Audacious Visions for the Future of Bees, Beekeeping and Pollination

December 11-13 2016
Marconi Conference Center
Marshall, California

CONFERENCE REPORT

Bee Audacious

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au·da·cious
/ôˈdāSHəs/

adjective

"A willingness to take surprisingly bold risks; bold, daring, fearless, intrepid, brave, courageous, valiant, heroic, plucky."

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EXECUTIVE SUMMARY

Bee Audacious was a collaborative working conference that utilized dialogue to envision bold evidence-based ideas through which honeybees, other bees, beekeepers and pollination managers could prosper.

These are not conventional times for bees, and the conventional wisdom about how to keep honeybees (Apis mellifera) and sustain non-Apis wild and managed pollinators no longer serves beekeepers, farmers or the critical need for environmental sustainability. The conference centered around generating bold new ideas that encourage beekeepers and pollination managers to act as stewards of both managed and wild bees, promoters of healthy environments, managers of economically sustainable apiaries, supporters of diverse, effective pollination management systems, and paragons of collaboration and cooperation.

The meeting, held over three days (11-13 December 2016) at the Marconi Conference Center in Marshall, California, adopted the dialogue process pioneered at the Simon Fraser University Centre for Dialogue, and used lessons learned from the bees themselves. Dialogue centers around concentrated conversation among equals, offering helpful ways to work cooperatively, encouraging mutual understanding between diverse perspectives and leading to stable, resilient outcomes.

There were no lectures beyond a keynote address. Rather, sessions alternated between facilitated breakout sessions with small groups of participants, and plenary reporting out/discussions with the entire conference. Note takers captured all the ideas generated by each breakout and plenary. As well, after every session we asked each participant to write on an index card what they thought was the one best idea they had heard, and one or two sentences explaining why they chose that idea. Following the main conference, there was a public event at Dominican University in San Rafael, CA the evening of 14 December 2016 at which the major outcomes of the conference were presented.

The perspective that evolved during the meeting was that it is not business as usual today for bees, beekeeping and pollination, and current challenges will require some novel solutions. In that spirit, the conference attempted to develop audacious ideas that would not only inspire discussion among all those interested in the health and welfare of pollinators, but also respect the diverse interests and perspectives in the bee-related community.

The complete results of our deliberations were a rich set of bold, tangible and actionable proposals. Below we summarize some of the audacious ideas that generated the most interest during the conference:

VALUES

Participants noted that concerns about bee welfare are often framed in terms of threats to human interests, such as economic impact, food security or production of goods such as honey or beeswax. Another central motivation for protecting bees should be our admiration for these unique and beautiful creatures. They discussed how bees are widely beloved and inspirational, even sacred in some cultures, and how this sentiment has often been expressed in art around the world. Further, bees contribute to a sense of well-being beyond material gain, strengthen social ties and build local communities.

Through bees, we can also express our concern and responsibility for the wider environment. Our ambition should be to protect pollinators while developing economically viable but also sustainable systems. Many actionable ideas emerged from the discussions about values, including investment in public education campaigns, becoming involved with movements for ecologically based food systems, insuring that bee products meet high quality standards, and furthering scientific inquiry through citizen science projects and improved communication of research to the general public. Interdisciplinary research should be encouraged, including historical, cultural, spiritual, artistic and scientific components.

HABITAT

Almost every session, no matter what the topic, touched on the essential importance of habitat for managed and wild bees. One core group of outcomes from Bee Audacious included many ideas to protect the integrity, diversity and overall health of the agricultural, natural, urban and in-between ecosystems upon which bees depend.

Pollinators require abundant and diverse forage, habitats free of toxic pesticides and appropriate sites for wild bees to nest and for managed honeybee apiaries to be located. For agro-ecosystems, one set of ideas emerged around effective lobbying to protect pollinators through upcoming revisions of the U.S. Farm Bill, as well as similar legislation in other countries. Lobbying might focus specifically on:

- Shifting farm subsidies and tax credits to sustainable agricultural systems that include pollinator protection as an important component of their management paradigms;
- Mandating considerably stricter regulations around pesticide use, including more extensive testing for pollinator impacts prior to pesticide registration, clearer label directions and enforcement to protect pollinators, monitoring of pesticide residues in the environment and in comb within beehives, a reporting system for pesticide use, and extensive research into reducing pesticide use while maintaining crop production;

- Regulating insecticidal seed coatings as pesticides rather than the current weaker regulation as “treatments;”
- Enhancing application of the Environmental Quality Incentive Program and the Conservation Reserve Programs to restore or enhance habitat for pollinators on working farms and private lands;
- Increasing conservation easement payments for growers to transform marginal agricultural land into bee-friendly zones;
- Establishing White House Task Force recommendations as policy in the bill; and
- Developing a clear, broad and agreeable pollination bill that could be rolled into the Farm Bill.

Habitat enhancements should also build on current local, state and federal programs to replant road, power line and rail rights of way, marginal habitat in and around farms, and degraded industrial /mining/forestry areas with nectar and pollen-producing plants.

It is encouraging that cities are quite engaged in proactively redesigning habitats to favor pollinators, including not only floral projects throughout urban environments but also by preserving appropriate nesting habitat for wild bees and passing bylaws so that beekeeping with honeybees will thrive. Rural regions have much to learn from the projects and policies that are now profuse in municipalities.

Another particularly striking outcome from our Bee Audacious conversations around habitat was the congruence between policies and programs that would benefit wild bees and those that would benefit managed honeybees. The shared interests between the wild and the managed were palpable, and bode well for creating the strongest possible alliances to protect all pollinators.

Finally, we realized that pollinator enhancement is an important tool to focus attention on the broader importance of diverse, healthy habitats for all organisms, beneficial for the multitude of creatures upon which our own health and livelihoods rely.

POLLINATION

Consensus developed on the value of protecting pollinators and diversifying the bees and other species used for commercial pollination. Three main strategies for supporting pollinator health and crop pollination systems emerged. First, it’s vital to provide sufficient and diverse forage and nesting habitat for bees and other pollinators in rural

and urban areas. Second, we must ensure the safety of pollinators in all habitats, particularly from harmful pesticides. And third, we should increase the use of locally sourced honeybees as well as non-Apis bees and other pollinators for crop pollination, to decrease demand and stress on colonies forced to undergo long distance and often multiple relocations.

To achieve the objectives of protecting and diversifying pollinators, intensive advocacy and education programs should be encouraged, everything from extension projects for farmers to sophisticated public education programs. Economic models need to be developed, specific to crops and regions, which demonstrate the financial viability and benefits for growers who implement pollinator-friendly practices. Technical support could be provided to advise farmers on their pollination options. A label, with accompanying certification, might be designed to inform consumers that their food purchases come from pollinator-friendly farms.

Finally, closer collaboration between beekeepers, wild bee advocates and farmers could be targeted, with economic incentives for each to participate. Developing such partnerships might involve reducing honeybee colony rental rates for farmers who practice verified habitat management and who encourage a mix of honeybees, non-Apis bees and other pollinators as components in a balanced and diversified pollination management practice.

NATIONAL BEE CORPS

Another audacious outcome from our conference was the exciting proposal to create a National Bee Corps across the United States and perhaps internationally, modeled after the Peace Corps. The Bee Corps would enhance extension/education for beekeepers, from the smallest scale hobbyists to the largest commercial operations. Its core objective would be to formulate and deliver programs that assist current beekeepers while educating the new generation of beekeepers that is expanding dramatically all across the United States and globally.

Extension and education around beekeeping used to be robust, with most states having inspection, regulation and education programs assisted by federal involvement in bees. Today, only scattered programs remain, some excellent but many poorly resourced, and there is no federal presence in beekeeping extension.

We propose a national-level Bee Corps that would provide significant federal resources to train professionals who would then fan out across the country and provide direct, local and hands-on services for beekeepers. Their network would be enhanced by developing core information about beekeeping, deliverable through web-based, social media and print options, using high-powered graphic and video presentation for clear, effective information delivery, and modified to suit local regions and a range of beekeeping styles.

The heart of the Corps would be its cadre of trained professionals, working in partnership with local organizations, so that the Bee Corps would function by collaborating with rather than supplanting already existing groups wherever possible.

Program deliverables would be adaptable for different audiences, including rural to urban, urban backyard to stationary sideline to migratory commercial operations, hobbyists with one or two colonies to beekeepers with tens of thousands. The Corps would work with all beekeepers to inspect, monitor and treat for diseases and pests, pesticide residues, and queen problems, provide education and advice about diverse management practices and assist in queen breeding and rearing projects.

One objective of the Corps might be to reduce synthetic pesticide treatments to honeybees by delivering advice on options from treatment-free to organic methods for beekeepers to choose from. Another key function of the Corps could be to intervene if bee or public health issues resulted from problematic honeybee management, and to mediate between perspectives about management approaches if conflicts arise between beekeepers. For example, new ideas such as Darwinian beekeeping and Natural Resistance (see below) may have merit, but often meet resistance from those using conventional options who are concerned that alternatives may increase the spread of diseases and pests or have other negative impacts on colonies.

A mix of government and private funding would be sought to provide ongoing resources to manage and deliver the National Bee Corps idea, but the upcoming Farm Bill might provide one funding option. There currently are limited local programs that if expanded conceptually and nationally might serve as useful models for a national Bee Corps, such as the Bee Squad at the University of Minnesota or the Tech Team at the Bee Informed Partnership, among others.

DARWINIAN BEEKEEPING

A number of ideas arose during Bee Audacious that reflected an increasing interest in better matching honeybee management practices with the natural biology of honeybee colonies. Indeed, it became clear during the conference that these ideas, well named as Darwinian Beekeeping, have reached the level of a not-yet-organized international movement.

We heard from beekeepers from around the world who are looking to the biology of wild honeybee colonies to redesign colony management, disease control and apiary geography. The essence of this bee-friendly beekeeping is to let the bees live as naturally as possible, making use of the adaptations that they have acquired over the last 30 million years. Darwinian beekeepers are willing to accept lower yields per colony and forego moving honeybees for pollination, in favor of improved colony health and survival as well as enhanced enjoyment for the beekeeper. Just a few of the management paradigms in this beekeeping philosophy include:

- Smaller colony sizes closer to that of average wild colonies;
- More space between apiaries, fewer colonies per apiary, and more distance between colonies within apiaries;
- Use of local queens, selected and reared for local conditions;
- Reduced or no swarm control, and capturing swarms to initiate new colonies and replace colonies that have died;
- No chemical disease or pest management, allowing natural selection to play a stronger role.

Darwinian beekeeping may be best suited to hobbyists or sideline beekeepers, but many elements in this management philosophy would be adaptable for commercial beekeeping as well. Further, participants strongly encouraged more extensive and regionally comprehensive management research that compares Darwinian beekeeping and related models such as Treatment-Free and Natural beekeeping with more conventional approaches, under hobby and commercial conditions.

New strategies to deal with diseases and pests: Virtually all the participants agreed on the need to reduce the use of pesticides, antibiotics and fungicides in beekeeping. We also recognized that hobby and commercial beekeepers may take different approaches, and not all will be as comfortable with the speed and extent at which chemical use might be reduced.

Still, there was considerable support to take audacious steps towards reducing or eliminating chemical and antibiotic treatments against diseases and pests, while recognizing the need for commercial beekeepers to have tools they can use in the interim. There have been many reports globally about resistant bees, but there has yet to be a well-funded, widespread international effort towards selection and breeding for natural resistance.

The first step would involve scaling up research and support teams, connected with beekeeping collaborators, to conduct management research that fosters non-chemical controls in combination with stock selected for natural disease/pest resistance. Queen breeders need to incorporate selection for regional conditions, so that not one but many resistant stocks would be developed.

Bee Audacious participants envisioned a well-coordinated international effort at a considerably broader scale than has yet been attempted. Breeding programs to date have been local, not always connected with hobbyist or commercial management needs and lacking the long-term funding through which successful stocks could persist. Partnerships with queen breeders would be essential, as would the research infrastructure to conduct robust, long-term and regionally focused projects to select and maintain successful stock

long-term, and to support tech teams that transfer successful stock to hobby and commercial sectors.

Implementation of natural resistance would involve a phased transition, slowly moving away from synthetic/antibiotic treatments, and eventually going treatment-free if the effort to select disease resistant stock is successful. Commercial beekeepers would be encouraged to run parallel operations using only organic acids for mite treatments, and burning hives with foul brood rather than using antibiotic treatments, until they become confident that natural beekeeping stock could be commercially viable.

DIVERSIFY

Just as diversity builds resilience into habitats, building more diversity into management systems would provide protection against high levels of honeybee colony loss and disruptions in pollination.

Bee Audacious turned what are often sources of conflict into positives. Beekeepers and pollination proponents often face off to argue about which system is better, sometimes vehemently and occasionally personally. Dichotomies develop: top bar hives vs. Langstroth, honeybees vs. non-Apis bees, treating for Varroa mites vs. treatment-free, antibiotics for AFB vs. burning, hobby vs. commercial, migratory vs. stationary.

All these views were represented, yet in the dialogue format we learned to appreciate each other's systems rather than criticize. It also became clear that there is very little reliable information, based on evidence from rigorous research, which would favor one system over another.

One bold recommendation emerging from the conference was to organize and fund a national research program to compare a range of management systems under different circumstances, to encourage more informed decisions concerning the advantages and disadvantages of various styles of beekeeping and pollination in diverse regions. Such research to date has been geographically spotty, relying on surveys rather than hard data. The conference proposed that the scope and scale of management research be considerably enhanced.

We addressed a number of specific tensions in the beekeeping and pollination communities, with some innovative bridge-building solutions emerging. For example, at times commercial migratory beekeepers and non-Apis bee proponents who support the ecological services of bees other than honeybees to pollinate crops have appeared to conflict. Yet, a consensus developed at Bee Audacious that a mixed pollination system that relied on habitat improvements to enhance wild bee numbers while also supporting managed honeybee colonies would be both resilient and economically viable for both beekeepers and farmers.

In another example, the conference addressed the tension between treatment-free beekeepers and those using pesticides and antibiotics. These groups have increasingly been in conflict; Treatment-free is perceived as contributing to pest outbreaks, while treating colonies is considered to interfere with the natural selection of resistant bees. The dialogue format of Bee Audacious allowed participants to respect the differences between these options while developing ideas for how both could thrive, perhaps by implementing geographic separation that encourages beekeepers to decide what they prefer in their locales.

BUILD ALLIANCES

Perhaps the most audacious idea of all was to build an alliance of interests that could effectively lobby for pollinators. The raw material is there for a robust and powerful lobbying force. There has been a public upwelling of interest and concern around bees, but it has not yet been well organized. Similarly, there are copious organizations with direct or tangential interests in pollinator health, but they have not coalesced into an effective lobby.

The Bee Audacious conference was enthusiastic about the creation of a National Pollinator Association (NPA), a group under the broadest possible tent that would respect each organization's individual mandates while working collectively to support broad areas of agreement around pollinator policy.

The groups that might collaborate together would include beekeeping and grass roots pollinator organizations, such as the American Beekeeping Federation, American Honey Producers, Eastern and Western Apicultural Societies, Project ApisM, local and state beekeeping associations and the groups that have emerged recently with interests in wild bee health, such as Seattle's Pollinator Pathway, New York City's Great Pollinator Project and the national Great Sunflower Project. Then there would be the non-profit organizations that are broadly advocating for pollinator health, such as the Pollinator Partnership, Bee City, Hives for Humanity, The Xerces Society and the Pollinator Stewardship Council.

A strong coalition should reach well beyond these pollinator-centric groups. Environmental organizations could be involved, such as the Sierra Club, Monarch Watch, Ducks Unlimited, Environmental Defense Fund, Centre for Food Safety, Centre for Biological Diversity, Friends of the Earth and Pheasants

Forever. The sustainable and organic farming communities would be another set of natural allies; examples include the National Sustainable Agriculture Coalition, Organic Trade Association, Whole Foods, Costco and the Rodale Institute, among many others. Finally, there has been an urban food revolution in recent years with a focus on local food, municipal agriculture and farmers' markets, a potentially powerful collection of consumers willing to support pollinator protection. Growing Power, Slow Food and Farm Folk City Folk are just a few organizations representing this field.

Two related issues emerged involving alliance building. First, there was considerable support for projects that engage the public in pollinator protection, from school groups to gardeners to those with a general interest in nature. There also was interest in improving communication with conventional growers, collaborating on ideas that would enhance farm productivity while benefiting bees. Planting clover, for example, on fallow fields would provide an excellent nectar and pollen source while improving soil quality.

Bee Audacious also considered how an alliance, and the other ideas that emerged at the conference, might be funded. A mix of funding is desirable, with strong participation from municipal, state and federal governments, foundations and private individuals. We also felt that the industry itself and those who benefit from bees should be generous in their support. For example, considering the current importance of honeybees for almond pollination, and the difficulty in supplying large numbers of colonies in February, conference participants suggested a $3/hive levy on almond growers, and $1/hive for beekeepers who move their hives into almonds.

Federal legislation could also play a significant role in pollinator protection. One function of the NPA would be to collaborate with government in crafting legislative supports for pollinator protection and enhancement. Policies that would allow beekeepers and wild bee proponents a greater voice in research, extension and regulation nationally might be desirable.

Finally, and most significantly, Bee Audacious demonstrated that diverse perspectives can indeed come together and reach broad, effective outcomes that still respect individual and organizational interests. Sometimes the most audacious thing we can do is reach across the aisles that separate us to work collaboratively with those with whom we disagree.

In that way Bee Audacious taught us something considerably more important than the pollinator issues that brought us together. Civility is possible, and positive collaborative outcomes likely, when we rise to respectfully listen to each other above perceived differences.

We are our finest and most effective selves when solitary becomes communal. It is through collaboration that our future prosperity and the health of pollinators will be best assured.

INTRODUCTION

Bee Audacious was a collaborative working conference using dialogue to envision bold evidence-based ideas through which honeybees, other bees, beekeepers and pollination managers could prosper.

We often support the importance of bees solely with economic arguments, neglecting the dimension of values, the principles we hold important and the personal and environmental standards that should be at the heart of beekeeping rather than at its fringes.

Bees are no longer healthy enough to respond with the resilience that allowed us to manage honeybees intensively, and ecosystems are no longer sufficiently diverse for wild and managed bees to thrive. Pesticides are ubiquitous, diseases and pests rampant, and the diversity and abundance of bee forage have plummeted.

These are not conventional times for bees, and the conventional wisdom about how to keep honeybees (*Apis mellifera*) and sustain non-Apis feral and managed pollinators no longer serves beekeepers, farmers or the critical societal imperative for environmental sustainability. It is time for bold new ideas that recognize beekeepers as stewards of both managed and wild bees, promoters of healthy environments, managers of economically sustainable apiaries and paragons of collaboration and cooperation.

It's time for some audacious thinking about the future of bees, beekeeping and pollination.

CONFERENCE DESIGN

Beekeepers from across the Northern Hemisphere helped to organize Bee Audacious, a collaborative working conference to envision bold, evidence-based solutions to help honeybees, wild bees, beekeepers and pollination managers prosper. Participants represented a diverse group, including international bee and pollination experts, beekeepers, farmers, community organizers and more. The conference was designed to ignite groundbreaking conversations and inspire actionable outcomes.

The Bee Audacious conference was inspired from an article by Mark Winston, "Manifesto," published in his blog and as a letter in Bee Culture magazine. The current serious issues facing bees suggested it was time for a new manifesto to guide beekeeping, one that recognizes beekeepers as stewards of both managed and wild bees, promoters of healthy environments, managers of economically sustainable apiaries and paragons of collaboration and cooperation. Winston suggested that it was time for some audacious thinking about the future of bees, beekeeping and pollination based on four principles:

- Beekeepers are **Stewards** of their honeybees, lightly managing colonies with minimal chemical and antibiotic input.
- Beekeepers are **Promoters** of healthy environments in which wild and managed bees can thrive, including reduced chemical inputs and mixed cropping systems in agricultural settings and diverse unmanaged natural habitats in urban and rural areas.
- Beekeeping is **Economically Viable**, so that hobbyists can enjoy their bees with some honey to give away, sideliners meet expenses with a bit of profit and commercial beekeepers have a consistent and sustainable income sufficient to support a family without the heavy personal stress associated with contemporary beekeeping.
- Beekeeping organizations are **Inclusive, Collaborative and Cooperative**, encompassing hobbyists with one hive to commercial beekeepers with thousands, wild bees enthusiasts to honeybee keepers, and honey producers to pollinators, under one umbrella organization that puts the health and prosperity of bees and the environment that supports them first.

Bee Audacious was not designed to be a traditional conference, but rather to be guided by the methods utilized at the Simon Fraser University Centre for Dialogue where Winston is a Professor and Senior Fellow, and Cornell University Professor Thomas Seeley's "Five Habits of Highly Effective Hives." There were no speeches at Bee Audacious beyond a short plenary keynote; most of participants' time was spent in small groups engaged in active dialogue. For further information on dialogue, see the website of the National Coalition for Dialogue and Deliberation.

Organizing Committee

The meeting was organized by a core group of Marin County beekeepers, assisted by many others from the Bay Area and across North America. The organizing committee was chaired by Bonnie and Gary Morse. Initially, Mark Winston served as scientific and program advisor, but was soon joined by Thomas Seeley and Marla Spivak. Other volunteers included:

Planning: Linda Albion, Branden Barber, Peggy Beckett, Richard Hyde, Catherine Jasan, Bonnie Morse, Gary Morse, David Peterson, Joan Roth, Diana Sammataro, Skip Smith, Anna Taylor Gravely and Barbara Yaeger

Conference, Panel Discussion and Hospitality: Marty Albion, Jennifer Berry, Brian Buxton, Lauren Cheong, Carla Culbertson, Jim & Judy Dowling, Scott Greenberg, Karen Hyde, Nickie Irvine, Kristin Jensen, Julie & Russ Keil, Lisa Lavrisha, Tuppy & Alex Lawson, Yuting Lee, Mary Nordquist, Connie Pelissero, Mary Rathbun, Jeff Roth, Sierra Salin, Jody Timms, Julie Pritchard Wright, and Marina Wright

THOUGHT LEADERS AND OTHER PARTICIPANTS

Ten thought leaders were selected to advise on the meeting agenda, facilitate breakout groups during the meeting, develop an audacious idea to seed discussion, assist in analyzing the conference outcomes, present the best ideas from Bee Audacious at a panel discussion held the day after the conference at Dominican University and write a short reflection after the meeting for this report. They included:

- Jim Frazier, Professor Emeritus of Entomology, Penn State University
- William Klett, Commercial Beekeeper
- Stephen Martin, Professor, School of Environment and Life Sciences, University of Salford
- Heather Mattila, Associate Professor of Biological Sciences, Wellesley College
- Chas Mraz, Champlain Valley Apiaries
- Francis Ratnieks, Professor of Apiculture, University of Sussex
- Thomas Seeley, Professor of Biology, Cornell University
- Marla Spivak, MacArthur Fellow, Distinguished McKnight Professor, University of Minnesota
- Neal Williams, Professor of Pollination Ecology, University of California, Davis
- Mark Winston, Professor and Senior Fellow, Simon Fraser University Centre for Dialogue

Additional participants were invited based on recommendations of thought leaders and others, as well as through registration applications. The objective in selecting those attending the meeting was to gather a group of constructive, collaborative and thoughtful individuals who brought experience from a wide variety of fields that involve pollinators. In total, there were about 100 attendees, including note takers and volunteers in addition to the other invited participants, who were tasked with developing bold, feasible, evidence-based solutions for the future health of bees and the prosperity of those who manage them.

DIALOGUE FORMAT

The meeting adopted a dialogue process centered on concentrated conversation among equals. Dialogue offers helpful ways to work together cooperatively, encourages mutual understanding between diverse perspectives, and leads to stable, resilient outcomes.

"*Debate is a conversation with sides, dialogue is a conversation with a centre*."
~ William Isaacs

Productive dialogue is entered with a spirit of curiosity, an interest in continually learning from and with others, and a willingness to be changed. Instead of arguing, convincing and advocating for what is already believed, dialogue encourages us to enter the unknown, exploring diverse experiences and values as well as points of agreement and disagreement. A few principles of dialogue include:

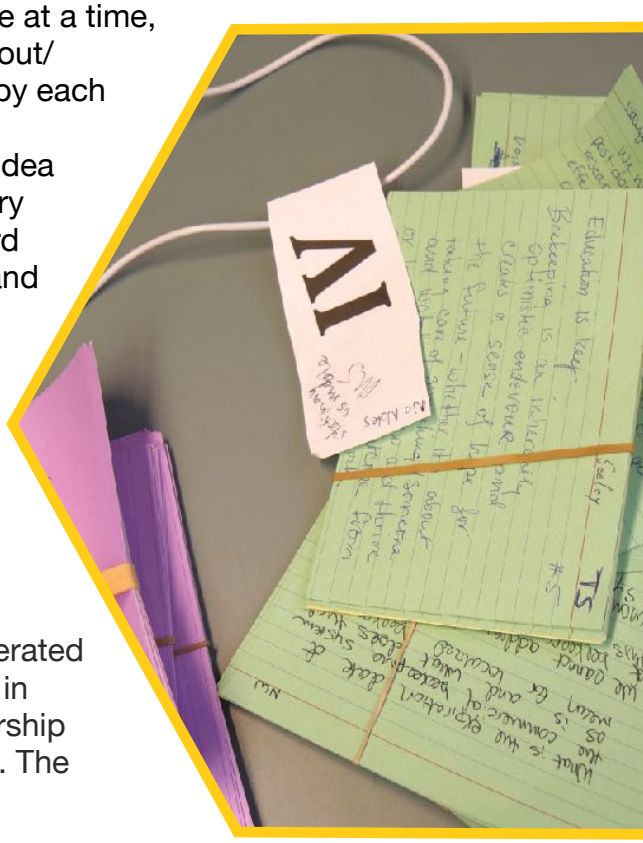
Be open to other perspectives: Disagreement is normal; use this as an opportunity to clarify and understand new ideas.

Be inquisitive: Ask thoughtful questions and listen openly to the answers. What do you mean? Tell me more. What leads you to believe this?

Speak personally: Share stories of lived experiences and personal values rather than set opinions.

Be disciplined in your participation: Be brief, focused and on topic, leaving time for others.

The conference alternated between breakout sessions (nine at a time, one thought leader facilitating each) and plenary reporting out/ discussions. Note takers captured all the ideas generated by each breakout, but reporting out to the plenary consisted of one representative from each breakout sharing one audacious idea the table had discussed, with a couple of details. After every session we asked each participant to write on an index card what they thought was the one best idea they had heard, and one or two sentences explaining why they chose that idea.



Some breakouts were organized with randomly assigned seating (I, II, III and VI) to insure mixing of participants with diverse backgrounds. Other sessions were open seating, and participants were invited to arrange themselves at sessions by topic of interest.

Following the main conference, the thought leaders participated in a panel discussion open to the public, moderated by Doug McConnell of *Bay Area Backroads* and presented in partnership with Dominican University's Institute for Leadership Studies and the Department of Natural Sciences and Math. The session was taped and is available online.

DETAILED AGENDA

Sunday December 11, 2016

4:30 PM: Welcome, Bonnie Morse
4:45 PM: Keynote address, Larry Brilliant, Chair, Skoll Global Threats Fund and author, *Sometimes Brilliant*
5:15 PM: Plenary: Conference structure and dialogue format
6:30 PM: Dinner
7:30 – 10:00 PM: Open lounge/social time

Monday December 12, 2016

8:30-10:00 AM: Breakout Dialogue, I, Values

What are the values we should bring to protecting bees, beekeeping and pollination services? What are some actions that might arise from these values.

10:20-10:35 AM: Five Thought Leader two-minute audacious ideas about honeybee management

10:35-12:00 AM: Breakout Dialogue II, Managing Honeybees

Breakouts will develop one or more audacious ideas for honeybee management, exploring their feasibility, outcomes, benefits, challenges and implications.

12:00-1:30 PM: Lunch

1:30-1:45 PM: Five Thought Leader two-minute audacious ideas about pollination

1:45-3:15 PM: Breakout Dialogue III, Providing Bees for Pollination

Breakouts developed one or more audacious ideas to provide bees (*Apis* and/or non-*Apis*, managed and/or feral) for crop pollination, exploring their feasibility, outcomes, benefits, challenges and implications.

3:15-3:45 PM: Break

3:45-5:00 PM: Breakout Dialogue IV, Open Space #1

Open Space Session: Participants were invited to choose a breakout with one of the following topics, and discuss in detail issues such as benefits, challenges, evidence favoring or against, what more information do we need, is it feasible?

- The business of pollination: could a pollination manager or advisor earn a living from a business that includes incorporating non-Apis (managed and feral) bees into a

management system? (not held due to low attendance)
- Could non-Apis bees reduce our dependence on honeybees for crop pollination by 50%?
- What would beekeeping look like if we managed bees based on their natural history, emphasizing management consistent with how honeybees survive and thrive as feral organisms?
- Bee health first: What would be the design of an overall management system for honeybees that puts the health of colonies as the primary objective?
- Stationary apiaries compared to moving bees for pollination: what's better for honeybee health and beekeeper economics?
- Managing honeybees with little or no pesticides or antibiotics. For Varroa control: how low can we go with treatments? For American Foul Brood, could we prohibit antibiotic treatments and use only burning for control?
- Research: What would you propose if there were a granting program for audacious ideas?
- Engaging the general population: What are the most important areas of engagement? Food purchasing decisions, products used in home / garden, voice they give to political discussions, or others?
- What might an effective extension and regulatory system look like, and would increased extension and regulation be desirable?

6:00-7:30 PM: Dinner

7:30-10:00: Open lounge/social time

Tuesday December 13, 2016

8:30-10:00 AM: Breakout Dialogue V, Open Space #2

Participants suggested ideas the night before, and thought leaders met and chose nine ideas for breakouts. Participants could join whatever breakout they chose, and could leave and join another group at any point, but the general topic in each room stayed the same. Participant-selected topics included:

- University, government and citizen science: what should we fund, and how might citizens be more involved?
- Teaching: training beekeepers, hobby to commercial, how to keep bees
- Reaching the public: educating and mobilizing the public to care about and protect bees
- Diseases and pests: what are the next generation of controls, from genetic to chemical to high-tech? Where should research go?
- It’s about habitat: what do we want to see in the next farm bill?
- Pride and product: enhancing the value of bee products (honey and others)
- The next generation of beekeeping management: imagine a number/range of future management models by which to manage bees. Hobby to commercial, migratory and stationary: Can they be compatible? Where are they similar, and where might they be in conflict? How can they respect each other?

- Bees in the city: wild and managed, how to encourage both in urban habitats, and why
- What should the game plan be to reduce pesticide impact on bees? Politically, with farmers, corporations, in backyards . . . what can we do?

10:00-10:30 AM: Break and checkout for participants

10:30 -12:00 AM: Breakout Dialogue VI, Redesigning the Organizational Landscape.

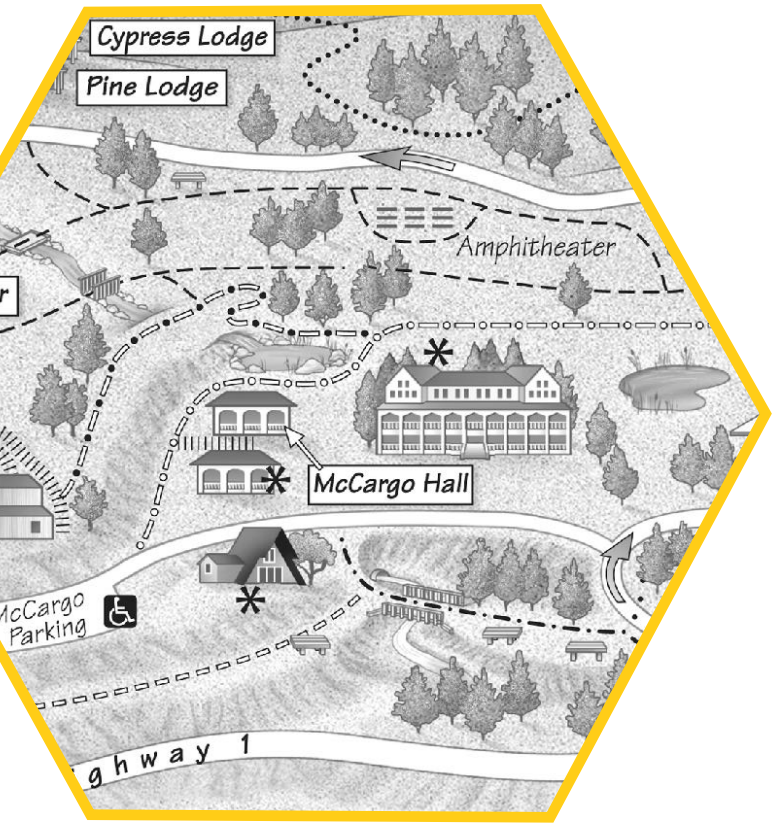
Breakout sessions were asked to propose how organizations representing beekeeping and pollination interests might be restructured, and reflect on next steps for participants to carry forward ideas from the conference.

At the end of the plenary session, each participant wrote down and submitted one step they commit to that will further the outcomes from the Audacious Visions conference.

12:00-1:30 PM: Lunch

1:30-3:00 PM: Plenary Discussion, Concluding Remarks

Open discussion. Participants were asked to write on index cards a brief statement about the one audacious idea that most impressed them, and why.



AUDACIOUS IDEAS

Thought Leader Outcomes

Each thought leader was asked to propose one short audacious idea for the conference program, to seed participant discussions.

Jim Frazier

I would like to suggest that we develop a new model for funding and conducting bee research that will result in increased efficiency of funding and enhancing the impacts of results on public understanding and policy. The federal funding of academic research has become so burdensome that researchers have too little time to actually spend on the conduct of research. I would suggest the BBSRC model of research funding as a departure point for discussion that offers improvements in overall efficiency; a limit of 8 pages maximum for the project description, suggested reviewers by the Principle Investigator, reviewers comments returned to the PI to respond to them, and then all comments to the grant panel for evaluation. This process thus reduces the time to write and review proposals, and prevents misunderstood reviewers comments from having undue influence in the panel evaluation process.

In his classic book, "*Toxic Exposures*," Phil Brown argues that the public understanding and following policy impacts of a scientific issue are reliant mostly on the personal experiences of people with the issue rather than a plethora of scientific results. Thus I propose we involve citizen science volunteers into our routine research efforts as one possible solution. This would reduce personnel costs, while giving highly motivated volunteers the opportunity to learn from experience the significance and demands of research. The current public policy response to the annual downturn of 30-45% of honeybees, the 3rd most important animal in the US food system, belies the critical nature of the problem as well as its importance in sustaining our food supply. Bee researchers need to be involved in changing this scenario.

William Klett

As panic and desperation begin to take hold in the face of low commodity prices, there is talk of taking up the next farm bill in the near term. Whether or not this happens, whenever the next one is being drawn up, an alliance of beekeepers, wildlife interests, organic/sustainable agriculture people and their concerned consumers needs to step up and insist upon a place at the table. This need not be hostile toward the big agricultural interests already benefitting from taxpayer support systems. It should be focused on stating what is obvious and reasonable: if the public is going to support agriculture, there should be incentives to use land in a way that produces food with minimal chemical input and that supports pollinators and wildlife. Ideologies and peripheral issues, dear to us as they may be, should be kept to an absolute minimum. We're not out to make enemies or further polarize people. There is nothing extreme about advocating for land use that doesn't eradicate habitat and contaminate land, air and water. I don't think there will be anything easy about this. But if land use doesn't change for the better and soon, what future do pollinators and wildlife really have?

Stephen Martin

Got to be cruel to be kind.

Beekeepers whether hobbyists or running large commercial operations never like to lose bees, or worse still, colonies. Based on economic reasoning or simply the love of the honeybee, small failing colonies are typically united or strengthen by the introduction of frames of brood. In fact, many beekeepers will try anything to save their colonies.
Is this really helping the bees in the long-term? You would never place a sick person suffering from an infectious disease within a healthy population and when more people get sick, try to cure them by adding in more healthy people. So why do beekeepers routinely do this as part of their normal beekeeping practice?

Honey bees have always suffered from a wide range of diseases, and highly virulent strains of fungi, bacteria or viruses by their very nature find it very difficult to persist within a fragmented population, such as that found in a widely dispersed wild honeybee population. Modern beekeeping in apiaries where large numbers of colonies are kept at high densities are a pathogen's dream. Up to 30% of the bees within a colony in an apiary were never born there! The mixing of bees between colonies deliberately or accidentally combined with the movement of honeybees both within and between countries allows pests and pathogens to rapidly spread and more importantly, allows virulent strains to persist within a population from much longer periods of time.

So my audacious idea is to destroy dwindling (sick) colonies as soon as possible and reduce by whatever means possible the movement of bees at all scales even between colonies by spacing colonies so drifting bees are eliminated. Let natural selection do the work.

Heather Mattila

Financial risk is one of the biggest challenges beekeepers face when confronted with the opportunity to assess and radically adjust their beekeeping practices. Risk can take many forms, such as potential colony losses when selecting for stress-tolerant bees or the infrastructure costs of diversifying the number of managed species in a pollinator portfolio. How can beekeepers mitigate some of these financial risks? Online crowdfunding may provide the answer. Funding platforms can provide small-scale entrepreneurs with seed money to overcome the monetary hurdles that must be tackled to bring novel ideas to life. The money comes from donations or investments made by members of the public who believe in the social movement that a campaign represents. Most beekeepers value time with their bees more than time spent on a device accessing social media, so they may need to be convinced about the power of these tools.

Barnraiser, an online fundraiser launched in 2014 to ease the financial burden of innovative farming, boasts a 65% funding success rate and an average sum of $12,000 raised per idea (according to a 2016 article in *Forbes Magazine*). For some operators, these funds mean the difference between doing something new or avoiding the risks of trying. In an extreme case, Flow Hive designers reached their $70,000 fundraising goal in the first 8 minutes of crowdfunding on Indiegogo (with pledges of $2.9 million after 24 hours). While the Flow Hive

will not rescue bees from the current pollinator crisis, it reveals how quickly an idea can take off with public support. We should ask ourselves throughout this conference how we might leverage public support to allow beekeepers to take financial risks. It is time for beekeepers to capitalize on the public's growing appreciation for the role pollinators play in secure food production and healthy ecosystems. If we are going to get creative about how we support pollinators, we will need pioneering funding models to fuel these changes.

Chas Mraz

I first have to address my greatest concern, one that I have the least control over, which is neonicotinoid use. **To address that concern we must work to get farmers onboard and avoid an adversarial relationship with them.** I have found that when the problem is explained properly, many farmers share my concern. Looking at the entire class of neonicotinoid chemicals as a bad thing is shortsighted. Pesticides are dangerous to bees no matter what they are. The problem with neonicotinoids is not necessarily the pesticide, but the extraordinary misuse of them. By using seed coatings and classifying them as "treated articles," the chemical and seed industries have managed to bypass state and federal pesticide laws and use these chemicals with complete disregard for Integrated Pest Management (IPM).

This abuse is the root of the neonicotinoid problem we are facing with both commercial and native pollinators. Abuse is not the only problem, but it is the reason that this class of chemicals is so harmful, and it is a serious problem that goes well beyond affecting pollinators. Educating farmers on this issue will be the most effective way to address the problem. Farmers are at the top of the consumer food chain, and they need to apply pressure so they have options with seed treatments, options that are simply not available to them now. We must partner with the farmers to ensure that beekeepers and native-pollinator advocates do not become the bad guys. If we do, we will only have governmental and judicial interventions to rely on, and at that point, we will likely lose this war on the environment.

Francis Ratnieks

My audacious idea is that the key need is to ensure that commercial beekeeping is sustainable in the face of diseases. For crop pollination, and to a lesser degree for honey production, we do need commercial beekeepers who keep large numbers of hives and who can move them in and out of crop areas, sometimes over long distances.

What can we do to help commercial beekeepers? Commercial beekeepers manage and treat their hives and, at least in the USA, often purchase queens from queen rearers and use these to requeen colonies and make up increase. Rather than have commercial beekeepers put most of their disease-control time, money and effort into treating hives with chemicals, I suggest that this would be better spent if disease management efforts were more aimed at improving natural disease resistance. One way of doing this is to encourage the breeding and selection of bees that shows high levels of hygienic behavior.

Thomas Seeley

Perhaps my idea is no longer terribly audacious, given the growing interest in "natural beekeeping," but it is that we embrace another way of keeping bees besides the standard approach of managing colonies to be 1) as large as possible, 2) as disinclined to swarm as possible, and 3) as productive of honey as possible. Specifically, I am suggesting an alternative approach that enables bees to live more like they do in the wild, and (hopefully) to enjoy the health that I am finding wild colonies possess. I am calling this approach "small-hive beekeeping" for it involves keeping colonies in one deep 10-frame Langstroth hive body for the brood nest and honey stores, along with one shallow super over a queen excluder for the honey crop. This housing arrangement has the following features:

1. the colony occupies a small nest cavity (like in wild colonies),
2. the colony is likely to swarm each summer (as do wild colonies),
3. the colony produces a modest surplus of honey for the beekeeper.

I think this approach will be attractive to beekeepers who do not want to treat their bees for *Varroa*, do not mind if their bees swarm, and do not seek a vast quantity of honey from each hive of bees.

This approach might also be strongly attractive to beekeepers who are unwilling or unable to invest in an extractor, bottling tank, uncapping knife, and the other equipment needed for extracting honey. For these folks, the honey super could be used to produce comb honey.

I will be testing this approach by creating apiaries managed in this way and seeing what levels of disease and colony mortality I find, and what size honey crops I obtain. As background, I have completed a 6-year study in which I have transferred swarms caught in bait hives into hives consisting of one deep, 10-frame Langstroth hive body with drawn combs, and have then left the colonies alone (no disease treatments, no feeding, no swarm prevention measures, and no honey harvests). I have found that nearly every colony changes its queen each year (probably by swarming), that the Varroa counts in these colonies stay low, and that most (80%) of these colonies survive each year.

Marla Spivak

With time, there could be a separation of bee stocks and management practices between large-scale and small-scale beekeepers. For example, small-scale beekeepers could rely on locally and regionally bred stocks (and swarms collected from Tom Seeley's small colonies!), and end their reliance on queens, package bees and nucs from other regions. Small-scale beekeepers in different regions would need to develop new management practices that work in their region, including when they can obtain new bees.

The results would be more locally adapted stocks that require fewer or no mite treatments. Large-scale, migratory beekeepers that move bees for pollination services and honey production would obtain queens, packages and nucs from current commercial bee suppliers.

Large-scale beekeepers would use bee-appropriate livestock management principles, such as treating in unison right before or after almond pollination, or during other appropriate window of time(s), and removing (eliminating) diseased colonies from apiaries. All states could employ a 2-3 mile limit between apiaries owned by different beekeepers, whether an apiary has 3 or 200 colonies, to reduce density of colonies and limit horizontal transmission everywhere.

Neal Williams

Vision: My vision for bees in managed lands is to create landscapes that are more beneficial to bees and also other aspects of the ecosystem. My vision for pollination is (unsurprisingly) for a broadly integrated approach that recognizes opportunities to use wild pollinators more effectively and moves the practice in a direction that allows for broader integration of these diversified approaches.

1. Ecologically we need to better understand how wild bee communities and managed bee populations interact over time, and how resilience of one component affects the resilience and persistence of the other (be it honey bees or other managed bees). We increasingly recognize that better forage opportunities and habitat promotes diversity of wild bees. These also appear to promote survival of managed honey bee colonies. We do know the net outcome of improved habitat on the two together.

2. Bee health within these landscapes is as much about people, including non-beekeepers, as it is about bees. As we move toward the vision of landscape that support bees, we need to understand why different people choose to manage things as they do. We must engage individuals and groups who own the land, those who cultivate the land, and those who work rangelands. If we are not likely to engage some groups because they have no vested interest in bee welfare; how to we, who do care, tailor actions that these individuals do care about to also benefit bees?

Mark Winston

My audacious idea is to turn pollination management upside down, making wild bees the primary crop pollinator and reducing honeybees to a minor role as supplemental pollinators.

What would it take for wild bees to achieve pollination prominence, and how might beekeepers still earn an income from pollination?

There has been a recent explosion of studies into using wild bees as commercial pollinators, including research around the planet on many high-value crops. While the results vary by crop, the general picture is that the 20,000 or so global species of wild bees not only have excellent potential to perform the majority of crop pollination, but they are already doing so in areas where agricultural practices have not diminished their numbers.

For wild bees, it's all about habitat. They require diverse nectar and pollen sources in and around crops to sustain their numbers when the crop isn't blooming, and habitat in which they can nest. Proactive practices to encourage robust wild bee populations include

reducing herbicide and insecticide use and planting hedgerows and floral strips in which bees can nest and forage.

Beekeepers might shift to become habitat managers, earning income by designing and implementing management zones and practices that foster and sustain wild bee populations. Honeybees would be a part of this system, but diminished from current model in which colonies are moved long distances, often a number of times a year and possibly to their detriment.

Government could assist through subsidies targeted to shift agriculture into pollinator-friendly directions. Hundreds of billions of dollars are spent globally each year supporting industrial agriculture, and if even ten per cent of those funds were moved into ecologically based farming, we would see a significant improvement in wild bee diversity and abundance. By reducing pressure on honeybees we would also see significant improvements in honeybee health.

PLENARY KEYNOTE

Larry Brilliant, currently Chair of the Skoll Global Threats Fund, founder of the Seva Foundation and a key member of the international team that successfully eradicated smallpox, delivered the keynote address at the beginning of the conference. The story of its eradication offers valuable insights on how to address issues of such magnitude and complexity. He noted that a global health challenge such as smallpox required global collaboration from diverse disciplines, and suggested that saving the bees will require a similar worldwide commitment.

Brilliant began his career as a young activist doctor driven by his belief that healthcare was a human right. He explained how terrifying the smallpox virus was. Extremely contagious, it resulted in 300-500 million deaths in the 20th century, cutting across race, class, and all other differences. There was nothing to do once someone contracted smallpox; the only solution was to prevent and eradicate it, although few believed it would be possible.

Brilliant highlighted key factors that contributed to their success. First, the work began with a global program housed at the UN, with the agreement and collaboration of all nations. This program acted as an innovation catcher, leveraging public will and offering a vehicle to implement ideas.

Further, the eradication of smallpox required not one, but various audacious ideas acting in conjunction towards a common goal. While vaccination was effective, it was not enough for the vast scope of the crisis. Prevention through vaccination was coupled with a global campaign to locate and contain all cases of smallpox. The group employed creative and ambitious strategies such as offering reward programs for people who reported cases, and monthly visits to every house in India, amounting to a total of two billion house calls over a year and a half.

Brilliant noted that the challenge facing bees and the environment as a whole is similarly critical to humanity, but also presents unique challenges. Such an international effort is justified because we are all vulnerable to the loss of bees. He pointed to five lessons from smallpox that might guide programs for bees:

- Global: this is an international problem, and needs to be addressed at that level.
- A reward system can be highly effective to encourage individual and organizational actions that favor the health of pollinators.
- We need an implementing agency that has an effective organizational structure.
- Funds: this will be expensive, and we should aim to raise a significant amount of money from governments, corporations, foundations and individuals.
- There needs to be one great idea upon which to build a campaign to save the bees.

Following the keynote, the audience was invited to consider the following questions, first in small groups and then to share their ideas in the plenary:

What does it mean to be audacious?

- to courageously offer something unique
- outside the box, comfort zone
- not being afraid to be wrong
- willing to be a fool
- ability to listen
- honest with self
- willing to change course
- anything is possible
- aspirational

How do you want to interact in the next couple of days to make this more of a dialogue?

- trust in process
- cell phones off; focused
- challenge each other politely
- be respectful
- be open
- be concise
- ask others to help challenge yourself
- ask questions to understand not to criticize
- listen, listen, listen
- listen to understand and not respond
- help others articulate what they want to say

BREAKOUT SESSIONS

DIALOGUE, I, VALUES

Participants focused on two key questions: What are the values we should bring to protecting bees, beekeeping and pollination services? What are some actions that might arise from these values?

> *"Conversations about values may be the best way to move towards action."*

Intrinsic value of bees

> *"They're not just things that die, they're things that live."*
> *"We are not just box movers, there are living animals inside."*

In almost all the breakout groups, participants expressed their deep respect for bees as living organisms with their own intrinsic value and right to thrive. Some participants noted that concerns about bee welfare are often framed in terms of threats to human interests, such as economic impact, food security, or production of goods such as honey or beeswax, while another central motivation for protecting bees should be our admiration for this unique and beautiful species.

They discussed how bees are widely beloved and inspirational, even sacred in some cultures, and how this sentiment has often been expressed in art around the world. Further, bees contribute to a sense of wellbeing beyond material gain. "*We just like to have them around,"* one participant stated, "*we like to hear them humming*." Participants described how people notice the absence of bees in their gardens and ask beekeepers and scientists about their welfare. There was a sense that bees share a unique relationship with humans, with some participants noting the sense of connection and reciprocity they feel with their bees. Some participants also mentioned how beekeeping can strengthen social ties, building communities locally and connecting people across time and space around this longstanding craft.

- Participants discussed how this love, admiration, and respect for bees could motivate action that furthers bee welfare. One participant described this as a "*virtuous loop*" whereby love and appreciation of bees can motivate better treatment of them and their environment, which will lead to greater material benefits from bees, and therefore greater appreciation.
- Some participants suggested re-framing the conversation as one of animal rights, developing a set of global standards that protect bee rights, or their intrinsic right to live and thrive.
- One participant noted that respecting bees requires that we care for the welfare of all bees.
- One group also suggested developing a research program to study bees from an inter-disciplinary systems approach, including historical, cultural, spiritual, artistic and scientific lenses.

Environmental welfare

A value motivating many participants was a concern and sense of responsibility for the health of the wider environment. Participants noted that bee health reflects environmental health, referring to bees as the "*tip of the iceberg,"* an "*indicator species*," and a "*canary in the coal mines*" warning us about a greater crisis.

Participants discussed how the synergistic, reciprocal relationship between bees and the environment could provide an opportunity to regain a more harmonious and sustainable relationship with nature that benefits both animals and humans. Supporting bees contributes to the betterment of the environment, as bees are critical to ecosystem health, while environmental protection is required to help the bees.

Participants emphasized the need to increase environmental consciousness and commitment to sustainability. Many expressed a concern that our society is becoming increasingly disconnected from nature, and noted the importance of fostering a sense of connection and relationship to local environments in order to promote respectful and responsible action. As one participant stated, *"If you've never seen it, how are you going to miss it?"*

Specific actions to support the welfare of bees and their environment include:

- Investment in public education campaigns that help society reimagine our lifestyle, consumption habits, and values and to support a new, more sustainable vision of progress. One group emphasized the need to find alternative outreach methods for more distanced groups instead of preaching to the choir.
- Using bees as a tool for broader advocacy on environmental health, animal welfare, ecosystems, and sustainability. Our cultural attachment to bees, and the prevalence of this species in different regions makes them more relatable than other animal species that are equally threatened by the environmental crisis.
- Allying with related causes and emerging movements, such as the back to earth and urban food movements, and sustainable farming, could be mutually beneficial and create new gateways to learning about bees and the actions needed to preserve them. Many environmental movements are becoming increasingly legitimized, mainstream, and even included in formal education.
- Local education campaigns about bees could help people develop a connection to their local environments and an understanding of the complexity and interconnection of their ecosystems. *"When you keep bees, you end up paying attention to what's blooming and that connects you to the ecosystem, the climate, soil quality, etc."* One idea was to develop field schools in collaboration with farmers and beekeepers to teach the public about local ecosystems, food production, farm practices, and opportunities to support sustainable practices.

- Encouraging and supporting beekeepers to take a leadership role as environmental stewards and advocates.
- Incentivizing the development and protection of natural habitat spaces, such as by increasing the Conservation Reserve Program (CRP).

Socially and environmentally sustainable food systems

"How can we find solutions that support the people who take care of bees and the bees themselves?"

All the breakout groups brought up the importance of building more sustainable food systems. As with the environmental crisis, some participants described the pollinator crisis as a warning about systemic problems in food production, and an opportunity to build a new model for sustainable agricultural and livestock practices.

Participants discussed a wide range of agricultural practices that impact pollinators, including reduced forage habitat, limited crop diversity, or use of pesticides. Many participants expressed a concern that current agricultural practices tend to emphasize short-term economic benefit and efficiency over sustainability and long-term food security.

While there was general agreement that changes in agricultural practices and values are necessary, participants were also sensitive to the economic needs of the agricultural and beekeeping industries. The welfare of workers was expressed as being equally valuable as the welfare of pollinators and the environment. Many participants stressed that these interests need not be mutually exclusive. Instead, participants advocated for a collaborative approach with diverse stakeholders to find common values and support their mutual interest of protecting pollinators and developing economically viable sustainable systems.

Groups brainstormed various ideas that could promote balanced change in support of pollinators, food security, farmers, and the bee industry:

Market-driven change and economic incentives

- Several groups noted the power of consumer demand to incentivize change, as evidenced in other movements (e.g.: increased demand for organic, non-GMO, or gluten-free products). Participants suggested investing in research and marketing to inform consumers about the sustainability of their food and change perceptions in consumer culture (e.g.: reducing expectations for year-round, perfect produce; increasing understanding of the cost of ethical, sustainable products).
- One group suggested developing an ecosystem health or sustainability index to inform consumers about their product choices. This could improve accountability and motivate farmers to make changes that improve their rating on the index.
- Develop a market for high quality bee products, and increase the monetary value of bee services.
- Economic incentives to expand and protect pollinator habitats, and to incorporate more sustainable land use and management practices. Ideas included regulating single crop use, and tax incentives for forage space.

- Support research on the economic viability and benefit of alternative agricultural practices, alongside education and outreach to disseminate findings and promote change through data-proven results.
- Support small-scale change, promoting sustainable practices amongst small-scale beekeepers and farmers.

Education and Outreach

- Education campaigns for beekeepers, producers, and consumers about the importance of bees and pollinators for food production, and the wider impact of certain agricultural practices.

Collaboration and Alliances

- Develop infrastructure and processes (such as working groups) to facilitate collaboration between different stakeholders, including:
  - Dialogue with farmers to better understand their needs, find common values, and lower antagonism and alienation (*"talking* with *instead of at"*). Consider different ways to frame the approach (e.g.: "*resilient agro ecosystems*")
  - Collaborations between beekeepers, farmers, and landscapers to increase forage habitat.
  - Dialogue between neighboring lands around conflicting management practices.
- Allying with movements and groups such as the urban food movement, organic movement, etc., to emphasize the role of bees in these causes and work in mutually beneficial ways, as well as allying with unlikely parties who share similar interests, including hunting groups that are also concerned about habitat preservation.
- Generate funding for educational campaigns, research, and lobbying by collecting a percentage of profits from allied farmers and beekeepers, as was done with the Almond Board.

Policy change

- Many groups discussed the need for policy and legislation to protect pollinators, such as national standards for bee treatment, honey production and safe agricultural practices. One group suggested considering bees as livestock to they can receive similar systemic protection and financial support to address issues such as disease.
- Re-framing the discourse in terms of food security to emphasize how pollinators are critical to the food supply. This may gain more understanding and traction at policy levels rather than just "nature preservation" or "pollinators."
- Creating an umbrella organization, at a national or even international level to support pollinator protection through a coordinated message for advocacy and education and funding for research and initiatives. One idea was to incorporate a group in the UN or OIE to address the health and welfare of pollinators and sustainable food systems, another was to create an online group.
- Build alliances with politicians and land managers who have a louder voice and more inroads in the political sphere.

Stewardship and Husbandry

One value that emerged in various breakout groups was that of taking pride in good stewardship or husbandry among beekeepers. In discussing their definitions of these terms, groups described responsible management, compassionate treatment of bees and

production of high-quality products. Markers of good stewardship and husbandry are high quality honey, and the health and survival of bees. Stewardship was described as arising from a sense of deep respect and love for bees, as well as a pride in craft, and including stewardship of the greater environment.

Groups brainstormed many ways their communities, policymakers and sectors can promote good stewardship and husbandry:

- Encouraging and supporting beekeepers as stewards for pollinators and their environment, acting as informed advocates about bees and the ecosystem. *"If you have bees, you are now an ambassador."*
- Promoting notions of stewardship, husbandry and the value of continual education amongst beekeepers through bee clubs and education/outreach campaigns.
- Developing a central source for up-to-date, reliable information on bee research and beekeeping practices, or a method for establishing credibility for information providers in order to avoid the spread of misinformation.
- Supporting the market of high-quality and artisanal honey through honey exhibitions and shows, valuing honey from particular regions (as with wines from a particular appellation), and regulatory practices to help increase their economic value.
- Further research and support for healthy bee management practices.
- Reducing the antagonism between beekeepers applying different approaches to bee management (*"Centralize intentions, decentralize approaches"*).

Scientific understanding and inquiry

"*Listening to what bees need*"
"Understanding the problem, for better or for worse"

A final value that surfaced in all the breakout groups was that of furthering scientific understanding and inquiry. Many participants noted the limits of our current understanding of the bee crisis, and the need for a humble approach with continued research into pollinators, the factors affecting their wellbeing, and their needs in order to direct responses in the right direction. One participant stated that they wouldn't just want a magical solution to the bee crisis, but also desire to understand the problem.

Research, ranging from the natural sciences to economics, was seen as a requisite to realizing many other audacious ideas participants discussed. They described the need for incorporating technology and innovation to create new solutions to current problems. Nonetheless, many participants expressed concerns that the gap between scientists and the public is widening. There is a distrust of academics, as well as ethical issues in university-community relations. Scientific literacy is decreasing, affected by skewed media reports of research and limited access to scientific journals.

Alongside scientific research, participants discussed the value of continuing education for beekeepers, the agricultural industry, and the general public. Almost all of the dialogue

sessions throughout the conference offered ideas for education and outreach campaigns to further general understanding about bees, their needs, and the environment.
Specific ideas raised in this dialogue session were:

- Increasing environmental monitoring, such as a database of pesticide use, seed coating application, soil and water conditions, in order to trace patterns and understand the impact of various factors on bee health.
- Simplifying granting systems to promote more research.
- Improving knowledge translation, including outreach into different cultural or linguistic communities and a train the trainer approach to disseminate information in communities.
- Increasing partnerships with community groups for research. One participant noted that scientific information has less impact on people's perspectives and actions than direct experience. Direct engagement can increase understanding and support of scientific research, and create community advocates for new information. Ideas included citizen science programs to engage the public as volunteers for data collection, offering research ideas to be taken up by local beekeeping clubs, or asking them for their needs from researchers.

DIALOGUE II, MANAGING HONEYBEES

In the second breakout session, participants developed one or more audacious ideas for honeybee management, discussing their feasibility, outcomes, benefits, challenges and implications.

Local and contextual management approaches

In this and other discussions throughout the conference, groups agreed that best management practices must be defined in context of geographic location, business model (hobbyist, commercial), desired outcome (honey production, colony increase, pollination, ecological benefits, personal satisfaction), and surrounding environmental factors (number and health of neighboring colonies, quantity and quality of local forage, pesticide use in colonies and in the field). Participants felt it was important to be respectful and tolerant of differences in order to increase constructive dialogue between beekeepers and move towards common goals.

- Instead of setting universal best practices for bee management, breakout groups recommended developing a compendium of credible, tested practices by region.
- Groups also recommended further local surveys, regional bee monitoring, and research supporting local beekeepers' particular needs and questions.

Bee sourcing and breeding

Several groups emphasized that good management needs to be reinforced with good quality bees. Groups discussed various strategies, including:

- Increasing local stock and local queen production, adapted for local conditions.
- Geographically decentralizing primary queen breeders.

- Better assessment of packaged bees and queen stock.
- Master Beekeepers going from hive to hive to re-queen.

Disease response

Almost all the breakout groups discussed ideas to manage and eradicate pests and diseases affecting bee colonies. Many groups emphasized the importance of regular monitoring and data collection in hives to help manage pests and diseases:

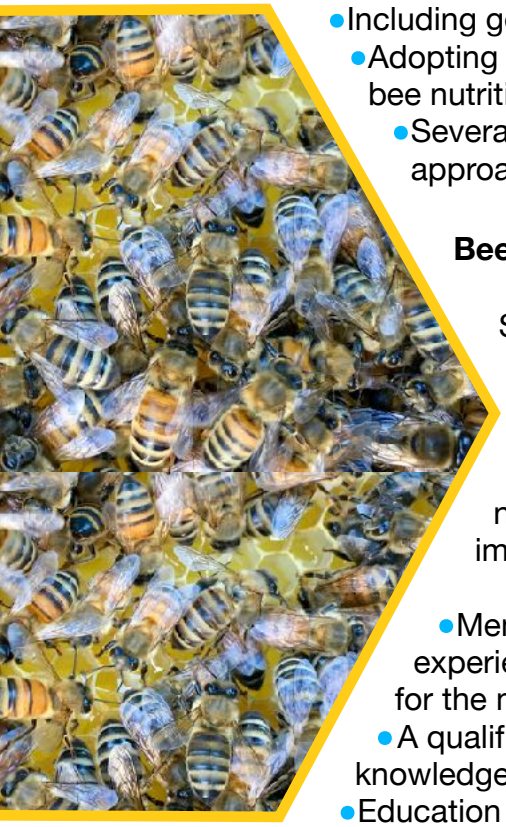
- New, hobby and urban beekeepers in particular should be encouraged and trained in how to monitor their hives, with guidelines and demonstrations.
- A standard monitoring calendar or "test and treat week" campaign could help promote regular monitoring and treatment.
- Colonies could be monitored with sensors tracking hive weight and temperature.
- Bee health could be monitored at a municipal, regional or state level with beekeepers or formal inspectors who would keep track of colonies and their health.
- Several groups suggested addressing pests and diseases at a national level, modeled on similar systemic approaches for human diseases or other livestock diseases (Centre for Disease Control, mad cow, bird flu). This body could track pests and diseases, and develop and disseminate treatment and management strategies.
- Some groups advocated managing diseases at a regional scale, increasing dialogue and collaboration between different levels of beekeepers (hobbyist to commercial) and finding solutions that are economically and ecologically viable.
- Several groups noted the increased risk of pest and disease transmission in migratory commercial bees. While some recommended reducing the amount of hive movement, others suggested checking hive health before moving them, or treating all bees when they enter a particular state.
- Finding the optimal comb turnover rate for particular regions and climates, and encouraging beekeepers to discard old comb.
- Decreasing the pollinator service contracts in a given operation, and spacing hives further.
- Developing a matrix-based mortality measurement to track causes and locations of bee decline so beekeepers can be informed of local issues.

Intervention and Treatment

There was a diversity of opinions among participants in regards to bee treatment and level of intervention in management. Some advocated for decreased treatment and a return to "traditional," "natural," or "bee-centric" approaches to management. While this creates some loss of bees, it can also increase resistance. Others noted the tension between treatment-free beekeeping and the economic need to intervene to save colonies, as well as the responsibility to treat hives to reduce the spread of pests and diseases in neighboring hives. Some of the perspectives expressed during this breakout session focused on how to balance the interests of treatment-free advocates and those who favor treatment. Audacious ideas included:

- Creating and researching treatment free areas for unmanaged honeybee colonies, including infested colonies to research the viability of natural selection as a response.

- Allowing swarming. Some discussed this as a natural way to control disease, though others noted it can instead spread pests and diseases further. Some participants also noted that allowing swarming in urban areas can be more challenging. One group mentioned that artificial swarming is a labor-intensive but effective management tool.
- Not combining sick and healthy hives.
- Caging queens to create broodless periods.
- Including genetics and non-interventionist strategies in beekeeper education.
- Adopting practices that reduce and mitigate stress on bees, and improving bee nutrition.
- Several groups suggested an Integrated Pest Management (IPM) approach, increasing chemical use only when required.



Beekeeper training and communities of practice

Several groups emphasized the importance of training for new beekeepers and knowledge exchange between beekeepers to promote sound management practices. One group noted that there is a large attrition rate for new beekeepers, while others discussed the abundance of misinformation online that can lead new beekeepers to adopt poor management practices. Ideas to improve beekeeping training included:

- Mentorship models, where beginning beekeepers can learn from more experienced beekeepers in their area, with ongoing support and oversight for the management of their hives.
- A qualification or certification system to ensure that new beekeepers are knowledgeable and prepared.
- Education of emerging beekeepers could provide an opportunity to increase the number of beekeepers trained in sustainable beekeeping practices, leading a tide of change.
- Promoting alternatives ways of getting involved for those who are less suited for keeping bees, such as building habitat, changing consumer habits, or reducing pesticide use.

Continuing education was also seen as important for experienced beekeepers. Some groups suggested strengthening communities of practice and communication between beekeepers to promote the sharing of best practices, tools, resources, data and experiences. Communities of practice could further work together for regional monitoring, supporting scientific research, advocacy and breeding local queens. One international participant noted that in their home community, beekeepers did not like to collaborate and this led to an increase in pests and diseases. Communities of practice were envisioned at different levels, including:

- Local groups.
- Online groups to connect beekeepers in different regions.
- Adding satellite sessions to major bee meetings.
- A beekeeping union or overarching group to establish guidelines and healthy practices.

Research

In this and other discussions throughout the conference, participants supported the need for further research on good management practices and healthy bees. Ideas for effective research included:

- Regional studies that test practices and frame success in context of local factors (environment, local non-*Apis* species).
- Support for experimentation and pilot projects to develop innovative new ideas.
- Standardized methods so findings can be comparable.
- Open access journals to help disseminate scientific information.
- Developing a system to help users discern the credibility of online sources.

The Bee Informed Partnership was cited as a good model, where survey data from beekeepers are collected to understand which management practices work best, and to gather pest and disease data. This non-profit group is governed by a coalition of researchers, advisors, and industry stakeholders who rely on bees for pollination.

Participants also commended Project Apis m., a nonprofit organization that funds research to enhance bee health.

Increasing forage habitat

Throughout the conference, participants emphasized the importance of increasing diverse forage habitat to support both wild and managed bees. Participants noted the various challenges to increasing forage, including a lack funds, labor, time and technical knowledge about the planting and maintenance of geographically specific forage plants. Limited land is also a challenge, particularly in urban areas, and forage habitat can take up to two years to develop. Ideas to support forage habitat included:

- Collaborative landscape partnerships between local beekeepers and farmers or other landowners (e.g.: land trusts) that emphasize the mutual benefit of developing forage habitat. For instance, research may show the economic benefits for a farmer to increase forage and rely on more local bees for pollination, or the agricultural benefits of intercropping. One group suggested that farmers should think of bees as livestock that require suitable pasture.
- Independent, certified land management consultants could advise farmers and other landowners on setting up and enhancing forage habitat on their land.
- Encouraging communities to take on responsibility for developing forage in their backyards.
- Creating bee-friendly quarter-acre forage lots in urban areas.
- Encouraging beekeepers to consider forage needs and sustainability when acquiring new hives. "*Before you obtain a hive, you need to ask if the environment can support the hive, is it sustainable?*"

Incentivizing changes to agricultural practice

Groups also discussed other agricultural changes needed to support bee health, including reducing chemical use, diversifying crops and transitioning to greater reliance on local bees for pollination. Economic incentives were proposed for growers who practice good stewardship, including:

- Tax credits
- Reduced hive rental rates
- Certifications

DIALOGUE III, PROVIDING BEES FOR POLLINATION

In the third breakout session, participants developed one or more audacious ideas to provide bees (including *Apis* and non-*Apis*, managed and feral) for crop pollination, exploring their feasibility, outcomes, benefits, challenges, and implications.

The discussion in all breakout groups centered around three main strategies for supporting pollinator health:

- Providing sufficient and diverse forage and nesting habitat for bees and other pollinators in rural and urban areas.
- Ensuring the safety of pollinators in habitat spaces, particularly from harmful pesticides.
- Increasing the use of locally sourced honeybees or wild bees and other pollinators for agricultural pollination to decrease demand and stress on large scale long distance movement of commercial honeybees.

Groups noted the financial and logistical challenges of implementing these changes, and brainstormed various approaches for supporting beekeepers and farmers in the transition.

Advocacy and Education

All groups emphasized the need for greater advocacy and education for both farmers and the public around fostering healthy environments for pollinators and the role of native/wild pollinators.

For the public, this included education around how to plant pollinator-friendly gardens and reduce pesticide use. Some groups also noted how other sectors can be involved in developing forage habitat for pollinators, such as on government lands or roadsides. For instance, one group cited the Roadside Managers Award, a campaign from the North American Pollinator Protection Campaign (NAPPC) that recognizes transportation agencies supporting pollinator-friendly roadside habitat protection and maintenance.

Participants stressed that farmers already face great uncertainty and risk from factors such as the weather, and that "*pollination cannot be a risk*." Ideas to advocate for change among farmers included:

- Further research into alternative agricultural practices in order to offer recommendations that are proven, context-specific, and managed for risk. Using small test sites to find effective methods can mitigate further risk to farmers.
- Further research into the synergy or conflicts between different pollinators, the suitability/efficiency of different pollinators for certain crops and the habitat needs of different pollinators.
- Developing an economic analysis/model to show the financial viability and benefits of implementing pollinator-friendly land use practices (e.g.: increased crop yields, reduced expense by using native bees), including offsets for potential losses.
- Highlighting demonstration farms that are successfully operating with pollinator-friendly agricultural practices (e.g.: apple orchards in New York that are using native bees, farms successfully working without pesticides).
- Educating farmers about native bee populations, their value to farmers, their needs, and how they are impacted by different farming practices.
- Greater translation and dissemination of scientific research for different audiences.

Participants discussed various approaches to advocacy, including:

- Allying with related groups and movements, such as Ducks Unlimited and Pheasants Forever, to support habitat development.
- Working with the Farm Bureaus to communicate to farmers.
- Setting up roundtables for pollinator protection with stakeholders, at a local, regional and national level.

Technical Support

Several groups proposed a Pollination Assessment Tool, Pollination Advisers/Managers or Pollination Assessment Service that could:

- Determine if a crop's pollination needs are being met.
- Identify pollinators (including *Apis* and non-*Apis*, and managed and feral, bees, as well as other pollinators) that would optimize pollination for a given crop.
- Offer advise on designing and maintaining habitats to support the necessary pollinators.
- Educate farmers on other agricultural practices that can support or hinder pollinator health.

It was suggested that beekeepers could be in a unique and informed position to take on this role, including adopting alternative pollinators into their arsenal for pollination services. However, one group questioned whether all beekeepers have the capacity or expertise to take this on.

One group also noted the need for technological developments to support different farming practices, such as multi-crop harvests.

Systems of Accountability

Several groups noted the importance of monitoring farms for risks to pollinators, particularly the use of harmful pesticides. If farms begin to keep their own honeybees, or depend more on native bee populations, the use of chemicals year-round can affect pollinator health. Unsafe practices can also affect migratory commercial bees, causing financial losses to beekeepers. To monitor and mitigate risk, participants suggested:

- Fostering better communication and stronger relationships between farmers and the beekeepers that serve them, in particular to develop an awareness of farmer's year-round practices. *"This communication is often very informal and might also be based on personal relationships that are variable and changeable. The challenge might be to support those relationships no matter the size, and encourage the establishment of new relationships."*
- Mapping pollination areas and their exposure to pesticides and diseases to identify safe areas and problem areas for pollinators.
- Developing a Risk Assessment Tool to index risks and benefits to managed pollinators (pesticide use, diverse forage). Participants envisioned this as a "*collaborative tool that holds all stakeholders accountable for mitigating risks, including beekeepers*." This could inform pollinator service providers about their risk working in different areas, while holding farmers accountable. It was suggested that the Assessment Tool could be tied to a sliding scale for pollination service fees, incentivizing farmers to make beneficial changes.

Financial Support and Incentives

Groups brainstormed various sources of funding to support habitat development, including:

- Government subsidies, or tax incentives.
- Large scale programs such as the CRP.
- Private, NGO fundraising. One group mentioned a pollinator license plate program in Virginia where part of the profits support the Pollinator Habitat Program in building habitats on roadside medians and rest stops.
- Surcharges on honey sale, honey export fees
- Increasing hive rentals by $3 a box, and contributing $1 to an umbrella organization to support bees or habitat development.

Participants also noted the power of market-driven change, suggesting:

- Consumer education campaigns and certifications/labels to help consumers identify and support products from bee-healthy farms.
- Boycotts of farms operating with unsafe practices for pollinators, or a sliding scale hive rental fee depending on the risks and benefits to pollinators at a given farm. One group discussed the limitations of these approaches, noting that there will always be beekeepers willing to lower rental rates or work with the farms if they need the income.

Policy Change

Several groups also suggested actions at a policy level that can support needed changes, including:

- Removing regulatory hurdles for habitat development or keeping bees on farms.
- Adding bees to endangered species lists to help encourage strategies/policies to protect them.
- Government lobbying for necessary legislation, in particular supporting a provision in the Farm Bill to incentivize or subsidize habitat development.
- Using the term "food security" to rally support and a sense of patriotism.

Systems Change

Some groups discussed systemic change that would support pollinator health and pollination sustainability, including:

- Reducing chemical dependency for beekeepers and farmers alike.
- Transitioning from monocropping to serial monocropping or multi-crop harvests.
- Transitioning to small-scale, organic agriculture.
- Reducing dependence on bee rental for pollination—seeing this as a "plan B" in favour of local wild bees, managed by local beekeepers or the farmers themselves. Participants noted that this would require both education for farmers on the economic benefits, as well as an income alternative for the many commercial beekeepers that rely on hive rentals for their livelihoods.

It was noted that it may be easier to introduce changes in small scale farms, but that respectful communication needs to remain open with big agriculture and policy makers to advance systemic change.

DIALOGUE IV, OPEN SPACE #1

Participants were invited to choose a breakout with one of the following topics, and discuss in detail issues such as benefits, challenges, evidence favoring or against, what more information do we need, is it feasible? There were eight simultaneous sessions, with no plenary discussion afterwards. Participants stayed in the room they chose for the entire discussion.

Non-*Apis* Pollination

This breakout group considered the feasibility of reducing dependence on honeybees for crop pollination by using non-*Apis* bees as well, discussing the benefits and drawbacks of using native and imported, managed and wild non-*Apis* bees.

Overall, the group agreed that feasibility would depend on the context, including the crop in question, which bee species was more effective at pollinating, the geographic location and the agricultural system. They indicated that it would be easiest to implement this idea in a

diversified crop system, harder but possible in a monoculture, and most difficult in a greenhouse system where bees would have to be highly managed.

Depending on the geographical location and the intended crop, the appropriate non-*Apis* bee might be found in native populations, or may have to be imported. Importing bees raises issues of mobile pollinator services and unnatural introduction of foreign bee species. However, there are also risks to trapping native bees (reducing natural populations), and participants noted that it can be unpredictable to rely on native bees for pollination on farms where growers use chemicals. Further, participants noted that non-*Apis* can be more difficult to manage and regenerate than honeybees. They suggested that some bee species (e.g.: leaf cutter bees, orchard bees) could be managed in ways more compatible with a healthy environment.

Participants identified two needs to make such a transition feasible:

- First, increased permanent forage habitats would be needed for both *Apis* and non-*Apis* bees. One participant suggested that farmers should *"farm for bees as well as for their crop,"* seeing it as a responsibility to nurture bee populations as well as produce their harvest. As in previous discussions, participants suggested demonstrating the effectiveness of creating forage habitat in economic terms, and offering financial incentives.
- Participants also suggested that further research is needed, including:
  - What non-*Apis* pollinator is the most effective for different crops? Which ones might be even more effective than honeybees? What stocking densities would be required?
  - Mapping the feasibility by crops and location *("gives us places to target for different actions"*).
  - Identifying successful models and how they could be scaled up (e.g.: native pollinators for apple crops in New York state, organic almond farms as models for good management without chemicals).
  - Researching the economic impact of transitioning to non-*Apis* pollinators.

Participants suggested the need for ongoing support from researchers for implementation. One participant stated "*You university people give us this tool, but then you leave us with it,*" while another suggested that farmers should be financially supported with crop insurance to experiment and pilot ideas.

Natural (Darwinian) beekeeping

In this group, participants considered what beekeeping would look like if we managed bees based on their natural history, emphasizing management consistent with how honeybees survive and thrive as feral organisms.

Participants noted that most standard management practices are motivated by human convenience and profit instead of bee health. Some participants suggested that a shift to natural beekeeping would require a shift in motivation—keeping bees primarily for their own sake

and providing for their needs, instead of manipulating them to produce more honey, pollination, wax or other commodities.

The group began by brainstorming the various bee management practices that are contrary to natural bee behavior, considering the feasibility, benefits, and challenges of natural management:

- Re-queening colonies: When we intervene, we take away the opportunity for the hive to supersede naturally, selecting their own queen.
- Swarming: Small colonies that are encouraged to swarm have a greater survival rate, although this can pose problems in urban areas or areas with Africanized bees.
- Intervention for pests and diseases: If hives are not close to others, it is possible to suspend treatment for pests and diseases and let sick colonies die. Eventually, bees would develop resistance, but in the meantime profit would be impacted for years. Thus, natural beekeeping may be less feasible for both urban beekeepers (where other colonies are too close) and commercial beekeepers (who rely on bee health for their livelihood).
- Spacing of hives: Well-spaced hives are more inconvenient for beekeepers to manage, but may reduce the spread of pests and diseases.
- Propolis (anti-microbial enzymes shroud): Beekeepers tend to remove it, selecting for bees that produce less.
- Artificial feeding may be less healthy for bees than nectar and pollen.
- Hive designs: We need to experiment with diverse hive designs to determine if and how non-Langstroth hives might contribute to colony health.

Overall, the group recommended further research into:

- Wild honeybee behavior in order to improve management systems and make them more in line with nature instead of forcing honeybees into a system that is artificial to them and requires often harmful interventions.
- Effective models of natural beekeeping; one participant noted that Kenyan beekeeping is example of natural/minimal intervention beekeeping.
- Feasibility and strategies for natural beekeeping in urban or commercial contexts

Bee health first

In this group, participants considered what would be the design of an overall management system for honeybees that puts the health of colonies as the primary objective?

Participants centered on the idea of a system that would prioritize and foster the evolutionary resilience of bees. There was some support for minimal intervention in sick colonies, with suggestions such as starting with twice as many colonies as needed in order to cull the weak, not supporting sick colonies indefinitely and prioritizing the health of the apiary over an individual colony. However, participants also discussed the prevalence of horizontal transmission of pests and viruses from untreated or feral hives, and the importance of good beekeeper education about bee health to promote responsible beekeeping practices (colony culling, genetics, monitoring/treatment of disease and pests, BMP, horizontal transmission, local queen rearing.).

In particular, participants noted the need for continual education, as best practices change rapidly, and context-dependent education since best practices will vary with location. It was suggested that sick colonies could become teaching tools. Participants also noted the role of government in supporting healthy management systems, complementing bottom-up education with top-down approaches including:

- Treating bee diseases as public health epidemics.
- Registration to help eradicate AFB.

Stationary apiaries compared to moving bees for pollination

Participants compared stationary apiary systems and moving bees for pollination in terms of their effects on honeybee health and beekeeper economics.

There are risks and benefits to all kinds of beekeeping, and respectful dialogue can help surface challenges and promote collaborative problem solving. The group stressed the value of diverse approaches and non-judgmental attitudes, and spent some time discussing the benefits and challenges of both beekeeping models.

Mobile beekeeping offers economic benefits and a valuable agricultural service, but also an opportunity to move bees to new blooms, supporting honey production. It was noted that trailer springs have greatly improved so that transit is smoother for colonies. However, mobile beekeeping is stressful on the bees, can help spread diseases, exposes bees to farms with harmful pesticides and can lead to unhealthy bee management as beekeepers are pressured to meet growers' needs.

While stationary beekeeping is less stressful and healthier for bees, it can be less economically viable. Bees may run out of forage, particularly in areas with monocrops, and may cause overcrowding, as beekeepers tend to congregate in good honey producing areas.

Suggestions included:

- Seeking alternative models to profit from bees without moving them for pollination.
- Seeking healthier, more sustainable methods for moving bees for pollination ("Be a good steward as you pursue your objectives").
- Promoting knowledge exchange between different kinds of beekeepers, and copying successful models.
- Developing metrics to compare stationary operations with migratory pollination operations to understand the risks for bee health.
- Supporting emerging beekeepers to transition into sustainable models of beekeeping. Participants noted the difficulty of surviving and thriving as a beekeeper, given the risks and lack of financing. Ideas included:
    - An enterprise fund, subsidized loan program, or new beekeeper startups to financially support beekeepers to make responsible decisions with their business.
    - Mentorship between emerging and established beekeepers.
    - Increasing the value of products like honey.

Managing honeybees with little or no pesticides or antibiotics

Participants considered the feasibility of treatment-free beekeeping, including questions such as the minimum treatments needed for Varroa control, and whether it would be possible to prohibit antibiotic treatments for American Foul Brood and use only burning for control. The group discussed all chemicals, both hard and soft/organic.

While there was no consensus in the group around eliminating chemical use entirely, there was agreement that a holistic approach is needed to at least reduce dependency on chemical treatments. The group suggested that greater emphasis should be placed on management practices that promote bee health, including better nutrition, reduced stress (bees that are not stressed manage Varroa better), regular monitoring and selection and breeding. As in other discussions, participants agreed that best management practices depend on context and geography.

Participants noted that many low treatment approaches work best with smaller colonies, and are harder to implement in large-scale operations. It is particularly difficult for commercial beekeepers to manage bees treatment-free because the effectiveness isn't certain, posing a risk for both the beekeepers and the agricultural system as a whole. However, one participant mentioned that commercial operations are learning to monitor and treat on the apiary level instead of the operation level.

Participants discussed the concern of drug resistance. They noted that antibiotic regulations now require veterinarians to prescribe them, curtailing inappropriate use. However, participants questioned how much veterinarians know about bees.

Participants questioned what would happen if beekeepers stopped treating pests/viruses altogether: would bees develop their own resistances? Are we only delaying collapse by a few years when we use chemicals? They noted bee species that have developed resistance, such as feral African and Russian stocks that have developed behaviors and adaptations to fight varroa. However, they also discussed the danger of re-infesting neighboring colonies if left untreated, and that finding out the consequences of treatment free approaches would take years and involve great risk.

This session evoked a considerable range of opinions, from fanciful ideas (poison ivy as a miticide) to "invent more chemicals, fast." Overall, the most audacious perspective included two components:

- We need a broad research program, with regional and beekeeper diversity, to test the various chemical, non-chemical and genetic options to manage the most serious pests, particularly Varroa mites and their associated viruses.

- Genetic resistance will always be the preferred management tool for any disease or pest, and we need to ramp up our efforts to select, breed and maintain resistant bee stock.

Research ideas

In this group, participants considered how research funding might be restructured to encourage audacity.

Participants stressed the importance of research funding to effect change in agriculture and apiculture, particularly for experimental and long-term (minimum 3 year) projects. Ideas for audacious research directions included examining agricultural and food systems as a whole, and seeking alternatives to monocultures. This field is underfunded and under-mobilized, and could capitalize on the growing public interest and political will behind bees, as well as harmonize and optimize resources to leverage funding.

Some described the burdensome process of research applications in academia that doesn't support risk taking, and pointed to the need to identify and assess barriers so they can be addressed.

- Foundations or crowd-funding campaigns were identified as alternative and accessible sources of funding.
- Private funding is another alternative. One participant described the successful seed grant program from Lush Cosmetics offering a maximum of $5000 for projects that are regenerative, supply chain relevant, related to local food sources and self sustaining.
- Participants also noted that projects tend to be funded more if they are using popular buzzwords such as "technology" based on topics of current interest. This can be a detriment to some research, or can be used to their advantage by framing projects around current buzzwords. Similarly, the economic value of honeybees can be used as an economic argument for funding research.

Participants suggested promoting further research collaborations with citizen groups, and increased funding to support these partnerships. There is a strong interest to get involved among beekeeper groups and members of the public, which can be seen as a resource to help make up for funding shortages. The Sentinel Apiary Program and the Wild Bee citizen scientist program in Vancouver were cited as good examples.

Finally, participants offered ideas for research structures that would support audacious ideas, including:

- The X Prizes model offers private sector funding to solve impossible problems, bringing together a team of problem solvers working towards a common solution.
- Shared laboratory spaces.
- The Fab Labs model of shared lab/knowledge exchange spaces offering the tools needed for innovation and enhancing ideas.
- A dedicated audacious research fund for creative and innovative ideas (*"proof of concept testing"*)
- One participant recommended the book "*Bold*" by Peter H. Diamandis and Steven Kotler as a resource.

Engaging the general population

Participants discussed the most important issues around which to engage the general population, and avenues to do this effectively. Participants noted the growing public interest in bees and their welfare; one participant described how people stop by his farm constantly to ask about the bees. There is an opportunity to build on this groundswell and help the public realize the potential impact of their lifestyle changes, political will and consumer power.

Participants discussed the importance of framing the topic in a way that is consistent with values in order to capture their interest. For instance, one participant suggested appealing to patriotism and recent political movements with a slogan such as "Make Farms Great Again," while a participant from China has seen habitat development promoted by designing rooftop spaces that are chic and luxurious.

Messages that the group felt were important to communicate to the public included:

- The value of pollinators, beekeepers, and bee products.
- Ecological literacy: education about native plants, pollinators, ecosystems and food systems.
- Promoting actions that help pollinators, such as building pollinator friendly gardens and rooftops, reducing/eliminating domestic pesticide use.
- Promoting consumption of products from local, sustainable, pollinator-friendly farms and beekeepers.
- Fostering an appreciation for wildlife, biodiversity, and the environment.

Participants brainstormed effective places to reach people (social media, farmer's markets, gardening groups, early education), as well as innovative mediums of communication including:

- Art projects in highly transited places; fundraising concerts; murals.
- Demonstrations and hands-on activities, such as lessons at an apiary, bringing frames of capped honey with a hand crank centrifuge to bottle, cap and take home, crafts with bee products.
- Educational games and apps.

Some audacious ideas for community engagement included:

- A series of one-minute, trendy video advertisements
  - A video illustrating a modern, hip and sustainable vision of the future where the environment is incorporated into every aspect of urban design and farm management. *("Promote a vision of future as green and lush instead of sleek and built"*).
  - A video illustrating the work of beekeepers in vivid detail, bringing visibility to a nearly forgotten art/craft/science, showing the human element, and the work that goes into bee products. (Could be modeled after Stella Artois commercials with visuals of honey production).

- Promotional material about the Bee Audacious conference ("*beekeepers gather and rally to save bees*…") as the beginning of a pithy, slick public education and outreach campaign about ensuring pollinator health.
- A social media campaign of factoids to foster appreciation of bees (e.g.: how many bees it takes to make a jar of honey, how much forage space do they need, how far they can fly to forage, length of bee's life).
- Visual representations of landscapes with and without bees.
- Supporting successful programs such as "Know Your Farmer/Know your Beekeeper" programs and Bee City USA.
- Offering technical support for developing pollinator-friendly gardens (demonstrations, networks of seed suppliers).
- Creating opportunities to be involved as citizen scientists.
- Creating networks of speakers.

There was also some discussion about the need to connect small, fragmented bee advocacy groups to share knowledge and resources and scale up. One idea was to create a geographic database of pollinator-related efforts across the country. Other proposals included providing choices in the marketplace that reward the landowners and companies that change for the better. Perhaps a new form of agricultural certification based upon habitat, biodiversity and sustainability would be desirable.

Extension and regulatory system

In this group, participants considered what an effective extension and regulatory system might look like, and whether increased extension and regulation is desirable. Participants noted that extension and regulation varies greatly between states and between the United States and Canada.

Extension programs have experienced a loss of funding, coupled with increased demand from the growing body of hobbyist beekeepers. Recent years have seen a loss in beekeeping-oriented extension programs, especially as extension specialists retire. Participants strongly recommended increased funding for extension, and brainstormed possible sources including:

- Lobbying for increased funding for extension programs in the Farm Bill.
- Seeking support from growers who depend on pollination.
- Seeking funding from beekeeping clubs and associations.
- Looking at self-funded, profitable extension programs as models.

The group also discussed the strong interest among commercial beekeepers for a national extension program that addresses their needs and issues, preferably independent of the regulatory system.

- Participants noted that BIP (Bee Informed Partnership) filled a niche as other programs were cut. They work at a national level, supporting commercial beekeepers (e.g.: to diagnose disease), and collecting a great amount of data. They could be supported to continue and expand in this capacity.
- Some participants suggested that backyard beekeepers could contribute $5 annually to fund an extension agent.

Similarly, participants discussed the need for increased extension programs for groups whose work impacts pollinators but who fall outside of traditional services, such as the landscape sector and homeowners. In particular, there are issues reaching out to those who use pesticides but do not require a license for it.

- Participants noted that Master Gardening and Master Beekeeping programs are reaching out to some of these groups, evolving into more extension-based formats, and participating in more citizen science and research. In one state, extension have received a grant to train Master Gardening as certified pollinator educators. Another participant described how a Master Beekeepers program has begun teaching beekeeping courses through extension; the Master Beekeepers benefit from extension's infrastructure, administration and marketing, while it is a profit stream for extension.
- Another potential collaboration is between extension and veterinarians, who are going to be involved with prescribing antibiotics and offering diagnostic services.

Participants compared the relationship between regulation and inspection in different regions. In some, inspectors also do extension work (field days, talks at bee clubs), and some don't understand that there is a difference between extension and regulation. One participant noted that field days can help beekeepers become more comfortable about apiary inspectors, changing their reputation of being a threat, or tied to government. However, they noted that extension shouldn't replace regulation.

Similarly, participants described how in many regions registration is voluntary or non-existent, and inspection programs have disappeared. Participants suggested building on the BIP model for sampling, harnessing the power of crews to take samples for a centralized lab. Sampling could be taught as an industry standard.

Finally, the group recommended more communication between extension groups in different states. They proposed a National Apicultural Extension Association (NAXA) or Bee National Extension for US (Bee NEXUS): connecting extension agents from different states to share resources, curricula, protocols for recommendations and national BMPs. *"It's like NASA, with a stinger."* (Note: such an organization already exists, the Apiary Inspectors of America).

DIALOGUE V, OPEN SPACE #2

Participants suggested ideas and submitted to thought leaders who met and chose nine ideas for breakouts. Participants could join whatever breakout they chose, and could leave and join another group at any point, but the general topic in each room stayed the same. The plenary reconvened to hear one idea from each group, presented by the Thought Leader facilitating.

University, government and citizen science

Participants discussed what kinds of research should be funded, and how citizens might be more involved in research.
The group discussed how citizen science improves scientific literacy, public trust in science and the impact of research findings. People are more likely to change their behavior if they feel involved in research and can relate to it personally. While they felt that university research could involve citizen scientists, challenges include managing large groups and ensuring good data collection. One participant noted that there is a danger for citizen science projects to be just feel-good and not create a deeper impact. Recommendations for engaging in citizen science included:

- Starting with small groups and expanding as projects progress.
- Finding projects that citizens are capable of participating in, such as research that requires a great deal of monitoring.
- Making citizens aware of funding sources and allowing them to have input in the direction of the project.
- Improving infrastructure to make citizen science data easier to collect reliably (e.g.: developing apps to help organize data).

The group discussed the multiple factors that influence choices in research topics, including researcher interests, grant sources, lab capacity and government administrations. However, they noted the value of research that affects people directly, suggesting generating research topics in consultation with beekeepers around locally relevant issues, as well as supporting applied research that can make a direct impact.
Participants recommended making more money available to early graduate students and postdoctoral students, and involving extension agents to make sample collection more uniform. Some suggested research directions included:

- Wild bees.
- Synergies between bees and other organisms, and the long and short-term synergistic effects of pesticides.
- Effectiveness of different pollinators for different crops.

Finally, the group discussed knowledge translation and dissemination. It was noted that currently the end user has to seek out information, and that the general public has limited access to research papers. Recommendations included:

- Disseminating research in various forms including published papers, books, and also social media.
- The Bee Informed project was cited as a good model for collecting and disseminating information to the public.
- Doing research in the field, under actual working conditions, rather than research in a university environment. This can improve the applicability of research and bridge the gap when trying to get the results out.

Teaching and training

Participants discussed strategies and needs for training hobbyists, sideliners (small scale, 20-200 hives) and commercial beekeepers.
Many in the group have noted high attrition rates amongst beginner or hobbyist beekeepers. They noted that many students come into beekeeping with romantic or unrealistic ideas of the work and "*the passion doesn't survive the reality*." As training new beekeepers often takes up hours of volunteer time for teachers, participants suggested ideas to better screen or prepare those interested in beekeeping, including:

- Developing an app to help newcomers consider the realities of beekeeping and whether they would like to take it on.
- Not selling bees to people until they've taken instructional courses.
- Suggesting other ways to help bees (e.g.: buying local honey, planting pollinator-friendly gardens).

At the same time, participants discussed the need to increase labor force training and attract and support new beekeepers in the profession. Ideas included:

- A job corps model for beekeeping.
- Training in entrepreneurial skills and marketing.

Participants emphasized that beekeeping requires continual education. *"Bees are not like chickens or dogs, in 30 years you're still going to be learning."* They discussed how sideliner beekeepers need to learn more advanced techniques (e.g.: splitting hives, local queen breeding, local botany), and as operations become bigger more depth of training is required. Some felt that commercial beekeepers don't often seek further training, although they could benefit from more education on ecosystem health and emerging research that impacts their practices. Some participants emphasized the need to teach good husbandry, and education that puts bees first, fostering a deep respect for them. (*"The bee is a teacher for my students and I"*). They noted that many beekeepers want to hear what was discussed at the Bee Audacious conference.

Finally, the group suggested strategies and models for training programs, including:

- Avoiding bee gurus (teachers with an agenda or only one teacher in a training program) in favor of multiple instructors who can expose students to diverse opinions and approaches.
- Developing a community-based cooperative or regional consortium comprised of several beekeeping teachers offering beginner, intermediate and advanced skills for all levels of beekeepers.
- Creating a nationwide or regional network of exemplary teachers.
- Increasing individual instruction and support.
- Some suggested creating a set of shared principles or standards for beekeeping education. Others noted that this would have to be balanced with locally relevant instruction and flexibility in how to apply standards.

Reaching the public

Participants in this group felt strongly that public education and outreach is critically important for the survival of bees. Public education can help increase awareness of the impact of actions such as using harmful chemicals for pests and gardening, or supporting local, organic and sustainable products. Further, it can promote the value and health benefits of bee products.
Recommendations for public education and outreach included:

- Cultivating an educational paradigm that emphasizes the importance and value of bees, instead of framing the issue in a negative light (e.g.: "*the end of bees is the end of humans*").
- Identifying and tailoring messages to specific audiences and their values (e.g.: homeowner associations, landscaping companies, farm bureaus).
- Identifying and reaching out to untapped audiences. The group challenged beekeepers to reach out to five groups or audiences they would normally not have contact with.
- Extension publications to inform homeowners on the impact of applying specific chemicals.
- Reaching out to landowners to introduce the idea of planting pollinator-friendly seeds.
- Increasing use of social media.
- Reaching out to youth to promote careers in beekeeping, and beekeeping training.
- Being models for change, taking leadership in our own behaviors and consumption to support sustainable agriculture and pollinator health.

The next generation of controls

In this group, participants discussed the next generation of controls for diseases and pests, from genetic to chemical to high tech, and considered promising research directions. Participants recommended further research into:

- Viruses, perhaps looking at bee colonies that have no viruses (e.g.: South African bees). Participants noted that many viruses can mutate and become an epidemic; they may be a bigger issue than varroa.
- Mites, including better solutions for treatment and mechanisms of resistance.
- Untreated hives, and the causes for them to survive or die (are they breeding better genetics, or is it management techniques?). These could also be a reservoir for good genetic strains. In particular, participants noted that backyard hives are often untreated, and suggested a project to monitor and consolidate backyard hives.
- Discovering audio or chemical markers for disease, to help beekeepers monitor their hives with sensors. Data could be connected wirelessly to track and share.
- Field teams could encourage beekeepers to monitor and collect data on pest loads, treatment approaches and efficacy, and survivor colonies. Monitoring kits and instructions could be distributed for free.
- Participants noted that overall bee health influences the effect of diseases and pests, recommending further research into other factors that impact bee health (e.g.: flower diversity, nutrition, pesticides, health of surrounding hives).

The group also encouraged more creative experimentation by beekeepers. "*The answers to most abnormalities could be in our own backyard, we just need to try it*." They noted that

while breeding programs can be useful, and should continue, they will take a decade or longer to work. Similarly, chemical treatments take several years to develop, while there are fewer hurdles to commercializing non-chemical treatments.

The group suggested various ideas to work collaboratively to solve common issues:

- Fostering discussions online or at local bee clubs to help beekeepers experiment and share findings.
- An overarching structure and common methodology to address key issues to avoid duplication of research and help replicate and scale up promising approaches.
- A Bee Corps (like the Peace Corps) mobilizing technology on food security and supporting bee health.
- Organizing movements for treatment-free regions, breeding from treatment-free stocks and local breeding for locally adapted bees to track the impact in different regions of the country.
- Greater collaboration and knowledge exchange between commercial and small-scale beekeepers, as well as beekeepers that do and do not use chemical treatments.
- An organization to support community breeding efforts and supply beekeepers with information and training.
- Developing national breeding standards.
- Finding ways to communicate research and good management practices in ways that are culturally appropriate and less polarizing.

Farm Bill and Habitat

In this group, participants discussed policy ideas to support habitat development for pollinators, including potential enhancements to various existing conservation programs, and ideas for the upcoming Farm Bill.

The group began by discussing several successful conservation programs, including:

- The Natural Resource Conservation Service's programs:
  - Environmental Quality Incentives Program (EQIP), offering financial and technical assistance for the implementation of initiatives that address natural resource conservation needs on farms.
  - Conservation Stewardship Program (CSP), offering financial incentives for conservation efforts, including pollinator and beneficial insect habitat enhancement.
  - Agricultural Conservation Easement Program (ACEP), putting land into easement from 30 years to permanent, and covering 90-100% of restoration costs.
- The Conservation Reserve Program (CRP), administered by the Farm Service Agency, offering financial incentives or cost shares to encourage farmers to remove environmentally sensitive land from agricultural production. Some programs within the CRP support pollinator habitat enhancement, including CP42, CP2, and CP4.
- The Endangered Species Act, supporting some habitat restoration initiatives and mandates.

They suggested several policy changes that could enhance pollinator habitat initiatives within these programs, including:

- Work with Farm Service Agency to bump up the percentage of required pollinator habitat in CP2, CP4 and other conservation programs to 5-10%. Pollinator resource concerns could be incorporated into any vegetative practice (e.g., riparian restoration). This could follow the model of EQIP program funds that require contracts to support livestock operations.
- Including pollinators in natural resource management goals and requirements for all easement and conservation programs, as currently done in some states, perhaps requiring a set percentage of pollinator habitat in easement lands, and helping farmers interested in Conservation Stewardship to design practices to support pollinators.
- Set clear criteria for yearly habitat establishment for monarch butterflies and rusty-patched bumblebees. There are some ambiguities in the Endangered Species Act that need to be clarified, as conflicting programs for rusty-patched bumblebee and monarch butterflies have impeded some farmers from establishing habitat for either.

Participants noted that previous Farm Bills have made significant advances for pollinator habitat that need to be maintained and built upon in future bills. Participants suggested that interests should be framed in terms of economic benefit instead of conservation, and even avoiding framing beekeeping as livestock which may create associations with an underfunded sector.

The group stressed that partnerships are essential for the successful advocacy of bee interests in the Farm Bill. They identified various sectors as currently successful partnerships or promising directions for new collaborations, including:

- Conservation and recreation communities (including hunting groups, Pheasants Forever, Ducks Unlimited, Nature Conservancy) to advocate for increased habitat conservation funding.
- The Farm Bureau is a possible ally, depending on their interests and how much pollinator interests would be compromised.
- There is an opportunity to include honey in the Specialty Crop section as there is no more price support or other subsidy program supporting honey as a commodity. The specialty crop community is organized and well represented, and would be a valuable partnership.
- Continue attempts to partner with orchard industries that depend on honeybees.
- Partnerships with big agriculture and commodity groups are necessary to increase funding in the Conservation Title of Farm Bill. They are difficult to establish, but there is interest in some compromises or agreements.
- Partnerships with soy and corn growers could help reinsert CRP acres lost in previous farm bill.

Central policy ideas the group suggested for the Farm Bill include:

- Increasing funding for the CRP.
- Establishing White House Task Force recommendations as policy in the bill.
- Moving beyond revenue-neutral tools, towards incentives.
- Supporting habitat development in undermanaged lands, such as idle federal lands, forest tracts.
- Maintaining USDA research funding.
- Developing better national sustainable agriculture goals, moving towards more diversified and organic farming practices such as mandating crop rotations.
- Developing a clear, broad and agreeable pollination bill that could be rolled into the Farm Bill. They recommended initially avoiding specific objectives or pet projects that can distance farm groups. The group brainstormed ideas for supporters, including the lobbyist Tom Van Arsdall from the Pollinator Partnership who represents beekeepers in DC.

Participants noted that it is important to continue working to secure funding after statutes are passed in the Farm Bill in order to bring initiatives to fruition.

Pride and product

In this group, participants discussed ideas on how to enhance the value of bee products and foster a culture amongst beekeepers of taking pride in their product and a sense of responsibility to "*be the best you can be*."

Ideas to improve quality and pride in product included:

- Increased training and education to achieve proficiency and create quality products. One participant noted that in the UK it takes seven levels of training to become a master beekeeper, and they have witnessed a strong culture of pride among beekeepers. (*"Knowledge leads to excellence, leads to pride"*)
- Independent verification of product quality.
- Recognition through honey shows, fairs and awards. For example, the Good Food award is independently verified and nationally recognized by the culinary industry. One participant noted that many of these awards and labels do not apply to urban beekeepers.
- Encouraging beekeepers not to put other products down, but rather raising theirs up.

Participants discussed the need to market products to the public, including through:

- Informative labeling.
- Popularizing honey shows and awards.
- Promoting local, artisanal products, modeled on the wine industry, to enhance the quality, uniqueness, and economic value of the products. (*"Do you want to be a 'honey packer' or an 'artisanal producer?'"*)
- Setting accessible price points for people of diverse socioeconomic standards. One suggestion was to create honey marketing cooperatives that could market bee-healthy honey at accessible prices.

The group also spent some time discussing the different criteria by which to judge honey, including both aroma/taste and presentation, which is often used by honey boards and shows.

The next generation of beekeeping management

Participants were invited to imagine a number/range of future management models by which to manage bees and consider how different levels of beekeeping (hobby to commercial, migratory and stationary) can be compatible. Where are they similar, and where might they be in conflict? How can they respect each other?

The group discussed the sense of divide and polarization between different levels of beekeepers, who may have different goals, values and work under different economic models. Some participants felt that large-scale beekeeping was a different world that could make small-scale beekeepers feel threatened, just as large beekeepers may feel stepped upon by the bigger machine of large agriculture and chemical industries.
In response to the question of how to work in harmony and respect, the group suggested:

- Identifying common points of interest, such as pests and diseases (which are exchanged by bees from different yards), shared forage, the need to feed and support pollinators and the need to attract and mentor the next generation of beekeepers.
- Encouraging different levels of beekeepers to consider each other's perspectives and learn what is at stake for them. Ideas included a documentary film, and an apiary round robin providing beekeepers with opportunities to work in and learn about other operations.
- Mobilizing small beekeeper clubs to communicate and collaborate with commercial beekeepers and learn about each other's work, setting goals and templates for their dialogue.

As participants in the group were predominantly small-scale beekeepers, they also took some time to discuss their own needs, including:

- Networks for training and knowledge exchange.
- Models and infrastructure for sustainability.
- Organization for collective advocacy and action.
- Local queen rearing movements.

Bees in the city

Participants discussed the value of urban beekeeping and strategies to encourage wild and managed bees in urban habitats. The group identified many factors that are motivating the growing movement of urban beekeeping, including:

- An opportunity to reconnect with nature in urban environments
- Growing urban agriculture movements that require bees as pollinators
- Bees are needed to nurture urban green spaces.
- An opportunity to build community, reaching past barriers and social divisions: *"Around a beehive there is a place for everyone"*
- An opportunity to develop and engage in related skills such as woodworking or

gardening.
- Beekeeping fosters wellness, and fills a need for quiet spaces for reflection and mindfulness: *"it's the quiet created by hundreds of thousands of beings working cooperatively."*

Participants discussed the nesting and forage needs for urban bees, noting that while there may be more diversity of forage in city environments, there may be less abundance. Land use restrictions and the multiple uses of green spaces in cities were noted as obstacles for the development of more bee-friendly habitat. Providing bee boxes, hives, or protected bee trees was mentioned, although participants noted the importance of positioning these so that they can be inspected and treated.

The group discussed the concerns some members of the public have about urban bees due to allergies or phobias. Suggested strategies for managing risk and developing trust with communities include:

- Risk assessment and response plans for harboring bees in public spaces.
- Sensitive public education and outreach that acknowledges and respects fears.
- Reaching out to children and youth in particular, who can become very supportive of pollinator programs.
- Providing opportunities for safe and positive interactions with bees (e.g.: putting hands on the outside of boxes to feel the heat created by bees inside, listening to the hive sounds)

"Beekeeping is an inherently optimistic endeavour and creates a sense of hope for the future —whether it's about taking care of something and watching it grow and thrive, or hoping for a good outcome from good planning and good work."

Reducing pesticide impact

In this group, participants discussed the current state of pesticide use around the world, and obstacles and strategies for advocating for further review and regulation.

- It was noted that the EU has banned neonics, with no discernible effect on agricultural yields, and Canada is currently reviewing their use asking public input to phase out Imidacloprid.
- In the US, participants spoke of the lack of transparency and due process at the EPA to review the effects of neonics and other pesticides. It was mentioned that the national boards are appointed by the USDA, and there are no independent boards. Participants discussed three cases where the EPA approved new products with multiple components without considering data on synergism. One participant recommended the book *Poison Spring* that addresses this. The 2014 Centre for Food Science report "Heavy Costs" offers a summary of the literature about the effects of neonics, and a recommendation to the EPA to curtail all neonic use immediately.
- Mosquito spraying programs for public health threats such as West Nile and Zika are exacerbating the situation.

Participants stressed the importance of banning the use of prophylactic seed treatments with neonics until there is a proper and thorough review of economic and environmental effects, as well as changing regulatory frameworks to better assess the effects of pesticides. They brainstormed various strategies to address this, including:

- Launching a letter-writing campaign to the EPA and elected representatives.
- Seeking alliances with other groups who have vested interest, such as the Almond Board, duck hunters, Audubon, the NRA, or supermarket chains.
- Leveraging the power of commercial beekeepers by:
  - Compensating beekeepers for withholding bees from pollination to pressure growers to curtail pesticide use and put pressure on the EPA on behalf of beekeepers. It was suggested that a crowd-funding campaigns could provide funding for the compensation.
  - Urging beekeepers to form a cooperative to increase hive rentals by $3 per hive to help fund advocacy, lobbying, and subsidies for the proposed pollination boycott.
- Increased collaboration between ABF and AHPA and other environmental groups.
- Organizing a Bee Audacious conference on pesticide impacts, bringing together all stakeholders to form a coalition and strategize to address the problem.

Participants also spoke of the need to increase public awareness of both the effects of domestic pesticide and herbicide use, as well as to harness the public will to support legislation. It was suggested that this be framed as a threat to food security. Finally, the group discussed the need for further research into the synergistic and sublethal effect of various chemicals bees are exposed to (e.g.: pesticides, IGR's, miticides, herbicides).

DIALOGUE VI, REDESIGNING ORGANIZATIONAL LANDSCAPE

In this breakout session, participants were invited to propose ideas on how organizations representing beekeeping and pollination interests might be restructured. Several groups began by discussing the current organizational landscape, identifying key players such as:

- Regional groups and clubs.
- State associations.
- National organizations (Eastern Apicultural Society, Heartland Apicultural Society, Western Apicultural Society, American Honey Producers Association, American Beekeeping Federation).

Internal Communication

Some participants felt there is a lack of communication between state and national bee organizations and the beekeepers they represent, particularly around the outcomes of meetings and progress at a policy level. "*We go to meetings and sometimes we don't know 'what happened' – what about actionables*?" stated one participant. Ideas to increase communication included:

- Working with distributors/retailers of beekeeping supplies to help disseminate information by reaching out to their broad contact lists of beekeepers.

- Funding a professional writer to record ideas from key meetings and distribute them to attendants and the public.
- Helping beekeepers discern quality information sources from the overwhelming amount of information found online with a neutral trustworthy group to vet and curate a collection.
- Greater accessibility to conferences and meetings, such as through live streaming, and funding for youth and other groups facing barriers to attend.

Gender Balance

One group discussed the gender disparity in beekeeping organization's leadership. While there is a growing number of female commercial owners and hobby beekeepers, the group felt that term limits for officers could help open space for more women on organization's boards.

Greater Collaboration

Most groups noted that while there are many organizations working on behalf of beekeepers, there is a lack of communication and collaboration between them, leading to duplication of efforts, competition for funding and unused potential for knowledge exchange. Further, many participants felt a disconnect between the different levels of beekeepers (commercial and hobbyist; beekeepers with different perspectives on treatment) leads to a fragmentation of their efforts and lobbying voice. One group spoke of the way local, grassroots organizations can often be more effective at bringing issues to the public eye and rallying support, while national organizations can be more effective at a policy level. Collaboration between the top-down and bottom-up support can help coordinate strategies. Groups suggested various strategies to build on and support each other's work, including:

- Creating a central directory of resources, projects, and organizations.
- Greater communication between local organizations about their goals and initiatives.
- Commercial and small-scale or backyard beekeeping organizations inviting each other to their meetings to open dialogue between the two groups and developing programming and advocacy for shared interests such as habitat development.
- Increased representation of backyard beekeepers among state officers and hive manufacturers, to better serve the diverse needs between backyard and commercial beekeepers.
- Pair/swap/mentor programs to learn about different initiatives.
- Developing a set of common guiding principles such as a Universal Declaration of Bee Rights or a Universal Declaration of Responsible Beekeeping that could be voluntarily adopted by organizations and beekeepers.

National Organization or Alliance

Almost all the groups proposed two forms of national leadership, one a National Pollinator Alliance that would centralize efforts and develop a unified message for lobbying and public outreach that would address issues common to all bees (wild and managed) and the second a Bee Corps focused on assisting beekeepers (commercial and small-scale). Groups brainstormed services these organizations could provide, including:

- Centralized communications systems and information databases.
- An online platform for updated, central, reputable information.
- Targeted and coordinated response to pests and disease.
- Beekeeping training and extension.
- Funding for research and initiatives.
- Technical assistance and resources.
- Public education and outreach.
- Lobbying force.
- Support for quality honey and hive products (e.g.: honey labeling).

Participants cited similar models in Europe that have helped beekeepers amplify their voice in policy, such as a national registry of beekeepers in Germany. Some suggested that it could be modeled on the Land Trust Alliance, involving local land trusts, individuals and volunteer boards. Beekeeping organizations could join the alliance and come together in national meetings to encourage communication and collaboration between them.

Some felt that current national beekeeping organizations could take the leadership in developing such an alliance or coalition, however they stressed the need for transparency in funding to avoid vested interests.

Partnerships

Some groups discussed possible partnerships between the bee sector and other groups that could help advance pollinator interests, including:

- Partnerships to encourage and support groups in developing pollinator habitat and forage
  - Agricultural Land Trusts
  - The Bureau of Land Management
  - Private landowners, businesses
  - First Nations groups
  - Developing entrepreneurial or social enterprise models to fund habitat development (e.g.: portion of honey profits contributing to fund CRP acres; brokering pollination habitat easements)
- Partnerships with diverse stakeholders for policy development and advocacy
  - Farmers
  - Pesticide companies and regulators and the organizers of state Pesticide Protection Plans, to find common ground.
  - Building coalitions with other movements and organizations that have shared interests to identify potential areas for collaboration (Xerces, botanical clubs, gardening clubs, hunters, fishermen, craftspeople and artists, permaculture movement, biodynamic farming movement)
  - Engaging the public to support change through consumer choices, voting, and crowd funding for initiatives.
  - Lobbyists and local representatives

Dialogue-based Meetings

Participants in various groups further suggested that dialogue-based meetings following the Bee Audacious model, with Chatham House Rule, could be effective at both a local and national level to encourage a safe environment for respectful conversations between diverse stakeholders. This was discussed as a strategy in building collaborative partnerships with groups that are often disconnected or adversarial, such as different levels of beekeepers (commercial/small-scale) or beekeepers and groups such as farmers, or pesticide companies. Building on the idea of a national organization or alliance, participants suggested that small regional or state conferences could report back to the central organization to share findings.

PLENARY DISCUSSION - REFLECTIONS

As the Bee Audacious conference wrapped up, participants came together in a final plenary to reflect on the conference format and key ideas that emerged, and to share their commitments to action as they move forward.

Reflections on Bee Audacious

Many lauded the dialogic nature of the gathering and the diversity of participants, which allowed those attending to hear different opinions and perspectives, share new information and learn from each other. One participant noticed that the group initially entered with their own agendas, but by they end of the conference they were focused on asking questions and listening. Another participant described it as "*socially therapeutic*" to hear divergent opinions as it helped broaden views and dissolve tensions. Others expressed the sense that the meeting had made them less judgmental of different beekeeping practices, and appreciative of each other's hard work, experience and passion. They felt that the Marconi Center in particular offered a beautiful setting in which to engage in conversations both within the dialogue sessions, as well as in informal meetings over meals and walking in the grounds.

To build on the value of this diversity and dialogue, participants felt that the meeting could have benefited from greater representation of commercial beekeepers and international perspectives. Similarly, they expressed an interest in including stakeholders who are in a position to directly effect change, such as landowners, growers, pesticide companies and food supply companies, noting that a non-adversarial dialogic approach could result in more innovative ideas than those generated in conventional meetings with these groups. However others felt that the conference offered a good start to begin organizing ideas form the beekeeper's perspectives, and developing the capacity for respectful dialogue across differences.

The breakout group format in particular was found to be highly productive, especially when groups stayed focused on listening and developing one key idea to share with the plenary. One participant described how this breakout group format illustrates and enacts the effective way bees search for a new home—sending out scout bees and discovering new options. Another noted that, in contrast to typical speaker-driven conferences, the non-hierarchical dialogue structure made solutions seem "*more accessible, not far away or reserved for experts.*"

Many participants expressed how the conference left them feeling encouraged, inspired and with a renewed sense of optimism after seeing the amount of work being done and the growing momentum around pollinator wellbeing. "*The doors have been opened, boundaries expanded*," one participant stated. They noted that the challenge now was to seize the momentum, and find ways to bring the ideas generated to fruition. Participants suggested setting up task forces or champions for particular ideas, sharing audacious ideas through a social media campaign, developing a list of legislators to contact, and organizing further dialogue-based meetings and conferences to continue the conversation.

Most Popular Audacious Ideas

Participants were invited to share an audacious idea that most impressed them from the conference. Those most commonly mentioned included:

- Forging partnerships with other stakeholders to create a national lobby organization to represent pollinator interests.
- Hiring a professional lobbyist to advocate for key issues such as habitat expansion, pollinator protection and stricter pesticide regulation, particularly in the upcoming U.S. Farm Bill.
- Developing the Bee Corps idea, offering diagnostic, educational and extension services to beekeepers and providing a common platform for knowledge exchange.
- Increasing collaboration and communication among different levels of beekeepers and local, regional and national beekeeping organizations.
- Increasing support for research, and collaboration between researchers and beekeepers.
- Shifting towards sustainable agriculture in partnership with farmers, including incentivizing changes that benefit pollinators (*"Farm for bees as much as for crops"*).
- Increasing public outreach to raise awareness and empower consumers to support pollinator-friendly products.
- Developing new management paradigms (referred to as Treatment-free, Darwinian and/or Natural beekeeping) that reduce chemical use and are modeled on how bees survive and thrive in the wild.

Commitments to Action

"Where do we go from here? It's not up to me to say, it's up to you to do…"

Participants set out from the conference by committing to one action that can further the outcomes of the conference. Commitments included:

A third of participants committed to helping with outreach knowledge exchange and education about bee issues. This included several participants who committed to spreading the word about the Bee Audacious conference and the ideas it generated by writing articles, and speaking with local beekeeping groups, conservation groups, farmers and elected representatives. Others committed to outreach initiatives such as a documentary on bees and beekeeping and a public relations campaign. Several participants committed to continuing working in beekeeper education, including one participant who pledged to create a local beekeeping teacher/education consortium. Still others committed to furthering knowledge dissemination of scientific research for the broader public.

About a quarter of participants committed to nurturing partnerships and alliances to further the work. Many spoke of developing connections with others they met at the conference, to share and implement successful initiatives and collaborate on new ones—one participant stated they would develop project budgets with organizations they were involved with. Still others spoke of forging better communications and partnerships with different levels of beekeepers, and diverse stakeholders, including those who wouldn't normally address bee causes. Some took up the challenge presented by one of the breakout groups

to talk to at least five new groups. Ideas included working with power line companies to consider planting pollinator habitat, connecting with commodity groups to resolve barriers to bee conservation efforts on agricultural lands and reaching out to innovative organizations and individuals to solicit project proposals.

Several participants were particularly inspired by the Bee Audacious conference model, and committed to incorporate breakout dialogues with local beekeeping groups, members of the public and even international beekeeper conferences to generate further audacious ideas. "*I commit to looking for more opportunities to talk to people and listen to people about their views, especially those with different perspectives*," stated one participant.

Many participants were inspired to champion ideas and causes discussed at the conference, including political advocacy for habitat development, pesticide use, improvements to the Farm Bill, local bee breeding programs and promoting the quality of honey and hive products. The idea of a national alliance, organization, or Bee Corps was particularly popular, while other participants pledged to further their research and reconsider their own bee management practices based on ideas they heard at the conference and current scientific understanding.

PANEL DISCUSSION

Thought leaders presented some of the important ideas from Bee Audacious at a 14 December 2016 panel discussion hosted by Dominican University in San Rafael, CA. About 400 people attended; the event was videotaped and subsequently posted.

Doug McConnell, former host of "*Bay Area Backroads*," the longest running television series in Bay Area history, served as moderator. Each thought leader briefly presented one significant outcome from the conference, followed by questions and comments from the audience. At the end of the evening, the audience was asked to fill out index cards with one audacious idea for bees, beekeeping and/or pollination, and one commitment they would make to help insure a healthy future for bees.

One group of ideas presented at Dominican centered on Darwinian beekeeping, focused on insuring that honeybee management was consistent with the biology of feral honeybees. Also included in this topic was the idea of natural beekeeping, moving away from chemical treatments for diseases and pests in favor of relying on the bees' own resistance.

A second set of ideas clustered around unmanaged habitat and agro-ecosystems, with audacious ideas designed to improve forage for all pollinators and nesting sites for wild bees. Upcoming revisions of the federal farm bill provide an opportunity to include bee-friendly policies. Beekeepers and other pollinator interests were encouraged to build collaborative relationships with farmers to insure that sustainability is a significant component in agricultural policy as well as on nearby unmanaged lands. Finally, a concerted effort to reduce pesticide use and improve regulations around those pesticides that are applied will be a key factor in improving pollinator health.

Alliances will be a key factor in promoting issues that favor pollinators. The idea of creating a National Bee Alliance with wide representation from beekeeping groups, agricultural interests, environmental organizations, local food movements, hunters and many others was presented as an important direction for effective lobbying.

The idea of a Bee Corps was discussed, modeled after the Peace Corps. Its function would be to create a cadre of trained professionals who could provide extension training around beekeeping and pollination, as well as public education about pollinators and pollination.

Finally, the conference model we followed for "Bee Audacious," a working collaborative dialogue between an unusually diverse set of participants, was suggested as a useful model for future meetings.

THOUGHT LEADER REFLECTIONS

Post Conference

Jim Frazier

The conference was incredibly well conceived, planned, organized and carried out with a broad contingent of participants representing a wealth of bee experience. We cannot thank Bonnie Morse and the Marin Beekeepers enough for their tireless efforts to plan and raise funds for this event and then host us in a most auspicious manner. The facilities and meals were outstanding and the reception at the Hedron Meadery and the panel presentation at Dominican University were fine capstones to the event. If there are continuing financial obligations that remain unmet, we should be involved to help complete them.

Feedback from the Audacious Conference was widespread at the North American Honeybee Conference just completed in Galveston, TX. Several people asked me about my take on the Audacious Conference, and said that there seem to be as many take away views as there were participants that they had interviewed. Some of the invited participants who were unable to attend offered their wishes that circumstances beyond their control were regrettably at play.

The dialogue format of this conference was followed well enough to win many converts as a result of their experiences here and the long term consequences of individuals putting this experience to work in their own ways as opportunities arise or are made will very likely be numerous for quite some time. Along with this familiarity of method was the creation of expectations that the time and effort invested in the Audacious Conference should have some concrete payoffs. As I have experienced in the past with strategic planning efforts using a similar approach, if the results of the effort are followed with substantial actions, the participants feel this was a good investment and the next time they are asked to be involved, it will be with an even greater enthusiasm for the effort. Thus, I would recommend that the final report pay special attention to specific points from the discussion that can be built upon in subsequent task forces, meetings, or conferences among stakeholders where the fruits of this first conference can find their full impacts.

Secondly, there were many specific points raised in the breakout sessions that we did not have adequate time to fully discuss, or develop specific action plans to address. The time available simply was not long enough to accomplish this. If the thought leaders were given the summary results of each of the breakout sessions, I feel certain that we could add substantial detail to these and suggest some realistic following actions or next steps that might provide momentum for implementation. This is of course a choice on how specific the final report is intended to be and since we have all left Mark to shoulder the lion's share of this, it is best perhaps his choice to make. I am just offering additional support on details relative to breakout discussions if this would be helpful to the overall effort.

Heard a quote from someone at the Galveston meeting who has worked with Mark in the past about what a gifted writer Mark is, and I share this conviction, so there are certainly no reservations as to the form and content of the final report he has committed to write. I for one am willing to help further if needed in any way, as I expect the other thought leaders may also be willing to assist.

I particularly enjoyed this experience and the opportunity to get to know the other thought leaders better and hope this will provide for greater cooperation in many ways in the future. Congratulations to Mark, Marla, Tom, and Bonnie for all their efforts to make this happen.

William Klett

The type of conference that was Bee Audacious needs to be experienced to be properly appreciated. Descriptions of the conference format sent out ahead of time gave no hint of the electricity that would be quickly generated among the participants once it all got started. The absence of all hierarchy was refreshing and key to the process. It enabled the breakout groups to very quickly begin developing ideas. With few exceptions facilitating was easy, as most people made no attempt to dominate discussions, and truly seemed to be listening. I congratulate Mark Winston and the people he's been working with at Simon Fraser University for developing this approach to problem-solving. Hopefully this won't be the last such gathering I'll attend.

What became immediately obvious was the importance of the pre-conference planning. Getting the right mix of people and working up a good selection of breakout topics made it work well. Interesting, too, was the way in which the group found its own direction, sometimes away from what seemed to have been anticipated.

What we all hope for is for something concrete to result from this, beyond the pleasure that we experienced in taking part. Looking at the website, I see that there is already some promising follow-up. Perhaps, in this age of online communication, simply allowing it all to develop as it will is enough. Mark Winston made the remark at one point that it may all come down to whether or not someone stands up and leads. In my mind I've been turning over an idea that may or may not be useful in future endeavors of this kind. What if a few participants, perhaps the thought leaders, perhaps someone else, agreed beforehand to serve as catalyzers for a period of time after the conference? Assuming that three or four major directions for possible action will emerge, would it be helpful for one person to act as temporary instigator/organizer for each? At the end of the conference participants could indicate their desire to join a follow-up effort. If there is enough energy behind it, the catalyzer could hand off over the following months to whomever appeared to be interested in leading. Just a thought; maybe unnecessary.

As far as the actual content of our meeting goes, two avenues of follow-up loom large for me personally. As a queen breeder I received a number of ideas that I'll be attempting to develop in my own operation. As a beekeeper, birdwatcher, and outdoorsman I was heartened to discover how many serious efforts are already underway to improve habitat and counter the overuse of pesticides. Clear to me now is that I'll need to collaborate with these other people, rather than grouse dourly about the deplorable state of the natural world. Concurrent with this is the obvious need to avail myself of the wealth of information that all of these other groups are putting out.

Most encouraging of all has been meeting so many intelligent, capable people of good will. It's easy to be cynical and pessimistic these days. But that gets us exactly nowhere. My thanks to the organizers and participants. As they said on that ill-fated airliner, "let's roll."

Stephen Martin

I, like almost everyone else, was not really sure how the Bee Audacious meeting was going to work, as this was a totally new format for any meeting we had ever attended. However, I, like almost everyone else, became a fan and was impressed at the energy generated and new knowledge and respect gained for each other's views. Most meetings become dominated by debate over a single topic, such as pesticide use, Varroa control, or hygienic behavior. Discussions often become polarized, with people agreeing to disagree, but with no progress being made towards a possible solution. This did not happen at the 'Bee Audacious' meeting due to the dialogue-not-debate format of the meeting.

Everyone is concerned about the recent declines in bees both wild and managed, irrespective if they are a commercial beekeeper managing tens of thousands of hives or a person who keeps one hive just to watch them. Current pests like the Varroa mite and the viruses they transmit currently impact right across the entire spectrum of beekeepers, with commercial beekeepers having to treat more frequently than ever and urban beekeepers struggling to deal with increased mite re-invasion. But is a solution to such problems achievable?

The meeting format fostered a greater respect among all the diverse groups of people attending and a realization of each other's problems, and concerns. Having to discuss different topics each time among a different group of people gave everyone a much wider view, rather than listening to one or two experts give a lecture. The layout of the various meeting rooms allowed new ephemeral groups to form and briefly chat on the way to and from the panel sessions, to be later followed up at meal times.

The concerns and topics discussed throughout the meeting were familiar, but uniquely out of all the chaos of the breakout meetings emerged potential solutions. To me, the most important one was the idea of forming a 'North American Pollinator Alliance' a topic that I chose to deliver at the panel discussion at Dominican University after the meeting. This audacious idea received unanimous support from the members of the audience including people from the Sierra Club and Wildlife services. There appeared to be a real appetite for this audacious idea, despite the massive size of the task that lies ahead. However, getting the importance of pollinators realized at the highest level will help reduce the impacts on habitat loss and effects of pests while highlighting the role and importance of pollinators.

Was the Bee Audacious meeting the small acorn from which a great oak tree (idea) will grow? Only time will tell.

Heather Mattila

I have worried in the past that the rate of pollinator decline would be outpaced by our collective will to reverse these trends, but Bee Audacious changed this bleak forecast for me. It showed me that there is a diverse yet cohesive group of people who are eager to rally and wrestle with the pressing issues pollinators face. Their hunger to enact change has turned what could be a hopeless situation into a hopeful one.

As a group, we want to implement an old but audacious idea: we must organize. We must organize within an urgent timeframe and for multiple purposes. Our first task should be to band together to mount a defense for *all* pollinators, both wild and managed bees, as well as the spaces they need to thrive.

Our conversations made it clear that there is a wide circle of stakeholders who have a vested interest in pollinator success; however, there is currently little crosstalk between these groups. We need to gather all of these constituents – commercial and hobby beekeepers, growers and livestock producers who rely on bee-pollinated crops, conservation groups, land owners who manage pollinator habitat – under a single umbrella organization that can advocate in multiple realms for a shared pollinator agenda.

Conference participants often mentioned a striking fact: the total contribution of bees' pollination services to crops consumed by humans and livestock puts their value second only to U.S. agriculture's heaviest hitters (cattle, hogs and corn). Despite this fact, we lack the strong voice that these sectors have when it comes to legislative and regulatory decision-making. It is imperative that this disparity be rectified for the healthy-pollinator movement to surge forward.

One proposed action that had broad support at Bee Audacious was the formation of a National Pollinator Alliance. This coalition of partners would give us a unified platform for protecting the best interests of bees. The activities of this alliance could be funded by the collection of a couple of dollars from each pollination contract. Such a modest fee would generate millions of dollars from a single year of almond pollination alone.

Once in place, the National Pollinator Alliance should define common ground among its members and allocate funds to lobby for political action on behalf of all pollinators. Those who work directly with bees could organize within this alliance to improve communication with farmers, promote research, foster pollinator habitat, collect data from its constituents and formulate programs to educate a new generation of beekeepers and stewards of bee spaces (some of the excellent ideas that were generated at the conference).

The principle of organizing a multitude of singular voices into one deafening chorus is not a novel one, but it would be a new call to action for pollinators in North America, and it was the most persistent message I heard from the change makers I met at Bee Audacious.

It is time! I am hopeful.

Bonnie Morse

Reflecting on the gathering at Marconi, I was most struck by the fluid conversations occurring between people of such diverse backgrounds and experiences. That was something I don't often see at bee meetings and conferences. It reinforced that we have more in common than not and have much to gain by supporting mutual interests and goals.

Despite the divisive rhetoric of a minority which skews the reality of the majority, the chasm between commercial beekeepers and small scale / hobbyists is not so great. By cooperating and sharing the strengths of individuals within each group, the beekeeping community as a whole could create a powerful alliance that would support our pollinators, our food system, and those who depend on that system to raise their families. The values of rural and urban people are not so different, even if the day–to-day activities and routines in different areas are.

Given the enthusiasm of participants, leaders, volunteers and public for ideas generated, it is clear that people are hungry for respectful collaboration and productive initiatives. If all involved carry that back to their communities and make one change to keep the momentum going and encouraging others to do the same, we can all contribute to meaningful and necessary change at this critical time in history as the activities of an expanding population increasingly impact the environment of the planet which supports us.

These challenges will not be solved in the isolation of the world of academia or alone in the farming communities or through government regulation. They are problems that need to be addressed by anyone consuming our planetary resources. In other words, everyone. And while it is easy to remain comfortably within the confines of our work and social groups, the problems which confront us will not be solved by an individual or individual group, but require the cooperation of as many engaged parties as possible.

Now how to keep the momentum building for that collaboration is what remains to be seen….

Charles Mraz

First, I have to say that attending the Bee Audacious Conference as a Thought Leader, though a lot of work, was a real privilege. Getting to know and working with the other leaders was a rare opportunity. We witnessed our own ideas as they ebbed, flowed and then grew into thoughtful solutions. Our ideas were not solely our own any longer as they were nourished throughout the conference by the minds of many.

The dedication to this collaborative process by all those who attended was quite remarkable. Everyone worked hard, listened carefully, and contributed thoughtfully. The professional and geographic diversity of the group was perfectly balanced and the collective intelligence and expertise was extraordinary.

Throughout the meeting, the problems and weaknesses of our concerns—as individuals and as a group—were revealed quickly and addressed, with everyone working toward solutions. Occasionally people left for the plenary frustrated, but more often they seemed pleased, and regardless, the conversation always continued.

Our discussions showed that there are areas of concern that we all share. This was evident before the conference but seemed to be very clear by the end. Those concerns are forage, pesticides, and Varroa mites. Each of these has multiplicities; for example, Varroa and viruses are synergistic, and if we can overcome varroa, perhaps the viruses will become manageable. Forage concerns are very much defined by location and solutions to improve them will need to be customized accordingly. And, pesticide misuse and abuse is likely causing the degradation of our pollinators, not necessarily the appropriate application of them.

Going forward, our efforts must address all these concerns. Failure to address all of them will result in just that—failure. To make audacious change in the dire state of our pollinators we must overcome not one or two of these concerns, but all of them. We also understood that in order to overcome these critical issues that we have to work together and build alliances. Most of the tools we need to address them already exist; they simply need to be picked up, cleaned up and put in the right hands. I could substitute this metaphor with "funded, collaborated and implemented."

I read an excellent article in the January 1, 2017 issue of the *Wall Street Journal* titled "Why Things Fall Apart" by Steven Pinker, a scientist at Harvard University. I highly recommend reading this article in its entirety, but one quote from Mr. Pinker stood out to me: "*I believe that [The Second Law of Thermodynamics] defines the ultimate purpose of life, mind and striving: to deploy energy and information to fight back the tide of entropy and carve out refuges of beneficial order*." This quote describes the efforts of the Audacious Bee Conference very well and I am confident that through continued efforts and collaboration we can overcome the seemingly impossible task of bringing the bees back to the health that they once enjoyed. The bees in turn will continue to propagate and allow life to thrive again, and we will have fought back the tide of entropy that threatens the honeybee industry as well as this world of ours.

Francis Ratnieks

Before attending Bee Audacious (BA) I was asked to provide an audacious suggestion. This was to Breed for Disease Resistance & Focus on Commercial Beekeepers. The interactions I had at BA, both in and out of the sessions, have reinforced this for me as one of the interesting ideas to emerge.

One important reinforcement was the comments of several commercial beekeepers who were clearly worried that current synthetic chemical pest/disease treatments were not working well (e.g., Amitraz against Varroa) and would work less well in the future. I also understood better the challenges commercial beekeepers are under, running small businesses that also employ other people whose families depend upon their jobs. Reinforcement also came from the comments of small scale beekeepers who wanted to

carry out beekeeping without synthetic chemicals and from the interest in the Tuesday breakout session on diseases and pests: what are the next generation of controls. I was not the Thought Leader in this session, but I heard that it was popular and that many participants were interested in non-chemical controls. It will be interesting to see if this is reflected in their individual Index Card comments.

Outside the sessions I also spoke to people discussing Darwinian beekeeping and others who were keeping hives in isolated regions without the use of chemical controls. Their comments and perspectives indicate that natural selection can result in honey bee colonies that have good survival without disease treatment and that also show high levels of natural resistance, such as via high levels of hygienic behavior. Combined with the results of my own research on breeding hygienic bees and their ability to lower varroa population growth and control deformed wing virus, I now feel that the time is right to make an audacious push to increase the use of natural resistance in the control honey bee pests and diseases, possibly aided with some soft chemicals such as oxalic acid to help in the control of Varroa (as resistance of the Varroa mite to this chemical is unlikely) and with the elimination of synthetic chemicals.

Beekeepers have little to lose by using natural resistance. They are already losing a large proportion of colonies each year even while using synthetic chemicals as these are not always very effective at controlling diseases and pests (e.g., Varroa) and can be harmful to the bees (e.g., Amitraz). In addition, several important diseases (e.g., chalk brood, deformed wing virus) have no chemical controls but can be controlled by hygienic behavior. Furthermore, where does pest and disease control with synthetic chemicals lead? Ultimately, it leads to resistance in the pest or pathogen. It does not lead to pest and disease resistance in the bees.

How can this be extended into action? One audacious way forward is to say that the time is now right for commercial beekeepers to switch to natural resistance. To do this will need assistance from scientists and support teams. Scientists also need to do further research and test and breed bees that have multiple natural resistance adaptations. I do not see how the beekeepers can have success without working with scientists. The scientists will also need help in funding and carrying out their work, and could well also use beekeepers to help in the testing of naturally-resistant bees versus unselected bees (on farm research). Beekeepers may also need help from bee teams to help monitor disease levels and natural resistance in their hives.

The dialogue process was a good one for sharing information and combing this in novel ways. However, it cannot be expected to deliver insights that are not in the experience of the participants. Thus, if you want scientific insights you need scientists, and if you want commercial beekeeping experience you need commercial beekeepers. In the public meeting I could see how the insights can easily result in fairly stereotyped audience responses of the “we are destroying the planet, isn’t that terrible” type. It is easy for the broader issues of pesticides or land use and habitat to overwhelm elements of the problem that are more bee-centric.

I agree that “habitat” or “habitat and food supply” are broad unifying messages relevant to honey bees and wild bees, and all wild life. Another important message was the need for

getting information to beekeepers via extension, bee clubs, books, articles, web sites, videos, etc.

Thomas Seeley

It is now three weeks since we left our lovely Bee Audacious conference at the Marconi Center, and since then I've found myself reflecting most on what I heard people say about why they value bees and why we should protect them. These values lie at the heart of why we all assembled at this conference, so I listened closely and took notes as best I could.

As expected, I heard many people talk about the value of bees for food production, mainly as pollinators rather than honey makers. It quickly became clear that everyone knew that "every third bite of food requires a pollinator."

What I did not expect, though, was hearing so many people talk about valuing bees for reasons separate from producing food for humans. For example:

"*It is a matter of environmental sustainability, ecosystem health. Nature needs bees*."
"*I value bees for themselves*."
"*Bees are a way of connecting city dwellers with nature. They can see bees*."
"*Bees are being treated poorly, with feedlot beekeeping and migratory beekeeping. We need to get back to our roots*."
"*The precautionary principle: When in doubt, be careful. We are in doubt a lot about the bees, but we are not being careful enough*."
"*Honey bees teach trust. People can mirror the cooperation of bees*."
"*Gardening for bees provides inner quiet in a city*."
"*Planting flowers and seeing them visited by bees increases people's sense of self-worth and helps them develop focus and attention. Nobody is too poor or too disabled to plant flowers and watch bees*."
"*Beekeeping is my most optimistic activity. It shifts my attention from the present to the future. How will the colony grow?*"
"*I love my honey bees for the pleasure of their company*!"

Hearing so many people talk about how they value bees, usually honey bees, as much for their spiritual benefits as for their importance in keeping the world flowering and fruitful, I was inspired to write an article that I will submit shortly for publication in the American Bee Journal. In it, I develop more fully the idea of Darwinian Beekeeping that I outlined at the conference. This is an idea that I think will be most useful to folks who have just a few colonies, have low expectations for honey crops, and get most of their pleasure from watching their bees and sharing them with others.

The essence of Darwinian Beekeeping is letting the bees live as naturally as possible, so they can make full use of the toolkit of adaptations that they have acquired over the last 30 million years. I want to stress that it is not a recipe for let-alone beekeeping. Indeed, it requires diligent beekeeping, especially in monitoring colonies for high levels of *Varroa* and preemptively killing colonies that develop skyrocketing mite populations. Doing so selects against colonies without resistance to *Varroa*, it creates selection against highly virulent mites, and it prevents resistant colonies from getting fatally flooded with *Varroa* from the neighbors.

What I am calling Darwinian Beekeeping is part of a growing movement toward Natural Beekeeping, aka Sustainable Beekeeping, Apicentric Beekeeping, and Bee-friendly Beekeeping.

I think that Darwinian Beekeeping will play an important role in guiding this movement because it is grounded in a solid, evolutionary perspective on beekeeping. It will be most appropriate for small-scale beekeepers who want to have a few colonies to boost the pollinators in their neighborhood and to have fun watching their bees' activities.

I have had good conversations about this with Mark Winston, and he has pointed out that unlike many of the other ideas from our Bee Audacious conference, developing good practices for Darwinian Beekeeping is "*one thing that we can do within our small beekeeping community without having to rely on others*." I hope it will be just one of many ways our conference will lead to improving the health of bees in general and the pleasure of beekeeping in particular.

Marla Spivak

Hats off to Bonnie and Mark, and everyone else behind the scenes, for pulling together the conference. The venue was perfect, food was great, and in particular the dialogue format was a refreshing relief from days of sitting in dark, cold rooms listening to Powerpoint presentations.

What struck me most is where attendees fit along a learning curve about bees, beekeeping, and factors affecting bee health. I was impressed by how many seemed in the early stages of knowledge (way left lower part of the curve) about the biology of bees but claimed expertise in how bees should, or should not, be managed. I thought the same was true about the factors that are negatively affecting bee health: Varroa, viruses, pesticides and lack of forage; there was a lack of knowledge but strong opinions on what should be done. This is not a criticism; this is an observation. My take home message, and question, was: Knowing bee biology informs bee management – how do I better educate beekeepers about bee biology? How do I better educate everyone about environmental and food system issues?

Before the conference I urged commercial beekeepers to attend. I felt they would be under-represented and possibly viewed in a negative light by some of the natural beekeepers. My experience working directly with them for about 40 years is that they love their bees as much as any beekeeper. Many are great beekeepers; some are not. I invited the greats but not all could come, and those that did were extremely hesitant (hence some only stayed one day, unfortunately).

The feedback I received from them was mixed: they liked the venue and dialogue, and those that sat in on sessions about landscape and forage were happy. Those that sat in on other sessions were frustrated with what they felt was a lack of understanding and appreciation for what it takes to make a living from beekeeping. I take responsibility for the unwieldy session on new ways to manage mites and diseases. In retrospect I should have randomly divided the group of 25 people into two groups and appointed a second facilitator. Instead, the conversation started with using poison ivy found in a backyard to treat bees, progressed to listening to and speaking with bee hives to help cure them, then moved to commercial beekeepers wanting to know what they could use tomorrow to keep their bees alive and researchers not having any answers. From that session emerged the Bee Corps idea, which I grabbed on to. But I think for many in the room, that session was frustrating. Perhaps it was the best, as all the diverse views really emerged.

Everyone is asking me: how do continue the momentum? How can we form an Alliance to lobby congress? How do we form and fund a national Bee Corps? Who will lead? I gained ideas of what I can do in my lab to move forward with education and more boots-on-the-ground help for beekeepers. But I am left shrugging my shoulders about how to take steps at a national level. It would be a good thing to sustain momentum.

Mark Winston

Perhaps the most audacious outcome from Bee Audacious was that those holding widely divergent points of view about bee and pollinator issues, perspectives that often appear in conflict, were able to collaborate and find broad areas of agreement.

Beekeepers and wild bee enthusiasts may clash about managed pollination vs. the ecological services of wild bees, yet through dialogue reached agreement on balanced policies that would support both. Treatment-free beekeepers and those who medicate against diseases and pests have been on opposite sides of a very argumentative fence, yet moved easily during our meeting to the joint position that diverse disease/pest management options are healthy, and strategies can be found through which they can coexist.

Vocal anti-pesticide advocates interacted with those concerned about alienating farmers who believe crop production depends on pesticides. The two perspectives established a common ground to work with progressive farmers to encourage pesticide-reduced options that would benefit bees while sustaining crop production.

Commercial beekeepers who run thousands of colonies, and hobby beekeepers with one or two, generally attend different meetings. Yet, for the two days of Bee Audacious we enjoyed getting to know each other, having meals and socializing, working hard together in breakout groups to generate audacious ideas that a wide range of beekeepers could support.

The boldest idea to emerge from Bee Audacious was that the full spectrum of those interested in bees and pollination could find accord, forming alliances organized enough to have considerable impact on the health and welfare of both managed and wild bees. Indeed, that common ground covered considerable territory, with a cornucopia of audacious, inspiring and actionable ideas that are spread throughout this report.

Bee Audacious provided another lesson for bees and beekeepers alike, the power of diversity to overcome singularity. The varied perspectives at the meeting generated ideas well beyond any individual, just as ecosystems characterized by diversity are more resilient and able to withstand considerably more perturbation than mono-toned habitats.

What is true for bees is true for us as well. Pollination systems that employ multiple bee species are far more stable and effective than single-species habitats, just as a beekeeping meeting attended by numerous points of view yields the most durable outcomes.

Sometimes the most audacious thing we can do is reach across the aisles that separate us to work collaboratively with those with whom we disagree. Disagreements dissolve and cooperation emerges when dialogue rather than debate becomes the modality of interaction.

In that way Bee Audacious taught us something considerably more important than the pollinator issues that brought us to the Marconi Conference Center. Civility is possible, and positive collaborative outcomes likely, when we rise to respectfully listen to each other above perceived differences.

We are our finest and most effective selves when solitary becomes communal. It is through collaboration that our future prosperity and the health of our bees will be best assured.

CONCLUSION

Bee Audacious was convened for one simple reason: pollinators are threatened all over the world. Managed honeybee colonies are dying at unprecedented rates, up to 45% annually in the United States, and wild bees appear to be in similar decline. The conventional tried and true methods to manage bees and pollinate crops are just not working any longer, and it's time to make some audacious changes.

The conference demonstrated two very crucial points. First, it is possible for the very diverse human interests that make up the beekeeping and pollination communities to collaborate together and develop exciting, actionable and effective responses to the crisis currently facing bees, and us. It's difficult in a report to capture the supportive, positive atmosphere that pervaded the conference, but it was indeed a remarkable experience for all the participants.

The approach we took in organizing and delivering Bee Audacious may have some bearing on how future bee meetings are framed and conducted, and for that reason we have provided detailed information in this report on how to structure a dialogue-based meeting. It was startling how quickly effective ideas arose to support a number of initiatives for pollinator health and the economic well being of beekeepers, farmers and the environment. Hopefully some of the dialogic strategies we used will be of use in future meetings, as they yielded a range of useful outcomes and a very satisfied set of participants.

Second, the ideas generated at the conference were indeed audacious, and worth testing further through the crucibles of research and application.

The most broadly applicable recommendations of the conference, affecting all pollinator species, centered on habitat. Pollinators require abundant and diverse forage, habitats free of toxic pesticides and appropriate sites for wild bees to nest and for managed honeybee apiaries to locate. Just a few of the audacious ideas that emerged to improve habitats included shifting farm subsidies and tax credits to sustainable agricultural systems, mandating considerably stricter regulations around pesticide use, expanding applications of various conservation programs to favor pollinators and replanting road and rail rights of way, marginal habitat in and around farms, and degraded industrial /mining/forestry areas with nectar and pollen-producing plants.

There was also a broad consensus reached on big tent lobbying: we need a big tent of allies and a more professional, organized approach to lobbying. Our concern around bees has yet to translate into an effective coalition of organizations lobbying collectively and effectively to support the interests of pollinators and those of us who depend on them. Bee Audacious recommended the creation of a National Pollinator Association, a group with the broadest possible range of participants that would work collectively to support broad areas of agreement around pollinator policy.

Just a handful of the potential member organizations might include the American Beekeeping Federation, American Honey Producers, Eastern and Western Apicultural Societies, Project ApisM, local and state beekeeping associations, Pollinator Partnership, Bee City, Hives for Humanity, Xerces Society, Sierra Club, Monarch Watch, Ducks Unlimited,

Environmental Defense Fund, Centre for Food Safety, Centre for Biological Diversity, Friends of the Earth, Pheasants Forever, National Sustainable Agriculture Coalition, Organic Trade Association, Whole Foods, Costco and the Rodale Institute, among many others. Also, participants recommended hiring professional lobbyists to better advance the cause.

The range of how honeybees are managed and wild bees employed, and the breadth of reasons why beekeepers manage honeybees, demanded a range of audacious ideas. Consensus developed on the value of diversifying the bees and other species used for commercial pollination. One audacious idea that emerged was to use a mix of locally sourced honeybees as well as wild bees and other pollinators for crop pollination, in order to decrease demand and stress on large scale, long-distance movement of commercial managed honeybees. Closer collaboration between beekeepers, wild bee advocates and farmers could be targeted, with economic incentives for each to participate.

Bee Audacious also encouraged diversifying the way we approach honeybee management. There is no one-size-fits-all, and supporting rigorous research to support a wide range of methodologies would be a better fit for the wide range of beekeeper approaches and interests.

If there was any one management idea that achieved near-universal support it was the desire to reduce, or even eliminate, chemical and antibiotic use in beekeeping, through a mix of breeding for resistance and implementing appropriate management paradigms. The gap between hobby and commercial beekeeping was also addressed during the conference, recognizing the there are different requirements across that very wide spectrum of beekeepers. For hobbyists, management styles such as Darwinian or Natural Beekeeping and Treatment-Free Beekeeping have considerable attraction, while commercial beekeepers are looking for methods that can be easily scaled to large numbers of colonies. We should be able to develop practices and policies by which both can thrive.

The idea of a National Bee Corps was well received, an extension and education program applicable from the smallest scale hobbyists to the largest commercial operations. Its core objective would be to formulate and deliver programs to assist current beekeepers while educating the new generation of beekeepers that is expanding dramatically all across the United States and globally. The heart of the Corps would be its cadre of trained professionals, seconded to work in partnership with local organizations, so that the Bee Corps would function by collaborating with rather than supplanting already existing groups wherever possible.

A final outcome of “Bee Audacious,” unexpected but vital, was to celebrate the rich human diversity that was revealed during the conference. Bees contribute to a sense of our human contentment far beyond material gain, acting as catalysts to strengthen social ties and build local communities, and providing an entry point into the realms of personal wellbeing and spirituality. Through bees, we can also express our concern and responsibility for the wider environment.

Perhaps the greatest and largely unheralded impact of pollinators is in what we can learn from them about our own communities. Bee Audacious provided a stunning example of just how much we can accomplish when we listen to each other, work together collaboratively and put the collective interests above the individual, all qualities of the hive.

Here's what audacious means: "*a willingness to take surprisingly bold risks; bold, daring, fearless, intrepid, brave, courageous, valiant, heroic plucky*."

We owe it to ourselves, and to the bees we love and depend on, to be audacious, together.

Photo by Sierra Salin, ©2016

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- Ronni Brega, incoming Secretary, Alameda County Beekeepers Association
- Brian Buxton, Marin Beekeeper
- Debbie Gilmore, Hall's Honey and Mason Valley Beekeepers
- Diane Greenberg, Marin Beekeeper
- Wendi Gilson, Apiary Inspector, B.C. Ministry of Agriculture and Black Horse Apiaries
- Sharon Lee Harris, Northern Arizona Organic Beekeepers' Association
- Ashley Renee Heutmaker
- Michalina Hunter, Green Bee Honey
- Wendy Klett
- Wendy Mather, Research Trial and Education Coordinator, NOD Apiary Products Ltd.
- Darwyn Moffatt-Mallett, Green Bee Honey
- Ann Moser, Mt. Diablo Beekeepers Assn. Treasurer
- Jennifer Ratke, BioFuel Oasis worker-owner and VP Alameda Co Beekeeping Assn.
- Rob Rowlands, Marin Beekeeper
- Sharon Schmidt, Cascade Girl Organization and Oregon Honey Festival
- Rob Tysinger, Marin Beekeeper

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