Native Bee Watch Community Science Program

Engaging Coloradans in research and education to support pollinator conservation

Lisa Mason, Colorado State University Extension

Colorado Pollinator Summit

November 5, 2020

COLORADO STATE UNIVERSITY EXTENSION

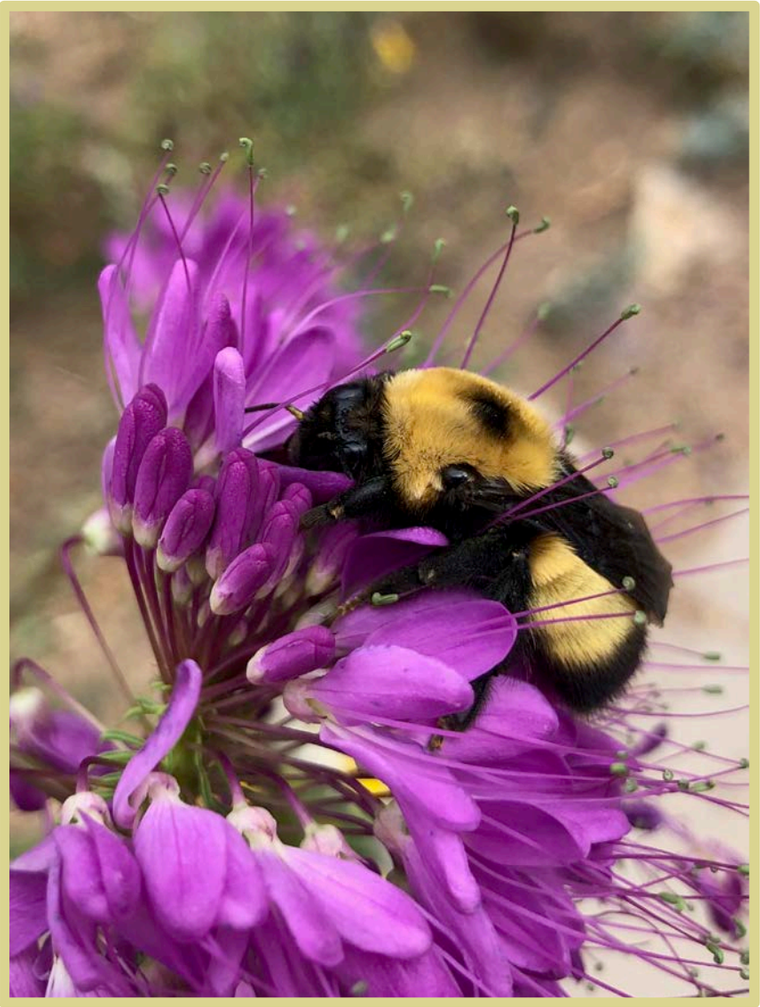
Agenda

- Why monitor bees?
- Native Bee Watch – Pre-Pandemic
- Native Bee Watch – Summer 2020
- Results from 2020
- Lessons learned and future directions
- Opportunities with youth

Why Monitor Bees?

Ecological Reasons

- Pollinator ecosystem services
  - 75% of more than 240,000 plant species rely on insects for reproduction
  - Approximately 1/3rd of the world's crops depend on insect pollinators
  - Bees pollinate $15 billion worth of crops each year
    - Fruits, vegetables, nuts
    - Meat and dairy industries
  - Provide other ecosystems services such as raw materials



Goulson et al., 2015, Klein, 2007; Klein, 2013; National Research Council, 2007; United Nations, 2014.

Ecological Reasons

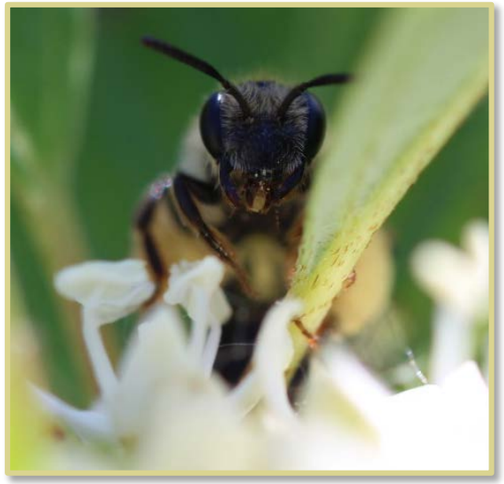
- Pollinators are declining
  - Habitat loss, urbanization, agricultural intensification
  - Parasites and diseases
  - Pesticides and chemicals
  - Climate change
  - Interaction between factors

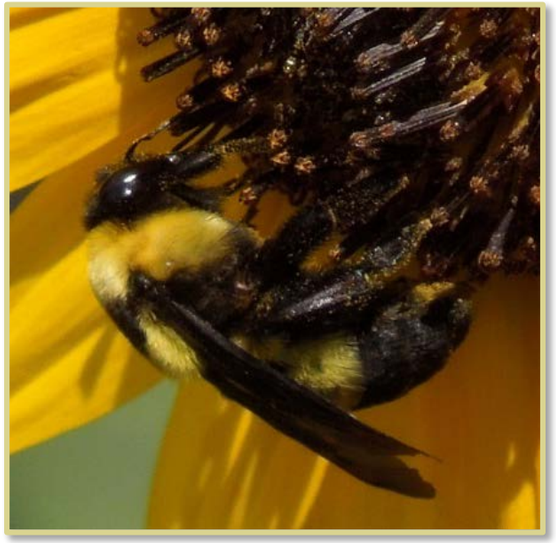
In North America, 82% of the population lives in urban areas and is expected to increase.

Goulson et al., 2015, Klein, 2007; Klein, 2013; National Research Council, 2007; United Nations, 2014.

Social Reasons

- Pollinator conservation will take efforts from individuals, neighborhoods, communities, non-profit organizations, industry, local, state, and federal governments
- Anyone can play a role in pollinator conservation and people want to help





Social Reasons

- Community science is a natural fit because it:
  - Increases research capacity with limited funds and resources
  - Provides broader spatial and temporal data collecting
  - Informs policy and decision makers about important issues
  - Bridges the gap between scientists and citizens
  - Increases opportunities for all backgrounds to get outside and appreciate nature
  - Increases scientific literacy
  - Creates potential behavior change

Community Science Challenges

- Data accuracy and consistency
  - Broad-level vs. specific-level
  - Taxonomy
- What happens to the data?
- Transparency to volunteers
- Bees are difficult to identify

Native Bee Watch

Phase 1 – Pre-pandemic

Background

- Evaluate efficacy of bee monitoring protocols
- 2016 – 2019 – Monitoring occurred in Fort Collins, CO
- 2019 – Monitoring occurred at the Carson Nature Center, Littleton, CO
- Transitioned to a CSU Extension program in 2019

CSU Trial Gardens

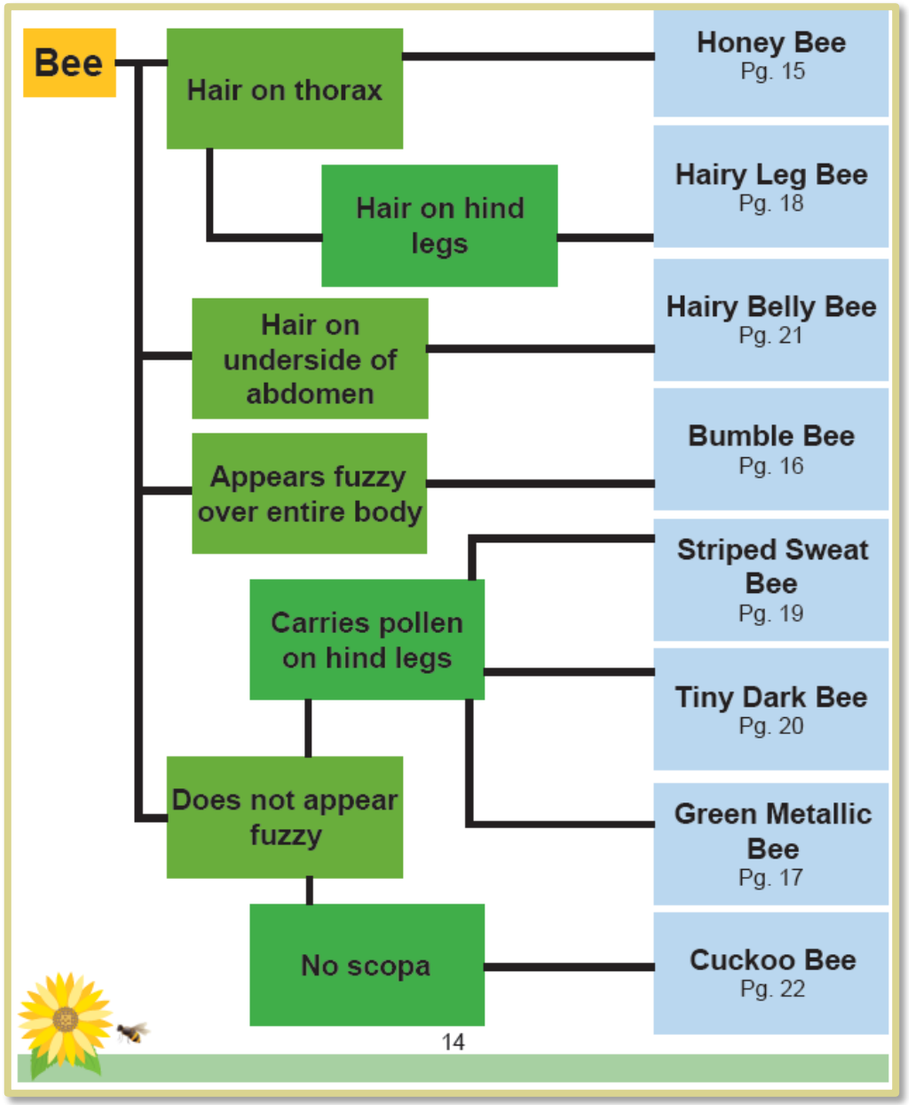
Nix Farm Natural Area

Gardens on Spring Creek

Native Bee Watch Field Guide

- Differentiate bees from flies and wasps
- 8 morphospecies categories
- Example: Hairy Belly Bees
  - Bee Family: Megachilidae
  - Small to medium
  - Pollen-collecting hairs (scopa) on underside of abdomen

Photo: Richard Greene

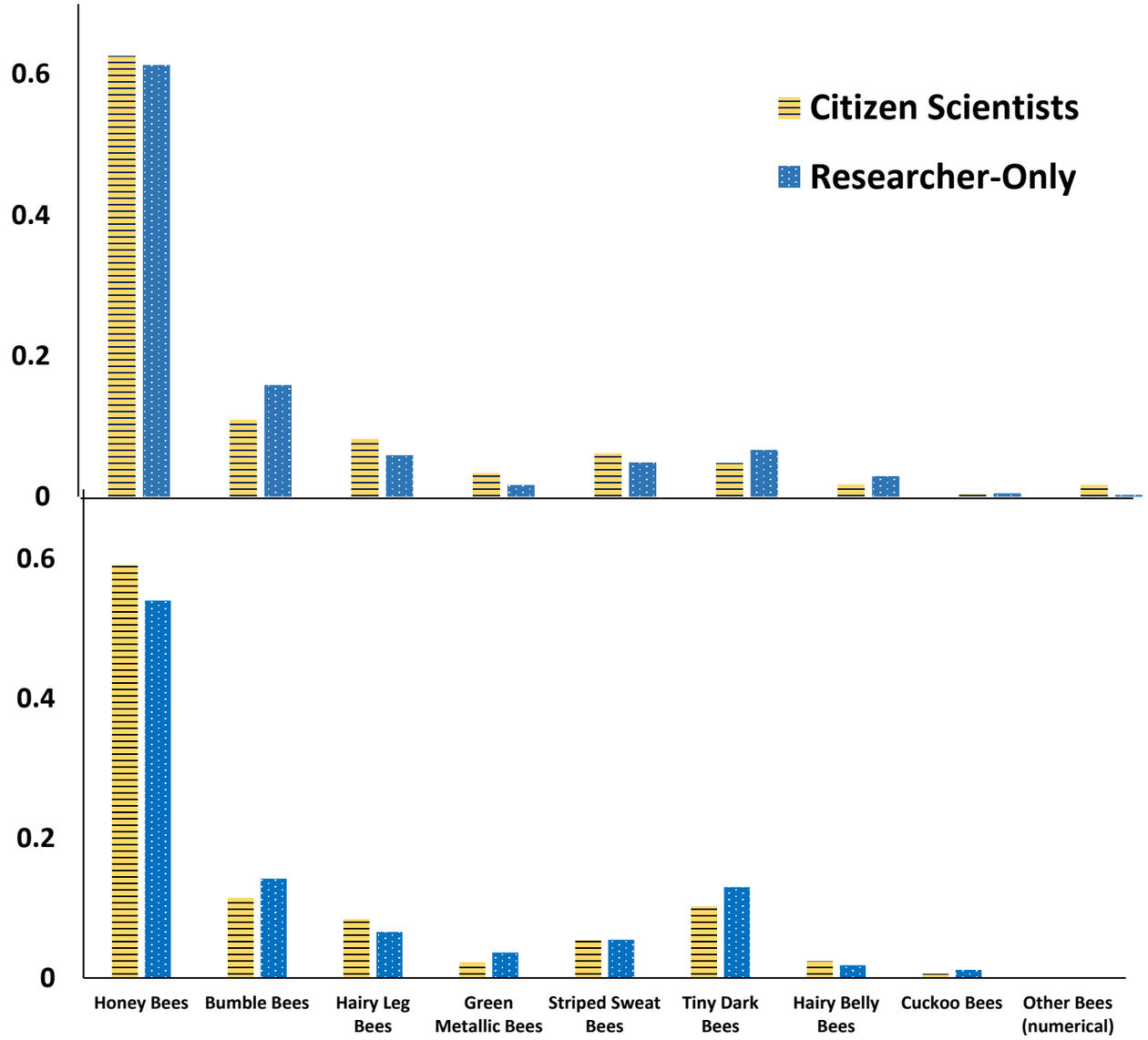


Methods

- Gardens monitored on a weekly basis between 9-11 am
- Volunteers walk along a designated transect
- Observe bees on flowering plants for 2 minutes
- Determine approximate floral resources
- Researchers repeated same methods as volunteers

Cane et al. 2000; Kearns and Inouye, 1993; Kremen et al., 2011

Comparable Proportions



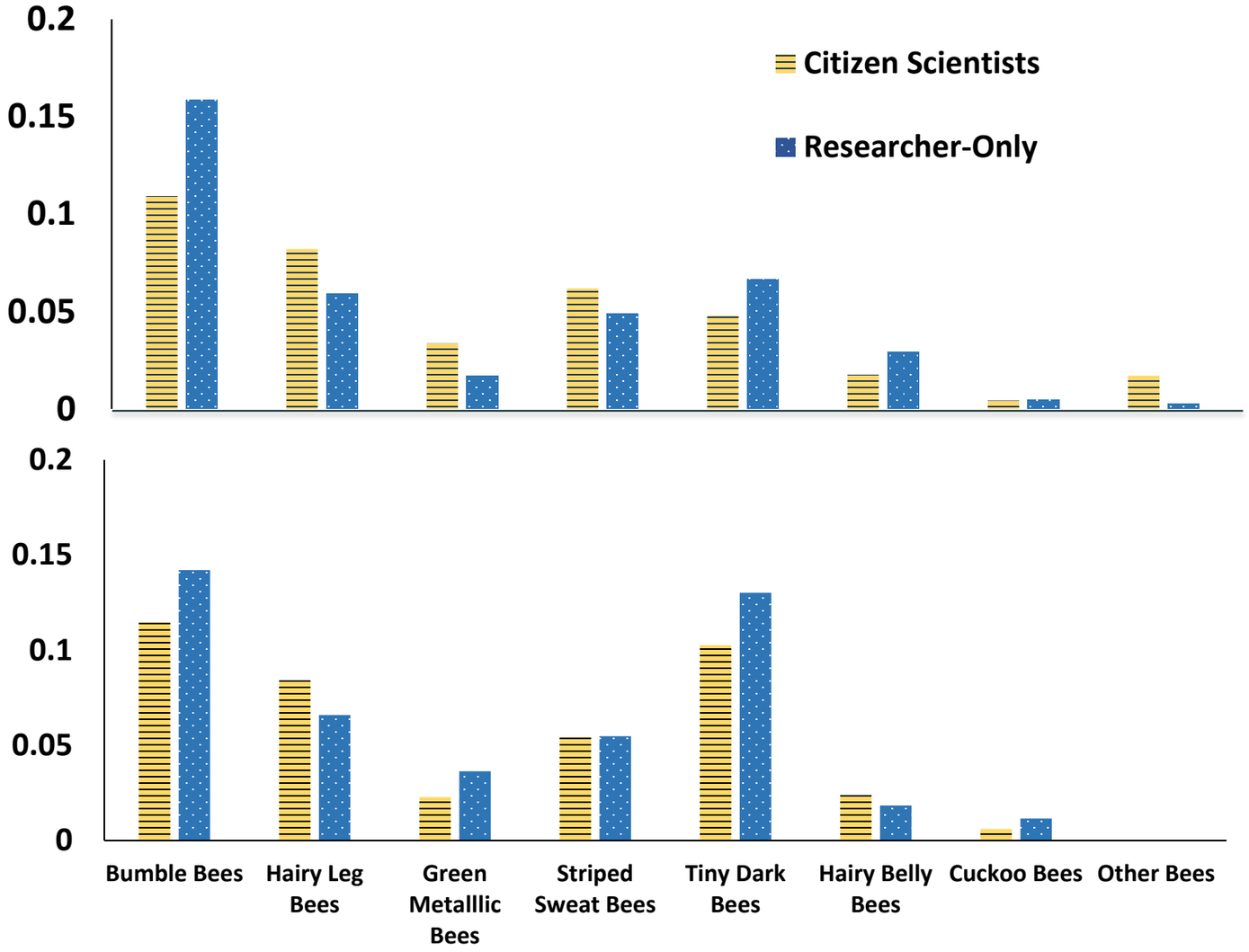
2016

$\rho = 0.92$

2017

$\rho = 0.98$

Comparable Proportions without Honey Bees



2016

$\rho = 0.88$

2017

$\rho = 0.98$

Conclusions

- Bee monitoring protocols were effective
- Investing time into training citizen scientists yielded data comparable to researcher-only data
- Citizen science programs can provide viable solutions for long-term biodiversity and pollinator monitoring
- Opportunities for experienced volunteers to train new volunteers
- Move to a train-the-trainer model

ELSEVIER

Global Ecology and Conservation
Volume 17, January 2019, e00561

Original Research Article

Assessing the efficacy of citizen scientists monitoring native bees in urban areas

Lisa Mason [a], H.S. Arathi [b]

Show more

https://doi.org/10.1016/j.gecco.2019.e00561

Abstract

With growing human population, urban areas expand, and natural spaces become more fragmented threatening the important ecosystem services provided by bee pollinators. Urbanization also provides a wealth of opportunities in the way of citizens who are willing to engage and develop strategies that improve the quality of urban areas. Knowing that pollinator

Mason and Arathi, 2019

Native Bee Watch

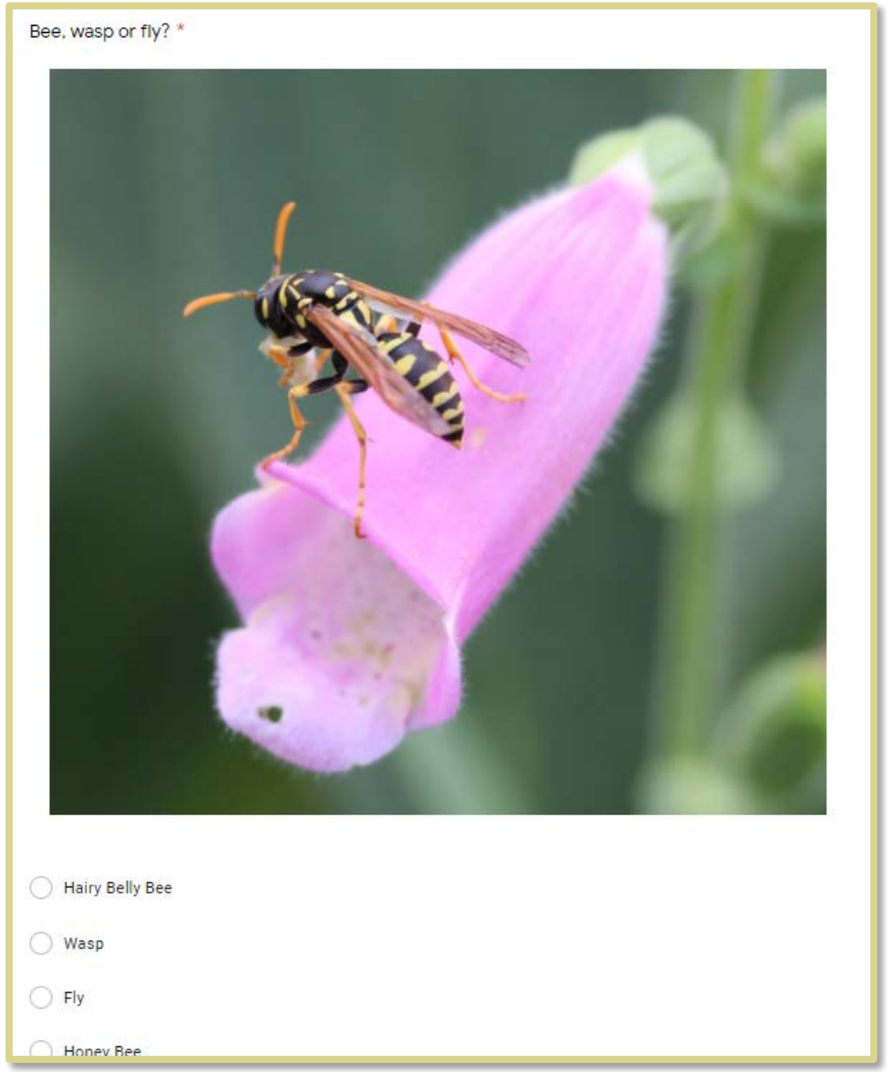
Phase 2 – Summer 2020

Native Bee Watch Goes Virtual

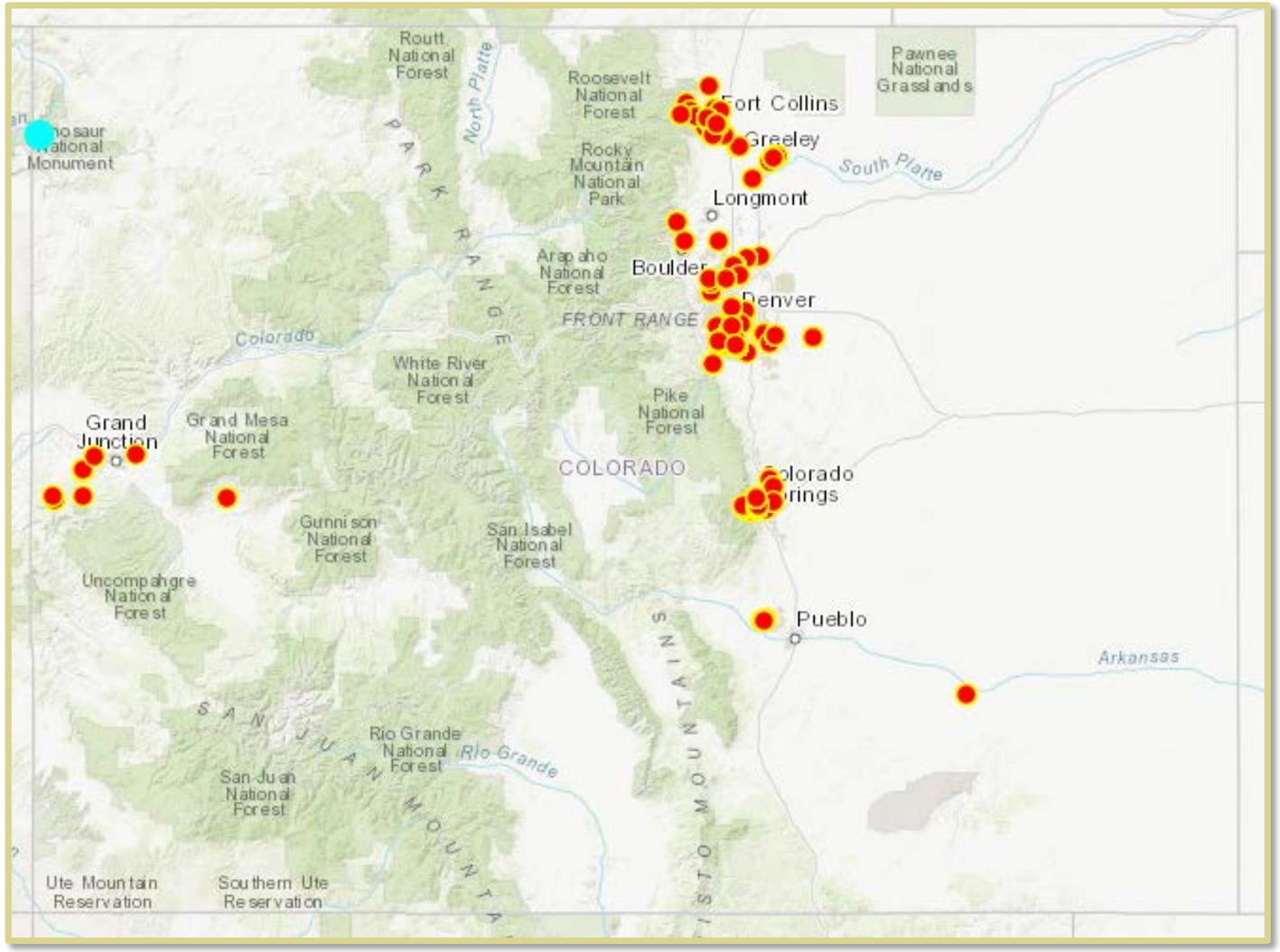
- The COVID-19 pandemic provided the opportunity to leverage technology and streamline the program
- Statewide accessibility
- All program aspects virtual including:
  - Online training
  - Digital data entry
  - Volunteer resources portal on the website
  - Private Facebook group for volunteers
  - A quiz to test volunteer’s knowledge before monitoring
  - E-newsletters
  - Webinars to supplement volunteer learning

Quiz to Test Volunteer Knowledge

- Following COVID protocols, volunteers collected data from their backyard gardens
- After training, volunteers took a quiz to test their knowledge
- They could retake the quiz as often as needed
- A score of 85% or higher was required to begin monitoring



Locations Monitored in Colorado in 2020



Preliminary Numbers

- Trainings
  - 210 people attended a training
  - 69 people couldn’t attend and received access to recorded trainings
  - 279 total people potentially trained
- 85 volunteers contributed data
- 30% retention rate
- Over 4,800 plant observations!

Social Science Research

- We received a grant from the College of Health and Human Sciences
- Research goals include:
  - Evaluating and evolving the current program for volunteers
  - Assess the effects of the program changes on a social and scientific scale
    - Volunteer skills and confidence
    - Scientific process and understanding
    - Quantity and quality of the ecological data
  - Provide recommendations to improve community science programs for adult learners
- We adapted with the pandemic
  - Conducted pre- and post-surveys
  - Used Zoom to interview participants

Aspects of Volunteer Training Webinar

Most helpful

Pre-Monitoring*	Post-Monitoring**
Lecture on bee and insect ID	Lecture on bee and insect ID
Studying the NBW field guide	Studying the NBW field guide
Practice identification using the training PowerPoint photos	Practice Quiz
Lecture on data collection tools and procedures	Lecture on data collection tools and procedures
Outdoor demonstration of monitoring by facilitator	Practice identification using the training PowerPoint photos
Lecture on reasons for pollinator decline	Outdoor demonstration of monitoring by facilitator
Update on how previous data has been used & future directions of NBW	Update on how previous data has been used & future directions of NBW
Lecture on pollination	Lecture on pollination
Structured Q&A through chat box	Structured Q&A through chat box
Practice quiz	Lecture on reasons for pollinator decline

Least helpful

n* = 53, n** =19

Field Resources Used During Monitoring

Post-Season survey responses

Most useful

Bee size comparison guide
Working one-on-one with a partner
NBW field guide
NBW Facebook group
The book Bees in Your Backyard
Recorded webinars available on the NBW volunteer resources webpage
Camera to take pictures
The internet
A magnifying glass
Other (binoculars, bee ID review, response to question via email)

Least useful

n =19

Reasons for Volunteering with NBW

Post-Season Survey Responses

To learn something new	66%
I enjoy participating in science	52%
I like contributing to bee conservation efforts	49%
I'm concerned about the bee population decline	45%
I love bees	21%
Other (e.g., earn CMG hours, it's something "different")	21%
To get out of the house	14%
I wanted to spend time outdoors	14%
To connect with other people in my community	7%

n =19, respondents were able to multi-select

General Feedback

- 95% of post-season respondents said they plan to volunteer in 2021.

  Most common factors influencing the decision to volunteer are other time/work commitments and the monitoring location (i.e., home or public garden)

Positive Experiences

"This has been an absolutely wonderful experience! I have learned so much about native bees, which were relatively unknown to me before. Also gratifying to know that I have contributed to understanding and preserving them."

Awareness and Appreciation

"What an enriching learning experience this has been! My awareness, and appreciation of the role of pollinators in the food chain, has increased ten-fold. Plus, it's just been plain fun to meet all the visitors to our immediate environment!!"

Broader Insect Awareness

"Watching for native bees also made me more aware of the butterflies and other insects in my yard."

Planting More Pollinator Flowers

"…We have already decided to plant more pollinator friendly flowers for next spring to draw more bees, and other pollinators to our yard.

(By the way, my husband and I are no longer afraid of bees.)"

Successes

- We reached:
  - A greater number of people
  - A wider geographic region
- Technology worked to our benefit and was low-cost
- Content was already developed to make the transition online easier
- Enthusiastic volunteers made this program happen

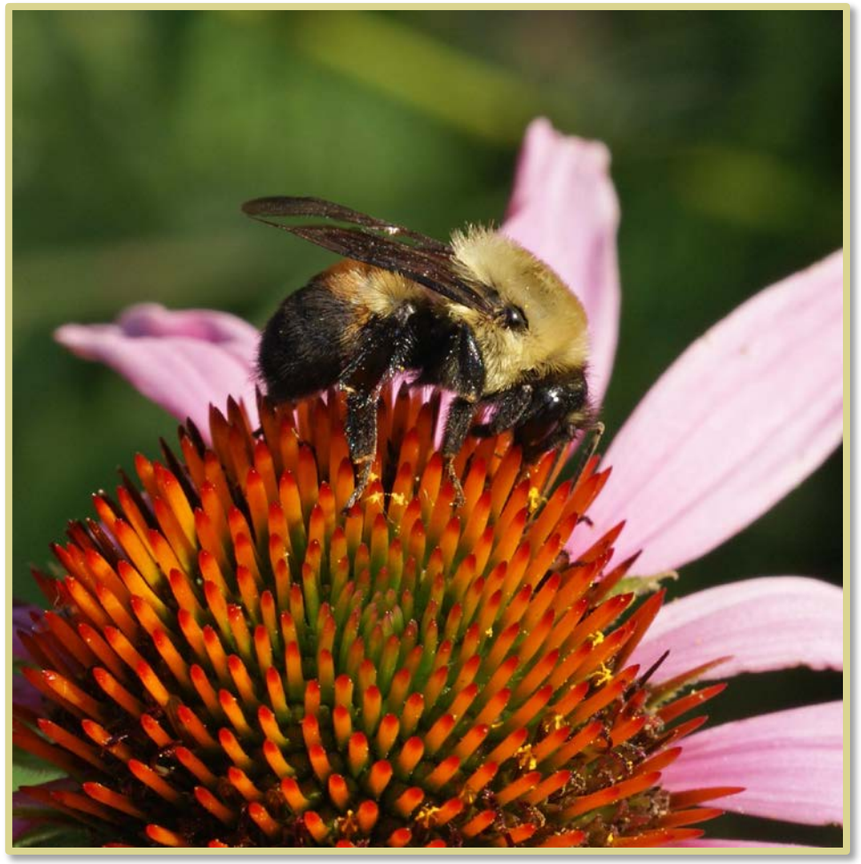
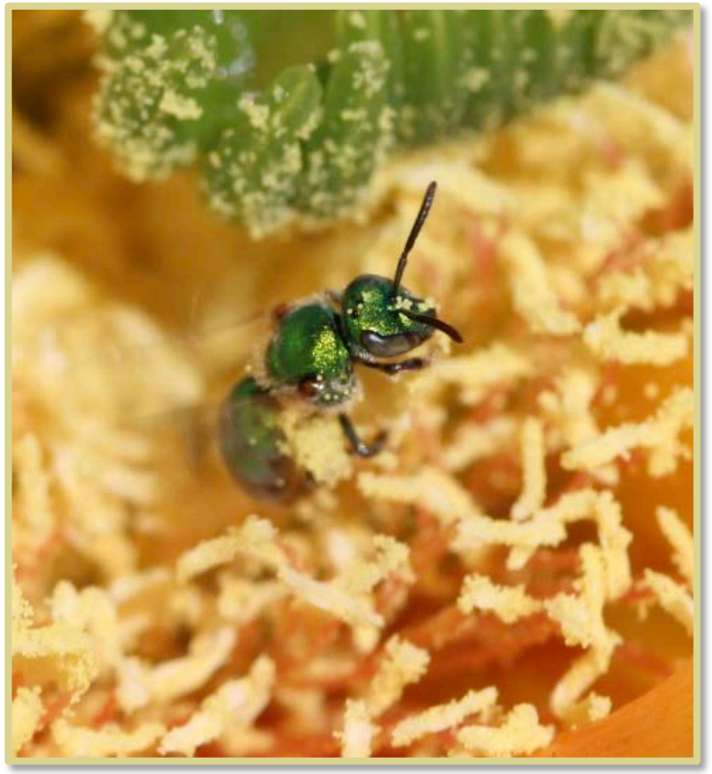


Photo: Diane Wilson

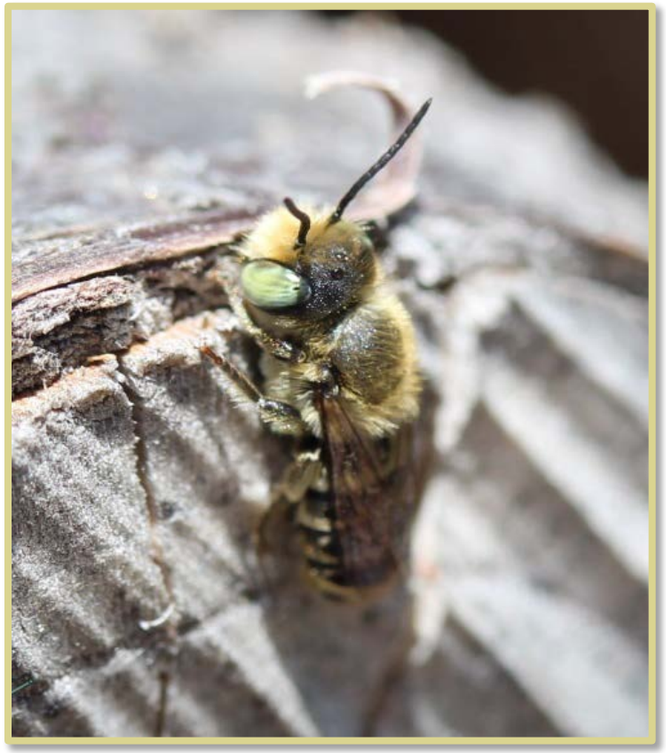
Challenges



- Needed the in-person interactions to:
  - Better train volunteers
  - Build community
  - Improve ecological data accuracy
- Volunteers:
  - Wanted to know in real time if their data was accurate
  - Had to be self-motivated learn the content and monitor
  - Had lower confidence levels without in-person interactions
  - Couldn’t access pinned bee specimens to study
- Data clean-up needed for consistency for analysis

Future Opportunities

- Improve engagement of adult learners
- Develop a hybrid model of virtual and in-person
- Create a mentoring program
- Design shorter training modules
- Make other improvements after full data analysis

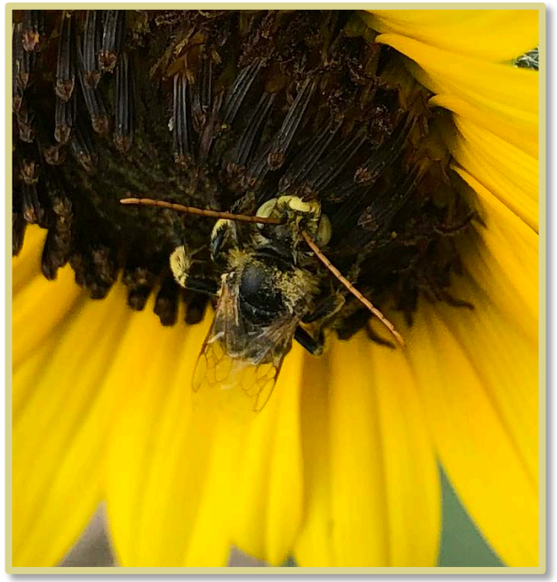


Long-Term Goals – Social Science

- Continue to improve the program design so that volunteers:
  - Have a better experience
  - Return year after year
  - Collect higher quality ecological data
- Mutually beneficial for the ecological scientists and volunteers

Long-Term Goals – Ecological Science

- Collect long-term data on bee abundance and diversity trends at local levels
- Assess characteristics of gardens and plants that improve bee abundance and diversity
- Make local recommendations to homeowners, municipalizes, HOAs, planners, and decision makers based on data in their area
- Continue to provide community outreach and education
- Make data publicly available



Opportunities

- Involve youth, schools, and a more diverse range of communities and demographics

Photo: CSU EOC

Photo: CSU EOC

Bees, Please! STEM Kits

- Developed by the CSU Natural Sciences Education and Outreach Center
- Kits are available to check out for FREE (includes free shipping)
- 15 kits designed to be used by partners of students up to 30 students
- Grades 7-12, but parts of the kits could be used for upper elementary
- Activity content include:
  - Native bee life history and specimen observation
  - Flower parts and pollination (build a flower model)
  - Flower preferences and data analysis
    - Class data visualized with Legos on a garden map
  - Picnicking with pollinators food sort
  - Interview with a scientists

Photo: CSU EOC

Bees, Please! STEM Kits

- The data analysis activity uses the community science data to model:
  - Which bees visit which flowers
  - Quantities of bees in relation to others
- Visit CSU's Education and Outreach Center for more info!
- https://www.cns-eoc.colostate.edu/stem-kits

All photos: CSU EOC

In Summary

- The Native Bee Watch Community Science program is:
  - Providing ecological and social benefits
  - Increasing a broader awareness to insect conservation, plants, and backyard ecosystems
  - Contributing ecological and social science research
  - Growing and improving to engage Coloradoan’s is pollinator conservation

Get Involved!

- Visit: https://arapahoe.extension.colostate.edu/nbw/
- Learn more about the program and resources
  - Field guide, fact sheets, blog posts, and more
- Sign up to stay informed about opportunities
- Email: Lisa.Mason@colostate.edu

NATIVE BEE WATCH
COLORADO STATE UNIVERSITY EXTENSION

Acknowledgements

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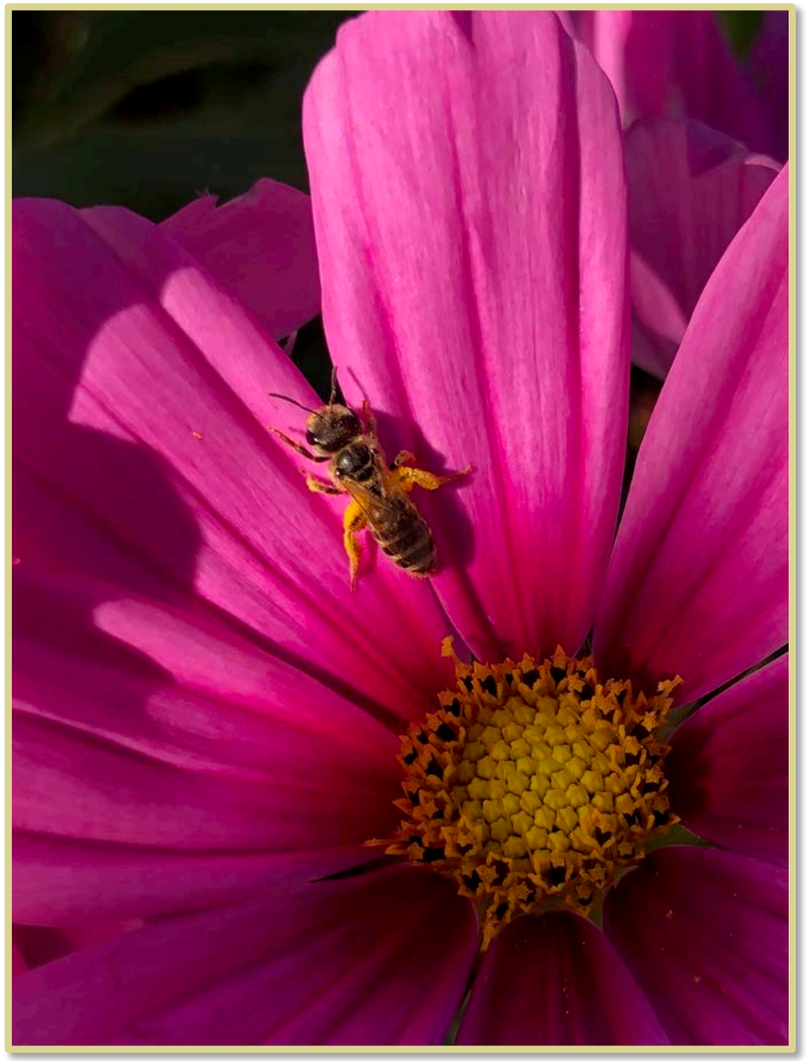
- CSU Natural Sciences Education and Outreach Center
- CSU College of Health and Human Sciences
- Plant Select®

THANK YOU, COMMUNITY SCIENCE VOLUNTEERS!

All photos taken by Lisa Mason unless otherwise noted.



Questions?

Thank you

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