places a high priority on efforts to protect and enhance animal pollinators (invertebrates, birds and mammals) and their habitats in both working and wild lands. More information about P2 may be accessed at *http://www.pollinator.org*.

P2 is a strong advocate of a collaborative, science-based approach. P2 is honored to have a number of beneficial pollinator partnership efforts ongoing through management of the North American Pollinator Protection Campaign (NAPPC), a tri-national, public-private collaboration of scientific researchers, managers and other employees of state and federal agencies, private industry and conservation and environmental groups dedicated to ensuring sustainable populations of pollinating invertebrates, birds and mammals throughout the United States, Canada and Mexico. NAPPC's voluntary participants from over 125 entities are working together to proactively:

- Promote awareness and scientific understanding of pollinators;
- Gather, organize and disseminate information about pollinators;
- Provide a forum to identify and discuss pollinator issues; and
- Promote projects, initiatives and activities that enhance pollinators.

Since its founding in 1999, NAPPC has been an instrumental cooperative conservation force in focusing attention on the importance of pollinators and the need to protect them throughout North America. More information about NAPPC and its collaborative efforts can be found at *http://www.nappc.org*.

Pollinators Play Critical Role in Agriculture and Are at Risk:

Insect and other animal pollinators play a pivotal part in the production of food that humans eat—with estimates as high as one out of every three bites—and in the reproduction of at least 80 percent of flowering plants. The commodities produced with the help of animal pollinators generate significant income for agricultural producers. For example, domestic honeybees pollinate an estimated $15 billion worth of crops in the U.S. each year, produced on more than 2 million acres. It is increasingly recognized that native bees also contribute significantly, providing "free" ag pollination services. Recent estimates credit native pollinators for providing about $3 billion annually in crop pollination services.

The cost for pollination services as a purchased agricultural input has *actually increased at a higher rate than energy prices* over the past several years. The availability and reliability of these pollination services are no longer certain. It is thus in the economic interest of both agriculture and American consumers to help ensure a healthy, sustainable population of honeybees and native pollinators.

Today, possible declines in the health and population of pollinators in North America and globally pose what could be a significant threat to the integrity of biodiversity, to global food webs, and to human health. A number of pollinator species are at risk. Due to several reported factors, the number of commercially managed honeybee colonies in the U.S. has declined from 5.9 million in the 1940's to 4.3 million in 1985 and 2.5 million in 1998. All indications are the problem has worsened in recent years.

About 900,000 rented colonies are employed to pollinate 500,000 acres of just one major cash crop, almonds, grown in California—and that acreage is increasing. Producers of other specialty crops are increasingly concerned about the reliability and cost of pollination services. Availability and reliability of pollination services are the top priority to producers—simply stated, *no pollination, no crop!*

CCD Wakeup Call for Pollinator Conservation Action:

Even as efforts are appropriately focused on research to find out how to address Colony Collapse Disorder (CCD) and other issues related to pollinator health, there are scientifically based actions we can take. We have the scientific understanding to know that improving habitat for both honeybees and native pollinators is an important tool to improve pollinator health. Here are some conservation actions that can be taken now:

- Farmers can incorporate pollinator-beneficial practices now in their conservation efforts.

[1] Founded as the Coevolution Institute, now does business as the Pollinator Partnership.

- Congress can help now by funding research and conservation provisions under the new Farm Bill to realize their potential to provide farmers and ranchers with pollinator assistance.
- USDA can help now by implementing pollinator provisions in the new Farm Bill, coordinating efforts and collaborating with the ag community and other natural resource managers.
- P2 pledges to help now by continuing to facilitate collaborative efforts on pollinator research, conservation and public awareness.
- All Americans can help now with pollinator-friendly practices in their own back yards.

New Ecoregional Guides Tool for Native Habitat for Pollinators:

To empower stakeholders with the information needed to move forward with pollinator habitat conservation efforts on the ground, P2 is pleased to announce the National Pollinator Week launch of the first six in a new series of practical Ecoregional Guides, "**Selecting Plants for Pollinators.**" There are 35 ecoregions in the United States, and within two years there will be a guide released for each ecoregion. Two new guides each will be released in July, August and September.

These guides are intended to be practical tools for farmers, ranchers and gardeners who want to establish habitat for honeybees and native pollinators through native plants that are specific to their own region. The guides are available in downloadable form for free at *http://www.pollinator.org* along with information about how to use them. ***Exhibit 1*** is a short Q&A on the guides. ***Exhibit 2*** is a 1-page flier on the new guides that is being widely distributed.

What is an ecoregion? Why aren't we developing guides by state or county or other familiar geographic delineation? Scientists in USDA and elsewhere told us that plants and pollinators don't "think" along state or county lines. Scientists recommended that we use an established system of ecoregions that could be used to match native plants and pollinators. Ecoregions (ecological regions, or bioregions) denote areas of general similarity in ecosystems and in the type, quality, and quantity of environmental resources. The biodiversity of flora, fauna (including pollinators) and ecosystems that characterize an ecoregion tend to be distinct from that of other ecoregions. These general purpose regions are critical for structuring and implementing ecosystem management strategies across federal agencies, state agencies, and nongovernment organizations that are responsible for different types of resources within the same geographical areas.

You have no idea what your ecoregion address is? P2 was struggling with a way to connect this tool to potential users. Our partners at the National Biological Information Infrastructure (NBII) pointed us to an existing online system. NBII is a broad, collaborative program to provide increased access to data and information on the nation's biological resources.

All you need is your ZIP Code, and our online **ZIP Code Habitat Locator** will connect you to your ecosystem map and guide. If the guide for your ecoregion is not yet available, you can enter your e-mail address and receive an alert when it becomes available.

For illustrative purposes, ***Exhibit 3*** is the full ecoregional guide for the Central Appalachian Broadleaf Forest. As indicated on the map on page 7 of the guide, this ecoregion includes the District of Columbia and parts of Virginia and Maryland, with the region portions of states from Pennsylvania to South Carolina. The first part of each guide covers standard information, including:

- Why pollinators are important, and Getting started
- Understanding the ecoregion covered by the guide
- Meet the pollinators, and Which flowers the pollinators prefer
- Developing landscape plantings that provide pollinator habitat
- Tips for—Farmers, Public land managers, and Home landscapes

Each guide provides plant-pollinator information *specific to that ecoregion,* including (1) Bloom periods; (2) Native plants that attract pollinators; and (3) Habitat hints. Finally, each guide provides additional resources and tips, including (1) Habitat and nesting requirements different pollinators; (2) Basic checklist; and (3) Where to access additional information.

It is important to emphasize that the guides are *science-based* and that great care has been taken to *avoid including any invasive species* in selecting the recommended lists of native plants specific to each ecoregion.

The guides are being funded by the National Fish and Wildlife Foundation, the C.S. Fund, the Plant Conservation Alliance, the U.S. Forest Service, and the Bureau

of Land Management. P2 is providing oversight. NAPPC volunteers have provided expertise in the development of the guides. The concept was also reviewed by a number of agencies and trade associations like the American Farm Bureau Federation and the National Garden Association. The guides will undergo continuing review and can be readily updated since they are maintained online.

The ecoregional guides were inspired by "Montana Native Plants for Pollinator-Friendly Plantings," a pamphlet published in 2005 by the Natural Resources Conservation Service (NRCS) in Montana under the leadership of David White, State Conservationist. The pamphlet was offered to farmers and ranchers and nurseries. On a trial basis, the State NRCS offered bonus eligibility points in selected cost-share programs like the Environmental Quality Incentives Program (EQIP) and the Wildlife Habitat Incentives Program (WHIP) to farmers and ranchers who opted to include pollinator habitat in their conservation efforts. P2 is conducting a follow up study under a Conservation Innovation Grant from the Montana NRCS—including a survey, field visits and a demonstration site to determine how well the program worked and how it could be made better in the future. One thing we have learned from this initiative is that native plantings differ in different parts of Montana. This helped prompt our effort to look for better approaches, which ultimately led to the ecoregional planting guides.

P2 hopes to collaborate with NRCS, using the Montana pamphlet and the improved information in the ecoregional guides to develop similar user-friendly pamphlets for other states.

National Academy Report Blueprint for Science-Based Actions:

The National Academy of Sciences (NAS) released a major report in late 2006—before CCD became an issue of concern—on the status and health of pollinators in North America that included a number of recommendations on research and conservation action. That report was released at a day-long Pollinator Symposium put together by P2/NAPPC and hosted by USDA. The NAS study came about as a result of a 4-year campaign by NAPPC partners and was supported by 52 national organizations including major farm, commodity and agribusiness groups. Diverse stakeholders found common ground in the principle that sound science is essential to guiding policies and actions related to the future of pollinators. In essence, the report from a cadre of top researchers in North America recommends that we must (1) improve our scientific understanding, (2) increase awareness about the amazing world of pollinators and their importance to our food supply and healthy ecosystems, and (3) take action to protect pollinators and their habitat. These recommendations are now serving as a science-based blueprint as we move forward on research, conservation and other initiatives.

P2/NAPPC Honeybee Health Task Force Research Efforts:

To help address multiple concerns about the health of our nation's honeybees, last fall P2 facilitated the establishment of a Honeybee Health Improvement Task Force through NAPPC. Top scientists from universities and federal agencies were recruited and teamed up with leading representatives of the beekeeping community.

Burt's Bees stepped up and donated vital funding to support the Task Force at NAPPC's International Pollinator Summit, hosted by the Department of the Interior last October. P2 applauds the leadership provided by Burt's Bees and major contributions for research on honeybee health and sustainable pollination to the University of California-Davis and Penn State by Häagen Dazs. Häagen Dazs has joined the growing P2 team this year as a partner and sponsor. An exciting but less well known story is that individuals from all walks of life are also making contributions to help support pollinator health efforts, from school children to private individuals and foundations.

The Task Force has worked to identify specific research needs that would complement research being funded by USDA. In response to a request for proposals, nineteen eligible proposals were received from applicants all around North America, totaling more than $200,000 in funding requests. The caliber and diversity of the proposals received speak to the importance of and need for honeybee health research. The five one-year grants awarded cover a broad range of honey bee related topics such as the effects of climate or environmental variables, the effects of nutrition on honey bee physiology and/or colony health, the effects of sublethal doses of pesticides (including miticides) on honey bee physiology and/or colony health, and genetic stock improvement. A list of proposals that have been awarded follows:

- "**Assessment of sublethal effects of imidacloprid on honey bee and colony health**" (University of Maryland Foundation; Dively and Embrey)
- "**Diagnostic gene panel for honey bee breeding and disease management**" (USDA–ARS Bee Research Lab; Evans and Chen)

- "**Effects of miticide and Fumagilin-B on honey bee survivorship and immune responses**" (Acadia University; Little, Shutler, and others)
- "**Changes in hormonal and protein levels in honey bees that are experiencing migratory transportation**" (Michigan State University; Huang)
- "**Nutritional effects on intestinal health and longevity of honey bee workers**" (University of North Carolina at Greensboro; Rueppell)

A more complete description of the Honeybee Health Task Force and research projects is provided in ***Exhibit 4*** and at *http://www.pollinator.org/honeybee_health.htm.*

We appreciate the increasing efforts by the U.S. Department of Agriculture (USDA) to conduct and coordinate research on CCD and other challenges impacting honeybees and other pollinators, such as USDA's CCD research action plan launched last summer. We also applaud this Subcommittee, the Agriculture Committee and the Congress for enacting a new farm bill that for the first time includes pollinator-specific research and conservation provisions that lay the groundwork for additional action. The Pollinator Partnership is urging the Congress to provide additional funding for pollinator research and conservation in the Fiscal Year 2009 appropriations. We also urge the research and conservation agencies at USDA to take maximum advantage of the new pollinator provisions in the farm bill in implementing their programs.

New Farm Bill Provides New Pollinator Protection Provisions:

P2 commends this Subcommittee and the Congress for including pollinator-beneficial provisions in the research, conservation and specialty crops titles of the new Farm Bill. A summary is available at *http://www.pollinator.org/Resources/PollinatingtheFarmBill,ConferenceReportSummary.pdf.*

Conservation programs can be highly effective in addressing factors which can contribute to pollinator declines including: habitat fragmentation, loss, and degradation causing a reduction of food sources and sites for mating, nesting, roosting, and migration; improper use of pesticides and herbicides; aggressive competition from non-native species; disease, predators, and parasites; climate change; and lack of floral diversity. Effective pollinator protection practices often overlap and complement other conservation practices, particularly those designed to improve wildlife habitat, and vice versa. In other instances, a practice designed to achieve wildlife or other conservation practices could generate significant pollinator benefits by integrating modest enhancements.

The focused objective of targeted modifications to authorizing language is to better equip and direct USDA research and conservation agencies to build on current pollinator-related efforts by the Agricultural Research Service (ARS), the Cooperative State, Research, Education and Extension Service (CSREES), the Natural Resources Conservation Service (NRCS) and other agencies and to help farmers, ranchers, foresters and other private natural resources incorporate pollinator needs in their conservation efforts. Pollinators, agriculture and healthy ecosystems deserve no less.

Pollinator Importation Can Do More Harm Than Good:

If CCD and other pollinator health issues continue to threaten ag pollination services, P2 cautions against scrambling to fill the void by importing non-native pollinator species from other countries or other eco-regions. If CCD proves to be a persistent problem, the pressure to allow such remedies could grow. We need to avoid compounding one problem by unintentionally creating others that could make the situation far worse. Imported species intended for a good use can quickly become out-of-control ***invasive*** species (including pests and diseases the imported species may carry and introduce). The unintended consequences could overwhelm the beneficial effects of research and conservation measures and actions facilitated by the Farm Bill.

This problem and the demonstrated risks involved are so great that NAPPC collaborators teamed up in 2006 and produced a "Bee Importation White Paper" focused on the risks and consequences of importing non-native bumble bees. The following excerpt captures what is at stake:

> "Non-native species introductions may have dramatic negative consequences. In the last century, invasive species of all types have cost the U.S. an estimated $137 billion in damages (Pimentel *et al.* 2000). Yet introductions of exotic plants and animals persist, partly because those who introduce exotic plants and animals may not fully understand or bear the consequences of their behavior (Perrings *et al.* 2002), which can be devastating on both economic and ecological scales." [p. 23]

The report is available at *http://www.pollinator.org/Resources/BEEIMPORTATION_AUG2006.pdf* and includes a number of key recommendations. If trans-boundary shipments of pollinating species are considered, the greatest care must be undertaken in developing effective protocols to prevent such unintended consequences.

National Pollinator Week June 22–28, 2008:

June 22–28, 2008 was designated as National Pollinator Week through a proclamation by Secretary of Agriculture Ed Schafer. A number of events across the nation to celebrate and *raise public awareness about our pollinating partners and the need to take actions that protect pollinators and their habitat.* For example—

- On June 25, P2 hosted a briefing on the status and plight of bees and other pollinators.
- Governors in 26 States have signed proclamations Pollinator Week at the State level.
- Pollinator Week activities and events are occurring in at least 38 States and Canada.
- P2 has launched the first six Ecoregional Guides, "Selecting Plants for Pollinators."
- P2 is signing a Memorandum of Understanding with the National Association of Conservation Districts (NACD), with the first action focused on the Ecoregional Guides.
- Pollinator Podcasts produced in partnership with the Department of the Interior *http://www.pollinator.org/podcast.htm.*
- Free items, including "Bounty of Bees" Poster and Pollinator Wheels.

The goal is to encourage actions in support of pollinators through the year. More information is available at (*http://www.pollinator.org/pollinator_week_2008.htm*).

CoE stands ready to work with this Subcommittee and interested stakeholders to help ensure that honeybees and native pollinators are sustained for the benefit of agriculture, consumers and healthy ecosystems.

Respectfully Submitted,

LAURIE DAVIES ADAMS,
Executive Director.

EXHIBIT 1

POLLINATOR PARTNERSHIP

FAST FACTS

INTRODUCES ECOREGIONAL PLANTING GUIDES

WHY PLANT FOR POLLINATORS?
Loss of habitat was identified by the National Academy of Sciences as one of the contributing factors to the decline in pollinators. Bees, bats, birds, butterflies and other pollinators suffer from real estate scarcity.

Both commercial bees and natives are facing diminishing locations for floral resources and nesting; development and edge-to-edge commercial farming have contributed to fragmented migratory corridors for butterflies and hummingbirds.

WHAT ARE THE ECOREGIONAL GUIDES?
The Ecoregional Guides are a series of 24 page, beautifully illustrated booklets describing all that is needed in each Ecoregion of the 35 Bailey's Ecosystem Provinces.

To see a map of all the provinces go to: http://www.fs.fed.us/colorimagemap/ecoreg1_provinces.html
Each guide has a different cover illustrating the farming and wildlife communities of the location. Each has a customized plant list for the Ecoregion, a list of bloom periods, and habitat hints. Specific instructions are given for farmers, public land managers and home gardeners. Also included are how-to checklists, background on pollinators of all types, resources for further investigation, and a request for feedback. Because the guides are online, we can update them and make additions as we receive feedback from users.

ARE POLLINATOR HABITATS HELPFUL?
Of all the stressors on pollinator populations (pathogens and disease, invasive species, chemical assaults), creating clean and accessible habitat is something everyone can do NOW. And the benefits are almost immediate – bees, butterflies, hummingbirds are the visible evidence of healthier, chemical free gardens and hedgerows when pollinator habitat is establish in homes, farms, schools, parks, golf course and corporate lands.

HOW DO YOU GET A GUIDE?
The Ecoregional Guides are FREE for downloading at www.pollinator.org based on a roll-out schedule for all 35. Pollinator Partnership is currently seeking funding to print the guides to help those who need or prefer a printed version

WHAT'S YOUR ECOREGION?
Hardly anyone thinks about the ecoregion they live in – but political boundaries like streets, cities or states, don't matter to the natural creatures who share our neighborhood. These new guides have made it easy for ANYONE to discover their place in the natural habitats of the world using their zip code as a locator. When you're ready to Plant for Pollinators, enter a personal zip code that matches where you live or work onto the www.pollinator.org website, where you'll be matched to your specific ecoregion. You will be connected to a map that shows you all the other places to which you are connected. Just download your free guide to find your natural habitat.

WHICH GUIDES ARE AVAILABLE NOW?
Guides are rolling out over the next 15 months, with 12 available throughout 2009. We plan to complete all 35 Guides by the end of 2009. If your guide is not online, simply sign up and the Pollinator Partnership will email it directly to you when it is. The titles kicking off the launch are:

- Eastern Broadleaf Forest: Oceanic Province
- Eastern Broadleaf Forest: Continental Province
- Outer Coastal Plain Mixed Province
- Prairie Parkland
- Chihuahuan Desert Province
- Central Appalachian Broadleaf Forest: Coniferous Forest-Meadow Province

A complete list of the roll out provinces, the states they cover and the schedule for release is attached.

WHAT IF YOUR ZIP CODE HAS MORE THAN ONE ECOREGION?
Many zip codes do! After all, zip codes are set up for postal delivery not by habitat. If more than one ecoregion transects your zip code, we'll show you all the choices. Simply go to the INTERACTIVE map provided for your zip code. Using Google technology you can locate yourself from both satellite and highway landmarks.

HOW DO THESE GUIDES DIFFER FROM OTHER PLANTING GUIDES?
Most garden planting and climate zone guides offer information about what CA grow in each location. The Ecoregional Guides offer a more specific recipe of what SHOULD BE PLANTED to encourage healthy pollinator habitat. The bonus? Healthy pollinator habitat means mostly native plants that are non-invasive, reduced water consumption, less soil erosion and provide more food and homes for ALL wildlife. More pollinators mean more happy flowers and crops. Moreover, the intangible benefit each time a butterfly swoops gracefully down to a plant you have nurtured gives us all the incalculable pleasure of being connected to nature in our corner of the earth.

PEOPLE + PLACE + PLANTS + POLLINATORS = PLANET PROTECTION

HELP THE BEES AND OTHER POLLINATORS

BY PLANTING HABITAT IN YOUR GARDEN, FARM OR FOREST

Supporting bees and other pollinators who bring us one out of every third bite of our food and 80% of our flowering plants is vital and important job - one that **everyone** can help with.

A crucial first step is to create habitat for pollinators to use for food and shelter.

There are 35 Ecoregional guides being created by the Pollinator Partnership and NAPPC and they're designed to reach all who can plant for pollinators -- **that's everyone!**

The Guides have been created to be very user-friendly, effective and **FREE!**

VISIT: **WWW.POLLINATOR.ORG**

CLICK ON: **FREE ECOREGIONAL GUIDES**

Especially helpful for farmers and ranchers, land managers and gardeners, these guides help place **YOU** in your habitat.

Most of us think of our locale as our city, town, or county but our **REAL neighborhood on the planet is our Ecoregion.**

We have an **Ecoregion Locator using your zip code.**

MAKE A REAL DIFFERENCE NOW!

The North American Pollinator Protection Campaign and The Pollinator Partnership
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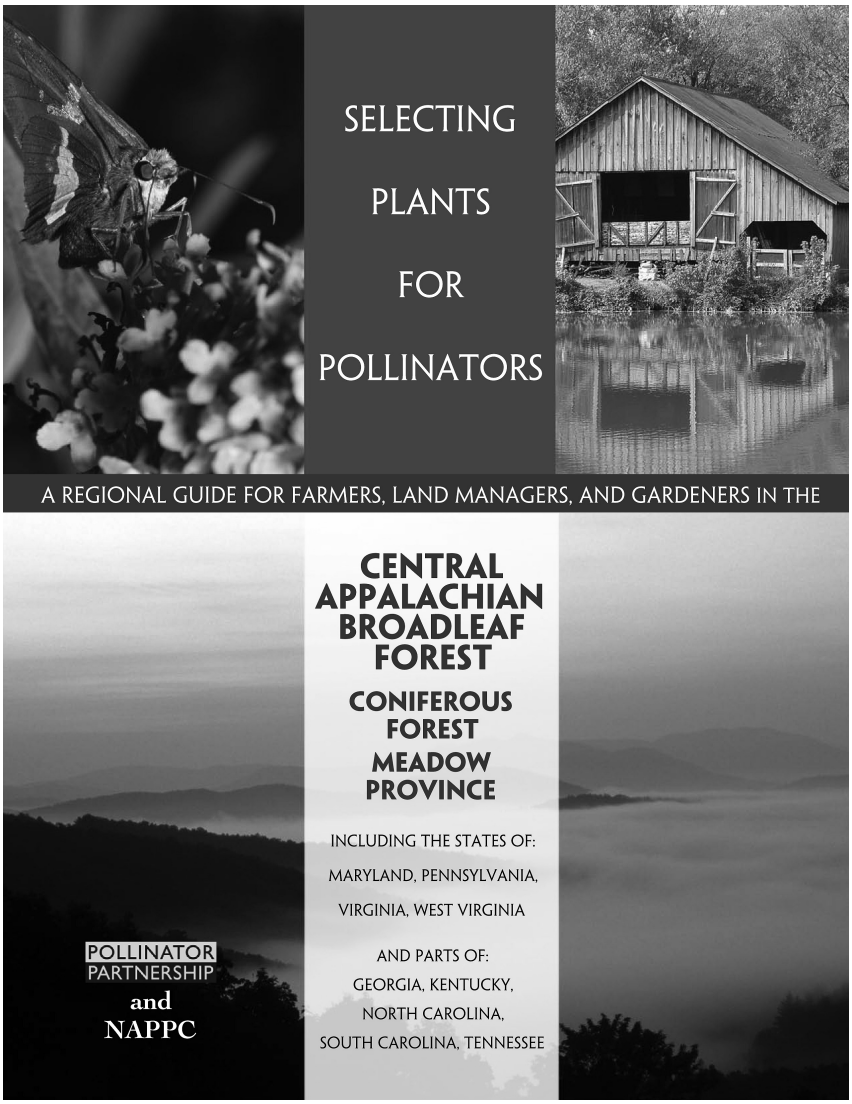
www.pollinator.org • info@pollinator.org • 415-362-1137

NAPPC

POLLINATOR PARTNERSHIP

EXHIBIT 3


SELECTING
PLANTS
FOR
POLLINATORS
A REGIONAL GUIDE FOR FARMERS, LAND MANAGERS, AND GARDENERS IN THE
CENTRAL APPALACHIAN BROADLEAF FOREST
CONIFEROUS FOREST
MEADOW
PROVINCE
INCLUDING THE STATES OF:
MARYLAND, PENNSYLVANIA,
VIRGINIA, WEST VIRGINIA
AND PARTS OF:
GEORGIA, KENTUCKY,
NORTH CAROLINA,
SOUTH CAROLINA, TENNESSEE
POLLINATOR PARTNERSHIP
and
NAPPC

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This is one of several guides for different regions in the United States. We welcome your feedback to assist us in making the future guides useful. Please contact us at feedback@pollinator.org

Cover: silver spotted skipper courtesy www.dangphoto.net

SELECTING PLANTS FOR POLLINATORS

A REGIONAL GUIDE FOR
FARMERS, LAND MANAGERS,
AND GARDENERS

IN THE
ECOLOGICAL REGION OF THE
CENTRAL APPALACHIAN BROADLEAF FOREST
CONIFEROUS FOREST
MEADOW PROVINCE

INCLUDING THE STATES OF:
MARYLAND, PENNSYLVANIA, VIRGINIA,
WEST VIRGINIA

AND PARTS OF:
GEORGIA, KENTUCKY,
NORTH CAROLINA, SOUTH CAROLINA, TENNESSEE

A NAPPC AND POLLINATOR PARTNERSHIP™ PUBLICATION

This guide was funded by the National Fish and Wildlife Foundation, the C.S. Fund, the Plant Conservation Alliance, the U.S. Forest Service, and the Bureau of Land Management with oversight by the Pollinator Partnership™ (www.pollinator.org), in support of the North American Pollinator Protection Campaign (NAPPC–www.nappc.org).

WHY SUPPORT POLLINATORS?

In their 1996 book, The Forgotten Pollinators, Buchmann and Nabhan estimated that animal pollinators are needed for the reproduction of 90% of flowering plants and one third of human food crops. Each of us depends on these industrious pollinators in a practical way to provide us with the wide range of foods we eat. In addition, pollinators are part of the intricate web that supports the biological diversity in natural ecosystems that helps sustain our quality of life.

Abundant and healthy populations of pollinators can improve fruit set and quality, and increase fruit size. In farming situations this increases production per acre. In the wild, biodiversity increases and wildlife food sources increase.

Alfalfa, apples, blueberries, and strawberries are some of the crops raised in the Central Appalachian Broadleaf Forest that rely on honey bees and native bees for pollination. Domestic honey bees pollinate approximately $10 billion worth of crops in the U.S. each year.

Unfortunately, the numbers of both native pollinators and domesticated bee populations are declining. They are threatened by habitat loss, disease, and the excessive and inappropriate use of pesticides. The loss of commercial bees to Colony Collapse Disorder (CCD) has highlighted how severe the issues of proper hive management are to reduce stresses caused by disease, pesticide use, insufficient nutrition, and transportation practices. Currently, the pollination services that the commercial beekeeping industry provides are receiving much needed research and conservation resources. The efforts to understand the threats to commercial bees should help us understand other pollinators and their roles in the environment as well.

It is imperative that we take immediate steps to help pollinator populations thrive. The beauty of the situation is that by supporting pollinators' need for habitat, we support our own needs for food and support diversity in the natural world.

Thank you for taking time to consult this guide. By adding plants to your landscape that provide food and shelter for pollinators throughout their active seasons and by adopting pollinator friendly landscape practices, you can make a difference to both the pollinators and the people that rely on them.

Laurie Davies Adams
Executive Director
Pollinator Partnership

"FARMING FEEDS THE WORLD, AND WE MUST REMEMBER THAT POLLINATORS ARE A CRITICAL LINK IN OUR FOOD SYSTEMS."

-- PAUL GROWALD,
CO-FOUNDER,
POLLINATOR PARTNERSHIP

GETTING STARTED

THIS REGIONAL GUIDE IS just one in a series of plant selection tools designed to provide information on how individuals can influence pollinator populations through choices they make when they farm a plot of ground, manage large tracts of public land, or plant a garden. Each of us can have a positive impact by providing the essential habitat requirements for pollinators including food, water, shelter, and enough space to allow pollinators to raise their young.

Pollinators travel through the landscape without regard to property ownership or state boundaries. We've chosen to use R.G. Bailey's classification system to identify the geographic focus of this guide and to underscore the connections between climate and vegetation types that affect the diversity of pollinators in the environment.

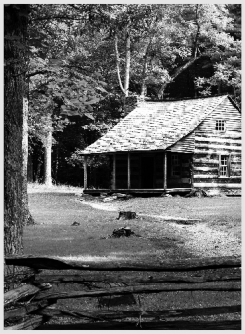
Bailey's Ecoregions of the United States, developed by the United States Forest Service, is a system created as a management tool and is used to predict responses to land management practices throughout large areas. This guide addresses pollinator-friendly land management practices in what is known as the Central Appalachian Broadleaf Forest, Coniferous Forest, Meadow Province.

Portions of nine states make up the 68,100 square miles of this forested, mountainous province. The topography is primarily composed of low mountains with greatly varied elevation, ranging from 300 to 6,000 feet. This province features a temperate climate with distinct winter and summer seasonal patterns, and all areas are subject to frost. Average annual temperatures are mild, ranging from 50° to 64°F. Average annual rainfall varies from 35 inches in the valleys to up to 80 inches on the highest peaks.

This province is characterized by vertical zonation. The southern Appalachian valleys feature a mixed oak-pine forest; above this zone lies the Appalachian oak forest, comprised of birch, beech, maple, elm, red oak, and basswood. Spruce-fir forests are also common on high peaks of the Allegheny and Great Smoky Mountains.

Long before there were homes and farms in this area, the original, natural vegetation provided continuous cover and adjacent feeding opportunities for wildlife, including pollinators. In choosing plants, aim to create habitat for pollinators that allow adequate food shelter, and water sources. Most pollinators have very small home ranges. You can make a difference by understanding the vegetation patterns of the farm, forest, or neighbor's yard adjacent to you and by making planting choices that support the pollinators' need for food and shelter as they move through the landscape.

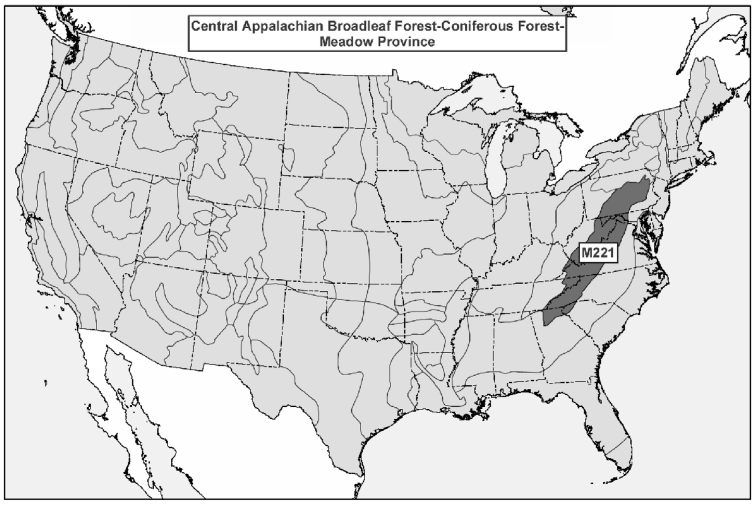
UNDERSTANDING THE CENTRAL APPALACHIAN BROADLEAF FOREST



- This region is designated **number M221** in the Baileys' Ecosystem Provinces. To see a map of the provinces go to: **www.fs.fed.us/colorimagemap/ecoreg1_provinces.html**
- Not sure about which bioregion you live or work in? Go to **www.pollinator.org** and click on **Ecoregion Locator** for help.
- 68,100 square miles within 9 states.
- Primarily forested and mountainous.
- Elevations ranging from 300 feet to 6,000 feet.
- Average annual temperature range from 50° to 64°F.
- Average year-round precipitation between 35-80 inches.
- USDA Hardiness Zones 5a-7a (1990 version).

CHARACTERISTICS

- Dominated by vertical zonation, with the lower limits of each forest belt rising in elevation toward the south.
- Common tree species include oak, pine, birch, beech, maple, elm, basswood, hemlock, and spruce.
- Chestnut was once abundant, but has now been greatly reduced because of blight.



The Central Appalachian Broadleaf Forest, Coniferous Forest, Meadow Province includes the states of:

Maryland, Pennsylvania, Virginia, West Virginia

And parts of:

Georgia, Kentucky, North Carolina, South Carolina, Tennessee

"ADDING NATIVE PLANTINGS IN RIPARIAN AREAS TO IMPROVE POLLINATOR HABITAT MAKES SENSE IN ADVANCING OUR FAMILY FARM'S CONSERVATION AND ECONOMIC OBJECTIVES, ENHANCING BENEFICIAL WILDLIFE AND IMPROVING POLLINATION IN OUR ORCHARD AND GARDEN."

--LEE MCDANIEL, FARMER AND PRESIDENT, NATIONAL ASSOCIATION OF CONSERVATION DISTRICTS

MEET THE POLLINATORS

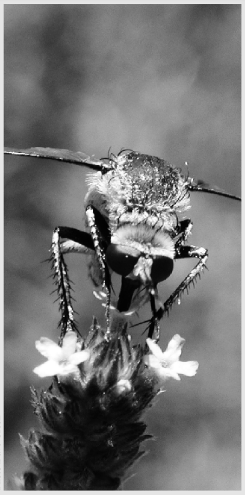


Photo Dave Green

Bombylid fly, or beefly.

Gulf Fritillary butterfly.

Photo courtesy www.dangphoto.net

WHO ARE THE POLLINATORS?

BEES

Bees are well documented pollinators in the natural and agricultural systems of the Central Appalachian Broadleaf Forest. A wide range of crops including apples, alfalfa, strawberries and blueberries are just a few plants that benefit from bee pollinators.

Most of us are familiar with the colonies of honey bees that have been the workhorses of agricultural pollination for years in the United States. They were imported from Europe almost 400 years ago.

There are nearly 4000 species of native ground and twig nesting bees in the U.S. Some form colonies while others live and work a solitary life. Native bees currently pollinate many crops and can be encouraged to do more to support agricultural endeavors if their needs for nesting habitat are met and if suitable sources of nectar, pollen, and water are provided. Bees have tongues of varying lengths that help determine which flowers they can obtain nectar and pollen from.

The bumble bee (*Bombus* spp.) forms small colonies, usually underground. They are generalists, feeding on a wide range of plant material from February to November and are important pollinators of tomatoes. The sweat bee (family *Halictidae*) nests underground. Various species are solitary while others form loose colonies.

Solitary bees include carpenter bees (*Xylocopa* spp.), which nest in wood; digger, or polyester bees (*Colletes* spp.), which nest underground; leafcutter bees (*Megachile* spp.), which prefer dead trees or branches for their nest sites; and mason bees (*Osmia* spp.), which utilize cavities that they find in stems and dead wood. Cactus bees (*Diadasia* spp.) are also solitary ground nesters.

BUTTERFLIES

Gardeners have been attracting butterflies to their gardens for some time. These insects tend to be eye-catching, as are the flowers that attract them. Position flowering plants where they have full sun and are protected from the wind. Also, you will need to provide open areas (e.g. bare earth, large stones) where butterflies may bask, and moist soil from which they may get needed minerals. By providing a safe place to eat and nest, gardeners can also support the pollination role that butterflies play in the landscape. It might mean accepting slight damage to the plants, known as host plants, that provide food for the larval stage of the butterfly.

A diverse group of butterflies are present in garden areas and woodland edges that provide bright flowers, water sources, and specific host plants. Numerous trees, shrubs, and herbaceous plants support butterfly populations.

Butterflies are in the Order *Lepidoptera*. Some of the species in the Central Appalachian Broadleaf

Forest are Brush-footed, Gossamer-winged, Swallowtail, Parnassian, Skipper, White, Sulphur and Milkweed butterflies. They usually look for flowers that provide a good landing platform.

Wet mud areas provide butterflies with both the moisture and minerals they need to stay healthy. Butterflies eat rotten fruit and even dung, so don't clean up all the messes in your garden!

MOTHS

Moths are most easily distinguished from butterflies by their antennae. Butterfly antennae are simple with a swelling at the end. Moth antennae differ from simple to featherlike, but never have a swelling at the tip. In addition, butterflies typically are active during the day; moths at night. Butterfly bodies are not very hairy, while moth bodies are quite hairy and more stout.

Moths, generally less colorful than butterflies, also play a role in pollination. They are attracted to flowers that are strongly sweet smelling, open in late afternoon or night, and are typically white or pale colored.

BEETLES

Over 30,000 species of beetles are found in the United States and many of them can be found on flower heads. Gardeners have yet to intentionally draw beetles to their gardens, possibly because beetle watching isn't as inspiring as butterfly or bird watching. Yet beetles do play a role in pollination. Some have a bad reputation because they can leave a mess behind, damaging plant parts that they eat. Beetles are not as efficient as some pollinators. They wander between different species, often dropping pollen as they go.

Beetle pollinated plants tend to be large, strong scented flowers with their sexual organs exposed. They are known to pollinate Magnolia, sweetshrub (*Calycanthus*), paw paws, and yellow pond lilies.

FLIES

It may be hard to imagine why one would want to attract flies to the garden. However, like beetles, the number of fly species and the fact that flies are generalist pollinators (visit many species of plants), should encourage us all to leave those flies alone and let them do their job as pollinators.

Recent research indicates that flies primarily pollinate small flowers that bloom under shade and in seasonally moist habitats. The National Research Council's *Status of Pollinators in North America* study states that flies are economically important as pollinators for a range of annual and bulbous ornamental flowers.

Plants pollinated by the fly include the American pawpaw (*Asimina triloba*), dead horse arum (*Helicodiceros muscivorus*), skunk cabbage (*Symplocarpus foetidus*), goldenrod (*Solidago* spp.), and members of the carrot family like Queen Anne's lace (*Daucus carota*).

BIRDS

Hummingbirds are the primary birds which play a role in pollination in North America. Their long beaks and tongues draw nectar from tubular flowers. Pollen is carried on both the beaks and feathers of different hummingbirds. The regions closer to the tropics, with warmer climates, boast the largest number of hummingbird species and the greatest number of native plants to support the bird's need for food. White-winged doves (*Zenaida asiatica*) are also pollinators of the saguaro cactus (*Carnegeia gigantea*) in the south central United States.

Bright colored tubular flowers attract hummingbirds to gardens throughout the United States. Hummingbirds can see the color red; bees cannot. Many tropical flowers, grown as annuals in the Central Appalachian Broadleaf Forest, along with native woodland edge plants, attract hummingbirds.

BATS

Though bats in the Central Appalachian Broadleaf Forest are not pollinators, bats play an important role in pollination in the southwest where they feed on agave and cactus. The long-nosed bats' head shape and long tongue allows it to delve into flower blossoms and extract both pollen and nectar.

PLANT TRAITS

WHICH FLOWERS DO THE POLLINATORS PREFER?

NOT ALL POLLINATORS ARE found in each North American province, and some are more important in different parts of the United States. Use this page as a resource to understand the plants and pollinators where you live.

Plants can be grouped together based on the similar characteristics of their flowers. These floral characteristics can be useful to predict the type of pollination method or animal that is most effective for that group of plants. This association between floral characteristics and pollination method is called a pollination syndrome.

The interactions of animal pollinators and plants have influenced the evolution of both groups of organisms. A mutualistic relationship between the pollinator and the plant species helps the pollinator find necessary pollen and nectar sources and helps the plant reproduce by ensuring that pollen is carried from one flower to another.

Plant Trait	Bats	Bees	Beetles
Color	Dull white, green or purple	Bright white, yellow, blue, or UV	Dull white or green
Nectar guides	Absent	Present	Absent
Odor	Strong musty; emitted at night	Fresh, mild, pleasant	None to strongly fruity or fetid
Nectar	Abundant; somewhat hidden	Usually present	Sometimes present; not hidden
Pollen	Ample	Limited; often sticky and scented	Ample
Flower Shape	Regular; bowl shaped – closed during day	Shallow; have landing platform; tubular	Large bowl-like, Magnolia

This chart and more information on pollinator syndromes can be found at:

AND THE POLLINATORS THEY ATTRACT

Pollinator				
Birds	Butterflies	Flies	Moths	Wind
Scarlet, orange, red or white	Bright, including red and purple	Pale and dull to dark brown or purple; flecked with translucent patches	Pale and dull red, purple, pink or white	Dull green, brown, or colorless; petals absent or reduced
Absent	Present	Absent	Absent	Absent
None	Faint but fresh	Putrid	Strong sweet; emitted at night	None
Ample; deeply hidden	Ample; deeply hidden	Usually absent	Ample; deeply hidden	None
Modest	Limited	Modest in amount	Limited	Abundant; small, smooth, and not sticky
Large funnel like; cups, strong perch support	Narrow tube with spur; wide landing pad	Shallow; funnel like or complex and trap-like	Regular; tubular without a lip	Regular; small and stigmas exerted

http://www.fs.fed.us/wildflowers/pollinators/syndromes.shtml

DEVELOPING LANDSCAPE PLANTINGS THAT PROVIDE POLLINATOR HABITAT

WHETHER YOU ARE A FARMER of many acres, land manager of a large tract of land, or a gardener with a small lot, you can increase the number of pollinators in your area by making conscious choices to include plants that provide essential habitat for bees, butterflies, moths, beetles, hummingbirds and other pollinators.

FOOD:

Flowers provide nectar (high in sugar and necessary amino acids) and pollen (high in protein) to pollinators.
Fermenting fallen fruits also provide food for bees, beetles and butterflies.
Specific plants, known as host plants, are eaten by the larvae of pollinators such as butterflies.

- Plant in groups to increase pollination efficiency. If a pollinator can visit the same type of flower over and over, it doesn't have to relearn how to enter the flower and can transfer pollen to the same species, instead of squandering the pollen on unreceptive flowers.
- Plant with bloom season in mind, providing food from early spring to late fall. (see Bloom Periods pp.16-17)
- Plant a diversity of plants to support a variety of pollinators. Flowers of different color, fragrance, and season of bloom on plants of different heights will attract different pollinator species and provide pollen and nectar throughout the seasons.
- Many herbs and annuals, although not native, are very good for pollinators. Mint, oregano, garlic, chives, parsley and lavender are just a few herbs that can be planted. Old fashioned zinnias, cosmos, and single sunflowers support bees and butterflies.
- Recognize weeds that might be a good source of food. For example, dandelions provide nectar in the early spring before other flowers open. Plantain is alternate host for the Baltimore Checkerspot.
- Learn and utilize Integrated Pest Management (IPM) practices to address pest concerns. Minimize or eliminate the use of pesticides.

SHELTER:

Pollinators need protection from severe weather and from predators as well as sites for nesting and roosting.

- Incorporate different canopy layers in the landscape by planting trees, shrubs, and different-sized perennial plants.
- Leave dead snags for nesting sites of bees, and other dead plants and leaf litter for shelter.
- Build bee boxes to encourage solitary, non-aggressive bees to nest on your property.
- Leave some areas of soil uncovered to provide ground nesting insects easy access to underground tunnels.
- Group plantings so that pollinators can move safely through the landscape protected from predators.
- Include plants that are needed by butterflies during their larval development.

WATER:

A clean, reliable source of water is essential to pollinators.

- Natural and human-made water features such as running water, pools, ponds, and small containers of water provide drinking and bathing opportunities for pollinators.
- Ensure the water sources have a shallow or sloping side so the pollinators can easily approach the water without drowning.

Your current landscape probably includes many of these elements. Observe wildlife activity in your farm fields, woodlands, and gardens to determine what actions you can take to encourage other pollinators to feed and nest. Evaluate the placement of individual plants and water sources and use your knowledge of specific pollinator needs to guide your choice and placement of additional plants and other habitat elements. Minor changes by many individuals can positively impact the pollinator populations in your area. Watch for - and enjoy - the changes in your landscape!

- CAUTION: Remember that pesticides are largely toxic to pollinators. Extreme caution is warranted if you choose to use any pesticide. Strategically apply pesticides only for problematic target species.

FARMS

Alfalfa, blueberries, apples and strawberries are a few of the food crops in the Central Appalachian Broadleaf Forest Province that will benefit from strong native bee populations that boost pollination efficiency. Incorporate different plants throughout the farm that provide food for native populations when targeted crops are not in flower.

Farmers have many opportunities to incorporate pollinator-friendly land management practices on their land which will benefit the farmer in achieving his or her production goals:

- Manage the use of pesticides to reduce the impact on native pollinators. Spray when bees aren't active (just after dawn) and choose targeted ingredients.
- Carefully consider the use of herbicides. Perhaps the targeted weeds can provide needed food for pollinators.
- Minimize tillage to protect ground nesting pollinators.
- Ensure water sources are scattered throughout the landscape.
- Choose a variety of native plants to act as windbreaks, riparian buffers, and field borders throughout the farm.
- Plant unused areas of the farm with temporary cover crops that can provide food or with a variety of trees, shrubs, and flowers that provide both food and shelter for pollinators.
- Check with your local Natural Resources Conservation Service (NRCS) office to see what technical and financial support might be available to assist you in your effort to provide nectar, pollen, and larval food sources for pollinators on your farm.

Illustrations by Carolyn Vibbert

"FOOD SUPPLIES FOR BEES ARE CRITICAL TO MAINTAINING STRONG HIVES FOR ALMOND POLLINATION THE FOLLOWING WINTER."

-- DAN CUMMINGS, CHICO, CALIFORNIA ALMOND GROWER.

PUBLIC LANDS

"FROM HUMMINGBIRDS TO BEETLES, TO BUTTERFLIES, NATURE'S POLLINATORS HELP KEEP MIDEWIN'S TALLGRASS PRAIRIE RESTORATIONS FULL OF DIVERSE FLOWERING PLANTS. INSECT MONITORING PROVIDES A KEY MEASURE OF OUR SUCCESS."

-- LOGAN LEE
PRAIRIE SUPERVISOR, MIDEWIN
NATIONAL TALLGRASS PRAIRIE

Public lands are maintained for specific reasons ranging from high impact recreation to conservation. In the Central Appalachian Broadleaf Forest, forests have been cut to allow for roads, buildings, open lawn areas, boat ramps, and vistas. Less disturbed natural areas can be augmented with plantings of native plant species. Existing plantings around buildings and parking areas should be evaluated to determine if pollinator-friendly plants can be substituted or added to attract and support pollinators. Public land managers have a unique opportunity to use their plantings as an education tool to help others understand the importance of pollinators in the environment through signs, brochures, and public programs.

In an effort to increase populations of pollinators the land manager can:

- Inventory and become knowledgeable of local pollinators.
- Provide connectivity between vegetation areas by creating corridors of perennials, shrubs, and trees that provide pollinators shelter and food as they move through the landscape.
- Maintain a minimum of lawn areas that support recreational needs.
- Restrict the use of pesticides and herbicides.
- Provide water sources in large open areas.
- Maintain natural meadows and openings that provide habitats for sun-loving wildflowers and grasses.
- Remove invasive species and encroaching shrubs and trees.

HOME LANDSCAPES

"A GARDEN IS ONLY AS RICH AND BEAUTIFUL AS THE INTEGRAL HEALTH OF THE SYSTEM; POLLINATORS ARE ESSENTIAL TO THE SYSTEM - MAKE YOUR HOME THEIR HOME."

-- DERRY MACBRIDE
NATIONAL AFFAIRS AND LEGISLATION CHAIRWOMAN,
GARDEN CLUB OF AMERICA

Gardeners have a wide array of plants to use in their gardens. Native plants, plants introduced from years of plant exploration from around the world, and plants developed by professional and amateur breeders can be found in garden centers, in catalogs, and on web-sites. Use your knowledge of pollinator needs to guide your choices.

- Choose a variety of plants that will provide nectar and pollen throughout the growing season.
- Resist the urge to have a totally manicured lawn and garden. Leave bare ground for ground nesting bees. Leave areas of dead wood and leaf litter for other insects.
- Strive to eliminate the use of all pesticides.
- Find local resources to help you in your efforts. Contact your local county extension agent or native plant society. Visit your regional botanic gardens and arboreta.

The scale of your plantings will vary but it is important to remember that you are trying to provide connectivity to the landscape adjacent to your property. Don't just look within your property boundaries. If your neighbor's property provides an essential element, such as water, which can be utilized by pollinators visiting your land, you may be able to devote more space to habitat elements that are missing nearby. It is best to use native plants which have evolved to support the needs of specific native pollinators. Some pollinators, however, are generalists and visit many different plants, both native and non-native. Be sure that any non-native plants you choose to use are not invasive. Remember that specialized cultivars sometimes aren't used by pollinators. Flowers that have been drastically altered, such as those that are double or a completely different color than the wild species, often prevent pollinators from finding and feeding on the flowers. In addition, some altered plants don't contain the same nectar and pollen resources that attract pollinators to the wild types.

- CAUTION: Take time to evaluate the source of your plant material. You want to ensure you get plants that are healthy and correctly identified. Your local native plant society can help you make informed decisions when searching for plants.

BLOOM PERIODS
FOR THE CENTRAL APPALACHIAN BROADLEAF FOREST

The following chart lists plants and the time they are in bloom throughout the growing seasons. Choose a variety of flower colors and make sure something is blooming at all times! Note for all charts: When more than one species of the same genus is useful, the genus name is followed by "spp."

Botanical Name	Common Name	March	April	May	June	July	Aug	Sept	Oct	Nov
Trees & Shrubs										
Aesculus flava	Yellow Buckeye		yellow							
Alnus serrulata	Tag Alder	brown								
Betula nigra	River Birch	bownish-green	bownish-green							
Calycanthus floridus	Sweet Shrub		red	red						
Cladrastis kentuckea	Yellow-wood		white	white						
Clethra acuminata	Mountain Pepperbush					white	white			
Cornus alternifolia	Pagoda Dogwood			white	white					
Cornus amomum	Silky Dogwood			white	white					
Cornus florida	Flowering Dogwood		white	white						
Diervilla sessifolia	Southern Bush Honeysuckle				yellow	yellow	yellow			
Euonymus americanus	Hearts-a-bustin'			greenish-white	greenish-white					
Halesia tetraptera var. tetraptera	Silverbell		white	white						
Hydrangea arborescens	Smooth Hydrangea			white	white					
Hypericum densiflorum	Bushy St. John's-wort				yellow	yellow	yellow			
Kalmia latifolia	Mountain Laurel			pale pink	pale pink					
Leucothoe fontansiana	Doghobble		white	white						
Liriodendron tulipifera	Tulip Poplar		light orange	light orange						
Magnolia acuminata	Cucumber Tree		white	white						
Oxydendrum arboreum	Sourwood				white	white				
Prunus serotina	Black Cherry		white	white						
Rhododendron arborescens	Sweet Azalea				white to pink	white to pink				
Rhododendron calendulaceum	Flame Azalea			orange, yellow, reddish-orange	orange, yellow, reddish-orange					
Rhododendron carolinianum	Punctatum		pink	pink						
Rhododendron catawbiense	Catawba Rhododendron				red to reddish-pink					
Rhododendron maximum	Great Laurel				white	white				
Rhus copallinum var. copallinum	Winged Sumac				greenish-yellow	greenish-yellow	greenish-yellow			
Rosa carolina	Carolina Rose			pink	pink					
Rubus odoratus	Flowering Raspberry				purple-rose	purple-rose	purple-rose			
Stewartia ovata	Mountain Camellia				white	white				
Viburnum cassinoides	With-rod			white	white					
Xanthorhiza simplicissima	Yellowroot	purplish-brown	purplish-brown	purplish-brown						
Perennial Flowers										
Actaea racemosa	Black Cohosh			white	white	white	white	white		
Actaea podocarpa	Yellow Cohosh			white	white					
Aruncus dioicus var. dioicus	Eastern Goatsbeard				white	white				
Asclepias exaltata	Tall Milkweed				yellow	yellow				
Baptisia tinctoria	Yellow Wild indigo									
Chelone lyoni	Appalachian Turtlehead					pink	pink			
Coreopsis pubescens var. pubescens	Hairy Coreopsis					golden-yellow	golden-yellow	golden-yellow		

Botanical Name	Common Name	March	April	May	June	July	Aug	Sept	Oct	Nov
Dicentra eximia	Wild Bleeding Heart		rose-pink	rose-pink	rose-pink					
Diphylleia cymosa	Umbrella Leaf			white	white					
Eupatoriadelphus fistulosus	Hollow-stem Joe-pye-weed					lavender pink	lavender pink	lavender pink		
Eurybia divaricata	White Wood Aster						white with yellow center	white with yellow center	white with yellow center	
Galax urceolata	Galax			white	white	white				
Gentianella quinquefolia ssp. quinquefolia	Eastern Aqueweed						blue	blue	blue	
Geranium maculatum	Wild Geranium		pink to rose	pink to rose						
Helianthus atrorubens	Appalachian Sunflower					yellow with purple center	yellow with purple center	yellow with purple center		
Helianthus microcephalus	Small-headed Sunflower						yellow	yellow		
Heuchera villosa	Rock Alumroot					white	white			
Hexastylis shuttleworthii var. shuttleworthii	Large-flowered Heartleaf			brown	brown					
Iris cristata	Crested Iris		blue	blue						
Liatris scariosa var. scariosa	Northern Blazing-star						rosy-pink	rosy-pink		
Liatris spicata var. spicata	Dense Blazing-star					rosy-pink	rosy-pink	rosy-pink		
Lilium michauxi	Carolina Lily					orange-red with purple spots	orange-red with purple spots			
Lilium superbum	Turk's-cap Lily					orange to yellow	orange to yellow			
Lobelia cardinalis	Cardinal Flower					red	red	red		
Lobelia siphilitica	Great Blue Lobelia					blue	blue	blue		
Monarda didyma	Bee Balm					scarlet red	scarlet red	scarlet red		
Penstemon canescens	Appalachian Beardtongue			violet	violet					
Penstemon smallii	Blue Ridge Beardtongue			deep pink to purple	deep pink to purple					
Phemeranthus teretifolius	Appalachian Fameflower				pink	pink	pink	pink		
Phlox divaricata var. divaricata	Eastern Blue Phlox		blue	blue						
Phlox stolonifera	Creeping Phlox		blue	blue						
Rudbeckia laciniata	Green-headed Coneflower					yellow	yellow	yellow	yellow	
Rudbeckia triloba	Brown-eyed Susan					yellow	yellow	yellow		
Sanguinaria canadensis	Bloodroot	white	white							
Sedum glaucophyllum	Cliff Stonecrop			white	white					
Sedum telephoides	Appalachian Live-forever					pink	pink	pink		
Silene virginica	Fire Pink			red	red	red				
Solidago curtisii	Curtis's Goldenrod						yellow	yellow	yellow	
Solidago roanensis	Roan Mt. Goldenrod					yellow	yellow	yellow		
Symphyotrichum cordifolium	Blue Wood Aster							blue	blue	
Symphyotrichum undulatum	Wavy-leaved Aster						blue to lilac	blue to lilac	blue to lilac	blue to lilac
Thermopsis villosa	Aaron's-rod			yellow	yellow					
Tiarella cordifolia	Foamflower		white	white						
Trillium luteum	Yellow Trillium		yellow	yellow	yellow					
Vernonia noveboracensis	Ironweed						purple	purple		
Vines										
Aristolochia macrophylla	Dutchman's Pipe			brown	brown					
Clematis virginiana	Virgin's Bower					white	white	white		
Parthenocissus quinquefolia	Virginia Creeper				yellowish-green	yellowish-green				

PLANTS THAT ATTRACT POLLINATORS
FOR THE CENTRAL APPALACHIAN BROADLEAF FOREST

The following chart lists plants that attract pollinators. It is not exhaustive, but provides guidance on where to start. Annuals, herbs, weeds, and cover crops provide food and shelter for pollinators, too.

Botanical Name	Common Name	Color	Height	Flower Season	Sun	Soil	Visitation by Pollinator	Also a host plant
Trees & Shrubs								
Aesculus flava	Yellow Buckeye	yellow	80'+	April	sun to shade	moist, well drained	hummingbirds, bees	X
Alnus serrulata	Tag Alder	brown	12-20'	February-March	sun to partial shade	moist to wet	bees, wind	X
Betula nigra	River Birch	bownish-green	50-75'	March-April	shade to partial shade	moist	wind	X
Calycanthus floridus	Sweet Shrub	red	4-6"	April-May	shade to partial shade	moist	beetles	
Cladrastis kentuckea	Yellow-wood	white	30-50'	April-May	shade to sun	moist	bees, butterflies	
Clethra acuminata	Mountain Pepperbush	white	7-12'	July-August	shade to sun	moist	hummingbirds, butterflies, honeybees	
Cornus alternifolia	Pagoda Dogwood	white	15-25'	May-June	partial shade	moist	butterflies, bees, flies	X
Cornus amomum	Silky Dogwood	white	4-10'	May-June	sun	moist to wet	bees, flies, butterflies	X
Cornus florida	Flowering Dogwood	white	15-30'	April-May	sun to partial shade	moist, well-drained	butterflies, bees, flies	X
Diervilla sessifolia	Southern Bush Honeysuckle	yellow	4-5'	June-August	sun to partial shade	moist	bumblebees, hummingbirds	
Euonymus americanus	Hearts-a-bustin'	greenish-white	3-6'	May-June	shade to partial shade	moist	bees, beetles, flies, ants	X
Halesia tetraptera var. tetraptera	Silverbell	white	30-40'	April-May	shade to sun	moist	butterflies, bees	
Hydrangea arborescens	Smooth Hydrangea	white	4-5'	May-June	shade to partial shade	moist	butterflies, bees	
Hypericum densiflorum	Bushy St. John's-wort	yellow	2-6'	June-August	sun	moist to wet, acidic	bees	
Kalmia latifolia	Mountain Laurel	pale pink	8-20'	May-June	shade to partial shade	dry to moist, well-drained	butterflies, hummingbirds	
Leucothoe fontansiana	Doghobble	white	18-24"	April-May	shade to partial shade	moist	bees, butterflies	
Liriodendron tulipifera	Tulip Poplar	light orange	to 100'	April-May	shade to partial shade	moist	bees	X
Magnolia acuminata	Cucumber Tree	white	60-80'	April-May	sun to shade	moist, calcareous or mafic	bees, beetles	
Oxydendrum arboreum	Sourwood	white	to 50'	June-July	sun to shade	dry to dry-mesic, acidic	bees, butterflies	X
Prunus serotina	Black Cherry	white	60-90'	April-May	shade to sun	moist	butterflies, bees, flies, wasps	X
Rhododendron arborescens	Sweet Azalea	white to pink	8-12'	June-July	sun to partial shade	moist, acidic	butterflies, hummingbirds	X
Rhododendron calendulaceum	Flame Azalea	orange, yellow, reddish-orange	4-8'	May-June	sun to shade	dry to moist, well-drained, acidic	butterflies, hummingbirds	X
Rhododendron carolinianum	Punctatum	pink	3-6'	April-May	sun to partial shade	dry, acidic	hummingbirds, butterflies	
Rhododendron catawbiense	Catawba Rhododendron	red to reddish-pink	6-10'	June	sun to partial shade	moist	hummingbirds, butterflies	
Rhododendron maximum	Great Laurel	white	6-25'	June-July	shade to shade	moist, acidic	hummingbirds, butterflies	
Rhus copallinum var. copallinum	Winged Sumac	greenish-yellow	20-30'	June-July	sun to partial shade	dry	butterflies, wasps, flies, bees	X
Rosa carolina	Carolina Rose	pink	3-6'	May-June	sun to partial shade	moist	bees, flies, beetles	X
Rubus odoratus	Flowering Raspberry	purple-rose	4-6'	June-August	sun to partial shade	moist	butterflies, flies, wasps, bees	
Stewartia ovata	Mountain Camellia	white	10-15'	June-July	shade to partial shade	moist, acidic	beetles, bees, flies	
Viburnum cassinoides	With-rod	white	5-6'	May-June	shade to sun	moist	butterflies	X
Xanthorhiza simplicissima	Yellowroot	purplish-brown	2-3'	March-May	shade to partial shade	moist to wet	bees	
Perennial Flowers								
Actaea racemosa	Black Cohosh	white	36-60"	May-July	shade to partial shade	moist	butterflies, hummingbirds	X
Actaea podocarpa	Yellow Cohosh	white	30-48"	July-Sept	shade to partial shade	moist	butterflies, hummingbirds	X
Aruncus dioicus var. dioicus	Eastern Goatsbeard	white	48-60"	May-June	shade to partial shade	moist	butterflies, bees, beetles	X
Asclepias exaltata	Tall Milkweed	white	36-48"	June-July	shade to partial shade	moist	butterflies, hummingbirds	X

Botanical Name	Common Name	Color	Height	Flower Season	Sun	Soil	Visitation by Pollinator	Also a host plant
Baptisia tinctoria	Yellow Wild indigo	yellow	2-3'	June-July	sun to partial shade	dry	butterflies, bees	X
Chelone lyoni	Appalachian Turtlehead	pink	24-48"	July-August	sun to partial shade	wet to moist	bees, butterflies, hummingbirds	X
Coreopsis pubescens var. pubescens	Hairy Coreopsis	golden-yellow	36-48"	July-Sept	sun to partial shade	dry to dry-mesic	butterflies, beetles, hummingbirds	
Dicentra eximia	Wild Bleeding Heart	rose-pink	12-18"	April-June	shade to partial shade	moist, well-drained, thin	hummingbirds, bees	
Diphylleia cymosa	Umbrella Leaf	white	18-30"	May-June	shade to partial shade	moist to wet	bees, beetles, flies	
Eupatoriadelphus fistulosus	Hollow-stem Joe-pye-weed	lavender pink	3-5'	July-Sept	sun to partial shade	moist to wet	bees, butterflies	X
Eurybia divaricata	White Wood Aster	white with yellow center	24-30"	August-Oct	shade to partial shade	moist	butterflies, bees	X
Galax urceolata	Galax	white	4-6"	May-July	shade to sun	moist to dry	bees, flies	
Gentianella quinquefolia ssp. quinquefolia	Eastern Aqueweed	blue	6-24"	August-Oct	sun to partial shade	dry to moist	bees, flies	
Geranium maculatum	Wild Geranium	pink to rose	18-24"	April-May	shade	moist	butterflies, bees	X
Helianthus atrorubens	Appalachian Sunflower	yellow with purple center	4-7'	July-Sept	sun to partial shade	dry	butterflies, bees	X
Helianthus microcephalus	Small-headed Sunflower	yellow	3-6'	August-Sept	shade to partial shade	moist to dry	bees, bees	X
Heuchera villosa	Rock Alumroot	white	8-24"	July-August	shade to partial shade	dry to moist, well drained thin soils, acidic	hummingbirds, butterflies	
Hexastylis shuttleworthii var. shuttleworthii	Large-flowered Heartleaf	brown	4-6"	May-June	shde	mesic, acidic	beetles, flies	
Iris cristata	Crested Iris	blue	6-10"	April-May	shade to partial shade	moist	hummingbirds, bees	
Liatris scariosa var. scariosa	Northern Blazing-star	rosy-pink	15-24'	August-Sept	sun	dry	butterflies, bees	
Liatris spicata var. spicata	Dense Blazing-star	rosy-pink	20-40'	July-Sept	sun	dry to wet	hummingbirds, butterflies, bees	
Lilium michauxi	Carolina Lily	orange-red with purple spots	30-40"	July-August	partial shade	dry	hummingbirds, butterflies	
Lilium superbum	Turk's-cap Lily	orange to yellow	to 8'	July-August	shade to partial shade	moist to wet	hummingbirds, moths, bees, butterflies	
Lobelia cardinalis	Cardinal Flower	red	36-48"	July-Sept	sun to partial shade	moist to wet	hummingbirds, butterflies, bees	
Lobelia siphilitica	Great Blue Lobelia	blue	24-40"	July-Sept	sun to partial shade	moist to wet	hummingbirds, bees, butterflies	
Monarda didyma	Bee Balm	scarlet red		July-September	sun to partial shade	moist to wet	hummingbirds, butterflies, bees	X
Penstemon canescens	Appalachian Beardtongue	violet	12-30"	May-June	sun to partial shade	dry to dry-mesic	hummingbirds, bees, butterflies	X
Penstemon smallii	Blue Ridge Beardtongue	deep pink to purple	12-24"	May-June	sun to partial shade	dry to dry-mesic	butterflies, bees, hummingbirds	X
Phemeranthus teretifolius	Appalachian Fameflower	pink	8-10"	June-Sept	sun	dry	butterflies	
Phlox divaricata var. divaricata	Eastern Blue Phlox	blue	12-15"	April-May	shade	moist	bees, butterflies	
Phlox stolonifera	Creeping Phlox	blue	6-8"	April-May	shade	moist	bees, butterflies	
Rudbeckia laciniata	Green-headed Coneflower	yellow	48-84"	July-October	sun to partial shade	moist to wet	bees, flies, wasps, butterflies, moths	X
Rudbeckia triloba	Brown-eyed Susan	yellow	24-42"	July-September	sun to partial shade	dry to moist	bees, flies, wasps, butterflies, moths, beetles	X
Sanguinaria canadensis	Bloodroot	white	6-12"	March-April	shade	moist	bees, beetles, flies	
Sedum glaucophyllum	Cliff Stonecrop	white	2-4"	May-June	partial shade	moist	butterflies	
Sedum telephioides	Appalachian Live-forever	pink	18"	July-Sept	sun	dry	butterflies	
Silene virginica	Fire Pink	red	8-12"	May-July	sun to partial shade	moist	hummingbirds, flies, bees, butterflies	
Solidago curtisii	Curtis's Goldenrod	yellow	1-2'	Aug-Oct	shade to partial shade	moist	butterflies, beetles, bees	X
Solidago roanensis	Roan Mt. Goldenrod	yellow	8-15"	July-Sept	sun	dry	butterflies, beetles, bees	X
Symphyotrichum cordifolium	Blue Wood Aster	blue	2-3'	Sept-Oct	shade to partial shade	moist	butterflies, bees, wasps, flies, beetles	X
Symphyotrichum undulatum	Wavy-leaved Aster	blue to lilac	3-4'	Aug-Nov	sun to partial shade	dry	butterflies, bees	X
Thermopsis villosa	Aaron's-rod	yellow	3-7'	May-June	sun to partial shade	dry to moist	butterflies	
Tiarella cordifolia	Foamflower	white		April-May	shade		butterflies, bees	
Trillium luteum	Yellow Trillium	yellow	4-12"	April-June	shade, higher calcium	moist	bees, beetles	X
Vernonia noveboracensis	Ironweed	purple	3-7'	August-Sept	sun to partial shade	moist to wet	butterflies, honeybees	X
Vines								
Aristolochia macrophylla	Dutchman's Pipe	brown	15-30'	May-June	shade to partial shade	moist	flies	X
Clematis virginiana	Virgin's Bower	white	to 30'	July-Sept	sun to shade	moist	butterflies, bees, wasps	
Parthenocissus quinquefolia	Virginia Creeper	yellowish-green	30-45'	June-July	sun to partial shade	moist	bees	X

HABITAT REQUIREMENTS FOR BEE-POLLINATED GARDEN FLOWERS AND CROPS

	Bumble	Digger	Lg Carpenter	Sm Carpenter	Squash/ Gourd	Leafcutter	Mason	Sweat	Plasterer	Yellow-faced	Andrenid
FLOWERS											
Catalpa			x								
Catnip	x	x					x				
Clover		x									x
Columbine	x										
Cow parsley										x	
Goldenrod	x	x				x		x			
Impatiens	x										
Irises	x		x								
Lavender	x	x	x			x					
Milkwort								x			
Morning glory				x							
Penstemon	x	x					x				
Passion flowers			x								
Phacelia	x	x		x		x	x	x	x		x
Potentilla										x	
Rose	x		x				x	x		x	
Salvia	x	x	x			x	x				
Saxifrages								x		x	
Sorrel				x							
Sunflowers	x	x	x	x		x		x	x		x
Violet								x			x
Wild Mustard		x							x		
Willow catkins									x		x
CROPS											
Almond	x						x				x
Apple							x				
Blueberry	x	x									x
Cherry							x				x
Eggplant	x		x					x			
Gooseberry	x										x
Legumes	x	x				x		x			
Water melon	x							x			
Squash/ Pumpkins/ Gourds			x		x						
Tomatoes	x	x	x					x			
Thyme	x	x					x	x		x	

HABITAT AND NESTING REQUIREMENTS:

Bumble Bees:
Abandoned mouse nests, other rodent burrows, upside down flower pots, under boards, and other human-made cavities. Colonies are founded by a queen in the spring and don't die out in the fall. New queens mate then and overwinter in a sort of hibernation. Bumble bees are usually active during the morning hours and forage at colder temperatures than honey bees, even flying in light rain.

Large carpenter bees:
Soft dead wood, poplar, cottonwood or willow trunks and limbs, structural timbers including redwood. Depending on the species, there may be one or two brood cycles per year. These bees can be active all day even in the hottest weather.

Digger bees:
Sandy soil, compacted soils, bank sides. Anthophorid bees (now in the Apidae) are usually active in the morning hours, but can be seen at other times.

Small carpenter bees:
Pithy stems including roses and blackberry canes. These bees are more active in the morning but can be found at other times.

Squash and Gourd bees:
Sandy soil, may nest in gardens (where pumpkins, squash and gourds are grown) or pathways. These bees are early risers and can be found in pumpkin patches before dawn. Males often sleep in the wilted flowers.

Leafcutter bees:
Pre-existing circular tunnels of various diameters in dead but sound wood created by emerging beetles, some nest in the ground. Leave dead limbs and trees to support not just pollinators but other wildlife. Leafcutter bees can be seen foraging throughout the day even in hot weather.

Mason bees:
Pre-existing tunnels, various diameters in dead wood made by emerging beetles, or human-made nesting substrates, drilled wood boards, paper soda straws inserted into cans attached to buildings. Mason bees are generally more active in the morning hours.

Sweat bees:
Bare ground, compacted soil, sunny areas not covered by vegetation. Like most bees, sweat bees forage for pollen earlier in the morning and then for nectar later.

Plasterer or cellophane bees:
Bare ground, banks or cliffs. Colletid bees can be active in the morning or later in the day.

Yellow-faced bees:
In dead stems. These bees are more active during morning hours.

Andrenid bees:
Sunny, bare ground, sand soil, under leaf litter or in soil in banksides and cliffs. These generally spring-active bees are most commonly seen on flowers during the morning when pollen and nectar resources are abundant.

"MONARCH BUTTERFLIES NEVER FAIL TO CATCH THE VISITOR'S EYE AND ALWAYS LEAD TO A TEACHABLE MOMENT."

-- LOGAN LEE,
PRAIRIE SUPERVISOR
MIDEWIN NATIONAL
TALLGRASS PRAIRIE

A BASIC CHECKLIST

BECOME FAMILIAR WITH POLLINATORS IN YOUR LANDSCAPE.

- Watch for activity throughout the day and the seasons.
- Keep a simple notebook of when and what comes to your garden. NOTE: It is not necessary to identify each species when you first get started. Simply note if it is a bee that likes the yellow flower that blooms in the fall.
- Consult a local field guide or web site when you are ready to learn more details.

ADD NATIVE PLANTS TO ATTRACT MORE NATIVE POLLINATORS.

- List the plants you currently have in your landscape.
- Determine when you need additional flowers to provide nectar and pollen throughout the growing season.
- Add plants that provide additional seasons of bloom, create variable heights for shelter, and attract the types of pollinators you want.
- Don't forget to include host plants that provide food and shelter for larval development.
- Contact your local native plant society or extension agent for more help.

USE POLLINATOR FRIENDLY LANDSCAPE PRACTICES TO SUPPORT THE POLLINATORS YOU ATTRACT.

- Use Integrated Pest Management Practices to address pest concerns.
- Tolerate a little mess – leave dead snags and leaf litter, keep areas bare for ground nesting insects, and leave some weeds that provide food for pollinators.
- Provide safe access to clean water.

NOTICE THE CHANGES THAT YOU HAVE HELPED TO CREATE!

RESOURCES

Many books, websites, and people were consulted to gather information for this guide. Use this list as a starting point to learn more about pollinators and plants in your area.

BAILEY'S ECOREGION MAPS

USDA Forest Service
http://www.fs.fed.us/land/ecosysmgmt/ecoreg1_home.html

POLLINATION/POLLINATORS

Pollinator Partnership
www.pollinator.org

Coevolution Institute
www.coevolution.org

Natural Resources Conservation Service
www.nrcs.usda.gov

North American Pollinator Protection Campaign
www.nappc.org

USDA Forest Service
www.fs.fed.us/wildflowers/pollinators/

Wild Farm Alliance
www.wildfarmalliance.org

The Xerces Society
www.xerces.org

Illinois Natural History Survey
www.inhs.uiuc.edu

Buchmann, S.L. and G.P. Nabhan. 1997. *The Forgotten Pollinators* Island Press: Washington, DC.

Committee on the Status of Pollinators in North America. 2007. *Status of Pollinators in North America* The National Academies Press: Washington, DC.

NATIVE PLANTS

Plant Conservation Alliance
www.nps.gov/plants

Seeds of Success
www.nps.gov/plants/sos

Lady Bird Johnson Wildflower Center
www.wildflower.org/plants/

USDA Hardiness Zone Map
www.usna.usda/Hardzone/

U.S. National Arboretum
www.usna.usda.gov/Hardzone/ushzmap.html

USDA, NRCS. 2007. The PLANTS Database
www.plants.usda.gov, 19 July, 2007
National Plant Data Center,
Baton Rouge, LA 70874-4490 USA

NATIVE BEES

National Sustainable Information Service
"Alternative Pollinators: Native Bees" by Lane Greer, NCAT Agriculture Specialist, Published 1999, ATTRA Publication #IP126
www.attra.ncat.org/attra-pub/nativebee.html

Agriculture Research Service
Plants Attractive to Native Bees table
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BUTTERFLIES AND MOTHS

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North American Buterfly Association
www.naba.org

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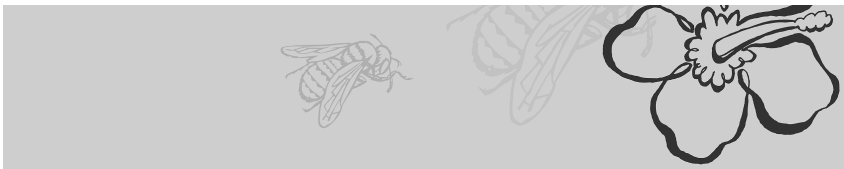

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EXHIBIT 4

NAPPC Honeybee Health Task Force [1]

Current Research Projects

- **Effects of miticide and Fumagilin-B® on honey bee survivorship and immune responses**
  Catherine M Little, M.Sc. candidate, Acadia University

Western honey bees (*Apis mellifera*) are exposed to a number of parasites. *Varroa destructor*, *Nosema apis*, and *N. ceranae* have particularly detrimental effects on colony productivity and survival. We will measure honey bee immune responses to infection by each of these three species of parasites and the effects of co-infection. We will then compare the results of infection with the effects of miticide and Fumagilin-B® use on honey bee physiology. Quantification of immune trade-offs which occur during infection by multiple parasites and the effects of standard chemical treatments may enable us to determine infection threshold levels for effective use of chemical treatments, thereby reducing the risk of chemical resistance developing in either *Varroa* or *Nosema*We will also determine if immune protein concentrations resulting from parasitic infection are predictive of honey bee survival, potentially leading to a means of assessing mortality risk during preparations for over-wintering honey bee colonies.

- **Assessment of Sublethal Effects of Imidacloprid on Honey Bee and Colony Health**.
  Galen P. Dively and Mike Embrey, Department of Entomology, University of Maryland

While the extent and causes of CCD are unknown, many believe that honey bees have reached a tipping point wherein the colony can no longer protect itself from a barrage of problems. The CCD Working Group developed an action plan of research that addresses four categories of factors that impact bee and colony health: 1) new or re-emerging pathogens; 2) bee pests; 3) environmental and nutritional stresses; and 4) pesticides. This project will address the latter category and examine the sublethal effects of pesticides, which is one of the priority areas identified by the HBHI Task Force for funding.

- **Nutritional Effects on Intestinal Health and Longevity of Honey bee Workers**
  Olav Rueppell, Dept. of Biology, University of North Carolina at Greensboro

This research project seeks to identify the effects of diet quality and malnutrition on the health of the honey bee worker intestine, as assessed by the activity of their intestinal stem cells. The intestinal epithelium is crucial to organismal health and it is one of the most exposed tissues in the animal body. Its cells are continuously replaced in a wide variety of organisms (Finch and Kirkwood 2000). Although early reports on proliferative cells in the intestine of insects exist (Snodgrass 1956), these cells have only recently been characterized as bona-fide stem cells in adults through molecular analyses in *Drosophila* (Micchelli and Perrimon 2006; Ohlstein and Spradling 2006). A certain level of cell proliferation is necessary to maintain a functional intestine, even in the adult insect. Thus, the activity of these cells has been linked to insect

[1] http://www.pollinator.org/honeybee_health.htm.

growth (Hakim et al. 2007) and they are responsive to toxin exposure (Loeb et al. 2001; Gregorc et al. 2004).

Furthermore, their rate of cell proliferation is positively correlated with food quality (Zudaire et al. 2004). Thus, the proliferative activity of intestinal stem cells may be an indicator of malnutrition with direct relevance to bee health.

- **Diagnostic gene panel for honey bee breeding and disease management**
  Jay D. Evans and Yanping Chen, USDA-ARS Bee Research Laboratory

Honey bees face numerous challenges, from nutritional stress to dedicated parasites and pathogens. A long-term goal of bee research is to develop and maintain honey bee lines that are resistant to disease, and that thrive with a minimum of chemical treatment of disease agents. New molecular-genetic tools can aid research on breedable traits, and, ultimately, these tools could be used directly by commercial bee breeders or others in the private sector. Beekeepers also rely on disease indicators and established thresholds while making management decisions. Such decisions could also be helped by genetic indicators for pests and for bee health. This gene panel would differ from previous entries into disease forensics (e.g., Evans, 2006) by including only the most informative markers, alongside reportable diseases found in bee colonies. In so doing, the panel can be cheaply applied to bee problems, and can also be 'exported' to future technologies for bee diagnostics and genetic research.

- **The Benefits of Propolis to the Immune System of Honey Bees**
  Marla Spivak, Dept Entomology, University of Minnesota

We have initiated a comprehensive line of research in my lab on the benefits of propolis collection to the immune system of honey bees. Propolis is a resin secreted by some plants that honey bees collect and deposit in the nest. Propolis has important antimicrobial value to humans, but its value to the bees is not known. Here I am requesting funds to test if colonies selectively bred for high- and lowpropolis collection differ in immune-related gene transcript levels. The applied goals of this research are to promote the natural immune defenses of honey bees and to promote the human use of propolis as an antimicrobial value-added product from the beehive.

- **Enabling genetic selection for resistance to viral pathogens: Developing a rapid and inexpensive cytometric method for screening honey bees for viral resistance.** Dr. J. Spencer Johnston, Department of Entomology, Texas A&M University-[*Funded by Dr. Peter Swift, GDS Legacy Foundation and Reid and Margaret E. Dennis*]

Preliminary evidence suggests that honey bee strains are more resistant to IAPV than honey bee lines from other sources. We propose to use quantitative PCR, flow cytometry and direct monitoring of colony health to rapidly compare changes in blood cells number, pathogen titre and colony level response. We hypothesize that it will be possible to use flow cytometry to distinguish resistant bees from susceptible bees and evaluate the efficacy or extent of immune

response to viral infection. If we are correct, then the results of the flow cytometry experiments could be used (in the place of more time consuming and expensive field trials) to quickly assess the presence or absence of viral resistance in aid of breeding programs to develop or propagate virus resistant honey bees.

Perhaps more importantly, flow cytometry should reveal whether differential immune responses correlate with virus resistant phenotypes, offering clues to some mechanisms of viral resistance.

- **Changes in hormonal and protein levels in honey bees that are experiencing migratory transportation.** Zachary Huang, Department of Entomology, Michigan State University

Aside from pesticides, perhaps the strongest stress honey bees experience comes from long distance transportation, commonly used for pollination purposes. For example, bees can transported from Maine to California, across four different time zones. No studies have ever been conducted to determine the physiological or behavioral changes induced by such stress. In this study, I propose to piggyback with Dr. Jeff Pettis's group to obtain data on physiological changes in honey bees that are experiencing migratory transportation. The objectives of this study is to 1) measure changes in juvenile hormones in bees that are being transported from Florida to California, and 2) determine the protein nutrition of the same bees. Proper control will be obtained from bees which are staying in Florida. *Update 5/19/08***:** We are currently measuring the hormone levels in groups of bees in Bakersfield, CA and Boston, GA. We still have to thaw the bees and bleed them for the CA samples. We might do a third trial if we see something interesting.

Honeybee Health Improvement Task Force Members

- Laurie Davies Adams, Pollinator Partnership/NAPPC
- May Berenbaum, University of Illinois
- Nicholas Calderone, Cornell University
- Dewey Caron, University of Delaware
- Christine Elsik Georgetown University
- Wayne Esaias, Oceanographer
- Diana Cox Foster, Penn State University
- Christina Grozinger, North Carolina State University (Co-Chair)
- G. W. (Jerry) Hayes, Apiary Inspectors of America
- Douglas Holy, USDA, Natural Resources Conservation Service
- Eric Mussen, University of California-Davis
- Jeff Pettis, Research Leader, USDA-ARS Bee Research Lab
- Gene Robinson, University of Illinois
- Colin Stewart, USDA APHIS PPQ
- Barry H. Thompson, Thompson Apiaries, LLC (Co-Chair)
- Daniel Weaver, Bee Weaver Apiaries, Inc. (Co-Chair)
- Wayne Wehling, USDA APHIS PPQ

The CHAIRMAN. Thank you very much, Ms. Davies Adams. You had mentioned that you wanted to share something with us right after your testimony. Do you want to do that at this time?

Ms. DAVIES ADAMS. Yes. If you go to *pollinator.org,* you will see this page. If you go to the next page, if you were to go up to the corner where the ecoregional guides are, you would go to a page that then asks you if you already know your ecoregion, you can get the guide for free, but you can also type in your ZIP Code and find your ecoregion. It will connect you to a map. This, for example, is a map that includes this area but it also shows you your total ecoregion. I actually have your ecoregion, Chairman. I can identify it for you but that guide is not coming until our next round. You are in the California dry step province.

But I think what is interesting is, this is a new way for people to actually look at where they live. A lot of people say, think global, act local. Local really means your habitat. It really means a natural system of which you are a part along with plants and animals, so this is a system we hope everyone will take advantage of.

The CHAIRMAN. Thank you. I couldn't agree more.

Mr. Godlin, I want to start by asking you a question. Concerns continue to be raised over the impact of agricultural pesticides on honey bee populations. In the March 2007 hearing of this Committee, we asked those questions, and my experience has been that farmers and ranchers are generally incredibly wise users of agricultural pesticides. In fact, there are two reasons. First of all, they know the impacts of those pesticides and they want to be judicious in their application, and second of all, pesticides cost dollars, and they don't want to apply any more and increase their cost any more than necessary. So generally I found that farmers are very responsible users of pesticides, and follow the label directions on pesticides that have impacts on these practices to minimize those effects, is my understanding. Yet concern over the role of pesticides continues to appear. Many of you mentioned it in your testimony today. We have heard it several times. I would like for each of you to discuss as you are capable of in greater detail your perspective on pesticide use *vis-à-vis* this problem, and as I asked last year, is labeling the problem, is it an education problem, does EPA need to reassess its methodology for registering pesticides in view of what has been claimed to be potentially lethal and sublethal effects on the bee population. We will start with you, Mr. Godlin, and then we will go down in the same order as you originally testified.

Mr. GODLIN. Thank you. It is true that they don't want to apply anything they don't need to, and———

The CHAIRMAN. That being farmers?

Mr. GODLIN. Farmers, and we are, as I said, we rent bees for almonds and we rent bees for seed alfalfa on the J.G. Boswell Company. They spray us. We know they are going to spray us. I don't put that many hives in that contract for that reason, but we always had a relationship with that company forever. They have tried very hard not to kill bees. They have worked on a number of concoctions trying to do as little damage as they can, and yet still protect their crop. Other crops that we sit around are corn, alfalfa and cotton, and again, these are places where I am sitting to try to benefit my bees with pollen and nectar, and farmers don't grow crops for bees,

they grow crops to sell to make money, and I am a guest. I pay them honey. I give them whiskey at Christmas. I am their best friend, and I am registering with the counties for pesticide notification so I can either move the bees out or not go, and we do have registration and pesticide notification that has been very helpful. But again, I am not going to tell that man, hey, you can't spray your crop. I am gone. He is going to say "What? You know, I am not growing this for you," and this is the problem is, we don't have a way to—I have to take the hit or not go, and if I don't go, I am sitting on what we call fencepost honey or dirt clod honey and those don't exist, so I am kind of forced to go to these locations year after year. Some years are worse than others. Some years, bug pressure is not bad, we don't have a problem. Other years, it is terrible and we are forced to pull out, give up, get out, it is bad, don't go. But we go to these growers with our hat in our hand to ask for these locations, and that is the problem. We don't have the authority or the right to tell these guys what to do with their crop.

The CHAIRMAN. We understand that. Let me ask a follow-up. With regard to, you were talking about one farmer that you still provide your bees to, you know they are going to spray. Have you seen significant detrimental effects post spray in those areas? Is that something that———

Mr. GODLIN. Sometimes.

The CHAIRMAN. Sometimes? So it may not be the cause all the time?

Mr. GODLIN. No, I don't think so. I know that they keep working on better and better materials, like the imidacloprid to get rid of the organophosphates that everybody knows are harmful. But as far as the labeling and things, I am not a scientist. I am not a spray guy. I just know that I think progress is being made, but it is terribly slow.

The CHAIRMAN. Thank you. Anyone else want to comment on this question? Yes, let us go on the order. Mr. Mendes.

Mr. MENDES. I think it is important to say that we are really not talking about misuse of pesticides. Certainly that could happen but that is not our concern right now. I have been in the pollination business 30 years. I work with 200 cranberry growers. I work with vine crops in Florida. Growers are responsible for the most part. You get an exception once in a while, but that is not my experience at all. Growers aren't the problem. The mode of action of the products that we are concerned with now has changed and the regulation has not kept up with it. The way that pesticides are regulated under EPA right now is a system called LD50s. It is a lethal dose that it kills a certain percentage of the bees, and the new products that we are concerned about have very low toxicity to adult bees. That is not our concern. We have dealt with that over the years. You get a bee kill, you get a lot of dead bees on the ground, you know what you hit, you know what happened, you move on with that, and I think that is what Steve was talking about.

But what has happened now, these new products, these systemics, they can be applied to the soil, they can be applied foliarly, they can be seed treated on corn, for instance. Corn is coming up everywhere. The price of corn is sky high. People that have had problems in the Midwest in the last 2 years, they planted corn

near their bee yards, all of a sudden their bees are coming apart and they don't come apart right away. The way these products work is, it does not kill the adult bees. The bees come back to the hive, it goes into the pollen. They feed that pollen to the bees in the developmental stages and it affects the nervous system of the bees. The reason we know this is, if you read the research on how these products are used in a normal way to treat termites, this is what they say, that it affects feeding behavior, it affects the immune system of the insect and it creates memory loss. That is what we are seeing in our hives. If you want to understand CCD, the frustrating thing is that the cause and effect seem separate. You could be exposed in March or April and your bees look fine through the summer. Come October, first little bit of cold snap or first time when there is no food coming into the hive, they are coming apart, or even in January they are coming apart. So the whole mode of action has changed.

So it is not a misuse. The farmers aren't the problem. It is the products that they have to work with, and the difficulty right now is these new products are the wave of the future. I talked to my blueberry growers, I talk to my cranberry growers. They are pulling the organophosphates and they are replacing them with these products and it is scaring me to death because I can't—I don't even know when I am hit. It has made the bees sick and you can't fix that once it is inside the hive. So it is a very different process than what we have dealt with in the past.

The CHAIRMAN. Thank you, sir.

Anyone else want to speak specifically to this? Let us go in order. Mr. Edwards.

Mr. EDWARDS. Yes. Thank you, Mr. Chairman. I would just like to say that I agree with Mr. Mendes that the farmers are going to use what they have available to them. Now, what tests the EPA are conducting with regard to the honey bees, we can't control that. Obviously it is a concern for us. We want to use these products as a tool, and in the most cost-effective and safe way as possible for the environment and for us.

One thing I think we need to be aware of, I think that a problem of this magnitude and what we are seeing happen to the honey bee in general, I think it is going to be like any other disaster. There is no one cause. I think at the end of the day when we figure this out, if it is tomorrow or if it is 15 years from now, it is going to be a multipronged issue that has several variations of problems to it. I think pesticides can be the easy scapegoat right now in the early stages and I will just push for more testing, more research, and that is definitely what we need at the university level because the first thing, pesticides cause everything from cancer to baldness, just the first thing you shoot off the hip from, and I think we need to be very careful, but we do need to address the issue.

The CHAIRMAN. Yes, I agree with you, sir, because it seems a little bit fishy to me. I don't dispute at all what Mr. Mendes says. I believe———

Mr. EDWARDS. And neither do I.

The CHAIRMAN.—it is very plausible. But on the other hand, you are seeing wild bees be affected. You are seeing bees being affected in other countries that wouldn't have access to those products. So

the fact that this is global in nature lends itself to the belief that there may be multiple causes, or there may be one cause that is affecting us that we haven't figured out yet. It could be just bees are made weaker by a combination of all these factors and then they are being more susceptible to diseases that then get spread through global transportation methods that are now being employed.

Mr. Flanagan, then Ms. Davies Adams.

Mr. FLANAGAN. Thank you, Chairman Cardoza. One quick comment. I have been in agriculture a long time and I am a believer in the benefits of the Clean Water Act and the Federal Insecticide, Fungicide and Rodenticide Act. Those two Acts came out of a crisis of the 1960s and I think it produced the safest food supply in the world and some of the best turnarounds in water quality possible.

So having said that though, I think in the beekeeping world, the CEO of a beekeeping company is the same guy that drives the truck up to your land, that puts the bees out, that watches them. So, when these guys give anecdotal evidence about what they are seeing, that is the essential common sense of the matter and I think what it has caused us to wonder at Wyman's is about the Federal Insecticide, Fungicide and Rodenticide Act and the EPA that governs it, maybe we should review how the practices are done. What they have observed does make you wonder about the impact, the growing impact of our chemicals. All of us are certainly motivated to use less and less chemicals, both from our customer base and from our own cost profiles, but we need some of them, yet then we listen to the stories of these fellows and we think we have to step back and take a look at the whole rulemaking process, I believe.

The CHAIRMAN. Thank you.

Ms. Davies Adams, the last person to come in on this question.

Ms. DAVIES ADAMS. This will be a quick recap of answering some of your questions. You asked about labeling. Yes, it is an issue. We need to work on more effective, easier to read, and easier to understand labels. We also need to think about multiple exposures. This is part of what the reality of the world is now. We need to also look at the mix and the combination of chemicals which are creating exposures. We also need to look at sublethal effects, which currently we don't look at, that is an easy thing to add, and long-term effects. Part of this is regulatory, part of this is monitoring, but we also need to look at the applicator certification programs state by state.

The CHAIRMAN. Thank you.

Mr. Mendes, I have a couple questions for you. You make reference to regulatory action in Germany and France. This is sort of a follow-up on the pesticide question. You make reference to regulatory action in Germany and France to restrict certain systemic pesticides. It is my understanding that European beekeepers are still suffering significant and nearly the same losses, if not more, despite these regulatory actions, and that the German decision was based on the action of a type of European planting equipment on the seed coating containing the pesticide rather than the misuse of the pesticide itself, as we were talking about earlier. Do you have any specific information on general health and condition of European bees that you can help us with? It is my understanding that

there have been no specific reports of significant honey bee incidents in the United States associated with the material that is in question in Germany, which is, as I understand it, clothianidin, which trade name is Poncho. So if you can———

Mr. MENDES. Sure. The situation in France was interesting. I will try to do this briefly. They did pull one particular product off for one particular crop. They couldn't use imidacloprid on sunflowers. Well, what they replaced it with was the same basic type of product so they said well, we pulled the product and nothing improved but that really wasn't a step ahead, and that is an ongoing issue.

The CHAIRMAN. You have to throw that question out is what you are saying. You can't say that———

Mr. MENDES. Well, you pull the imidacloprid and you replaced it with fipronil so they both have a similar mode of action. So, to say why didn't it fix the problem, that is one thing that you put another product that had a similar mode of action. The second thing is, these products do stay in the soil. We know they are persistent in the soil. I don't have to say "we think." We know they are persistent in the soil. Some of our early information in looking at this issue came from Canada, where they would use soil applications on potatoes. Bees don't work potatoes at all. They would put a soil application. The following year, they would rotate and put a cover crop of clover, and the bees would die from the clover a year later because this stuff stays in the soil for a long time. We know it stays there for a long time. The residuals are a big issue in all of this. Anything that is applied is there for a long time, very different than contact killers that once they are dry no longer are as much of a problem.

As far as in this country, Poncho is used. I don't believe you cannot purchase any good quality corn seed in this country that is not seed treated. The folks that are getting hit really bad right now are in areas where there hasn't been corn traditionally. They have bought either CRP land or land that was on other crops to switch over to corn. This happened last summer. In the fall, the bees are coming apart. So these products are used here. It hasn't been documented because the cause and effect isn't clearly understood. There are a lot of beekeepers. This is not generally understood in the beekeeping world. Dave Hackenberg and I have started right from the beginning on this and we have done a lot of research, and I would love to have the data to either prove or disprove. That is really what we are asking is, give us the ability to collect the data. If we are wrong, nobody is going to be happier than us because this is such a big issue that it would be wonderful if this was just a specific bee virus that is causing this problem. We just don't see that happening.

And what I will add in, this is anecdotal but my own experience and experience of several beekeepers is, you bring your bees to an area where these products are being used. Several months later, they are collapsing. The bees that you left in the woods far away from those crops, they are just fine, and this has happened for 2 years now. Anything that is exposed, several months later, those bees are no good. The bees that stayed away from it, same manage-

ment practices, those are fine. But you can't change regulation with that kind of information.

The CHAIRMAN. Correct. I understand that. Thank you.

Let me follow up just briefly. Is there anyone here who uses their bees to pollinate organic crops? There are two names for this Committee. It is Horticulture and Organics. Organics are a growing area. It would make sense if what you say is correct that the organic fields wouldn't have the same cause. Now, they could be next to a field that has some other products so that can't be a direct necessary link but does anyone want to speak to that question?

Mr. MENDES. Sure. I work with a couple of organic farms in Florida that grow vegetables, but they are adjacent to orange groves or something else where the bees are exposed and organic agriculture in this country is in small pockets. It is not widespread enough. And in my case, I pick up the bees and I move them. I take them to blueberries, I take them to cranberries, and so———

The CHAIRMAN. You can't speak to the specific exposures?

Mr. MENDES. No, not at all.

The CHAIRMAN. Okay. Thank you. That question didn't help us very much then. Mr. Mendes, I am going to follow up with you one more time, and that is, has the ABF conducted any assessment of the potential effects on the recent floods in the Midwest and the fires in the Southeast and in California, what those calamities might mean to bee production and your industry?

Mr. MENDES. Well, we are farmers. I mean, we are subject to weather. Anybody who is in those areas certainly is devastated. It is more common to have problems with drought. I mean, we have had drought in several parts of the country for the last couple of years, California last summer. I mean, any weather-related incident is certainly going to affect beekeepers as much as anything, so the floods, the droughts, whatever we have is going to hurt things. The problem the industry is having is, we are in a weakened position already, so any additional damage is going to show up more.

The CHAIRMAN. Thank you.

Ms. Pien, can you tell us how your company began identifying pollinator health as an economic issue rather than simply as a marketing issue and that type of question?

Ms. PIEN. Yes. We first discovered issues through reports from *The New York Times* and CBS's *60 Minutes,* and when we learned that honey bees are responsible for one out of every 3 bites that the Americans take, we felt compelled to leverage really the passion that consumers have for Häagen-Dazs ice cream to help draw attention to this crisis. You know, as I have spoken out, we did a survey and more than half of Americans aren't even aware of the honey bee crisis, and given that this crisis impacts every one of us who cares about the food that we put into our mouths, we felt like this is an issue that we had to get involved in and help address and proactively take action towards.

The CHAIRMAN. Thank you.

Mr. Replogle, does your company own any of its own hives or do you just purchase the products that you put into your own products, purchase the ingredients, and how does your company view its support for the Pollinator Partnership long term, and what were

the decisions that led you to support the program for a second year?

Mr. REPLOGLE. Very good question. Currently, we do not have our own hives although our roots are from a beekeeper. Burt and Roxanne, the founders of our company, Burt is a beekeeper. In fact, I spoke to him on the way here this morning, and he is very passionate about this issue, as a beekeeper would be, and he believes that that has to be the force of business is to protect well-being. Our company's mission is to make people's lives better every day naturally, and this is a fundamental issue that goes back to the roots of our business, back to Burt as a beekeeper, and so today actually we source all of the bee byproducts from others. We do not have any of our own hives today but we are advised and guided by our legacy and by Burt, who is and has been an active beekeeper.

The CHAIRMAN. Thank you.

Ms. Davies Adams, thank you for your testimony today. I appreciate it. Can you tell us more about the process used by the Pollinator Partnership in deciding which proposals are funded?

Ms. DAVIES ADAMS. We have a Honey Bee Health Improvement Committee that has a distinguished list of scientists, all of whom are listed in my written testimony, but they include the chair of the National Academy of Sciences study, May Barenbaum, Nick Calderone, Gene Robinson, a number of distinguished scientists who are already engaged, including ARS scientists. We put a Request for Proposals out to the scientific community and we received 22 proposals. We had a review committee consisting of bee scientists who evaluated them and determined a ranking for each of the proposals, and we then funded the number of proposals that we had money for. Those that we thought were extremely important and vital, we went out and looked for money for and we actually received funding not just from our corporate partners but from an oncologist in Vermont, from a 4th-grade class in California. We have sought more funding because there were so many proposals that we felt were worthy.

The CHAIRMAN. It really is amazing, the passion, when you talk about that 4th-grade class and others, the passion that has been brought to this issue from the grassroots and just concern by the public at large has been remarkable. I had interviews with a number of news media groups from all other the world including the BBC just last month, so I am very familiar with what you speak.

That was my last question. I am going to turn it over now to Mr. Etheridge, who has a series of questions. Mr. Etheridge, the floor is yours.

Mr. ETHERIDGE. Thank you, Mr. Chairman. Let me first apologize to our panelists. I had a bill on the floor and I couldn't be in two places at once, and we have a fairly important piece of legislation dealing with the CFTC and all the issues surrounding the issues we worry about today. So thank you, and I am sorry I wasn't here, and if you have answered any of these questions when I get to them, just let me know and I will move to my next question.

Mr. Replogle, it really is good to see another North Carolinian here today, so thank you for being here.

Mr. REPLOGLE. Thank you, sir.

Mr. ETHERIDGE. And I would venture to say with 400 people that drive in from a pretty good distance, and I would almost guess some of them live in my district, so I am going to take that as a yes anyway. But I don't think you mentioned this in your testimony, but my question has to do with, has the CCD problem and the shortage of bees that it is creating thus far had an economic impact of significance on your business because you indicated you have no bees but you buy your wax from producers. So it stands to reason that you have a loss of hives across the country. You have to be expanding your area of where you are purchasing your materials.

Mr. REPLOGLE. That is right. It goes back to simple supply and demand. We have a demand for direct pollinated products. Sixty percent of our products use ingredients that are linked to pollination by bees and another 40 percent of our products use direct byproduct, wax, beeswax or honey. And therefore our supply being curtailed and as we heard today in testimony, the crop yield shrinking or the ability to plant more crops being impacted by the plight of the honey bee is certainly increasing the cost of our raw material ingredients, our natural ingredients. So far we have been successfully able to offset those costs by efficiencies in our business, but along with other price increases and cost increases in our business, it is putting a strain on our business, on our well-being and on the choices we make every day in terms of the well-being of our employees. So to continue to thrive and grow in the Tarheel State, we need to have a national solution to the honey bee crisis so that further detriment to the crops, and therefore the costs of doing business, not only for Burt's Bees but for the $4 billion natural personal care industry and the wider $50 billion personal care business is not impacted.

Mr. ETHERIDGE. Thank you. I think a lot of folks don't really think about this sometimes. They think it is truly an agricultural piece or a piece dealing with one segment but I think your point and each one of you made this indirectly, we are all linked together in this thing and it is more fragile than we want to admit where we are on this planet and our food supply is a part of that.

Mr. Godlin, we hear more and more and we have heard testimony about how it is becoming imperative that bees have to travel greater distances simply because of the problems we face. My question to you is, not knowing a lot about it, can you tell us how well bees adapt to the travel, and also both moving from field to field and from, I guess at the same time, from one part of the country to another, from one environment to another, with humidity, high temperatures, cooler temperatures, what kind of impact———

Mr. GODLIN. It is a very precarious job. It is a very precarious job. You have to have good operators. You know, we contract all the interstate stuff from the Dakotas and Minnesota. All those bees are hired trucks. We just run our own trucks within the state, 22-foot flatbeds, and we move them at night. You can't stop.

Mr. ETHERIDGE. Why not?

Mr. GODLIN. Well, the bees come home. The bees come home in the evening every night. All the foragers come in, get into the hives. You load them on the truck in the evening and move them to where you are going to go and unload them in the morning or

in the middle of the night. It depends on the pressures to get it done. And the interstate trucking is that you have to have them netted and certain times of the year you can cook them. You can literally cook these bees, just like cattle. You have to———

Mr. ETHERIDGE. Tell us what you mean when you say "cook them."

Mr. GODLIN. Kill them. Overheat. You have to hose them down———

Mr. ETHERIDGE. I understand that, but we have cameras in the room and———

Mr. GODLIN. You have to hose them down and keep them cold and you have to run that truck all day long and fuel up at night and you have to plan your stops. It is pretty much a 3-day run, and you have to be diligent to do it right. You know, I have heard horror stories of guys unhooking in Vegas and taking off with the tractor and there sat the bees in the parking lot, crazy stuff. But it is a dangerous, delicate job that we just try to keep a low profile on. We don't want people to know that when you are driving down I-5 through L.A. that, you got a load of dynamite on your truck there.

Mr. ETHERIDGE. Thank you, sir.

Mr. GODLIN. There you are.

Mr. ETHERIDGE. Mr. Edwards, let me also thank you for taking time. I know how busy things are on the farm right now, especially in North Carolina and I assume it is true in most of the country. And I think we all know just how serious this problem has become, and I don't think there is any question the need for research is critical. I think this Committee knows that and certainly the Chairman does and he has pushed hard for it in the farm bill we passed and he is now talking about doing more. I think that is appropriate, given where we are with this situation. But you made a point I think we need to hear again about helping out the beekeepers who are on the verge of going out of business, because once they are gone, we are really going to be in a bind. All of us are going to have a problem because I don't think folks want to go out and do like we did years ago with some commodities and actually pollinate them by hand, and we still do that for seeds and others and I don't think folks understand that. Aside from some type of crop insurance for the beekeepers, what else do you think we can do to better assist them beyond that and research? And also, are you aware personally of any beekeepers certainly in your area that you deal with that just aren't able to stay in business? You talked about having cut your production in half. How many other farmers that you are aware of in your region where an awful lot of cucumbers are grown that just are cutting back?

Mr. EDWARDS. As far as the second question, as far as beekeepers, a very long-time beekeeper and I think some of the previous panel may have known him, will be quitting this year. It has just gotten too tough and I think he has fought it a little too long. It definitely is a labor of love to keep bees. I can pretty much tell you that these guys are not doing it for the money. So to me, they are very, very powerful ally. I know we talked and focused on saving the bees when we really need to be focused as well on saving the beekeeper. I think he is your number one ally in this, or she

is our number one ally in this fight. They have been doing it long before it became popular. So as far as how to go about that, that is a very good question. Going from an idea to implementation is always a challenge, but I am not sure about this new farm bill, but I know in the previous one, a beekeeper, and I was talking with a good friend of mine that does bees and asked. They were not classified as a farmer in the Farm Service Agency so they had no access to low-interest loans, which could be a good option, or some type of insurance. They could not get any assistance. Basically they were classified as a farm service provider and not necessarily an agricultural producer or farmer, whichever you want to call them. I don't know if that has changed in the new legislation. So forgive me if I am wrong on that. But I think we definitely need to be very proactive in helping these guys out because they are definitely on the brink. Jeff Lee, who supplies my bees out of Mevin, North Carolina, Jeff has a Ph.D. in organic chemistry so he has done a total 180. He worked for a large company in the realm of chemistry and he just lost his job to outsourcing and became a beekeeper, but he has his house mortgaged, his credit cards totally maxed out. These guys are not doing it for the money. I mean, I don't think anybody will put on a suit and go among 500,000 swarming bees—I don't think they are doing it for the money. They have to love it on some level and I think we need to—we can use that passion that these guys have. I am not discounting the university-level research. That is absolutely crucial to the beekeeper and to the farmer, but I think we need to be very, very aggressive in helping the beekeeper and do something as quick as yesterday.

Mr. ETHERIDGE. Thank you, sir. I would not want to go into 500,000 bees. I haven't done it recently. The last time we had a bunch, we had them in our church and it took a while to get them out. You know, they found a new home, and that was not an easy process.

My final question, Mr. Edwards, and you mentioned this a little bit in your testimony about cucumbers and where you had one hive per acre, and now you have cut your acreage in half. If someone else wants to comment on this, that would be fine too, but have you had to increase or decrease the number of hives per acreage, as an example, put out hives for an acre and a quarter to an acre and a half? Do you know of anyone that has, and if they have, what did that do for production?

Mr. EDWARDS. Well, I can tell you 10, 15 years ago, well, 15 years ago my father grew cucumbers and other guys, really, pollinators were a way to enhance yield. It wasn't a necessary. Today I don't plant cucumbers unless I definitely know I can get the bees, because the native populations just aren't there. We used to do a hive to 2 acres, maybe even more, maybe 3 acres. Now we are having to do a hive per acre because the native bees aren't there, and if we don't have them there, it causes yield problems, obviously, but the other thing it causes is misshapen fruit, which we can't harvest.

Mr. ETHERIDGE. Can you explain to folks what you mean by that statement?

Mr. EDWARDS. If the pollination doesn't occur, and I am not an entomologist, but if the pollination doesn't occur in a timely fash-

ion, our fruit set is very intense, very heavy in a very short time period so if you don't have a lot of bees out there really fast doing what they do best, it will cause misshapen cucumbers, nubs, they are also called, and crooks that can't be processed by the processing companies or the consumers won't buy them. They won't fit in a jar, a host of reasons why they are just not usable.

Mr. ETHERIDGE. Thank you, Mr. Chairman, and thank you for this hearing and let me thank each of you again for coming, and I yield back.

The CHAIRMAN. Thank you, Mr. Etheridge. You have done a great job as always.

I just want to make two observations as we close up today. The first one is that if in fact you cut down on acreage, as you have testified that you have done this year, there is a significant result of that. Agriculture is a supply *versus* demand commodity-driven, cost-driven industry, and when you have less supply and you have the same demand, you are going to have increased costs to the consumer, and so what the consumers are already conveying to Members of Congress is that they are concerned about their food prices going up. Well, based upon the testimony that we have seen today, we are going to see increased food prices because of the lack of pollinators.

The second point and one of the more globally concerning points that I have heard continuously since we have been researching this topic, is that the natural bees, the bees in the wild that may have been pests to us when we were growing up and we were kids walking in the woods and suddenly getting stung have disappeared. That has got to give us all some significant concern, not just for food production but what is happening globally, and is there something that we don't understand that we need to understand about our environment and what is happening around us.

So both of those things are of great concern to this Committee, to me personally, to Mr. Etheridge and all of us concerned about this question, and I would just encourage the researchers and the bureaucrats who have testified today, we are all going to have to get busy and get to the point of what is causing this before we have some calamitous effects that we can't control.

So with that, I am going to end this hearing today. Thank you all for being here. Thank you for your testimony. We have some serious work to be done.

[Whereupon, at 1:15 p.m., the Subcommittee was adjourned.]

[Material submitted for inclusion in the record follows:]

SUBMITTED MATERIAL BY MARYANN T. FRAZIER, SENIOR EXTENSION ASSOCIATE, DEPARTMENT OF ENTOMOLOGY, THE PENNSYLVANIA STATE UNIVERSITY

This was prepared and is being submitted in response to Chairman Cardoza's request for specific information on what resources are needed to address the issues of CCD and declining pollinator health in the U.S. in a time critical manner over the next 12–18 months. While a core team of scientists from multiple institutions and disciplines has assembled and has sought funds to support research, the time critical nature for a solution to this national emergency requires additional personnel and resources to allow these scientists to have maximal impact in the immediate timeframe.

Immediate objectives and needs (addressing the cause(s) of CCD; 6 months)

To complete pathogens and pesticides analyses of acquired samples on current CCD projects (meeting Goals 1 and 2 in the action plan)

These samples come from 8 different studies or CCD field surveys and also include a small number of beekeeper submitted samples. We currently have a backlog of 4039 samples in storage and/or in the process of being generated from on-going projects. Some of these will be analyzed for pathogens and others for pesticides. The cost per sample for pathogen analysis is $15. The cost for pesticide analysis ranges from $95 to $259 depending on the hive matrix and residues being tested for. We estimate that to complete the analyses of the remaining samples will cost $250,000 beyond our current resources. The eight studies include cooperative efforts by the working team to examine the prevalence of pathogens across the U.S., the exposure of bees on pollination contracts on the East Coast to pesticides and the effects of gamma irradiation on pathogens and pesticides in comb from CCD colonies. While we have not completed the analysis of all samples, the results to date are being used to design and carryout hypothesis-driven research to help reduce colony losses. Additional resources for these analyses, would allow researchers to redirect current resources to support these experiments.

Intermediate objectives and needs (addressing the cause(s) of CCD; 12–18 months)

While no one factor has been identified as the cause of CCD, several key questions have been generated from the significant work that has been done to date. Answering these critical questions is the next logical step to identifying the cause(s) and potential cure(s) for CCD. The research questions here represent current key areas of effort by the CCD working team to identify the cause of CCD. However, the resources currently available are inadequate to fully address these questions in the identified timeframe. The following objectives and resources are the best estimates of the CCD working team members to increase their impacts. A similar analysis of the USDA CAP grant multidisciplinary team could yield similar results, but were considered beyond the time allotted for this response.

Key Areas of Investigation

(1) Pesticides

Are pesticides a key factor contributing to CCD and to pollinator decline?

Key investigations

- Conduct toxicity tests of individual pesticides and their combinations to assess their causative association with CCD.
- Determine sublethal effects of pesticides and selected combinations of pesticides on physiological and behavioral systems of insects, including immune system suppression, interference with associative learning, and detection and/or alteration of the chemical senses of honey bees.
- Determine if adjuvants are toxic (compare toxicity of formulated material to technical materials or active ingredient.
- Determine if pesticides in combination with other stressors like IAPV are responsible for CCD
- Determine if gamma radiation can be used to mitigate pesticide build-up in bees wax comb and food

Key personnel (CCD working team)

Chris Mullin/James Frazier/ Maryann Frazier (PSU) Jeff Pettis (USDA), Diana Cox-Foster (PSU) (second and last objective)

Current Funding

Most of this funding has been spent on CCD and beekeeper sample analysis

Critical Issues; $89,000 (6/08–6/10)

NHB; $11,897 (2/1/08–12/31/08

Pending:

USDA–NRI 51.2B; $216,479 (1/1/09–12/31/10)

Protecting Honey Bee Pollinators, CAP; $90,000 to Mullin et al. in yrs 3 and 4 (8/1/08–7/31/12)

Resources needed to address these questions:

Additional Personnel: $80,000

Operating Funds: $75,000

Total: $155,000

Investigation of pesticide involvement in bee declines requires use of high-performance liquid chromatography/tandem mass spectroscopy (LC/MS–MS) methods to successfully analyze samples for systemic pesticides such as neonicotinoids and their metabolites at the sensitivity required for FDA/EPA compliance. LC/MS–MS analytical capability is particularly essential for understanding honey bee health in regards to systemic insecticides, since honey or pollen contaminated with neonicotinoids at ppb levels are known to impair bees. Multiresidue pesticide and toxic metabolite analysis that requires LC/MS–MS instrumentation is expensive, and the available analytical labs routinely analyzing neonicotinoid residues under good laboratory practices using LC/MS–MS is severely limited. Moreover, the infrastructure for graduate education of pesticide analytical chemists in the U.S., where there is sufficient equipment and expertise to address the fate and ecotoxicology of systemic pesticides, is almost non-existent.

Equip a MS facility with LC/MS–MS, GC–MS, workstation with deconvolution software and toxic substance libraries; salaried for a qualified GLP technician for 4 years: $1,500,000.

(2) Pathogens

Pathogens are clearly part of the problem underlying CCD. Increased pathogen loads are found in colonies undergoing CCD and suffering collapse. Recently, we identified a virus that appears to have been introduced into the U.S. within the last 8 years; the Israeli Acute Paralysis virus (IAPV) is not extensively found in samples collected across the U.S. in 2004 and has only been found in one sample collected in 2002. This virus was a good predictor of CCD by itself and in combination with three other pathogens (*Nosema ceranae, Nosema apis,* and Kashmir bee virus) it is a 100% predictor of CCD. At least two strains of IAPV are found in the United States and data indicate that the virus has greater variation than other bee viruses. How this variation in the virus is linked to CCD is not known. Current studies in containment greenhouses indicate that this is a fairly virulent virus; however, in the field, we have evidence that additional stress is needed to trigger the collapse. It is critical to identify these stressors and to learn how the diseases progress in the colony with CCD. In addition, we now have extensive evidence that these viral diseases not only are infecting the honey bee but also native pollinators. It is critical to learn how these diseases are impacting the native pollinators and if these diseases are contributing to the overall decline in native pollinators.

Another essential component that is critically needed is the ability to effectively analyze the pathogens present in samples. Currently, few labs in the U.S. are able to detect these pathogens and none have the capacity to analyze increased numbers of samples from beekeepers, state apiarists or even from APHIS collections. In particular, individual beekeeping operations have requested analysis of pathogens in their colonies and have found these services greatly limited. Currently, discussions are being held on how the diagnosis of bee pathogens can be added to the National Plant Diagnostic Network portfolio. The NPDN has a regional distribution across the U.S. and the capacity to handle large numbers of samples. New detection methods are also needed that are faster and more sensitive across several magnitudes and that can identify known pathogens and parasites.

Key investigations

- Do different strains of IAPV have different virulences?
- How do stresses such as sub-lethal pesticide exposure affect the disease status of a colony?
- What is the impact of the honey bee viruses and other pathogens on native pollinators?

- How can the NPDN portfolio and capacity be increased to detect bee and pollinator diseases?
- What measures can be taken to decrease the overall disease prevalence in a colony and increase colony health and strength?

Key personnel (CCD working team)

Diana Cox-Foster (PSU), Jeff Pettis/Judy Chen/Jay Evans (USDA), Dennis vanEngelsdorp (PDA), Dave Tarpy (NC State), additional university and USDA/ARS researchers

Current Funding—Cox-Foster

Penn Dept Ag.; $100,000 for viral work (through 7/09)

Critical Issues; $52,000 (end 12/2008)

Resources needed to address these questions

Additional Personnel: $80,000

Operating Funds: $75,000

Total: $155,000

Improved detection methods for known pathogens/parasites: $500,000

Increased capacity of the NPDN—additional equipment, materials, etc.: $1,000,000

National Survey of pathogens/parasites in honey bee colonies and queen breeding operations (APHIS and Apiary Inspectors of America): $2,400,000

(3) Genetic Diversity

What is the role of genetic diversity in the overall health of colonies and the honey bee population?

Key investigations

- Correlate queen mating frequency with the incidence and prevalence of CCD and *Nosema* spp.
- Compare the gene-expression levels of several important antimicrobial peptides by larvae in response to disease challenge and determine if genetic diversity within a queen's brood influences the degree of immune response
- Test a continuum of mating numbers by instrumentally inseminated queens by inoculating full-sized field colonies with disease to determine the minimum mating number of queens by which they may gain health benefits from having their colonies genetically diverse
- Determine the physical health, insemination success, and mating numbers of commercially produced queen bees to assess the "mating health" and genetic diversity of the honey bee stock in the U.S.
- Quantify the level of genetic diversity in the feral honey bee population, particularly in comparison to the managed population
- Determine if the non-managed honey bee population is comprised of "escaped swarms" or is truly feral (i.e., survivor stock); if the latter, the feral population may serve as an untapped resource for genetic diversity and disease resistance in the managed population

Key personnel

David Tarpy & Deborah Delaney (North Carolina State University), Dennis vanEnglesdorp (PDA), Jeff Pettis (USDA), Jay Evans (USDA)

Current Funding

North Carolina Department of Agriculture & Consumer Services, Plant Industry Division, 2008–2009 (one year); "Intracolony dynamics of *Nosema* infection in honey bees"; **$15,000** [terminates 05/30/09]

United States Department of Agriculture, Arthropod and Nematode Biology and Management (A): Organismal and Population Biology, 2008–2010 (two years); "The collection of non-managed honey bee colonies from the southern United States: characterization and quantification of genetic diversity in U.S. honey bee populations" (PD: D. Delaney); **$125,000** [terminates 08/30/10]

United States Department of Agriculture, Arthropod and Nematode Biology and Management (A): Organismal and Population Biology, 2007–2010 (three years); "Assessing the mating health of commercial honey bee queens"; **$346,500** [terminates 07/31/10]

Resources Needed (recurring)

Additional Personnel: $75,000

Operating Funds: $50,000

Total: $125,000

Long-term objectives and needs (addressing CCD and declining pollinator health; 2–5 years)

Provide additional funding aimed at understanding pollinator (honey bees and native species) decline and improving pollinator health and conservation in the form of competitive granting program (NRI, CSREES; Critical Issues, CAP, PIPE). The PIPE program funding we recently competed for has been "suspended" due to financial restraints. Competitive funding programs like this are vital if researchers are to respond in a time critical manner to emerging threats to our food supply.

Availability of this funding would allow the attention of the wider research community to be focused on improved pollinator health.

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