The Importance of Insect Education for All Ages

Honors Thesis

Presented in Partial Fulfillment of the Requirements for the
University Honors Program

Colorado State University

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Fall, 2025

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Fall 2025

Background

The most recent Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) report (2019) states that although it is difficult to determine the proportion of insect species threatened with extinction, known evidence supports the assumption that ten percent of all insect species are at risk. This loss can be blamed on habitat loss attributed to human actions and an overall lack of regard for insects as a whole. One exception to this is honey bees; they are the one taxon that people know is declining and elicits an emotional response to their loss. Sumner et al. (2018) published a paper exploring the reasons for the universal love for bees and the universal hate for wasps. Sumner states that despite both taxa having ecological importance, bees are widely studied and tend to have positive functions tied to them, while wasps are an unpopular research topic with negative emotions often associated with them. These negative emotions tied to insects are deeply rooted in society and cultural beliefs; much of the revulsion towards roaches, fleas, mites, spiders, and wasps can be traced back to the Bible, often used as a form of punishment.

The emotions surrounding these species are traced back to a very small percentage of each of these insects that are harmful to humans in some way. For wasps, this is less than one percent that possess the ability to sting, a mere 67 species that come into contact with humans. This is also seen with roaches; there are a total of 4,500 described species of roach, and of these, only 30 are seen in association with humans. Of these 30, only three are major pest species: the

German cockroach (*Blattella germanica*), the Oriental cockroach (*Blatta orientalis*), and the American cockroach (*Periplaneta americana*) (Petruzzello, 2025). The importance of insects far outweighs their harmful interactions with humans; they pollinate crops, regulate disease and pest populations, decompose organic matter to recycle nutrients, and till soil. Sumner et al. (2018) found that as people's self-reported interest in nature increases, their knowledge about insects increases, and in turn, they may have more positive emotions associated with insects. This finding is why Insect education is so important for the sake of our natural world. If we can positively change how people feel about insects, we can work towards protecting them and, in turn, maintain their crucial ecosystem services.

My Inspiration

Throughout my time at Colorado State University, I have volunteered with the CSU Bug Zoo, and during these years, my passion for insect education has grown exponentially. Because of this passion, I knew that I wanted to incorporate insect education into my Honors thesis. However, I did not want to focus solely on children; in my opinion, teaching adults about the importance of insects is equally important. Unfortunately, there are very few resources targeted directly at adults; however, some universities offer online courses in Entomology, and there are YouTube channels, Reddit communities, and some great books for self-teaching (*Online Programs and Courses in Entomology*, 2025). Despite these resources, there is a gap in outreach opportunities for adult-focused events, and through this project, I wanted to get a foot in that space.

When I first started volunteering for the CSU Bug Zoo, it was immediately clear how little people have been taught about insects, despite them making up 70-80 percent of all

described animal species (Smithsonian, 2019). This lack of knowledge is passed down from generation to generation, through exaggerated stories, misconceptions, and falsehoods portrayed in the media. There is a common disregard for education on invertebrate species, specifically insects, which are often seen as pests, limiting our understanding of these species and their potential benefits for the survival of ecosystems and humans as a whole. In a paper by Cardoso et al (2011), it is stated that perceptions of insects are likely to change if people are made aware of how insects function in the broader ecosystem and the benefits that come with this, whether direct or indirect to humans. This is why people need to be exposed to insects up close and learn more about them in a controlled setting without someone telling them that bugs should be feared.

There are many benefits to insect education, especially at the primary school level. Children are susceptible to the emotions of those around them; oftentimes, parents or teachers will express fear or disgust towards insects, leading to the children mimicking and internalizing those emotions. However, if children are shown the positive aspects of nature from a young age, they tend to harbor a responsibility for the environment and strive to protect it as they grow older (Weeks & Oseto, 2018). These early experiences in nature are often credited as reasons adults have pursued a career in conservation. Conservation should be a highly valued career, due to the exponential rate at which the health of the planet is declining due to environmental catastrophes, such as climate change.

My experience included tabling and presenting at Bug Zoo and Entomology Club outreach events for the Fort Collins community, geared toward both children and adults, to examine how responses to insects varied. My involvement provided me with unique insights into the world of wildlife education and helped me develop valuable scientific communication skills.

Along the way, I encountered numerous challenges, including obtaining IRB approval and a shortage of volunteers to assist me at various events.

Initial Ideas and Proposal

My original plan for this project was to table at both events geared towards children and adults, and at each event, ask about both positive and negative experiences that these individuals have had with insects. I was hoping to see how the descriptions of these experiences varied based on age, and in turn, gain insight into whether there is an age at which insect education is no longer effective. However, I faced some issues with this.

Institutional Review Board

When talking to my advisor, I learned that even if you are asking anonymous questions to people, if you are using it for research purposes, it counts as testing on human subjects and requires approval from the Institutional Review Board (IRB). The role of the IRB is to protect the individuals who are participating as subjects in research and to ensure that research is being done ethically with the subjects' welfare in mind. To use responses to my questions at outreach events and to make a general conclusion in my Honors thesis, I would have to have my study approved by the IRB (*Institutional Review Boards Frequently Asked Questions*, 2019). This was a process that I was completely unsure of and had no clue how to even start.

In hopes that there was a chance that my research did not need IRB approval, I sent an email to the CSU IRB and tried my best to explain the situation, stating that all data would be anonymous and that it would not be shared outside of the university. Unfortunately, I did not get

my point across well enough, as I was just told that they did not have enough information to decide whether my study required IRB approval. Thankfully, they provided an informative flowchart that detailed which studies need approval and the type of approval needed.

After meticulously looking at the flowchart, I realized my research would fall into the expedited review category. When looking at the IRB website and the manual for expedited review submissions, I was immediately overwhelmed. I would have to write up my proposal, my hypothesis, my procedures, the purpose, and how my research will benefit people in my field of study. I didn't know half of these, all I had was a rough Idea of what I wanted to achieve. Thankfully, because my study was so simple, and I did not have actual medical procedures or psychological treatments that I was implementing, and I was not doing a study on prisoners, there wasn't a conflict there. However, because I would be including children in my study, there was a complicated process relating to that.

After a lot of procrastinating, I sat down with the application and was able to fill it out relatively quickly. The application caused me to think deeper about my study and really understand what I wanted to accomplish. I was definitely unsure about a lot of what I submitted, but I figured I would address the feedback as it came for me and as I gained a better understanding of what the review board wanted. It took a couple of weeks, but I finally got my submission back to be revised. The only revision needed was that I had put myself as the PI, but I was informed that students could not hold this role and that a member of the faculty would have to serve in this position instead. I also had to undergo CITI training. I am used to doing training for various club leadership positions, and I thought it would be a similar process, but boy, was I wrong. The process of doing the CITI training was very intimidating; it consisted of 11 modules,

each with a lot of information to retain. This frustrated me as practically none of the modules I had to read through applied to my research project.

Once I finished the training, I realized that because I changed who the PI was on my project, I would have to message them to submit instead. It was at this point that I had to reevaluate what I was going to do for my project. If I were to send a message to my PI, it would add time to the process that I did not have. I decided way too last-minute to scrap the entire research idea and instead just focus on volunteering at as many outreaches as I could and reflecting on the experience. I knew that although the experiences wouldn't contribute knowledge to the existing research being done on the subject, I would still gain a broader understanding of the effectiveness of insect education across all ages. Through these events, I was still able to answer some of my own personal questions about how children vs adults speak of their previous experiences with insects.

Planning Outreach Events

This semester has been a really complicated one for the CSU Entomology Club. I joined the officer team as the Vice-President in the Fall of 2024. I was lucky to have the support of the other longstanding officers, who knew the process for everything. Unfortunately, after a semester of everything going smoothly, every single officer graduated, leaving me to pick up the pieces with a team of entirely new officers. Thankfully, the officers who took their places have been incredible and shadowed their positions before fully taking over, but there was still a lot of catching up to do for all of us to make up for our lack of experience.

Through this turnover of the Entomology Club officers, I learned a lot about leadership and time management. From my experience, one of the most crucial aspects of leadership is being able to delegate tasks to other officers. At the beginning of the semester, I had no clue how

much responsibility I would be taking on as the President, and in turn, took on the majority of the work myself. Towards the end of last semester, when we held our officer election, one of the roles was social media manager. I was very excited to have this position filled, as in the past, I had taken on the responsibility of the social media account. Unfortunately, after two weeks of having a social media manager, they stepped down from the position due to it being too much of a time commitment. This left me to once again be in charge of the social media account for this semester. Due to this extra responsibility, I had to learn to share responsibilities with the other officers. We held officer meetings on weeks when we didn't have club meetings, and during these meetings, we all collaborated on meeting ideas and chose a time that worked for all of us to set up beforehand. While I was still in charge of the social media account and making meeting posters, there was a lot less weight on my shoulders. I then realized that I had to focus more on time management and making sure that leading the Entomology Club didn't interfere with my schoolwork for my final semester. This was really hard for me. I have always been a major busybody, working two or more jobs at a time since I was in high school, so I am not one to limit the amount of responsibilities that come at me. However, I knew that putting too much on my plate was not a good idea, so I had to really utilize my Google Calendar to organize the events that I had planned for the Entomology Club and set aside blocks of time for hobbies and hanging out with friends.

To make things even more complicated, it came to our attention that in years past, the president of the Entomology Club had also been the outreach coordinator for the CSU Bug Zoo. I had little association with the Bug Zoo in the past, volunteering at many outreach events with them, but never working in the husbandry side of things or organizing outreach opportunities. I simply went where I was told and talked to people about bugs. When I spoke to one of the

Entomology Club advisors, Matt Camper, we chose to move away from community outreach this semester as a club and focus more on events on campus for our club members and gaining a larger membership. Despite trying to distance ourselves, we still continuously received emails from community members requesting a visit from the bugs at the Bug Zoo. We tried our best to send them to the current Bug Zoo contact, stating that we were a separate entity, but the zoo was also experiencing issues of low volunteer interest, as many of their volunteers have graduated. This resulted in us either turning down opportunities or taking on way more than we could chew with our small team of four officers. I felt terrible turning people down, and I really enjoy volunteering at outreach events to teach people more about insects, so I ended up volunteering at most of the events by myself because I was the only one available.

Outreach Event Experience

As I stated previously, I adore engaging in outreach events for the Bug Zoo. I used to always say that I hated children, I never knew how to interact with them, and I avoided them at all costs. However, these volunteer events have helped me learn to better engage with children. I now love interacting with children, their curiosity about the world, and eagerness to ask questions about everything they do not understand is so inspiring. Although I am currently fascinated by nature, I strive to regain the pure curiosity for nature that I once held at a younger age.

This semester, the outreach events I organized could be classified into two types: those geared towards a younger audience and those geared towards an older audience, essentially children versus adults. I didn't want to focus solely on children, although they are the most moldable and curious group; adults can have a change in mindset as well, and I believe that is

equally important. I would also like to mention that for the rest of this paper, I will be using the word bug in its colloquial form, not its technical form.

The first event that I organized was geared towards a younger audience. This event was part of the Great School Escape program at the CSU Environmental Learning Center, which consisted of around 20 children, and my talk took up roughly 90 minutes of the lesson plan for the day. Let me level with you for a second: this event was a bit of a nightmare. To start, I am not used to presentations; most of my events are tabling-style, where people approach me and can leave as soon as their attention span dwindles. To add to this, the day this event was held was cold, and wind gusts were strong; due to this, the children had been cooped up inside all day. While I was presenting, the children were unable to stay still and were yelling over every word I said. The counselors tried their best to keep the room quiet and focused, but there was nothing they could do. Despite this, I still gave the best presentation I could and tried my best to keep the children engaged through facts and questions. One of these questions that engaged the group was, “What is the first word that comes to mind when I say the word bug?” (Figure 1). The results of this question really surprised me. I expected a lot of emotion-driven answers, but instead, many of the children named a type of bug, such as: fly, beetle, centipede, etc. Although most of the students didn’t quite adhere to the one-word aspect of the question, I still chose to include their full responses. It seems that most of the emotion-based responses were related to annoyance. I didn’t include it on the paper, but one of the children named the kid next to her, and when asked her reasoning, she stated it was because

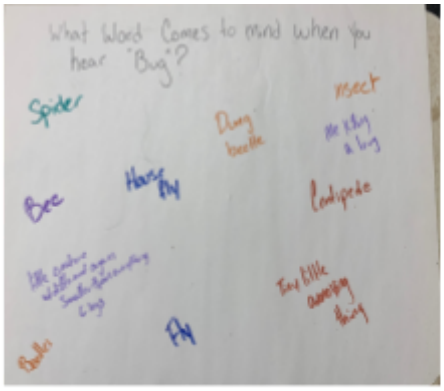

Figure 1: This image shows responses to the prompt what word comes to mind when you hear “bug”? Responses consist mainly of types of bugs and a couple of emotions expressing annoyance

he is annoying. By the end of this event, I was pretty disappointed in my ability to keep the group engaged and feeling like a failure. However, when I emailed the main event organizer to thank her for hosting me, she told me that the children were excitedly telling their parents about the bugs they saw when they were picked up that afternoon. This eased most of my disappointment and made me feel like less of a failure.

The next child-geared event was the CSU Chemistry Club's annual Halloween event. Due to our lack of volunteers in the Entomology Club and the Bug Zoo, I nearly cancelled our involvement in this event. However, the pressure to attend was too great; we attend this event every year, and every year they rave about the bug room, so I knew I couldn't back out. I was able to convince two other Entomology Club officers to join me, and thankfully, the space they gave us to set up in was relatively small, so we could easily have officers to control each area. I have found that if there are not enough officers, and a section of the table goes unwatched, it is very likely a child will end up grabbing and shaking one of our critters' enclosures, which is extremely stressful for them. I set up a similar activity for this event, asking people what the first word was that came to mind when they heard the word bug (Figure 2). I noticed a very similar pattern with this activity; children were

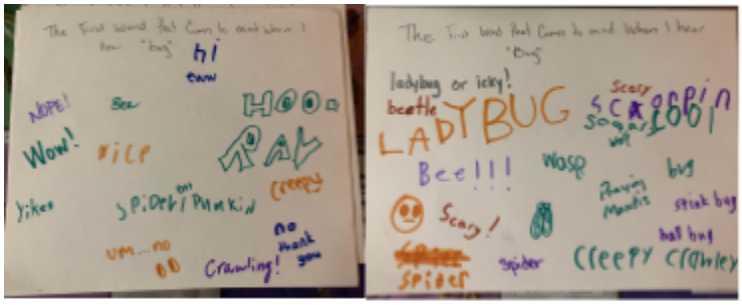

Figure 2: Two photos showing the responses to the prompt: The first word that comes to mind when I hear "bug". Both papers placed out at the same time to allow for less crowding. Responses range from positive to negative emotion and bug types.

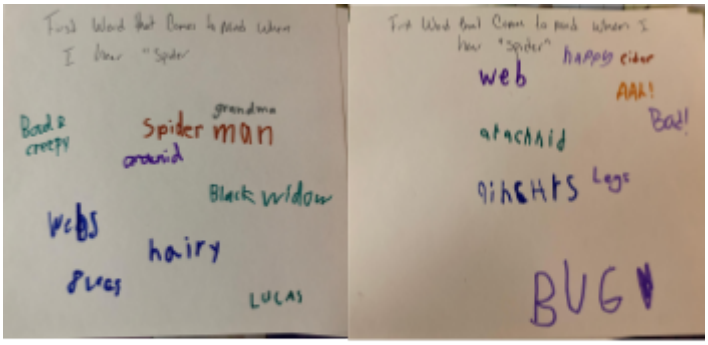

Figure 3: This image shows responses to the prompt: First word that comes to mind when I hear "Spider". The responses to this question were all over the place, some media references, some emotional responses (primarily negative), and some descriptors. There was only one type of spider listed

likely to put down the first bug that they thought of. There were also some parents who participated, and I saw a difference in responses for this group. It was about 50/50 on whether the adults would put an emotion or if they would put a type of bug. I also decided halfway through the event to switch the wording for this question, and instead of the word bug, I wrote spider to see how the responses would differ (Figure 3). The changes in response caused by this wording were not entirely surprising to me; I expected a lot more negative emotion to be tied to this word compared to the word bug. However, I expected there to be a lot more "Spiderman" responses, and I was pleasantly surprised with the feature description words. A lot fewer adults responded to this prompt, but I did notice that their responses encapsulated the majority of the negative emotions.

Lastly, I did participate in one outreach that was entirely geared towards adults. As a club, we were invited to table at the Residential Learning Communities Fall Fest event. This one caused me a lot of stress as I was the only person available to be there from the club, and I had no clue how bustling this event was going to be. I also had work that night, so I was only able to table for half of the festival. Unfortunately, this event did not have that great of a turnout, it was poorly advertised, and the only people that they were able to recruit into the festivities were unsuspecting people walking by who were promised free things. This limited the number of people that I was able to talk to, but I was still satisfied with the event overall. I chose to put out the same prompt to see if there was a difference in responses from college students (Figure 4). However, the answers were incredibly biased, as the

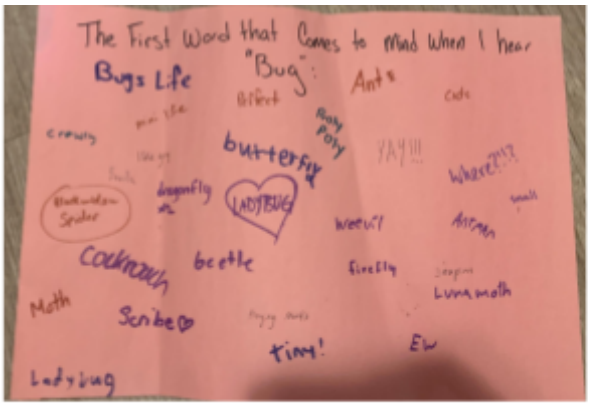

Figure 4: Responses to the prompt: The first word that comes to mind when I hear bug. Prompt was given to college students attending the RLC Fall Fest and responses consisted of types of bugs as well as mostly positive emotions

only people who approached my table were people who were interested in bugs in the first place. I was really hoping to talk to some people who were absolutely revolted by bugs, but I did not get that chance. Even though the results were not what I expected them to be, I still enjoyed seeing what people wrote and interacting with people who think bugs are cool.

Conclusions

Despite the amount of stress all of this planning and volunteering has caused me, I would do it all again in a heartbeat. Insect education is one of the most dire things for conservation right now, and I hope that I can do my part to contribute to the inspiration of our future entomologists and ecologists. The lack of negative emotional responses to the prompt activity I gave to both children and adults gives me hope that people's viewpoints on insects and arthropods in general can be changed, and that we can inspire people to care about insect conservation enough that regulations and further initiatives will be put in place to protect declining insect species.

I think that, especially for adults, these outreaches can be beneficial for attitude changes toward insects. One of the most meaningful aspects of these events is clearing up misconceptions around bugs. There were numerous times when an adult asked me a question about a bug or just told me a "fact" that they knew, which was wildly wrong and harmful to the image of that insect. I was able to clear up a misconception or correct that person on the "fact" that they told me, and I could tell that this person was now a little less worried about being near that insect. This brought me hope that we could improve people's perceptions of bugs if we just provided them with correct information and allowed them to see these bugs up close through outreach events. Even if we inspire someone to look into what they can do in their own yard to increase insect diversity, I call that a win.

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