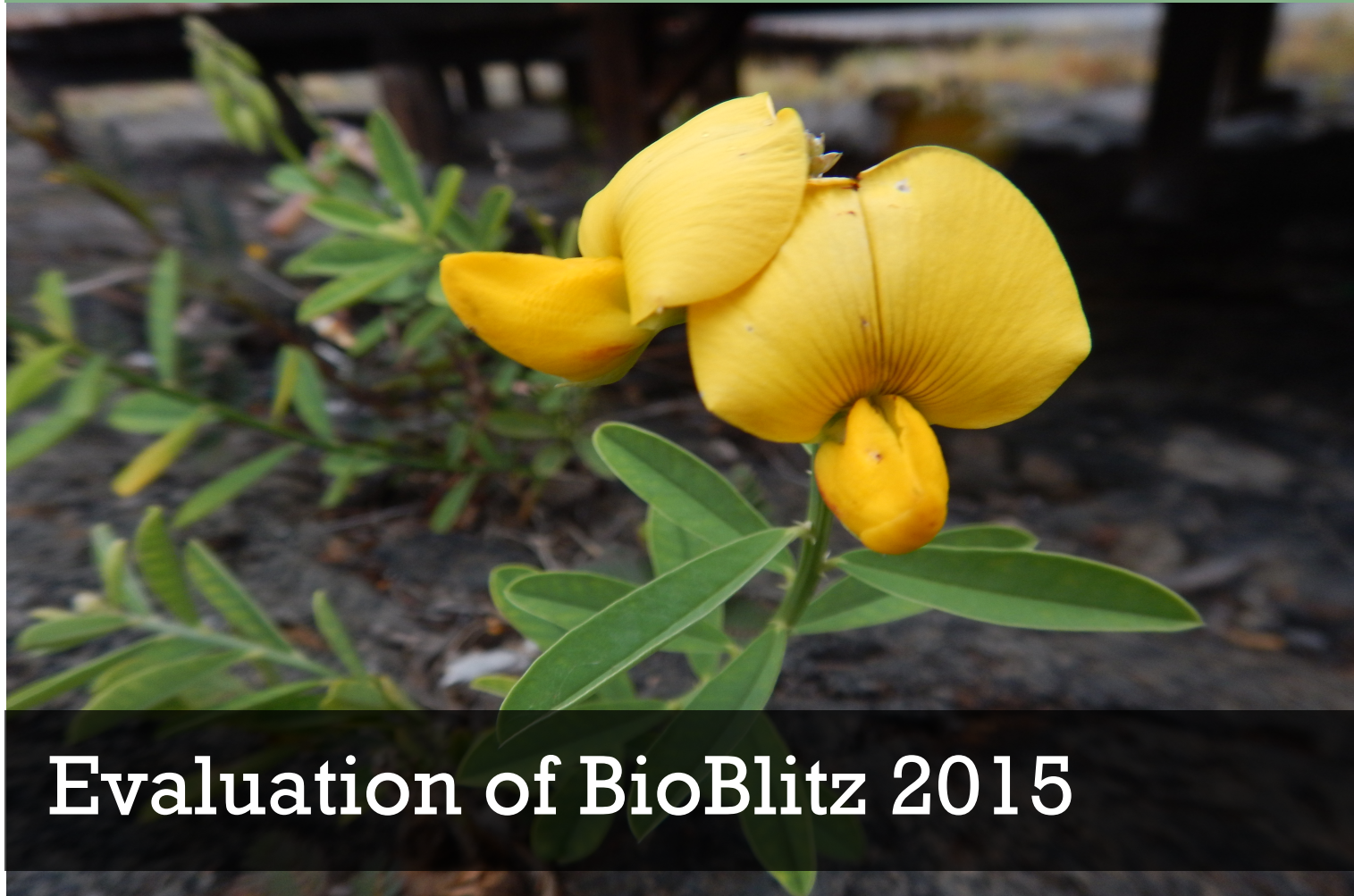




Evaluation of BioBlitz 2015

Hawai'i Volcanoes National Park

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Executive Summary

In May 2015, the national BioBlitz was held in Hawai'i Volcanoes National Park. Among the goals were: 1) to collect data on the diversity of species in the Park; 2) help scientists understand the benefits of communicating about science to the public; 3) help the general public (including students) appreciate and feel comfortable in nature, learn about biodiversity, and explore the world using all of their senses.

The evaluation showed that students, teachers, and the general public generally found BioBlitz to be fun and inspiring with most having a greater appreciation for, and comfort in, nature than they did before participating in BioBlitz. Future BioBlitz events could be improved by allowing more time for exploration and participation in activities by having a less packed and confusing schedule, as well as better communication, and improved transportation logistics.

BioBlitz Engaged

Students and teachers connected with BioBlitz on different levels. The program increased their fascination and comfort in nature, and encouraged active learning.

- **Increased Fascination & Comfort in Nature:**
After BioBlitz, students and teachers felt like stronger advocates for the environment, and had a greater understanding of, and appreciation for, biodiversity.
- **Kids Love Insects & Hands-on Activities:**
Youth especially appreciated the hands-on activities. The insect collecting and bird watching activities rated the highest and resulted in an increased fascination with nature.
- **Nature Seems Natural:**
The experiences at BioBlitz made nature more approachable. Participants enjoyed using their senses and powers of observation.
- **Greater Connectedness:**
Following the programs most students were able to identify different ways nature is important for humans and see nature as a source of beauty and relaxation. Some students believe they might pursue career paths in nature conservation.
- **The Park's Influence in Experience & Disposition:**
Although students' attachment to Hawai'i Volcanoes National Park influenced their experience at BioBlitz, it did not necessarily change their comfort being in nature.

How BioBlitz Can Be Improved

Although the overall feedback from students and teachers was mostly positive, there were some suggestions for improving BioBlitz in future years.

- Allow more time for exploring the activities and conducting species inventories
- Have better communication for planning and scheduling
- More time in the field for hiking, learning, and being in nature

Summary for the General Public

Members of the general public were also asked to evaluate the BioBlitz. Although most of the general public consisted of local Hawaiians, four countries (including the United States) and 12 other states were represented. Of those who returned their surveys, most were employed females with college degrees.

Benefits for the General Public

The general public was more likely to already be comfortable in nature than the students so they benefited from BioBlitz more from the educational experiences than any changes in their personal relationship with nature. Many continued to learn on their own following their participation in BioBlitz by doing research via the internet, magazines, and books.

- **Learning from the Experts:**

The most valued experience by the general public was the opportunity to learn and ask questions from the scientist leaders at the national park.

- **Cultural Events Inspired:**

Participants found the cultural events to be inspiring and unique. Many were impressed with the quality of the arts, crafts, music, and dancing. Others greatly appreciated how BioBlitz blended culture and nature into an educational program for both adults and children.

"I think combining cultural festival and the BioBlitz was brilliant: it tied together culture and science in ways that strengthened interest in both."

How BioBlitz Can Be Improved

Although the general public, like the teacher and students, were mostly very impressed with all aspects of BioBlitz, they had some suggestions for improvement.

"I wish that more people could have experienced what I did. It should have been better advertised."

- Have better advertising and communication both in advance and during inventories
- Improve the transportation logistics
- BioBlitz could be more thorough and in-depth in order to meet scientific goals

Create a less jam-packed schedule. In reference to the final bullet point, participants felt that they often were missing beginnings or endings between activities. Most of the general public participants were employed and found it difficult to get to the Friday evening events on time.

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EVALUATION OF BIOBLITZ 2015

Hawai'i Volcanoes National Park

Introduction

A BioBlitz is a 24-hour event in which teams of volunteer scientists, families, students, teachers, and other community members work together to find and identify as many species of plants, animals, microbes, fungi, and other organisms as possible. A BioBlitz can have many goals, from improving a base of scientific knowledge to helping people appreciate the natural wonders of the National Parks.

In May 2015, the national BioBlitz was held in Hawai'i Volcanoes National Park. Among the goals were: 1) to collect data on the diversity of species in the Park; 2) help scientists understand the benefits of communicating about science to the public; 3) help the general public (including students) appreciate and feel comfortable in nature, learn about biodiversity, and explore the world using all of their senses.

The National Geographic Society, in collaboration with the National Park Service, and The Lawrence Hall of Science at University of California, Berkeley, conducted the evaluation of the 2015 BioBlitz. The main evaluation questions were:

- Who attends the BioBlitz?
- What are the benefits to students from participating in BioBlitz?
- What are the benefits to the general public from participating in BioBlitz?
- How do teachers integrate classroom and field activities?
- How can future BioBlitz events be best evaluated?

The evaluation questions were answered using two main data collection methods: survey and observation. Surveys were administered to teachers and their students and to members of the general public. The surveys were administered within two weeks of the completion of the BioBlitz. Surveys were returned from 492 students, 23 teachers, and 91 members of the public. Two evaluators (one from National Geographic Society and one from UC Berkeley) visited the BioBlitz and observed the inventories in action. This report presents the results from all data collections events.

What activities did participants engage in?

The BioBlitz at Hawai'i Volcanoes National Park consisted of two major elements: the Species Inventories and the Biodiversity and Cultural Festival. For students and their teachers, a scientist and an alakai'i, or holder of local and traditional ecological knowledge, led species inventories. During the inventory, students rotated between three different stations: a) bird-watching; b) insect-collecting; and c) plant-counting.

The student events began with a large group activity, where the cultural interpreter, or *alakai'i*, would introduce the site to the students and talk about the connectedness of nature. Students would then engage in an *oli* or chant, thanking the site for the visit. Students would then be divided into three groups and rotate through the stations. After the completion of the three 20-minute rotations, the large group would reconvene and offer a different *oli*, expressing their gratitude.

The bird-watching station usually began with the scientist describing local birds and their sounds. Some scientists presented recordings of the bird sounds, to help students with their identifications. The use of binoculars were also explained to students (how to protect the binoculars by wearing the strap, how to focus). Then, students were encouraged to listen for bird sounds and to use the binoculars to identify the birds they heard. Birds that flew overhead were also identified. Most scientists encouraged students to record the birds using iNaturalist. (Tablets were provided to the students for the inventory, so that they would be able to record their findings.)

For the insect-collection, students were introduced to the tools of collection: a beat sheet and an aspirator. They were then sub-divided into groups and sent into the bushes to beat the trees and collect insects. In general, the scientists then helped students identify different species. Volunteer students moved the insects into collection vials using the aspirator. Most scientists encouraged students to record the insects using iNaturalist.

The plant-counting was designed to introduce students to the concept of the transect and quadrat. In practice, few groups were seen using the transect and quadrat as intended, but the scientists varied the practice based on the layout of the environment where they were. Students identified plants and were introduced to some of the most pernicious invasive species. The scientists described the different types of invasive species found in the Park and discussed why invasive species were often a problem and what students could do to help protect the native species of the Park. Again, students were encouraged to record plants using iNaturalist.

The public inventories varied in location, purpose, and the extent to which participants were asked to count and record species. The events were spread throughout the regions and reach of the Park, from the coastline to the higher elevations. The events were all educational – presenting information on native and invasive species. The scientists who led the inventories also discussed their own research and explained the research conducted in the Park. Among some of the topics covered were learning about the nene or Hawaiian goose, counting frog species – both native and invasive – through their croaking, and understanding the geology of the lava flows.

Who attended the BioBlitz?

Students, teachers, and members of the general public who attended BioBlitz were asked to complete a survey; we received responses from 492 students, 23 teachers, and 91 members of the public. There were participants who did not return surveys; the data presented here

are only representative of those who returned surveys. The distributions for students, teachers, and the public are presented in Figure 1¹.

FIGURE 1. PARTICIPANTS BY RACE/ETHNICITY (ALONE OR COMBINED WITH OTHER RACES)

Race/Ethnicity	Students N=492	Teachers N=23	Public N=91
African-American	6%	0%	2%
American Indian or Native Alaskan	13%	4%	6%
Asian	29%	39%	24%
Hispanic/Latino	15%	5%	8%
Native Hawaiian or other Pacific Islander	63%	17%	6%
White	36%	57%	75%
Declined to state (number)	80	0	40

Note: Some participants identify with multiple races, so totals are greater than 100%

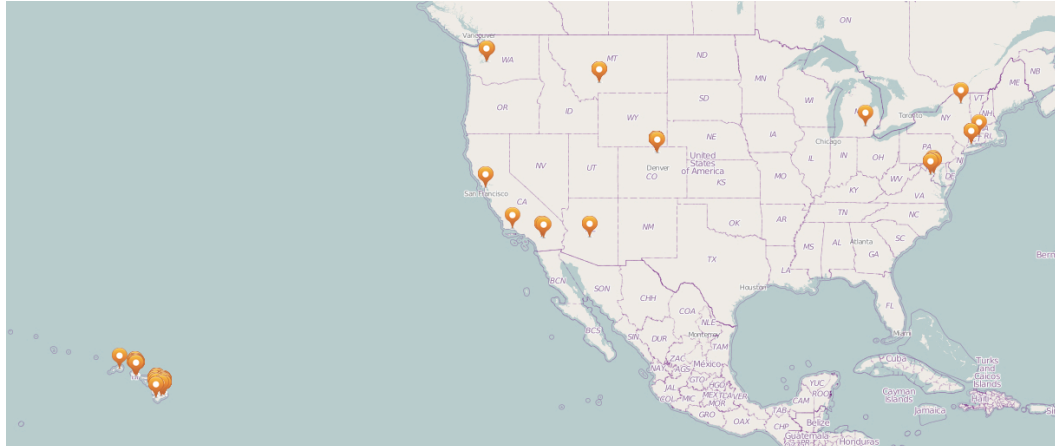
Many of the participants were familiar with Hawai'i Volcanoes National Park. Of teachers, 70 percent had previously visited the Park with students. Similarly, 70 percent of students had visited the Park before BioBlitz. Students and their teachers mostly came from schools on the island of Hawai'i, although at least one classroom came from Oahu. In addition, many students indicated that they have visited the Park more than three times, and some, from a local school, said that they had visited "hundreds of times."

The people who attended the public programs varied from the student and teacher population. Approximately 250 people² registered as public attendees came from 12 different states in the United States, Canada (2 attendees), Great Britain (2 attendees), and South Korea (2 attendees). Most attendees (70 percent) were from the state of Hawai'i, and from the islands of Oahu, Kauai, and Hawai'i. The map below shows the range of ZIP Codes from which people were registered through the public registration system.

¹ These distributions were compared with the populations of Hawai'i from the census; however, the census collects ethnicity data by asking how individual identify with ONLY one race or asking if they identify with MULTIPLE races, but without asking them to specify which races they identify with. This means that, in the census data, only people who identify *solely* with, for example, Asian or Pacific Islander are included in that category. Anyone that identifies with both Asian and White are identified in the "multiple" category. Since these data were collected by asking people to mark all races or ethnicities with which they identify, the percentages are not comparable with the census data. However, we can assume that some of the people who responded that they identify with "multiple" races belong to each of the individual races, so that percentage of each of those would be even higher.

² Because one person could register for multiple people, it is hard to tell exactly how many different individuals registered. This number comes from the EventBrite report, minus duplicates in instances where more than two tickets were purchased for the same event by one person.

FIGURE 2. PUBLIC REGISTRANTS BY ZIP CODE



While attendees were not asked specifically about why they signed up for BioBlitz, in the comment sections of the survey, several people mentioned why they had attended. Social reasons – meeting like-minded or other local people – were mentioned most frequently. For example, one person said they wanted “the opportunity for my grandchildren to interact with environmentally enlightened humans.” Others came to help the Park with an important scientific activity.

Teachers as well brought their students for many different reasons, including doing something important, doing something beneficial to others, and seeing scientists at work in the field. Fewer teachers indicated that they expected BioBlitz to help address state educational standards or to benefit them in their own careers.

STUDENTS AND THEIR TEACHERS

This section provides information about how participation in the BioBlitz benefited students and their teachers.

Enjoyment of Activities

The BioBlitz consisted of the Festival and Inventory activities. On the survey, respondents were asked which of the activities they participated in and what they liked about the activities.

Students reported enjoying all of the activities. Most students participated in working with scientists and cultural experts, and doing science in the field, though 30 percent of them did not engage with the iNaturalist app. Figure 3 presents data on the percentage of students who reported that they participated in different components and data on how much those participating students enjoyed each component.

FIGURE 3. PERCENT WHO PARTICIPATED IN AND RATINGS OF DIFFERENT COMPONENTS OF BIOBLITZ

	% Experienced		Of those who experienced each component					
			Did not like it		It was okay		It was great!	
	Students	Teachers	Students	Teachers	Students	Teachers	Students	Teachers
Working with scientists	94%	100%	2%	0%	24%	17%	74%	83%
Working with cultural experts	92%	87%	2%	5%	29%	15%	69%	80%
Being able to do science in the field	92%	100%	1%	0%	23%	22%	76%	78%
Using iNaturalist to submit observations	69%	87%	8%	15%	34%	55%	58%	30%

In Figure 3, we can see that most students were able to do science in the field, work with cultural experts, and work with scientists. Many were able to use iNaturalist to submit observations. The activities were all popular with the students, as the majority responded “It was great!” to all items. Of all the components, working with scientists in the field garnered the most enthusiasm. For example, in open-ended survey responses, students shared that “The BioBlitz was a thrill to go and meet scientists” and “Seeing the scientists’ point of view in BioBlitz changed my thoughts about being in the nature.”

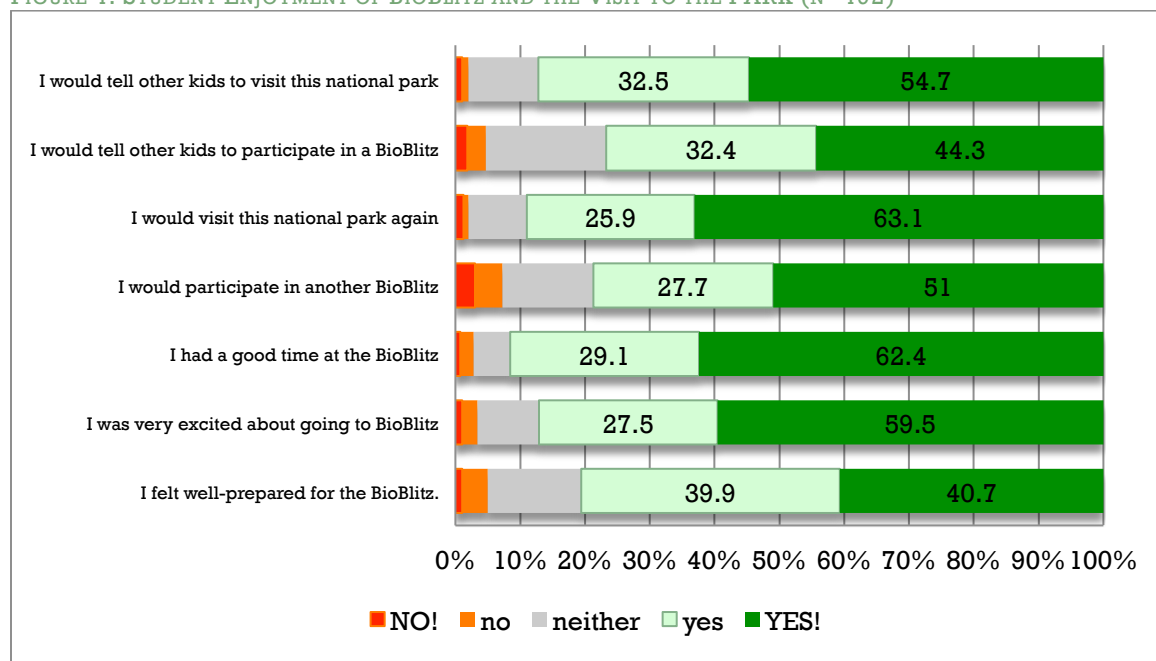
Using iNaturalist was most likely to generate the response of “it’s okay,” particularly amongst teachers. According to one teacher, “iNat was tricky, and there is not much support from field volunteers so training them could help.” Other teachers also mentioned that “It was really difficult to use the iNaturalist app in the sunshine.” and “We had problems using iNaturalist in the field. No one had time to go back and upload pictures. I did not think iNaturalist was explained well.”

During observations, it was noted that the student activities tended to be very pressed for time. In the insect and plant activity, there was usually enough time to present the different tools to the students and have students engage in a small amount of species collection. After this, there was limited time to help the students identify the species – this was usually done by the scientists themselves. There was also little time to talk about how the tools themselves might be used in scientific research. Despite this, most students seemed engaged, and the results seem to indicate that they are now more interested in nature and the practices of science than they were prior to the BioBlitz.

Students reported enjoying both BioBlitz as a whole and their visit to Hawai'i Volcanoes National Park. Visiting the Festival, which allowed them to “win prizes and hang out with friends,” was very enjoyable for students. Student also talked about how much they enjoyed, at the Festival, doing “Hawaiian activities” including tattooing, kapa stamping, and making foods like poi. Several students also mentioned how much they enjoyed learning the Hawaiian chant, or oli, “because it sounds nice.”

Overall, the vast majority of students enjoyed the BioBlitz and would visit this National Park again. It was clear from comments, from survey responses, and from observations that the BioBlitz was engaging for students. Results can be seen in Figure 4.

FIGURE 4. STUDENT ENJOYMENT OF BIOBLITZ AND THE VISIT TO THE PARK (N=492)



What are the benefits to students?

Students were asked a variety of questions about their opinion of the BioBlitz, including how much they enjoyed it and what aspects they most enjoyed. In addition, they were asked to rate their attitudes towards four major ideas: Fascination with Nature, Comfort with Nature,

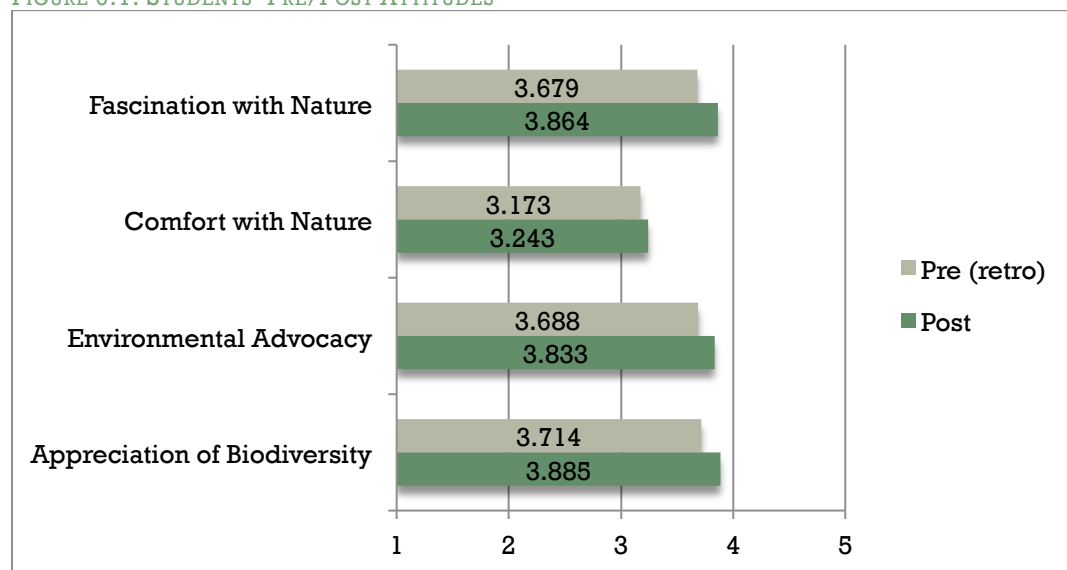
Environmental Advocacy, and Appreciation of Biodiversity. Students were asked first to rate how they felt at the end of the BioBlitz and then were asked to rate how they felt before the BioBlitz. In all cases, students reported significant gains in all four constructs. Given the limited time that students spent engaged in activities of the BioBlitz, the fact that we can detect a change in attitudes suggests that this program has immediate impact on students. It would be interesting to follow a group of students for a longer period to determine if the impact is long-lasting or fades after a few weeks. Figure 5 and Figure 6 present the overall results from the current study.

FIGURE 5. STUDENTS' PRE/POST ATTITUDE (WITH TECHNICAL DETAIL)

Construct	n	Pre (retro)	Post	t-test	p-value	Effect size (Cohen's d)
Fascination with Nature	431	3.679	3.864	7.121	<0.0001	.20
Comfort with Nature	474	3.173	3.243	2.624	0.009	.02
Environmental Advocacy	412	3.688	3.833	5.959	<0.0001	.20
Appreciation of Biodiversity	447	3.714	3.885	7.627	<0.0001	.30

The effect size calculations are able to detect changes for three out of the four constructs. The greatest effect, was found with students' appreciation of biodiversity. The biggest change was related to biodiversity, which was one of the main goals of the BioBlitz. No differences were found between boys and girls.

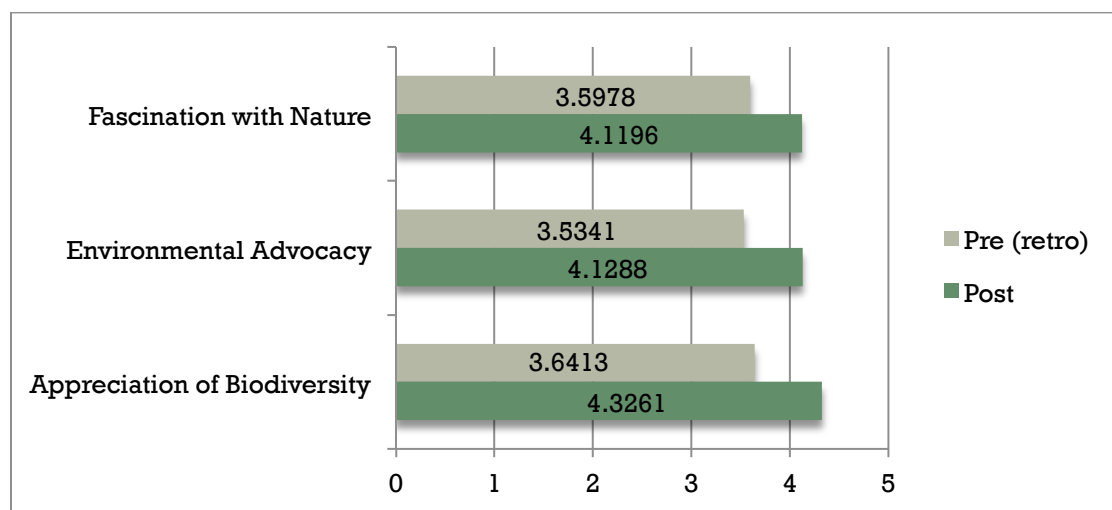
FIGURE 6.1. STUDENTS' PRE/POST ATTITUDES



Note: Mean score on a scale of 1 to 5, with 5 equaling *most fascinated, strongest advocate, most comfortable, and greatest appreciation*.

Generally, both the teachers and students reported that after the BioBlitz experience, the students are more fascinated and comfortable with nature, are stronger advocates for the environment, and have greater appreciation of biodiversity. Interestingly, teachers reported lower pre scores and higher post scores for their students on average, resulting in a greater difference of students' attitudes on each of the scales after the BioBlitz experience. In other words, teachers felt that participating in the BioBlitz had a greater impact on students than that reported by students. This is not uncommon, and they both may be "right." Teachers may see impacts students are not aware of, but teachers may also focus on a small number of students, rather than reporting on the "average" impact for their class.

FIGURE 6.2. TEACHERS' ASSESSMENTS OF STUDENTS' PRE/POST ATTITUDES



Note: Mean score on a scale of 1 to 5, with 5 equaling *most fascinated, strongest advocate, and greatest*. Teachers were presented with a different set of questions than the students (with fewer items per scale), and so the scores for teachers and students cannot be compared directly.

Teachers tended to believe that the impact on the students was greater than what the students reported. With the exception of Comfort in Nature, however, teachers and students placed the different constructs in the same rank order. In other words, both teachers and students generated a higher score related to Appreciation for Biodiversity than they did for Fascination with Nature, which was, in turn, higher than the score of Environmental Advocacy. Interestingly, teachers gave the highest score for their students to "Comfort in Nature," to which the students themselves, as a whole gave the lowest score. This is likely due to the way the questions were asked, which will be discussed in more detail in the Appendix.

Kids love insects and hands-on activities

The students appeared to enjoy many aspects of participating in the BioBlitz: in particular they enjoyed the insect collection activity. The activity is engaging and hands-on (and it was the only station of the three that was presented regularly with hands-on delivery), and many students responded positively to it, identifying it as their favorite activity. "My favorite part

of the BioBlitz was looking for the insects. This was my favorite part because there were many different types of insects and we had to try and catch them with little aspirators.” Some of the students who did not themselves use the aspirators still enjoyed the activities, “watching people sucking up the bugs” or seeing “many insects.” Students described this activity as “interesting and fun” and suggested that the variety of insects, and the “cool abilities” some insects have, were a major part of the appeal. While a few students said it was their least favorite activity, there were two different reasons. Some students who did not like this activity said it was because, for example, “I am terrified of bugs” or “I hate touching bugs”, but several also said, “because we only saw a few insects” or “we did not have time to study the insects.” The activities were sometimes rushed, and students did not have the opportunity to follow the entire activity to its conclusion.

Several students also identified bird-watching as their favorite activity. One said, “It was my favorite part because I enjoy bird-watching,” while another said, “because [the birds we saw] aren’t what you see everyday.” One student enjoyed the process of identifying the birds “because we could hear what bird it was and how far away it was.” Again, the process of being engaged in observing and sense-making – through identifying species – seemed to appeal to students. For the students who did not enjoy the bird-watching activity, it was usually because “we did not see any birds.”

All individual items on the “Fascination” scale showed increases in the means. Some students identified a greater interest in nature since BioBlitz. As one said, “It started me learning, and now I want to learn more.” Another said, “Participating in BioBlitz changed my interest in learning about living creatures in the park ... by touching them. It was interesting and I want to know more about them.” Again, the hands-on, direct experience appears to be the experience that resonates with students.

The experience made nature seem natural

Although the survey did not indicate change in students’ comfort in nature at an aggregate level, the experience impacted some students. Several indicated that they now felt that they appreciated nature more, finding it “calm and relaxing.” Others enjoyed using their senses and their powers of observation. As one student said, s/he enjoyed “get to actually explore and being with the plants. Seeing the sunshine was really good and relaxing. I loved observing the animals in nature.” Youth, who often spend many hours inside, in a controlled environment, often see, as one respondent said, “nature as scary and dirty.” But experience of being outdoors can change that: “...but now it feels good because I experienced that it’s okay to be dirty, touching plants and looking at animals.” The insect inventory activity seemed have a the specific impact of helping students be more comfortable around insects: “It changed my feelings about being outside in nature by me looking at different bugs and that made me feel not scared of bugs anymore.” Of the individual items, students were much more comfortable sitting on the ground, encountering wild animals, getting bitten by insects, getting hot/tired/thirsty, and being in a remote location. They were less comfortable, as a group,

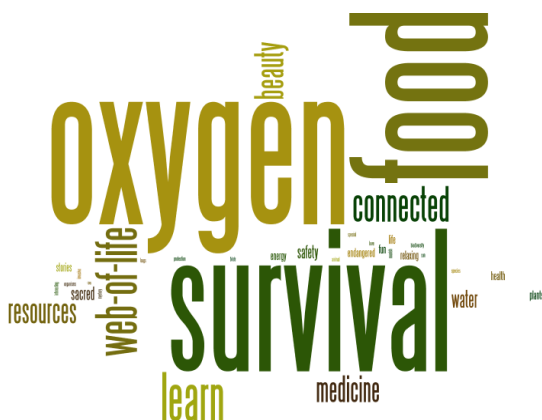
“Before I used to sit in the house and play video games, but now I go outside and try to identify birds with my little sister.”

walking on a non-paved trail and getting itchy. (All other items showed no change; see Figure 24 in the technical appendix for details.)

Greater understanding of and desire to protect biodiversity

Students emerged with a great understanding of the importance of biodiversity, as well as with a greater desire to protect the environment. Many expressed the desire to participate in another BioBlitz. Others found ways that they can help protect the environment: “I now pick up litter, take care of trees, and leave birds alone.” Another student said, “I will take care of the natural species and plants by replanting.” Students learned a great deal about the importance of biodiversity. As one student said, “Now that I understand the importance of biodiversity, I want to learn more about the creatures in the park. Another said that s/he would “explain the importance of biodiversity to others.” In a similar vein, a few students said that they would talk to others about “the importance of protecting the environment and taking care of natural areas.” One student sees a career path: “I will try to become a scientist or tell others about the park. This is so I can help more plants and animals.”

FIGURE 7. WORDS USED BY STUDENTS TO DESCRIBE THE IMPORTANCE OF NATURE FOR HUMANS



Students also identified why nature is important to humans. The most common reasons were related to survival, such that plants produce oxygen and food. Many students also identified cultural or psychological reasons nature is important: its beauty and calming aspects, its ability to connect humans to each other, and the sacredness of nature. Few students were unable or unwilling to explain the importance of nature to humans. A word cloud in Figure 7 demonstrates the relative frequency that words were used by students in their

responses to the question, “Please give us an example of why you think nature is important to people”. Students frequently defined “nature” as plants and animals, and indicated that plants and animals are necessary for human survival: for example, plants generate oxygen, and both plants and animals provide food. Students also identified nature as a source of beauty and relaxation for humans, that our connectedness to nature is a vital part of many cultures, especially the Hawaiian culture.

Students’ attachment to the Park influenced their BioBlitz experience but not changes in dispositions

Many of the students had visited the Park prior to BioBlitz (69 percent students indicated that they have visited the park before, and among these students, 44 percent of them have visited more than three times prior to the BioBlitz), and this seemed to create for them a sense of place. In other words, students who had visited the Park three or four times in the past seemed to have a stronger connection or sense of place regarding Hawai’i Volcanoes

National Park than did students who had only visited once or had not visited the Park at all (see Figure 20 in Technical Appendix).

When controlling for ethnicity and students' past visits to park, their sense of place could predict students' perceived effectiveness of the event. In other words, how students feel about Hawai'i Volcanoes National Park in general would significantly influence how students like their experience at the BioBlitz. However, there is no such correlation between students' perceived effectiveness of the event and students' demographics or their previous visits to park (see Figure 20 in Technical Appendix).

None of the variables, including sense of place, predicted the change in students' reflective statements. In addition, no significant correlation between students' fascination after BIOBlitz and students' previous comfort level with nature and their awareness of biodiversity before the BIOBlitz is identified (see

Figure 22 in Technical Appendix). Finally, there was no significant relationship between students' environmental awareness after the BIOBlitz and students' previous comfort level with nature and their awareness of biodiversity before the BIOBlitz as well (see Figure 23 in Technical Appendix). This means that BioBlitz seemed to have an equal impact on many different types of students – certain students were not “primed” for results. BioBlitz participation benefits many students, no many their starting points in terms of experience or attitude.

How can BioBlitz events be improved?

Although teachers generally found BioBlitz effective and successful with their students, they did offer suggestions for improving the event.

FIGURE 8. TEACHER RATING OF LOGISTICAL ELEMENTS (RANKED FROM HIGHEST TO LOWEST SCORE)

	Poor	Satisfactory	Excellent
Assistance provided by NPS staff	0%	4%	96%
Assistance provided by volunteers	0%	4%	96%
NPS/NGS sponsorships to help defray the cost of participation	0%	5%	95%
Expertise of scientists, naturalists, and technical staff	0%	9%	91%
Provisions for: Overall visitor safety	0%	13%	87%
Transportation to event sites	0%	16%	84%
Information on wildlife handling	0%	17%	83%
Promotional material	0%	19%	81%
Provisions for: Minor first aid	0%	27%	73%
Clarity of required waivers (e.g., for photos, survey permissions, etc.)	0%	29%	71%
Information concerning safety risks	0%	32%	68%
Availability of bathrooms	0%	41%	59%
Provisions for: Sunburn	0%	42%	58%
Provisions for: Dehydration	0%	43%	57%
Information for planning and scheduling	0%	43%	57%

Availability of drinking water	0%	47%	53%
Scheduling of events	4%	43%	52%

When asked about whether they experienced certain supports and how well those supports met their needs, teachers were very positive about the National Park staff, volunteers, and scientists/naturalists.

While overall provision for public safety was rated “excellent” by 87% of teachers, fewer offered that rating for the provisions for sunburn, dehydration, and bathroom needs. In addition, while transportation was highly ranked, the scheduling of events received the lowest overall score, and information on planning and scheduling was also very lowly rated. Overall, the teachers felt that there was not enough time for exploring the Festival activities and doing the inventories. For example, one teacher indicated that “I wish we had more time to do the activities. We could only do the bird and fishhook. Also we should have walked around first to see what activities were being presented.” Some teachers also suggested that “next time we should give more time in the field rather than paying attention to the certificates and stamps.” This suggests that these are the areas for greatest improvement for next year.

THE GENERAL PUBLIC

Out of the approximately 250 individuals³ who registered for BioBlitz, surveys were returned from 91 people, for a 36 percent response rate. As noted above, while most participants came from the state of Hawai’i, four countries (including the United States, Canada, Great Britain, and South Korea) and 12 states were represented. Public participants were overwhelmingly female (77%), and they were likely to have had earned at least a college degree (83% with 4-year college degree or higher – see Figure 28 in the Technical Appendix for details).

Most visitors (65%) participated in multiple inventories. While 35 percent participated in just one inventory, 37 percent participated in two inventories, 23 percent participated in three, and 4 percent participated in four or more. Saturday inventories were the most popular, with 42 percent of visitors participating in early Saturday inventories and 72 percent participating in late Saturday morning inventories. Indeed, several visitors commented that Friday inventories, even ones offered Friday evenings, were awkward, as they interfered with work schedules. In fact, most were employed (68%), while less than one-fifth (17%) considered themselves “retired.” Ten percent were students, either part-time or full-time (see Figure 29 in the Technical Appendix for details).

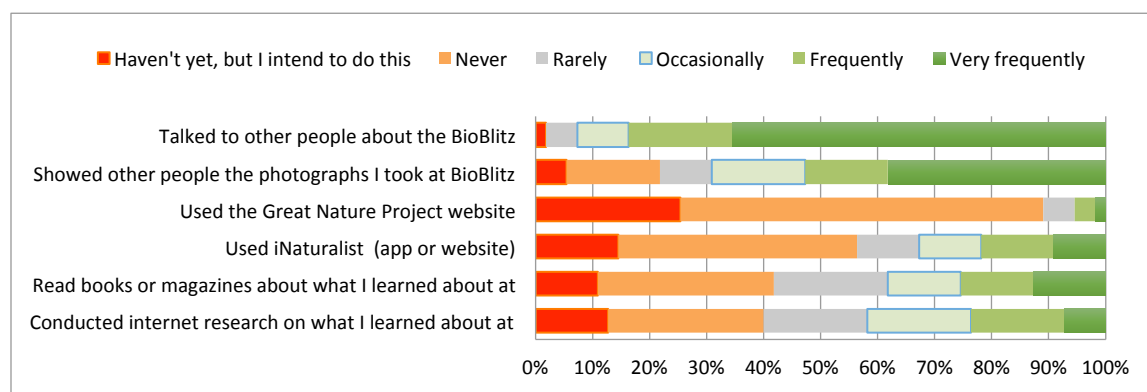
What are the benefits to the general public?

³ Because an individual could register for multiple people and multiple events, it is impossible to determine exactly how many individuals were registered for BioBlitz. For a complete description of the data collection methods, see the Technical Appendix.

The public who participated differed from students in a variety of ways, including age and ethnicity/race. They were more likely to be White and more likely to be already comfortable with being in nature. In addition, the public participants generally indicated a sense of adventurousness, scoring above 3.5 in all but 8 (out of 55) cases on the Curiosity and Exploration scale.

After BioBlitz, members of the public talked to others about their experience in BioBlitz, and they were likely to share photographs they had taken during the event. Almost half conducted internet research or read books or magazines about content they had learned at BioBlitz. Fewer used the iNaturalist app or website, and very few visited or used the Great Nature Project website, although 25 percent intended to do so.

FIGURE 9. POST-BIOBLITZ ACTIVITIES



In terms of the appreciation for biodiversity, the majority of visitors felt they that had greater appreciation of biodiversity at the end of BioBlitz, as can be seen from Figure 10. Not surprisingly, the biggest gains were those that were specific to the Park.

FIGURE 10. IMPACT OF BIOBLITZ ON APPRECIATION FOR BIODIVERSITY

Appreciation of Biodiversity-Average Impact Ranking	% A little or a lot more improved after BioBlitz
I have a good understanding of the different types of plants and animals at Hawai'i Volcanoes National Park	77%
I know a lot about Hawai'i Volcanoes National Park's ecosystems	77%
It is important to protect a wide variety of plants and animals	73%
Plants and animals play an important role in Hawaiian life	67%
Microorganisms are important in keeping our planet healthy	62%
I feel that nature is sacred	58%
My life is better because there are a lot of different kinds of plants and animals	56%
I believe that I am a part of the web of life	56%
Invertebrates are interesting and fun to watch	44%
We should get rid of bacteria and other microorganisms	29%

It does not matter how many different types of plants and animals there are

23%

When asked to describe what s/he learned, one respondent said, “I learned about the importance of the plants and creatures: biodiversity that thrives in recent lava flows and native rain forests, from the coastline to the summit of Kilauea volcano. Also, I learned about the endangered species, about diversity in plants and soil.”

The public also reported increased *fascination* with nature (see Figure 11). One participant said that s/he will now, “get out into nature more.” Others said that the details of what they learned were inspiring, especially learning more about the birds and other species in the Park. One participant was inspired to rethink graduate schools, saying:

“Each of the inventories I participated in helped me expand my knowledge of the different environmental topics and showed me the real life applications of the things I studied throughout my undergraduate education. It also gave me insight into the ecology and environmental sciences – enough so that it’s changing the graduate degree options I’m looking into.”

FIGURE 11. IMPACT OF BIOBLITZ ON FASCINATION WITH NATURE

Fascination with Nature--Average Impact Ranking	% improved after BioBlitz
I know a lot about invasive species.	78%
In general, I love learning about nature	76%
After a really interesting natural science activity is over, I look for more information about it	73%
In general, I find learning about nature interesting	69%
I want to contribute to what we know about nature at Hawai'i Volcanoes National Park	67%
I wonder about how nature works	60%
I can use all my senses to understand the world around me	55%
I want to read everything I can find about nature	51%
I need to know how nature works	50%
I want to know how to do everything that the scientists at BioBlitz do	47%
I am good at asking questions about nature	44%
I would consider a career studying nature	40%

Finally, however, given, as a group, their already high levels of comfort with nature, we saw few changes in their attitudes towards being in nature. Many said that they were already comfortable in nature. For example, one respondent said, “A lot of these experiences are typical of my recreation, so there wasn’t a huge change in my attitude about being outdoors. I ALREADY LOVE IT!” Despite this, several people said that specific experiences were unique and uniquely inspiring, including seeing volcano at night.

FIGURE 12. IMPACT OF BIOBLITZ ON ATTITUDES TOWARDS BEING IN NATURE

Comfortable with Nature--Average Impact Ranking	% improved after BioBlitz
Touching plants when walking	28%
Encountering spiders and insects	26%
Spending a full day in nature/outdoors	24%
Getting hot/tired/thirsty/sweaty from hiking outside	24%
Being in a remote location far from the nearest city	24%
Encountering wild animals	19%
Sitting on the ground	19%
Walking on a non-paved trail	19%
Getting dirty	17%
Going to the bathroom in a porta potty	13%
Getting itchy	11%
Getting bitten by insects	7%

Interacting with scientists was highly appealing

Members of the public enjoyed the opportunity to interact and learn from scientists. When asked what they liked best about BioBlitz, the modal response talked about how much they enjoyed asking questions and learning from the scientist leaders. As one person said, “I thought the guides did a fantastic job with each of the sessions I attended. I loved being able to ask knowledgeable people about plant species, cultural aspects, and general information about the park.”

Cultural events were inspiring and unique

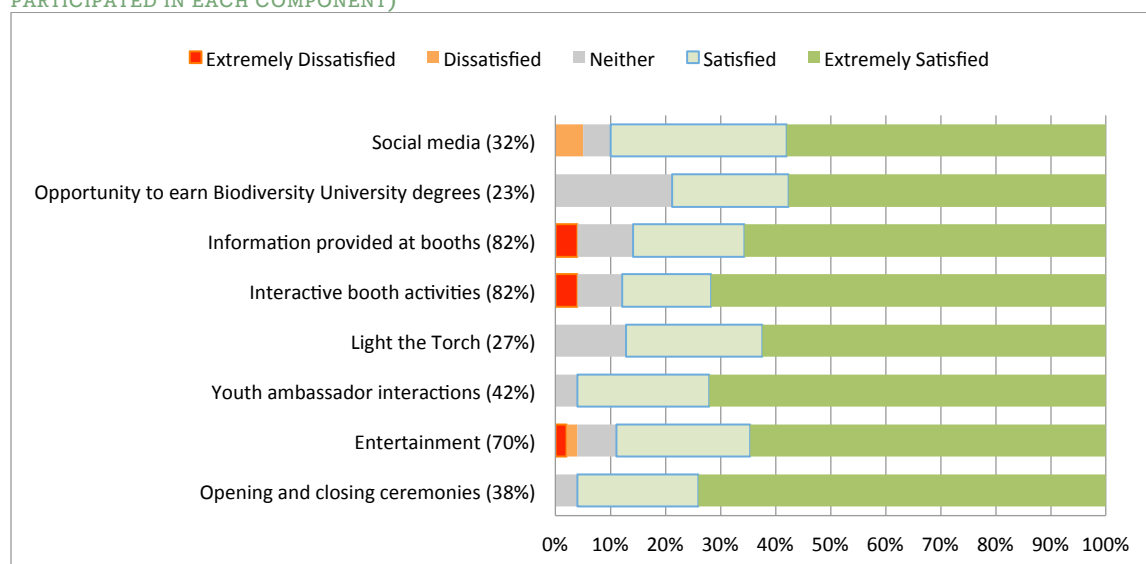
The integration of the cultural events, particularly in the Festival, was appreciated by many participants. Several mentioned the quality of the music, arts, crafts, and dancing. One respondent said, “You did extremely well integrating learning about Biodiversity with learning about Hawai’ian culture. As someone who knew only a little about the ecology and culture of Hawai’i before coming to BioBlitz, I was really impressed by the way you blended the two into an educational program.” Other respondents appreciated learning some of the history of the Park and its surroundings, including the local ranches and Kilauea Military Camp.

“I think combining cultural festival and the BioBlitz was brilliant: it tied together culture and science in ways that strengthened interest in both.”

How can BioBlitz events be improved?

On the whole, the BioBlitz was appreciated by attendees and they appreciated the efforts of the National Park and National Geographic staff to create a welcoming atmosphere. While the extent to which visitors participated in the different components varied, the individual components were well-received (see Figure 13, which is based upon only those that participated in each component).

FIGURE 13. SATISFACTION WITH BIOBLITZ COMPONENTS (NUMBER IN PARENTHESIS INDICATES % OF VISITORS WHO PARTICIPATED IN EACH COMPONENT)



While the overall level of satisfaction was very high, visitors, even those who were satisfied, offered a few suggestions for change, mostly focusing on providing better information both in advance and during the inventories as well as improved logistics around transportation. Since the inventory events were scattered throughout the park, excellent transportation and directions – and sufficient time to move between different locations – are critical to the success of the event.

One recurring comment was that the **schedule** seemed too packed, and that, for the public, attending the event on Friday was frequently not feasible, as it often conflicted with work schedules. Several people felt that the inventories should not overlap with the Festival, as they did not have time to do both. As one person said, “I really disliked how rushed I felt Saturday's events were. I was sad that because I was part of the inventories all weekend I didn't get to spend enough time at the cultural festival. The events should've been longer (until evening) on Saturday, after the inventories finished, to give us the equal chance to meander through the performances and participating partners. OR I would encourage an ‘after party’ for all the inventory participants and experts, a social with dinner, drinks, and entertainment.” Other people commented that the timing between sessions was, “too tight,” and that, because of this, they “missed the beginning of sessions while in transit from one to the other.”

Combined with the tight schedule, some visitors felt that they **lacked the information** to find their inventory groups. One visitor said, “I guess my family and I didn't realize we had to take a shuttle once we got into the park to get to our BioBlitz destination. We barely made it to our first tour.” Several responded complained about the confusing parking instructions or lack of information about how to find their group. Others felt that the descriptions of the inventories were “too limited,” and that the “location of inventories were unclear.” One summed it up, saying, “I signed up for the hike, but I didn't know exactly what it entailed

and if I was going to be helping with any sort of inventory. More detailed tour/event information would have been appreciated.”

“I wish that more people could have experienced what I did. It should have been better advertised.”

Along with lack of good information once someone arrived at the Park, many people felt that the **advertising or communicating** about the event could be improved. As one person said, “I wish that more people could have experienced what I did. The BioBlitz should have been advertised better.” One attendee never saw anything about it in the local paper or notice board but only learned about the event because s/he visited the Park just the week before.

Finally, a few people questioned whether the BioBlitz could meet **scientific goals**. One said, “I think the BioBlitz could have been more thorough. All the hikes I went on were “on trail” hikes so we were not likely to find the more rare or specialist species of the park.” Another noted that the inventory did not seem to have a scientific purpose but was more of a “nature walk.” Although it was interesting, s/he said s/he had signed up to “help scientists gather data,” not to learn about birds.

APPENDIX A

Recommendations for future evaluations of BioBlitz Events

One goal for this was to identify potential methods for measuring outcomes with future BioBlitz events. A major component of this work includes adapting and adopting item banks that might be used to create scales that can be used on future surveys. During the 2015 BioBlitz, we piloted five scales: Fascination with Nature, Comfort with Nature, Appreciation of Biodiversity, Environmental Advocacy, and the Curiosity and Exploration Index. This section presents the details about each of the scales and our recommendations for future use of the scales in evaluation of BioBlitz.

Fascination with Nature

This scale was based upon work conducted by the Science Learning Activation Lab (ActLab), a consortium consisting of UC Berkeley, University of Pittsburgh, and SRI, International. (See www.activationlab.org for details on the scales.)

For students, the items functioned well as a scale, with a Cronbach's alpha⁴ of .904. If this scale is retained, we recommend retaining all items. Figure 14 presents the results of the scale reliability analysis.

FIGURE 14. FASCINATION WITH NATURE SCALE RELIABILITY RESULTS

Item	Cronbach's Alpha if Item Deleted
I am good at asking questions about nature	0.902
I can use all my senses (sight, hearing, touch, taste, smell) to understand the world around me	0.903
I wonder about how nature works	0.898
In general, I love learning about nature	0.892
After a really interesting natural science activity is over, I look for more information about it	0.892
I need to know how nature works	0.897
I want to read everything I can find about nature	0.892
In general, I find learning about nature interesting	0.891
I want to know how to do everything that the scientists at BioBlitz do	0.892
I want to contribute to what we know about nature at Hawai'i Volcanoes National Park	0.893
I am interested in a career studying nature	0.896

⁴ Cronbach's alpha is a measure of internal consistency, that is, how closely related a set of items are as a group. It is considered to be a measure of scale reliability.

Comfort with Nature

This scale was based upon previous work conducted by the National Park Service and Dr. Gerard Kyle at Texas A&M University.

For students, the items functioned well as a scale, with a Cronbach's alpha of .858. We recommend retaining all items for this scale. This scale also was divergent from the other three scales administered as part of this evaluation (see Figure 19 for more information about the divergence and convergence of the scales). Figure 15 presents the results of the scale reliability analysis.

FIGURE 15. COMFORT WITH NATURE SCALE RELIABILITY RESULTS

Item	STUDENTS Cronbach's Alpha if Item Deleted
Getting itchy	0.854
Sitting on the ground	0.848
Getting dirty	0.841
Getting bitten by insects	0.845
Touching plants when walking	0.849
Walking on a non-paved trail	0.845
Spending a full day in nature/outdoors	0.848
Getting hot/tired/thirsty/sweaty from hiking outside	0.844
Being in a remote location far from the nearest city	0.845
Encountering wild animals	0.848
Going to the bathroom in a porta potty	0.854
Encountering spiders and insects	0.846

Environmental Advocacy

This scale was based upon a variety of different scales, but most particularly on the work conducted by the Ocean Literacy Project.

The items generally functioned well as a scale, with a Cronbach's alpha of .877. This scale includes two reverse items – items that are presented with a negative valance. Often, the goal of including items such as these is to provide information that respondents are actually reading the items and reacting to the content, not just skimming and marking everything with the same general high or general low region of the scale. The challenge is that items such as these often do not work well with younger students, who have difficulty interpreting how to respond to such items. We found something very much like this with the Environmental Advocacy scale. This scale yielded a Cronbach's alpha of .882 (for students). We recommend rewriting the two reverse items so that they have a positive valance. Figure 16 presents the results of the scale reliability analysis.

FIGURE 16. ENVIRONMENTAL ADVOCACY SCALE RELIABILITY RESULTS

Item	Cronbach's Alpha if Item Deleted
a. I want to be involved in protecting and taking care of natural areas	0.856
b. I want to give some of my own money to help protect wild plants and animals	0.863
c. I think we are doing an adequate job taking care of plants and animals	0.865
d. I think nature is easily harmed by people	0.881
e. I am not interested in taking care of natural areas in my neighborhood	0.911
f. I want to participate in other activities to protect plants and animals at Hawai'i Volcanoes National Park	0.855
g. I would spend my free time on a project to protect wild plants and animals in my community	0.856
h. I like to learn about different ways scientists in a national park can make a difference	0.857
i. I think I can protect plants and animals in my own back yard	0.860
j. I am interested in a career with the National Park Service to protect plants and animals	0.858
k. I want to find ways contribute to protecting the environment	0.853

Appreciation of Biodiversity

The biodiversity scale was adapted from the European's Commission study of Attitudes Towards Biodiversity (see http://ec.europa.eu/public_opinion/flash/fl_379_en.pdf for details). This scale includes two reverse items – items that are presented with a negative valance. Often, the goal of including items such as these is to provide information that respondents are actually reading the items and reacting to the content, not just skimming and marking everything with the same general high or general low region of the scale. The challenge is that items such as these often do not work well with younger students, who have difficulty interpreting how to respond to such items. We found something very much like this with the Appreciation of Biodiversity scale. This scale yielded a Cronbach's alpha of .688. We recommend rewriting the two reverse items so that they have a positive valance.

FIGURE 17. APPRECIATION OF BIODIVERSITY SCALE RELIABILITY RESULTS

Item	Cronbach's Alpha if Item Deleted
My life is better because there are a lot of different kinds of plants and animals.	0.648
It is important to protect a wide variety of plants and animals.	0.634
Microorganisms are important in keeping our planet healthy	0.631
I have a good understanding of the different types of plants and animals at Hawai'i Volcanoes National Park	0.644
Invertebrates are interesting and fun to watch	0.663
We should get rid of bacteria and other microorganisms	0.741

I know a lot about Hawai'i Volcanoes National Park's ecosystems and the things that live there	0.676
It does not matter how many different types of plants and animals there are.	0.733
I believe that I am a part of the web of life	0.633
Plants and animals play an important role in Hawaiian life	0.631
I feel that nature is sacred	0.674

Curiosity and Exploration Index (CEI)

This scale was adopted, with permission, from Todd Kashdan at George Mason University. On BioBlitz surveys, this scale was only used with the general public. This scale yielded a Cronbach's alpha of .896 for the general public. Most respondents agreed or agreed strongly with most of the statements.

FIGURE 18. ITEM ANALYSIS FOR CURIOSITY AND EXPLORATION INDEX

Item	Cronbach's Alpha if Item Deleted
I actively seek as much information as I can in new situations.	0.895
I am the type of person who really enjoys the uncertainty of everyday life.	0.900
I am at my best when doing something that is complex or challenging.	0.885
Everywhere I go, I am out looking for new things or experiences.	0.890
I view challenging situations as an opportunity to grow and learn.	0.882
I like to do things that are a little frightening.	0.891
I am always looking for experiences that challenge how I think about myself and the world.	0.878
I prefer jobs that are excitingly unpredictable.	0.877
I frequently seek out opportunities to challenge myself and grow as a person.	0.873
I am the kind of person who embraces unfamiliar people, events, and places.	0.887

Correlations between the scales

Finally, we explored the correlations between the different scales on the student surveys, to see if any of the scales were redundant and could be eliminated from future surveys. Although the correlations were significant, they varied in their strength. The scale "Comfort with Nature" had only weak correlations with any of the other three scales. The two scales with the strongest correlation were "Fascination with Nature" and "Environmental Advocacy." These two scales measure very different constructs, however, so it is difficult to recommend eliminating any particular one. The correlations are presented in Figure 19.

FIGURE 19. CORRELATIONS BETWEEN REFLECTION CONSTRUCTS

	Biodiversity	Fascination	Advocacy
Comfort	.268**	.283**	.280**
Biodiversity		.537**	.562**
Fascination			.790**

** Correlation is significant at the 0.01 level (2-tailed).

Post/Retro-Pre Approach

We recommend continuing to incorporate a retrospective post-then-pre design, where participants are asked to assess their self-ratings before and after participation in the same survey. Retrospective post-then-pre designs are useful to reduce problems that arise when program participants under or over-report their knowledge or abilities on pre-tests due to a lack of understanding. Retrospective post-then-pre tests are designed to reduce this “response shift bias” (University of Wisconsin-Extension, 2005)⁵.

⁵ University of Wisconsin (2005). Quick tips: Designing a retrospective post-then-pre Question. Retrieved from: <http://www.uwex.edu/ces/pdande/resources/index.html>

APPENDIX B

Technical Appendix

FIGURE 20. RELATIONSHIP BETWEEN CHARACTERISTICS OF STUDENTS AND PERCEIVED EFFECTIVENESS OF BIOBLITZ

After using ethnicity (v23r, v24a-v24d), students' past visits to park (v9ar) and their sense of place (v11_average) as three predictors to predict students' perceived effectiveness of the event (average of v7a-v1), a significant correlation between students' perceived effectiveness of the event and their sense of place is found. In other words, how students feel about Hawai'i Volcanoes National Park in general would significantly influence how students like their experience at the BioBlitz. However, there is no such correlation between students' perceived effectiveness of the event and students' demographics or their previous visits to park.

Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
1 (Constant)	2.029	.142		14.288	.000		
v23r	.005	.058	.004	.079	.937	.980	1.020
v24a	.071	.057	.063	1.248	.213	.924	1.083
v24b	-.012	.047	-.013	-.254	.800	.937	1.067
v24c	-.036	.088	-.020	-.407	.684	.961	1.041
v24d	.034	.044	.039	.767	.444	.924	1.082
v9ar	-.030	.045	-.033	-.674	.501	.984	1.016
v11_average	.211	.032	.325	6.587	.000	.972	1.029

a. Dependent Variable: v7_average

FIGURE 21. RELATIONSHIP BETWEEN CHARACTERISTICS OF STUDENTS AND RATINGS/CHANGES IN REFLECTIVE STATEMENTS

Students' change in reflective statements can't be significantly predicted by their ethnicity, previous visits to park or their sense of place, although there is an approaching significant correlation between students' sense of place and their reflective statements.

Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
1 (Constant)	-.104	.145		-.722	.471		
v23r	-.042	.060	-.037	-.694	.488	.984	1.016
v24a	-.070	.058	-.066	-1.214	.226	.922	1.085
v24b	.034	.048	.039	.720	.472	.934	1.071
v24c	.083	.087	.051	.964	.336	.958	1.044
v24d	.054	.044	.067	1.236	.217	.930	1.075
v9ar	-.048	.045	-.055	-1.054	.293	.990	1.011
v11_average	.064	.033	.104	1.954	.051	.973	1.028

a. Dependent Variable: reflective_change_average

FIGURE 22. RELATIONSHIP BETWEEN COMFORT IN NATURE AND APPRECIATION OF BIODIVERSITY WITH FASCINATION WITH NATURE AND STEWARDSHIP

Using the average for Q12 pre data, Q14 pre data, and Q16 pre data to predict Q16 post data, no significant correlation between students' fascination after BioBlitz and students' previous comfort level with nature and their awareness of biodiversity before the BioBlitz is identified.

Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
1 (Constant)	1.038	.174		5.975	.000		
v16_2_average	.752	.037	.760	20.421	.000	.734	1.363
v12_2_average	.014	.032	.015	.455	.649	.892	1.121
v14_2_average	.003	.051	.002	.058	.954	.719	1.391

a. Dependent Variable: v16_1_average

FIGURE 23. RELATIONSHIP BETWEEN STUDENTS' COMFORT WITH NATURE AND AWARENESS OF BIODIVERSITY

There's no significant cause and effect relationship between students' Environmental Advocacy after the BioBlitz and students' previous Comfort with Nature, Appreciation of Biodiversity, or Environmental Advocacy before the BioBlitz as well.

Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
1 (Constant)	.962	.160		6.032	.000		
v18_2_aver age	.732	.035	.768	20.989	.000	.741	1.350
v12_2_aver age	.034	.029	.039	1.177	.240	.888	1.126
v14_2_aver age	.018	.046	.015	.395	.693	.725	1.379

a. Dependent Variable: v18_1_average

FIGURE 24. COMFORT IN NATURE, INDIVIDUAL ITEMS

Some items demonstrated significant change, as presented in table below.

Item	Before	After	Change	t	Sig
12j2. Encountering wild animals	3.49	3.836	0.346	6.046	0.000
12d.2 Getting bitten by insects	2.21	2.476	0.266	4.531	0.000
12b2. Sitting on the ground	3.127	3.366	0.239	5.248	0.000
12i2. Being in a remote location far from the nearest city	3.687	3.796	0.109	2.714	0.007
12h2. Getting hot/tired/thirsty/sweaty from hiking outside	2.827	2.935	0.108	2.278	0.023
12e2. Touching plants when walking	3.813	3.866	0.053	1.033	0.302
12k2. Going to the bathroom in a porta potty	2.36	2.407	0.047	0.957	0.339
12c2. Getting dirty	3.206	3.242	0.036	0.764	0.445
12g2. Spending a full day in nature/outdoors	3.913	3.928	0.015	0.323	0.747
12l2. Encountering spiders and insects	3.221	3.142	-0.079	-1.354	0.176
12a2. Getting itchy	2.59	2.456	-0.134	-2.292	0.022
12f2. Walking on a non-paved trail	3.783	3.597	-0.186	-3.22	0.001

FIGURE 25. GENDER OF PUBLIC PARTICIPANTS

Participants in the public programs were overwhelmingly female.

What is your gender?

Female	77%
Male	23%

FIGURE 26. EDUCATION OF PUBLIC PARTICIPANTS

Participants in the public programs tended to have at least a four-year college degree.

What is your highest level of formal education you have completed?

Less than high school	2%
Some high school	2%
High school graduate	2%
Vocational/trade school certificate	2%
Some college	0%
Two-year degree	9%
Four-year college degree	49%
Master's degree	28%
Ph. D. M.D. J.D. or equivalent	6%

FIGURE 27. EMPLOYMENT OF PUBLIC PARTICIPANTS

Participants in the public program were likely to be employed. Only 17% were retired, and 10% were students.

What is your employment status?

Full-time employed	53%
Part-time employed	15%
Not working by choice	2%
Retired	17%
Full-time homemaker	4%
Full-time student	8%
Part-time student	2%