

Demographic summary of attendees:

Table 1. Summary of invitees (n = 529) and attendees (n = 157) of the RCN workshop on existing bee monitoring efforts by location in USDA Farm Production Regions. Regions do not include Alaska, Hawaii, Canada, or International invitees/attendees.

	Invited	Attended
Northeast (MD, DE, DC, NJ, PA, NY, RI, CT, MA, VT, NH, ME)	121	31
Mountain West (MT, ID, WY, CO, NV, UT, AZ, NM)	105	27
Pacific West (WA, OR, CA)	64	26
Corn Belt (IA, MO, IK, IN, OH)	49	18
Lake States (MN, WI, MI)	42	15
Appalachia (KY, TN, WV, VA, NC)	35	7
Northern Plains (ND, SD, NE, KS)	29	8
Canada	18	6
Southern Plains (TX, OK)	16	7
International	14	1
Southeast (AL, GA, SC, FL)	12	3
Delta (AR, LA, MS)	10	2
Alaska	7	5
Hawaii	4	0
N/A	3	1

Table 2. Summary of invitees (n = 529) and attendees (n = 157) of the RCN workshop on existing bee monitoring efforts by employment sector.

	Invited	Attended
Academic	220	62
Federal	176	53
State	53	16
Nonprofit	32	10
Consultant	17	6
Industry	11	4
Extension	7	3
County	4	2
Tribal	4	0
Local	3	1
N/A	2	0

Synthesis of breakout group discussions

Question 1:

How can the National Monitoring Plan be designed to address the needs of federal agencies?

Strong consensus emerged here around data sharing across agencies. There were many calls for a centralized, interagency database of native bee observations or specimens that is publicly accessible and aims to be FAIR-compliant. Federal agencies are generally working to achieve data transparency with new and future projects; coupling this with the standardization and synthesis of existing datasets and databases would create a robust resource describing native bee occurrence throughout the U.S. Integrating existing sources of data, including the large collections associated with the USGS Bee Inventory and Modeling Lab in Maryland and the USDAARS Logan Bee Lab in Utah may be difficult owing to variation in metadata and management, but as a long-term solution, the establishment of a single online source of native bee records remains the most frequent request of attendees at RCN workshops to date. Ideas were posed as to potential structures or standards for this single source; for example, adopting a set of metadata standards and creating portals or landing pages to access data associated with different agencies. Data security and management were also mentioned. A single, centralized database would need long-term infrastructural support to gain credibility for use by those collecting native bee monitoring data. A sound management plan for these data that includes regular backups and secure back end access was suggested. A clear, easy-to-use front end for this database that can accommodate simple or complex search queries and quickly generate datasets for download would promote buy-in from end users. For specimen storage, there were suggestions to formalize a national, interagency repository. A partnership between existing collections could be formed, and agencies that do not have their own collection could establish agreements on storage location for any specimens they collect through monitoring activity. To support personnel in curation and processing for storage, including costs associated with collections labor and logistics in research proposals could be encouraged.

To gather data to contribute to a centralized, public database on native bee occurrence, the native bee monitoring community suggested creating a standardized survey protocol, another request repeated from previous RCN workshops. This protocol would have a core set of minimum required information, including location, date of observation, and species identification, that would ultimately contribute to clarifying native bee abundance and species richness throughout the U.S. Additional data could be collected that corresponds to other monitoring goals, including vital rates, habitat quality, and environmental stressors through add-on modules to the core protocol. Building this flexibility into a national protocol has been consistently requested, as it would be more likely to meet the diverse needs of participating agencies and non-federal partners. Any standardized native bee survey protocol should be written to be repeatable and sustaining to gather longer-term information on population trends; securing financial and infrastructural support for a long-term effort is critical to the success of a national native bee monitoring program. To this end, clarifying the budget requirements of native bee

monitoring was suggested as a means to facilitate proposal preparation. Administration of this protocol could be nationally coordinated but regionally implemented; many federal agencies have regional offices responsible for operations across multiple states. Regional implementation of national-scale native bee monitoring could be tailored to meet unique geographic needs, including species or habitats of concern; additionally, use cases of collected data could be regionally specified. National coordination of a standardized core protocol allows for the collected data to be scaled up to the national level and achieve the desired national goal of understanding native bee species distributions across the U.S. To facilitate inclusion in statistical analyses, a standardized native bee monitoring protocol would require some measure of sampling effort. Such measures account for the number of visits to a survey site or spatial sampling bias if sites are not randomly sampled across a grid. Recording absences or zero observations at survey sites was also suggested to bolster any monitoring data collected and improve statistical modeling efforts. Multiple federal agencies employ native bee monitoring protocols; synthesizing them into a centralized document could be helpful for guiding the creation of a standardized national plan. Considering the data needs of agencies, in particular, the stringent requirements of bee data submitted to the EPA or the information required for Species Status Assessments conducted by USFWS, may determine the components of a core protocol. A second standardized protocol was suggested specifically for specimen management. Specimens collected through a national native bee monitoring effort should be cleaned and pinned properly for identification to species. Establishing standard specimen labels would facilitate preparation, processing, and long term curation in collections. When sending specimens to taxonomists, sorting them to morphospecies streamlines the identification process and saves taxonomist's time. Ideally, people formally trained in curation would process specimens, though offering some training through a nationally standardized protocol may lead to more efficient specimen management.

Representatives from multiple federal agencies requested support to facilitate specimen identification, primarily through the establishment of additional taxonomy positions throughout the country. As with collections and specimen management, including costs associated with the logistics and labor of native bee species verification by taxonomists in research proposals was suggested, along with establishing a formal connection with taxonomists while writing project proposals. Establishing a national network of taxonomists, reference collections, and DNA libraries based in different regions of the U.S. could reduce barriers to access reliable species identification and provide training opportunities for aspiring taxonomists through apprenticeships, internships, or workshops. When identifying native specimens, providing DNA to allow genetic confirmation of species identity would both boost DNA barcode libraries and ensure accurate identification.

An efficient, complementary approach to national-scale native bee monitoring was frequently suggested as a means of meeting the needs of most participating federal agencies. Clearly identifying the needs, motivations, priorities, and desired outcomes related to native bee monitoring for each participating agency may lead to the development of a strategic national-scale approach that highlights the strengths of each agency and economizes efforts by reducing redundancy. The USDA does this through their Annual Strategic Pollinator Priorities

and Goals Report; other agencies could begin to produce something similar. Among and within federal agencies, native bee monitoring goals may be place based (NPS, BLM, USFWS Refuges), population based (USFWS Ecological Services), or resource based (USDA, Forest Service). Agencies focus on managing one or more of three ecological needs: species, habitat, or stressors. Additionally, each agency has different regulatory needs, is assigned distinct mandates, and produces various deliverables. As with the suggested protocol, a national goal for native bee monitoring could be established, with each agency optionally adopting additional goals tailored to their needs, priorities, or necessary outputs. One approach suggested by the native bee monitoring community described USDA focusing monitoring efforts on generalist crop-pollinating species and agencies including USFWS, NPS, and BLM focusing monitoring efforts on species of conservation concern. Agencies with more animal expertise could partner with agencies with more land management expertise to monitor native bees on federal land. A similar partnership could source plant material for native bee habitat restoration work across agencies from BLM's Seeds of Success program.

Facilitating a complementary approach to national-scale native bee monitoring requires consistent communication to encourage sustained collaboration across agencies. There were many calls to improve inter- and intra-agency communication related to native bees, primarily through identifying or establishing a central online location to share native bee monitoring work. Identifying and sharing the most appropriate points of contact at each agency on this platform could simplify initiating collaborations. A master list of ongoing projects was suggested, with details including start date, end date, and methods used; a public resource such as this could prevent duplication of similar efforts or promote emerging ideas. Sharing native bee monitoring protocols and resources on this platform, including identification keys, budgets, suppliers, and supplementary readings, could streamline planning and implementation processes for monitoring projects, supporting agency efforts. Additionally, continuing online meetings in the style of the RCN workshops was suggested at the national level and at regional or state levels to connect, collaborate, and network across agencies and with non-federal partners. Addressing agency management on the importance of native bees and pollinator decline could garner their support for national-scale monitoring efforts. The interagency Pollinator Task Force led by the USDA is working to address these needs; there were comments supporting their work, acknowledging its inclusivity across agencies and with non-federal partners, and requesting the group continues meeting and prioritizing native bees.

Streamlining, synthesizing, and standardizing native bee monitoring protocols for field surveys, specimen management, identification, and data sharing across federal agencies will require sustained institutional support and the designation of dedicated employees to implement and carry out a national native bee monitoring plan. Identifying existing sources of funding from participating agencies is a starting point. These efforts would require at least one, if not multiple dedicated employees; for example, support staff to handle inquiries related to data collection and quality control for a centralized database. The agencies and office locations of these employees is as yet undetermined; if the effort is across agencies, agencies that can provide salary support will need to be determined.

What are lessons learned from non-federal initiatives that may help in ensuring as many federal needs as possible are addressed?

Incorporating citizen science into federal agency bee monitoring efforts emerged as the strongest point of consensus around this question. Many existing non-federal native bee monitoring efforts rely on citizen science, and federal efforts could do the same through public activities on federal land or private landowner willingness to share data with government agencies. The broad reach of the federal government could address the geographic bias found in most native bee monitoring efforts to date, possibly through organized volunteer surveys such as BioBlitzes. Specifically engaging underrepresented groups reduces the access bias associated with citizen science. The NPS uses iNaturalist to gather biodiversity observation from park visitors; iNaturalist has been a common platform for successful non-federal native bee monitoring projects, and expanding its to other land management agencies may be useful. In addition to online engagement, demonstration gardens or pollinator habitat on federal lands can engage the public directly with native bees and could serve as sites for long-term monitoring. Online observation data from citizen scientists lacks absence records and does not quantify sampling effort, making statistical analyses with such data difficult. Finding and sharing beneficial use cases for these data or devising a way to also gather absence data may promote adoption of citizen science projects across federal agencies and encourage partnerships with non-federal partners. These partners include University Extension and local community groups. One suggested outcome of a national native bee monitoring program was the establishment of state-based Native Bee Societies similar to the Native Plant Societies that exist across the U.S. Such a group could incorporate native bee monitoring into their activities and contribute the data to a national, centralized database.

Non-federal native bee monitoring initiatives are constrained by the taxonomic bottleneck and struggle to find experts who can reliably identify collected specimens in a timely manner. The demand for high-quality taxonomic resolution is far greater than the current capacity to achieve it, and this information is crucial to accurately determine native bee species distributions across the U.S. Alleviating the taxonomic bottleneck was another strong point of consensus in response to this question. The federal government has the potential to expand this capacity by funding more permanent taxonomist positions at existing research facilities and potentially establishing additional facilities to serve federal agencies and non-federal partners. More positions would encourage more training in bee taxonomy, though support for such training would need to be provided. At the current capacity, establishing a central point of contact for taxonomists providing species verification services would eliminate hurdles in finding these personnel. Establishing contact with taxonomists early in project preparation allows for the costs of their services to be integrated into project funding and is considerate of their time and the backlog of specimens to identify they generally face. Incorporating proper processing and curation of specimens was further suggested to aid taxonomists and encourage long term storage for future reference and training.

The native bee monitoring community shared many other lessons from non-federal initiatives that can inform federal agency efforts. Well-known state-based bee monitoring projects,

including the Oregon Bee Atlas, the Empire State Native Pollinator Survey, and The Xerces Society Bumble Bee Atlases all have streamlined sampling protocols with clear data requirements. These features in combination with strong public support and participation have led to the creation of robust data sets on native bees in these states. Additionally, these projects have broad and diverse institutional support as partnerships between federal agencies, state agencies, nonprofit organizations, and universities. Bumble bee monitoring projects in Wisconsin and Minnesota were noted for their mix of local expertise and public participation. All of these characteristics have led to successful monitoring programs and could be translated to federal agency efforts. Based on a 14-year dataset on the phenology and abundance of native bees collected at the Rocky Mountain Biological Dataset, it was suggested that federal native bee monitoring efforts continue over multiple years to account for wide interannual variability in bee populations and emergence timing. Including habitat information, particularly nesting habitat, in surveys was suggested to incorporate land management outcomes into native bee monitoring. Many non-federal initiatives rely on non-lethal sampling, and there was interest in incorporating similar methods, including photo ID, tarsal collection, or visual observations, into federal native bee monitoring. Sampling for endangered native bee species or in areas where these species have been observed must be non-lethal in compliance with the Endangered Species Act. In these cases, visual observations could target easy to identify bee species or photo-based sampling can be used to inform AI identification efforts. Non-lethal sampling would also reduce the workload of taxonomists already facing an extensive specimen backlog. There were also multiple comments in favor of specimen collection and lethal sampling. Physical specimens are often the most reliable means to determine accurate species identification. Collecting specimens supports building DNA libraries, which can eventually be used to confirm species identifications. Additionally, reference specimens are used to build taxonomic expertise. There were frequent comments about data quality associated with a national native bee monitoring effort. Agrochemical companies and the EPA have very high data standards; aiming to meet those standards through federal native bee monitoring would produce a high-quality dataset suitable for regulatory, academic, and exploratory activities. Digitizing existing data would provide a more complete picture of current and historic native bee distributions and may inform future monitoring efforts. Establishing clear priorities and protocols for field data collection, statistical analyses, and specimen processing before monitoring work would contribute to achieving high data quality. Further, partnering with database experts may facilitate sound data digitization, sharing, access, and long-term management. The nonprofit organization NatureServe uses biodiversity data to assess species conservation status. NatureServe has produced publications on the conservation status of U.S. Bumble bees, mason bees, and leafcutter bees. In 2020, they released a map of imperiled pollinator distribution as part of its Map of Biodiversity Importance. These efforts are based on limited data, and a national native bee monitoring could support future mapping efforts and conservation status assessments. Indeed, NatureServe has demonstrated the longevity and institutional security to support, share, and manage biodiversity data such as what would be collected through national-scale native bee monitoring. They also administer the Natural Heritage Network, a state-based anticipated primary end user of this data. Supporting NatureServe financially or establishing a partnership with their organization could provide broad benefit to federal native bee monitoring efforts.

These lessons will be most effectively integrated into a national native bee monitoring program through collaboration and centralization across federal agencies. Identifying clear goals across agencies and prioritizing those that can most feasibly be met can help ensure successful implementation. How to set and prioritize these goals was debated among the native bee monitoring community. The approach could be broad or narrow in scope; additionally, initial efforts could begin with or without considering existing data on bee distributions in the U.S. Goals and priorities could be clarified by sharing research needs across agencies, perhaps through a central platform. Ideally, a national network of entities operating at different scales and with different priorities related to native bee monitoring will help meet a diverse set of goals and priorities. When initiating new monitoring projects, identifying similar or related efforts and connecting with personnel involved could streamline or modify project preparation. Further, connecting with personnel associated with successful, interesting, or inspiring monitoring projects could also aid in new project development. These connections could be made through an online clearinghouse listing past, current, and anticipated native bee monitoring efforts across the U.S.

Question 2:

What strategic opportunities do you see for bringing the efforts of the {agencies that spoke} together? e.g., what existing monitoring efforts could benefit data users, where can monitoring efforts dovetail together?

Workshop attendees emphasized strategic interagency collaborations that take advantage of existing resources by not duplicating initiatives that may already exist. However, awareness of current initiatives is low owing to a lack of consistent communication across agencies covering native bee monitoring projects. Multiple federal agencies may be surveying land in the same state and may not be aware of each others' work; creating an avenue for connection and collaboration could consolidate and economize existing or proposed native bee monitoring efforts. Some workshop participants have made new networking connections simply by attending these workshops, and attendees have called for similar online gatherings to be held in the future on topics related to native bee monitoring. Interagency collaboration requires greater understanding of each agencies' goals, needs, and priorities. Formally, a data gap analysis could be conducted to identify areas for collaboration. Agencies with different mandates or monitoring goals could then complement each others' work, potentially creating efficient economies of effort and scale.

Consensus emerged around building a national native bee monitoring strategy that supports U.S. Fish and Wildlife Service (USFWS) Species Status Assessments (SSAs). Most conservation choices made by federal and state government agencies are driven by Endangered Species Act (ESA) listing or ESA-listed species needs. The SSA framework was introduced in a previous RCN workshop; the consensus reached in this workshop may indicate that the SSA framework may form the foundation for a national native bee monitoring strategy. However, there were concerns regarding how such a framework would be translated from on the ground research and monitoring into regulatory actions. Workshop attendees called for more

concrete connections between research and policy related to native bees, even within departments; for example, a disconnect between the U.S. Department of Agriculture's Agricultural Research Service (ARS), a research agency, and the Natural Resources Conservation Service (NRCS), a policy agency, was mentioned in multiple group discussions. More broadly, there was consensus that a national native bee monitoring program engaging multiple agencies would be most effective if it had fine grain spatial and temporal resolution, sampling across the country over many years. A central basic protocol that informs trends in species abundance and richness over time continued to be discussed, and there were continued calls for optional add-on modules that could answer additional questions related to native bee populations and communities.

Federal agencies working together to establish and support a national native bee monitoring strategy may provide motivation to seek legislative action that would secure long term support and institutional backing from the federal government. An executive order, similar to the one made by President Obama in 2014, could open up resources for federal agencies. Federal agencies are motivated by efforts in some states to formalize native bee monitoring practices; however, there was concern that state-based efforts may not "trickle up" for adaptation at the federal level. Another option for federal funding may be as part of an infrastructure bill. There is anticipation among the native bee monitoring community for the successful passing of the Recovering America's Wildlife Act (RAWA), which would open up substantial resources for state and federal wildlife agencies that could be used in native bee monitoring.

Workshop attendees frequently mentioned sharing methods and data related to native bee monitoring across agencies. Working together while developing monitoring protocols presents an opportunity to optimize and streamline methods employed by participating agencies. It also creates an avenue for building flexibility into a standardized scheme by integrating each agency's priorities and mandates. Further, connecting research and policy arms of participating agencies was suggested to draft science-supported policies and generate a greater understanding between scientists and policymakers. Centralization of native bee monitoring information and resources was a recurring theme in these discussions; specific suggestions included cross-agency toolkits for protocols and supplies, video demonstrations of field methods, interagency centers for standardized specimen processing and curation, a national network of taxonomists and accessible reference collections, and a centralized database of all collected data. Designation of interagency centers and taxonomic resources located within one day of driving time (6-8 hours) of field offices or other agency facilities was suggested to ensure accessibility. Leveraging existing platforms for a centralized native bee database and following existing biodiversity data standards was also suggested; making these designations would promote data sharing and use across agencies.

Disseminating information generated from federal agency native bee monitoring efforts in an efficient and accessible manner was frequently suggested. Workshop attendees were roughly half academic and half non-academic; non-academic attendees were mostly federal employees, though state agencies, nonprofit organizations, industry, and consultancies were also represented. Academic research on native bees is primarily disseminated through

peer-reviewed publications in scientific journals, whereas non-academic work is distributed directly to the public or internally through reports and presentations. Accessing this work outside of the respective disciplines is typically difficult, with peer-reviewed publications often locked behind paywalls and non-academic work hard to find across multiple potential outlets, including agency websites and online databases. Centralizing these outputs was suggested to increase information sharing across agencies. Additionally, creating more dynamic outputs, such as easy to implement management recommendations or educational materials and interactive online tools was suggested to increase public awareness and participation in federally-supported pollinator monitoring and conservation practices.

There were multiple suggestions for interagency land sharing partnerships for national scale native bee monitoring. The Department of Energy presented on agrivoltaics to promote pollinator conservation on solar energy lands; it was also suggested for DOE to partner with the Bureau of Land Management on their land in the western U.S. BLM is also currently conducting vegetation monitoring on some of their land; it was suggested to incorporate native bee monitoring into this existing protocol. The Forest Inventory and Analysis (FIA) program of the U.S. Forest Service is another existing vegetation monitoring program that could incorporate native bee monitoring. The Forest Service has already provided land access in Region 6 in partnership with the U.S. Geological Survey to assess native bee eDNA sampling methods and efficacy. The USDA Natural Resources Conservation Service coordinates habitat restoration on agricultural lands; establishing native bee monitoring sites on these restorations would provide information on bee communities and restoration effectiveness. There were suggestions to increase the diversity of landscapes and habitat types currently assessed for national native bee monitoring. There is currently no systematic native bee monitoring occurring on agricultural lands; using NRCS land is a potential way to provide these lands. NRCS would also be a natural partnership for native bee monitoring on DOE agrivoltaics projects. Lastly, state agencies that have native bee monitoring practices in place could partner with federal land owners to implement those practices on federal lands.

There were additional suggestions for partnerships beyond land sharing. There may be opportunities through the 30x30 climate plan. Partnering with tribal nations and their agencies was frequently suggested. Creating regional working groups and building localized networks within the professional native bee monitoring community may promote adoption of native bee monitoring and lead to innovations surrounding monitoring protocols. Connecting federal research capacity with academics was requested by workshop attendees within and outside of academia; both groups described uncertainty around the initiation of such collaborations but implied strong interest and enthusiasm to enter into them. One potential avenue is through the USGS Cooperative Fish and Wildlife Research Units, a federal program based at universities throughout the country. There were two solutions presented to address taxonomic issues: 1) leveraging the USDA APHIS PPQ insect identification pipeline and 2) developing a partnership between the USDA Logan Bee Lab and the USGS/USFS eDNA research in USFS Region 6. Finally, promoting wider adoption of existing federal native bee monitoring protocols, including those of the U.S. Fish and Wildlife Service and employed on the Grand Staircase-Escalante National Monument as opposed to creating an entirely new protocol from scratch was

suggested. The GSENM protocol in particular was highlighted as accessible, repeatable, and compatible with current efforts and priorities of multiple agencies.

Workshop attendees gave positive feedback on current practices related to native bee monitoring within and across agencies. Reception of the RCN workshops themselves has been largely positive; attendees requested these large meetings continue indefinitely to facilitate collaboration and communication about current or upcoming bee monitoring work. The USGS and USFWS Native Bee ID trainings led by Sam Droege and Clare Maffei were praised for bringing technical skills to a broader audience; participants were eager to continue these training sessions. The National Bee Distribution Tool created by the USFWS generated excitement, and attendees suggested greater promotion of the tool to encourage wider use. Many agencies that spoke at the workshop use iNaturalist to collect native bee sightings on their lands; this was well received by workshop attendees, who encouraged adoption of the platform across agencies. Multiple agencies mentioned developing or testing eDNA methods in their presentations; there was substantial interest in continuing and expanding eDNA efforts in national scale native bee monitoring. For many workshop attendees, the pollinator conservation initiatives of the Department of Defense (DOD) were new knowledge, and there were suggestions to continue these and increase interagency collaboration related to them. Lastly, there is strong support for the USDA Honey Bee and Pollinator Research Coordinator position; attendees suggested having such a position at other agencies.

Federal initiatives that provide inspiration for a national native bee monitoring strategy include efforts focusing on monarch butterflies, bats, birds, and regional native bee partnerships. The Monarch Conservation Science Partnership, a North American interagency group established in 2009 and led by USGS, developed the Integrated Monarch Monitoring Program in 2015, which is ongoing and managed by the nonprofit organization Monarch Joint Venture. The North American Bat Monitoring Program is another interagency initiative coordinated by USGS that launched in 2015. Both these initiatives are conducting continental scale systematic monitoring programs with clear goals and accessible online data portals. Related specifically to pollinators, attendees suggested revisiting the output of the Pollinator Task Force established by President Obama to find existing goals and infrastructure for native bee monitoring. Also, the Great Lakes Restoration Initiative, an interagency partnership led by USFWS, has a Pollinator Task Force working to establish native bee inventory and monitoring practices on USFWS, USFS, and NPS land surrounding the Great Lakes. A legislative model that provides sustained funding for bird conservation work, including monitoring, is the North American Wetlands Conservation Act. This Act was passed in 1989 in response to the North American Waterfowl Management Plan, which was signed in 1986. Lastly, the Gulf of Mexico Research Initiative Information and Data Cooperative (GRIIDC) was suggested as a data sharing model.

Attendees also suggested strategic opportunities that can be found outside of federal agencies; broadly, these involve partnerships providing access to private land, non-federal monitoring protocols, or public-private data collection and sharing. There was discussion from attendees across sectors to increase efficiency of public-private partnerships between federal agencies, state agencies, NGOs, and academia. More specifically, NRCS native bee monitoring goals may

be met using Bumble Bee Atlas protocols and data. The Association of Fish and Wildlife Agencies (AFWA) was suggested as an avenue to disseminate federal-level information to the states, along with NatureServe through the Natural Heritage Network.

Question 3:

In what ways are programs especially compatible/ potentially incompatible, both with one another and/or with non-federal monitoring efforts?

As discussed in the RCN workshop on conservation goals, federal agencies and the native bee monitoring community as a whole share an interest in establishing baseline information on native bees across the U.S. Attendees suggested that a reasonable amount of this information may already exist, but is likely dispersed across agencies and stored in an inaccessible manner. Federal agencies are very interested in interagency collaboration to conserve native bees; further, many attendees expressed willingness to follow consistent data collection and handling practices to promote data sharing across agencies. There is interest in an interagency data platform for native bee observations, and one suggested platform was GBIF. USGS manages the U.S. GBIF node and may make a natural partner or coordinator for centralizing these data. Land management agencies could partner and coordinate surveys and survey methods on lands they own that are near each other; potentially streamlining simultaneous efforts. Some agencies are compatible in that they answer different questions about the same organisms. For example, agencies that manage species, such as USFWS, have partnered with DOD, who manage large land areas; this and similar partnerships could continue and expand to support native bee conservation and monitoring. In Alaska, NPS, BLM, state agencies, and the University of Alaska Anchorage all collaborate to monitor, conserve, and manage land for native bees. Another area with strong potential for continued interagency collaboration is the development of eDNA methods for native bee monitoring. USGS and USFS are currently collaborating on eDNA surveys of native bees in Forest Service Region 6; this collaboration could continue and expand. The USFWS, DOD, and the USDA Logan Bee Lab spoke of their interest in developing eDNA methods for native bee monitoring in their workshop presentations; with the potential eDNA has to support non-lethal native bee monitoring, facilitating a broad collaboration of these agencies seems timely. Lastly, multiple agencies spoke of community science efforts, including Bioblitzes, recording observations through iNaturalist, and general education and outreach programs associated with federal lands. Collaborating on community science programs focused on native bees could strengthen messaging and foster more meaningful engagement with the public.

While many federal agencies are currently pursuing or are interested in pursuing native bee monitoring, these agencies may differ in their goals, priorities, and mandates for doing so. Agencies vary in land use and management strategies. Federal land is not all suitable as native bee habitat, and suitable land may be difficult to access. Further, the amount of land managed varies across agencies, informing management approaches that may be incompatible to support, restore, or conserve native bee habitat. Agencies also vary in operational structure; in particular, BLM and NPS units are decentralized, whereas USFWS has more collaboration

among its units. This, along with the siloed day-to-day operations of the agencies overall, has hindered effective interagency collaboration on native bee monitoring. Bureaucracy was frequently mentioned as a barrier to collaborations within, and especially across, federal agencies. Permitting access across jurisdictions or ownership boundaries happens locally instead of regionally; for a national scale effort, this may lead to substantial wait times for approvals. A specific example provided for this point was the consultation required with USFWS if a project involves a listed species. Formal paperwork is required for data sharing across agencies and most other projects both within and between agencies. The time and effort needed to complete this paperwork was mentioned as a hindrance to intra-agency collaboration. Academics working in collaboration with federal agencies specified the internal review process required for agency employees to author peer-reviewed publications as a bureaucratic barrier; these reviews take time, and in the case of multiple agencies collaborating on one paper, can lead to considerable delay in publishing. There were broad comments on addressing bureaucracy to facilitate more efficient and effective collaborations within, between, and outside federal agencies. Workshop attendees frequently mentioned data management as an incompatibility among federal agencies, specifically siloed data storage platforms. When collecting data on native bee observations, agencies may have used different sampling methods. This may prevent interagency synthesis of native bee observations to date, though it could inform future survey methods and data management practices. Data standards vary across agencies; the highest standards may prevent collaboration owing to the feasibility of meeting them. A specific point made on data management was the role and capacity of taxonomists in handling native bee observations. Observations may be verified by different taxonomists at each agency, potentially leading to discrepancies in species identification. Broadly, there are not enough taxonomists to meet existing demand for specimen verification, creating a long backlog of collections to identify. Multiple agencies discussed eDNA methods as a means of relieving the taxonomic bottleneck, though some workshop attendees expressed concern about relying too heavily on these methods when they have not been fully tested and vetted. Agencies differ on how results are disseminated. Generally, agencies are mandated to provide results from projects to the public, but they vary on how they accomplish this. Outputs may go into technical reports, seminars, signage, management guidelines, online databases, or other platforms. Scientific output from federal agencies does not often go through the peer review process for publication in academic journals owing to cost constraints. Peer-reviewed publications could result from academic/agency collaborations, though both academics and federal employees mentioned difficulty establishing these collaborations. Agency efforts may be set on different time scales; this effect is compounded by frequent staff turnover and presidential administration changes. Federal funding for native bee monitoring is limited and also varies with staff and administration changes. Spatial scale of influence varies across agencies and projects within agencies; projects may have a local, regional, or national focus and may be difficult to scale up or down. Complicating potential national scale efforts, collaborating with state agencies may be prevented in states where regulatory authority for native bees does not exist. Further, not all states with regulatory authority over native bees are interested in monitoring them. This applies to federal agencies in that not all agencies prioritize native bees in their work.

If incompatible, are there ways to overcome these hurdles?

Despite a long list of incompatibilities potentially hindering collaborative native bee monitoring efforts, workshop attendees provided a longer list of how to address these issues and foster cooperation. While agency goals, priorities, and mandates vary, clearly identifying them as they relate to native bees could reveal areas where agencies complement each other's approaches, leading to more efficient and effective collaborations. There were suggestions to figure out how to work with what we have; assessing current efforts and reviewing past projects to fully describe the existing body of information on native bees gathered by federal agencies may prevent duplicative efforts and provide a strong foundation for future plans. Work that needs updating could be done as needed while considering agency resources, relevant laws and policy, and current scientific knowledge. Understanding where the capacity to update and continue native bee monitoring efforts can be found among agencies and determining the cost, efficiency, and capability of completing such projects would simplify coordination across agencies and streamline the process of implementing new work.

To bring multiple agencies and their diverse objectives together, workshop attendees suggested developing one clear central goal for national scale bee monitoring that is broad enough to meet the basic needs of participating agencies but specific enough to ensure the collection of rigorous and relevant observation data on native bees. There were frequent suggestions for add-on modules to gather additional information as participating agencies are interested or able. Also frequently suggested as critical to a national native bee monitoring strategy were standardized protocols for data collection, specimen curation, identification, and data storage and sharing. Data storage has been a consistent topic of discussion throughout the first three RCN workshops; the discussion continued in this workshop through advocating for a centralized, publicly-accessible repository for native bee observation and identification data. This repository could also include or link to EPA data on pesticide toxicity for pollinators; integrating these data into a national native bee monitoring scheme was a common request. Involving federal IT personnel in determining or developing this repository would incorporate best practices for data security, sharing, and management. Suggestions to encourage adoption of this repository included agreeing to its use in any data sharing agreement and selecting it as the data sharing platform in native bee monitoring RFPs. Connecting with existing large databases, such as those of the USGS Native Bee Inventory and Monitoring lab and the USDA Logan Bee Lab, may be a starting point for establishing standardized native bee data management practices. Investing resources into these existing databases and increasing native bee data accessibility from other agencies were frequently suggested. Verifying these records as part of a synthesis project was suggested to ensure a shared platform is established with the most accurate data. However, these verifications will require trained taxonomists, who already have heavy workloads. Investing resources into training and employing taxonomists was commonly requested, through means such as contracting, internships, or long-term technicians on soft money; promoting existing training opportunities and funding new or more accessible options, and increasing funding for basic taxonomic research can all encourage rigorous yet sustainable native bee taxonomic infrastructure. Further, establishing taxonomic standards, including a common nomenclature convention, was suggested.

Another theme in workshop discussions on overcoming incompatibilities was improving coordination and communication related to native bee monitoring within, across, and outside federal agencies. More interagency communication could minimize competition for limited resources and duplication of efforts. Committing to creating clear interagency or multi-agency agreements for collaboration could reduce friction in native bee monitoring project progress and completion. There were multiple suggestions to foster collaboration among agencies through an online bulletin board sharing site availability or project opportunity. Many attendees cited the USDA email newsletter, "The Latest Buzz," as an example of communication improvement. That newsletter is put together by the Honey Bee and Pollinator Coordinator at USDA, a position requested by multiple other agencies in workshop discussions. If available resources cannot support this, designating native bee monitoring leads at each agency (we are aware of leads at USFWS and BLM) and committing to more communication among them may alleviate the isolation many agencies are currently experiencing. An interagency coordinator or team of coordinators (similar to the USDA Pollinator Task Force, but focused on native bee monitoring) was also suggested; centralizing knowledge of native bee monitoring work at federal agencies could substantially improve awareness of current and future efforts. Coordinating among agency administration as opposed to scientific staff or at least educating administrators about the importance of native bee monitoring may help promote monitoring as a priority in agency operations. Connecting with administrators may also lead to stronger support for federal funding of native bee monitoring efforts. Outside agency partners include state agencies, academic institutions, and nonprofit organizations. Partnering with these groups could expand available land area and increase personnel and logistical capacity to conduct surveys, though workshop attendees outside federal agencies requested a clearer framework to find relevant government partners.

Question 4:

Do you personally imagine connecting with these Federal efforts in your bee monitoring work? (If so, in what ways? If not, how could these agencies improve collaborative efforts to connect with your efforts?)

There is a lot of excitement among RCN workshop attendees about the potential for a national scale native bee monitoring program. Data sharing was frequently mentioned in these discussions, and some agencies are currently sharing data inside and outside of the federal government. One common request is the designation or development of a centralized, open data portal to gather information on native bee observations. Improving collaborative relationships for native bee monitoring could identify complementary roles or strengths of participating agencies to streamline efforts and take full advantage of available resources; for example, the eDNA efforts of USGS, the native bee species ID capacity of the USDA Logan Bee Lab and the USGS Native Bee Inventory and Monitoring Lab, the Species Status Assessments of USFWS, and the amount and diversity of land managed by DOD, BLM, NPS, DOE, and USFS could all be leveraged in a robust collaborative national scale native bee monitoring strategy. This could lead to regional partnerships across or outside agencies to facilitate native bee monitoring and the implementation of associated protocols and data

standards. Gathering this information could be used to develop outreach materials to share on federal lands or through federal outlets, it could help design future research to align with agency needs related to national monitoring goals, and it could potentially influence regulatory efforts.

However, the long-term sustainability of a national native bee monitoring program would ideally be laid out before widespread buy-in is achieved. Strong leadership will be needed to ensure success, and consistency in agency staff may be a barrier to long-term project participation. Establishing a national scale native bee monitoring program with clear goals and a streamlined, approachable protocol with little redundancy could encourage and broaden participation across and outside federal agencies. The roles of federal partners should be clearly defined, as well as any means or opportunities to collaborate with federal partners on native bee monitoring projects. The administrative burden of creating federal agency partnerships would ideally be reduced or clarified to encourage collaboration. The list of participating agencies should be inclusive, spanning science and policy, however, there were concerns about managerial costs and loss of efficiency across agencies to meet federal standards. Encouraging partnerships with non-federal land owners and clarifying how these partnerships can be developed may increase the likelihood of participation in areas of the U.S. with little federal land management. Further, integrating graduate student research into the implementation or development of native bee monitoring methods would expand participation into academia and the resources associated with academic institutions.