

Evaluation of 2016 National Park BioBlitzes

A report submitted to The National Geographic Society by The Lawrence Hall of Science, University of California Berkeley.



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Evaluation of BioBlitz 2016

Executive Summary



BIOBLITZ: OVERVIEW

In 2016, more than 120 National Park Service (NPS) units conducted BioBlitzes, supported by a collaboration between National Geographic Society and the National Park Service. The majority occurred the weekend of May 20-21 to coincide with the cornerstone BioBlitz in Washington DC, and the rest took place between March and October. The cornerstone BioBlitz took place in 13 NPS units located throughout the National Capital region. In addition, there were seven large (regional) Showcase BioBlitzes in New Mexico, Alaska, Washington, California, South Carolina, Ohio, and Delaware. Many of the parks also hosted Biodiversity Festivals which typically consisted of booths with activities, outreach opportunities for local conservation organizations, speakers, cultural demonstrations, art, food, and entertainment.

National Geographic and The Lawrence Hall of Science, University of California Berkeley, conducted a 360-degree evaluation of the outcomes for the four groups of participants: students, teachers, public, and inventory leaders and pro-observers. Surveys were obtained from 733 students, 35 teachers, 174 public participants and 160 inventory leaders/Pro-Observers. Observations were conducted at 22 BioBlitzes in 15 states and DC.

For students and public participants, the evaluation looked at:

- Engagement (affective, behavioral and cognitive)
- Learning about science
- Curiosity and intentions
- Change attitudes: appreciation of biodiversity, interest in environmental advocacy, and comfort in nature

The evaluation found positive changes in attitudes for students and the public indicating that even short-duration activities like BioBlitz, can have a positive impact on participants, and that there are measures sensitive enough to pick up on changes.

The report also includes 3 short case studies, recommendations for future BioBlitzes, and the survey and observation instruments.

BIOBLITZ: BENEFITS FOR STUDENTS

Students – from elementary through high school – participated in a BioBlitz through their schools. Most students were provided with an opportunity to participate in inventories, working with scientists or other experts. Students’ reactions were overwhelmingly positive across a range of indicators.

- 85% of students either strongly agreed or agreed with the statement “I liked BioBlitz”
- 87% either strongly agreed or agreed that “BioBlitz was educational”
- 77% strongly agreed or agreed that “BioBlitz was entertaining”
- Curiosity was a predictor of engagement
- A minority found attending both an inventory and festival was too long

Students also communicate about what they learned: about being comfortable in nature, about protecting the environment, about biodiversity. They also learned about what scientists do in the field.

About comfort in nature

- “I learned that I am not scared to touch unknown things.”
- “The most amazing thing on the BioBlitz field was the slugs.”
- “I saw some bats and I think it was amazing because I’ve never seen a bat.”

About interest in protecting the environment and biodiversity

- “It was amazing because it was beautiful and it shows people care for living things and plants.”
- “There’s only a small amount of water that is drinkable on earth.”

About science and what scientists do in the field

- “It changed my idea [of becoming a scientist/park ranger] because I can keep my parks safe and learn more about animals.”
- “Scientists do more than study!”
- “I think it was when we learned about turtles and how they live and how they lay eggs.”



BIOBLITZ: BENEFITS FOR THE GENERAL PUBLIC

Public participants included adults alone or in groups, grandparents and grandkids, corporate volunteers, and many others. They came to enjoy the parks, be outdoors, be together as a family, and participate in science research. Many began the event comfortable in nature, and/or with high levels of interest in advocating for the environment, and an appreciation of biodiversity. We found that:

- Public respondents were overwhelmingly positive about the experience
- Scores on all scales increased significantly for participants
- Participants were able to actively engage in the practices of science
- Hands-on activities, using the tools of science, such as bug nets or beat sheets or binoculars, were the most engaging
- The public learned more about what scientists and park rangers do
- Expressed their fascination with all they witnessed
- And developed an appreciation for the co-dependence on biodiversity
- Most participants would be willing to engage in another BioBlitz

Members of the public said:

“BioBlitz simply reaffirmed my respect for good scientists and their passionate curiosity.”

“I never knew how diverse and fascinating Fungi could be on a rainy day!”

“It was amazing seeing birds that were rare to the area near the White House Oval, because it is in a big city, and you wouldn't expect to see rare creatures in an area with so many people”



BIOBLITZ: BENEFITS FOR TEACHERS

Teachers could engage in BioBlitz through a variety of different activities or opportunities both before and after the event. Professional development was available for teachers in the Washington, DC area, and a selection of materials was offered online. Some teachers also experimented with iNaturalist prior to BioBlitz, in order to better prepare their students.

- The vast majority (89%) of teachers strongly agreed or agreed that BioBlitz was a good teaching tool.
- 86% of teachers strongly agreed or agree that BioBlitz was a good use of their teaching time. Many enjoyed seeing their students engaged in interacting with nature. As one teacher recounted, "...one of my students remarked "This is the best field trip I have ever been on.""
- Majority of teachers reported that the experience increased their likelihood of
 - using parks to teach (91%)
 - conducting future field trips in nature (91%), and
 - bringing future classes to a national park (83%)
- Some teachers found ways to continue the learning after BioBlitz: "Following BioBlitz we took a trip to our school garden to observe the diversity of foods another class had previously planted."
- Students of teachers who participated in professional development prior to BioBlitz were more likely to show increases on the outcomes of interest.
- Students of teachers who had taken their class out of doors prior to BioBlitz were also more likely to show increases on the outcomes of interest.

A group of people, including men and women of various ages, are gathered outdoors in a natural setting, possibly a park or forest. They are wearing hats and backpacks, suggesting they are participating in a field activity like a BioBlitz. The background shows trees and a path.

BIOBLITZ: BENEFITS FOR INVENTORY LEADERS

Inventory leaders came from a variety of institutions. Some were university academics, researching species found in the park. Others were National Park Service biologists, resource managers, and park educators. The inventory leaders conducted the inventories, describing and providing information about species, showing participants where best to find organisms, how to identify species, and post pictures to iNaturalist.

- Majority were satisfied & 70% would participate in another BioBlitz.
- Most feel they contributed to educating participants about the parks, about plants and wildlife found in the parks, and about what scientists do.
- Appreciated being able to provide the public, visitors and youth, particularly to local underserved youth, with opportunities to learn and appreciate biodiversity.
- Saw themselves as role models for being a scientist – demonstrating that scientists do not all wear white coats and work in a laboratory, that there are opportunities to be out of doors, protecting the environment, and educating the public.
- “Working with the macro invertebrates, this gave the opportunity for folks to see and appreciate some life samples of some of the species that determine the water quality in streams. This has led to folks volunteering for the local water quality monitoring program. The BioBlitz created more public awareness.”

Evaluation of BioBlitz 2016

Report and Appendices

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INTRODUCTION

A BioBlitz is an 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 in a defined period of time, typically a half-day to 24 hours. A BioBlitz can have many goals, from improving a base of scientific knowledge to helping people appreciate the natural wonders of the national parks and other outdoor environments.

In 2016, more than 120 National Park Service (NPS) units conducted BioBlitzes, supported by a collaboration between National Geographic Society and the National Park Service. The majority occurred the weekend of May 20-21 to coincide with the cornerstone BioBlitz in Washington DC, and the rest took place between March and October. The cornerstone BioBlitz took place in 13 NPS units located throughout the National Capital region. In addition, there were seven large (regional) Showcase BioBlitzes held in parks in New Mexico, Alaska, Washington, California, South Carolina, Ohio, and Delaware.

The NPS BioBlitz goals were:

- 1) Contribute to the NPS Centennial goals of: Inspiring the Next Generation of Park Stewards, Visitors, and Advocates, the “Find Your Park campaign, the NPS goal to “Go Digital,” and the President’s initiative to get “Every Kid in a Park.”
- 2) Conduct safe and successful scientifically-based biodiversity inventories in which citizen scientists of all ages are active participants.
- 3) Inspire, educate, and involve the next generation of stewards and scientists, especially underserved audiences.
- 4) Build relevancy of biodiversity and national parks to people of all backgrounds and ages so that they become invested in resource protection and stewardship.
- 5) Increase knowledge of parks’ biological resources and capture biodiversity data.
- 6) Build, maintain, and advance relationships with scientists.
- 7) Foster partnerships and collaboration with a variety of stakeholders.
- 8) Highlight the NPS Centennial through a national BioBlitz citizen science event through communication, outreach, and educational offerings.

To achieve these goals, participants engaged in “species inventories” where data were collected about the biodiversity in a park. The inventories took many different forms: some focused on a single taxon, such as butterflies or reptiles, while others asked participants to document anything they encountered. Most inventories were led by inventory leaders, scientists, park rangers, naturalists, and other knowledgeable volunteers, who imparted information to participants, showed them how to locate the target species, and helped them identify discovered species. A smaller number of inventories were less structured, allowing participants to explore at will. To

engage participants in citizen science during BioBlitz, the National Park Service and National Geographic encouraged participants to use iNaturalist, which is a smartphone app and website that allows for uploads of geotagged photos of organisms and provides identification by a network of experts. Once individuals join iNaturalist, they are able to continue to contribute observations anytime, anywhere, even beyond their experience through BioBlitz. These observations become part of a large international dataset of species distribution and biodiversity. Though not all parks and inventories used iNaturalist, and not all species are amenable to photo identification, the app enabled widespread engagement of members of the public in scientific inventories.

In addition to the inventories, many parks offered Biodiversity Festivals, which varied by location but generally consisted of booths with activities, outreach opportunities for local conservation organizations, speakers, cultural demonstrations, art, food, and entertainment. Festivals also often engaged youth in craft making, usually tied into the BioBlitz activities, such as the building of bug boxes, with a naturalist on hand to explain their purpose. In general, festivals served to educate about biodiversity, raise awareness on environmental issues, and entertain attendees.

Two main groups of participants attended BioBlitzes. The first group consisted of the general public. These participants could be regular park visitors or volunteers, tourists and passersby, local residents who do not usually visit the park, families, friends, scout troops, corporate volunteer groups, or anyone else who thought the event sounded fun or like an excellent way to contribute to science. Parks reached out to these groups in different ways, and inventories were structured differently, but, in general, participants gathered at a national park and engaged in BioBlitz during one 24-hour period.

The second group consisted of teachers and students who came to various parks. Teachers were recruited early and received materials that could help them integrate activities about BioBlitz into their classrooms prior to the field trip. Many parks also provided optional professional learning opportunities. Teachers brought their own students to BioBlitz or selected students from a variety of other courses or classrooms from their school. Most students ranged in age from upper elementary to high school; some schools brought special needs students or offered the field trip to BioBlitz to students who had deep interest or high achievement in science. Although implementation varied, student groups often participated in a single inventory while at the park, and attended additional activities, such as the Biodiversity Festival.

GOALS AND EVALUATION OUTCOMES

Through these activities, it was hoped that participants would learn more about each park and be exposed to species both familiar and new to them, that scientists would understand the benefits

of communicating science to the public, and that parks would obtain improved data about biodiversity within park boundaries.

The evaluation goals were based on several short-term participant outcomes that were of interest to National Geographic and the National Park Service. Through active participation and engagement in BioBlitz, it was hoped that the students and the general public would show increases in the following:

- 1) Appreciation for biodiversity
- 2) Interest in environmental advocacy
- 3) Comfort being in nature
- 4) Knowledge and understanding about the nature and practices of science

Some of the goals are related to National Geographic's Learning Framework [<http://nationalgeographic.org/education/learningframework>], while others, such as comfort in nature, were identified by the National Park Service. To the extent possible, the evaluation looked at outcomes that were included in the 2015 BioBlitz evaluation. The 2015 report is available on the National Park Service website, <https://irma.nps.gov/DataStore/Reference/Profile/2231952>

The outcomes are operationalized as follows:

Appreciation of Biodiversity is a major goal of BioBlitzes which promote learning about biodiversity within a given location. This outcome ties in with the Learning Framework dimension of Knowledge. BioBlitzes highlight National Geographic's desire for people learn about "Our Living Planet" and "Critical Species" that inhabit our planet. As National Geographic states, individuals "need to understand how our ever-changing and interconnected world works in order to function effectively and act responsibly." Someone with an appreciation of biodiversity would agree strongly with a statement such as, "My life is better because there are a lot of different kinds of plants and animals." The biodiversity scale was adapted from the European's Commission study of Attitudes Towards Biodiversity: (http://ec.europa.eu/public_opinion/flash/fl_379_en.pdf).

Interest in Environmental Advocacy ties in with the Learning Framework dimension of Responsibility, as "an explorer has concern for the welfare of the natural world." Through learning about the role that biodiversity plays in the global environment and local ecosystems, it is hoped that participants will continue to or learn to protect the environment through stewardship and advocacy. An individual who is a strong advocate for the environment might agree strongly with a statement such as, "I want to be involved in protecting and taking care of

natural areas.” The scale we used to Measure this was based on several surveys, but most items were derived from the Ocean Literacy Project: <http://oceanliteracy.wp2.coexploration.org>.

Comfort in Nature is linked to the dimension of Curiosity, as an explorer “acts on curiosity, respect, responsibility, and adventurousness and persists in the face of challenges.” While some participants might already be comfortable being out in nature -- getting hot or dirty, encountering insects or snakes -- one of the goals of this large-scale distribution of BioBlitzes was to ensure that people who do not usually visit parks have that opportunity. It was hoped that having fun and being fascinated by the event would help those participants realize that they can be comfortable in nature and remove a potential barrier to their ongoing engagement with the parks. An individual with a high comfort in nature would report being very comfortable with activities such as “encountering spiders and insects.” This scale was based upon previous work conducted by the National Park Service and Dr. Gerard Kyle at Texas A&M University.

EVALUATION APPROACH

The National Geographic Society, in collaboration with The Lawrence Hall of Science at University of California, Berkeley, conducted an evaluation of the 2016 BioBlitz. The overarching evaluation goal was to explore the outcomes of BioBlitz from a 360-degree perspective. We were interested in learning about the benefits to participating students and the public, scientists, park rangers and volunteers, and the parks themselves, from the wide range of BioBlitz settings, events and inventories that were offered. The evaluation questions were:

- Q1. How were BioBlitzes implemented in the different parks? How did implementation vary?
- Q2. How **engaging** were BioBlitzes?
- Q2a. What was their level of affective engagement?
 - Q2b. What was their level of behavioral engagement?
 - Q2c. What was their level of cognitive engagement?
- Q3. What did participants **learn** about science (content and practices) from BioBlitz?
- Q3a. How did participants engage in asking questions?
 - Q3b. How did BioBlitz change public perspectives on science and scientists?
 - Q3c. How did BioBlitz foster appreciation of National Parks?
- Q4: Did participants’ appreciation of biodiversity change?
- Q5: Did participants’ interest in environmental advocacy change?
- Q6. Did participants’ comfort in nature change?
- Q7. What was the impact on science research in National Parks?

The evaluation questions were answered using two main data collection methods: survey and observation. Surveys were administered to teachers and their students, the general public, inventory leaders/Pro-Observers and selected park representatives. The surveys were administered within two weeks of the completion of the BioBlitz. Surveys were returned from 733 students, 35 teachers, 174 members of the public, and 160 inventory leaders/Pro-Observers. To conduct the observations, eight NGS observers, 5 NGS contract observers, and 6 evaluators from UC Berkeley visited 22 BioBlitzes in 16 different states plus the District of Columbia. This report presents the results from all data collection. Follow-up surveys were also sent to the parks where we had observers to gather feedback about BioBlitz from their perspective.

Data Collection Event	# Parks Represented	# Instances
Student survey	15	733
Teacher survey	13	35
Public adult survey	32	174
Inventory Leader survey	40	160
Observations	22	245
National Park staff survey	14	21

FINDINGS

Detailed findings are presented in the follow pages. The highlights of our findings include:

- Teacher preparation before the event was related to changes in appreciation of biodiversity.
- Public participants equally enjoyed the activities regardless of whether they attended an inventory, festival, or both.
- Compared with the public, students showed more growth in appreciation of biodiversity after participating in BioBlitz, possibly because they were starting with lower levels of appreciation and thus had more room to grow.

Q1. IMPLEMENTATION

This section presents a brief summary of BioBlitz implementation findings. A full analysis can be found in Appendix A

The National Park BioBlitzes usually consisted of both an inventory and a festival, although a minority of parks hosted only one or the other. Through the inventories, students, members of the public, and/or professional scientists would collect data about biodiversity in the park. Some of

these inventories searched for specific species or taxa, while others were open-ended. Two of the primary goals of the inventories were to encourage public participation in science and to help the park collect needed data about biodiversity within its boundaries. Festivals focused on engaging participants in a different way, through music, food, activities, and booths hosting educational and cultural activities or information.

There were four major constituencies for BioBlitz: (1) Inventory leaders, who were often professional scientists either associated with or invited by the park; (2) iNaturalist Pro-Observers, who, when they were present, were engaged in ensuring that inventory data were effectively uploaded to iNaturalist; (3) the general public, who volunteered to collect data as part of an inventory and/or who attended the festival; and (4) K-12 teachers and associated students who came as a group to participate in BioBlitz inventories and/or festivals.

More information can be found in Appendix B.

Q2. HOW ENGAGING WAS BIOBLITZ?

National Geographic Education hypothesized that engagement – including affective, behavioral, and cognitive dimensions – would support positive outcomes for participants. Engagement was assessed in two ways: through observations made by the evaluation team during inventory activities, and through participant self-reports. During the observations, evaluators rated engagement for members of the public and students as they participated in various activities. Activities were categorized as one or more of the following: walking, collecting data, listening to the scientist lecture or give instruction, engaging in science practices besides data collection (for example using materials, observing, or exploring), and conversing with the inventory leaders/scientists. During the activities, evaluators noted participants' affective engagement (i.e., how they appeared to feel), behavioral engagement (i.e., what they were doing), and cognitive engagement (i.e., the types of thinking displayed). Participants' self-reports of engagement were assessed through survey questions about their experiences. We found:

- Participants were able to actively engage in the practices of science
- Hand-on activities were the most engaging
- Participants were more likely to be cognitively engaged when personally interested in the material

This section addresses participants' affective, behavioral, and cognitive engagement in more detail.

Q2A. WHAT WAS PARTICIPANTS' LEVEL OF AFFECTIVE ENGAGEMENT?

Throughout this report, affective engagement is conceptualized as the emotions that occur during a science learning activity. Affective engagement was measured in two different ways. First, on a survey, respondents answered a series of questions about their level of engagement in BioBlitz. These questions form the “Engagement and Intention Scale” developed by Dr. Joe Heimlich at COSI. (More about this scale can be found in Appendix B.)

In addition, affective engagement was measured through observations of participants' behavior and inferring their emotions or sentiments. Observed affective engagement was broken down into 5 types:

1. Flat/neutral: Participants were scored as flat/neutral when they showed no outward signs of affect.
2. Positive aroused: Participants were scored as positively aroused when they appeared amazed, happy, or enthusiastic.
3. Positive unaroused: Participants were scored as positively unaroused when they were alert, calm, or relaxed.
4. Negative aroused: Participants were scored as negatively aroused if they appeared upset, frustrated, or angry.
5. Negative unaroused: Participants were scored as negatively unaroused if they appeared sad, tired, or bored.

The same types of activities typically engaged both public adult and student participants. For example, both groups were positively aroused when there were many opportunities to engage in science practices. In particular, participants were particularly positively aroused when using the tools of science, such as binoculars, nets, and vials. Additionally, both were usually positively unaroused (alert or calm) when listening to the scientist lecture or walking a lot, especially if they also had opportunities to engage in science practices such as observing or recording data. In some cases, these less active activities evoked flat or neutral affect. For example, some students evinced a flat affect after they had been listening to the inventory leaders provide background information for a long period of time, while public adults occasionally showed a flat affect after they had been walking a lot.

There were rare instances of being negatively unaroused (tired or bored) while listening to the inventory leader's lecture. For example, a small number of students sometimes appeared distracted, bored, or fidgety when listening to an inventory leader talk about a trail or particular species. The rarity of these negative unaroused observations was consistent with teachers' comments, in which the majority praised how engaging the activities were, and only one reported

that the activities were too lecture-based. There were no instances of being negatively aroused (upset or frustrated).

Self-reported Engagement & Intentions

National Geographic hypothesized that if participants were engaged in their BioBlitz experience – thought it was fun yet educational – then they would be more likely to have positive outcomes. We found:

- Students and members of the public on the whole enjoyed BioBlitz
- Most participants would like to engage in another BioBlitz
- Rare instances of negative experiences were related to either predispositions or logistical concerns

Student self-reports

Students came from elementary school through high school and had varying levels of prior classroom experience in nature. Despite this heterogeneity, students' reactions were overwhelmingly positive across a range of indicators. In a feedback survey, participants were asked 11 questions about their engagement in the BioBlitz events and their intentions following the event. These questions included items such as “I liked BioBlitz” and “I learned new things about nature/biodiversity from participating in BioBlitz” and were answered on a 1-5 Likert scale, where 1 represented “Strongly Disagree” and 5 represented “Strongly Agree.” Across these 11 items, students averaged 3.85 out of 5, indicating a high level of agreement with positive evaluations of their experience. Furthermore, 85% of students either strongly agreed or agreed with the statement “I liked BioBlitz,” 87% strongly agreed or agreed “BioBlitz was educational,” and 78% strongly agreed or agreed “BioBlitz was entertaining.”¹ In their open-ended responses, most students said that they thought it was a “fun and interesting experience,” and many said that they would like to do it again.

Unlike the public, students attended the BioBlitzes with their classes and may not have chosen to attend on their own. Consequently, it is unsurprising that, though students overall enjoyed their experiences with BioBlitz, there were some factors that influenced engagement for subsets of students. For instance, students who attended only an inventory reported the highest levels of engagement compared to students who attended a festival only or students who attended both. In fact, students who attended both a festival and an inventory were more likely to say the event

¹ The full distribution of responses for this, and for all items, is presented in Appendix B.

was too long and/or was boring than students who attended one or the other. In addition, students who attended just a festival were more likely to say the event was too long than students who attended just the inventory. It should be noted however, that the majority of students thought that BioBlitz was neither too long nor too boring.

Figure 1. Student Ratings of BioBlitz Events by Type of Event Attended

	I thought BioBlitz was boring. ^a		BioBlitz was too long. ^b	
	<i>N</i>	Mean (<i>SD</i>)	Mean (<i>SD</i>)	Mean (<i>SD</i>)
Festival only	296	2.02 (1.28)	2.20 (1.31)	
Inventory only	100	1.77 (0.83)	1.84 (0.86)	
Both	236	2.34 (1.26)	2.34 (1.26)	

a. "Both" is significantly higher than "Festival" and "Inventory" at the $p < 0.05$ level.

b. All three comparisons are significantly different from each other at the $p < 0.05$ level.

Another factor related to reported engagement and intentions for students was grade level. Elementary-aged students reported highest engagement in the event (mean (M) = 4.12, SD = 0.63), compared to both middle school (M = 3.78, SD = 0.75) and high school students (M = 3.54, SD = 0.75). These reactions were corroborated by one teacher, who remarked, "a lot of activities were geared for younger students so maybe make a tent for older kids."

Most student open-ended survey responses about engagement were predominantly positive – as noted above, over 85% agreed with the statement "I liked BioBlitz." For example, one student commented that the experience "made me enjoy the outdoors and want to spend more time [there]." Another reflected, "It was fun, because nature is beautiful."

There was a small sample of students whose open-ended responses reflected negative experiences, however. While students who previously felt ambivalent towards nature showed an increase in enjoyment after the BioBlitz, some of those who began with particularly negative feelings about nature did not show any such change. One student, for instance, wrote "I still can't stand plants, insects and animals." Other students expressed negative feedback about the BioBlitz due to other reasons such as physical exhaustion and the heat. For instance, one such student wrote, "It is tough to be outside for a whole day." Of course, even with the occasional negative comment, it is worth noting that only 5% of students strongly disagreed or disagreed with the statement "I liked BioBlitz" (while 11% were neutral). Thus, students' experiences were overwhelmingly positive.

General public self-reports

Overall, patterns in public engagement and intentions responses were similar to those of students. For example, across all engagement and intention questions, public participants averaged 4.38 (SD = 0.61) out of 5. Furthermore, 95% either strongly agreed or agreed that they

“liked” BioBlitz,” and 94% strongly agreed or agreed that it was “educational.” In their survey responses, many members of the public expressed eagerness to participate in more activities like BioBlitz: “Loved it! Will definitely do more next year if the opportunity arises” and “I loved it! Wish there were more opportunities like it.”

Only 3% of public participants strongly disagreed or disagreed when asked whether they “liked” BioBlitz. The few members of the public who did not enjoy the experience typically reported difficulties with coordination and communication. For example, one participant expressed frustration after traveling to the event but finding no staff there upon arrival: “We showed up to the event, but it was apparently ‘canceled’ - No one from BioBlitz ever showed up (the tent and signage were there, but no personnel).” Another participant reported tensions between their inventory’s expert and volunteers, describing the expert as “condescending, inappropriate, rude and often incorrect.” However, far more participants praised the staff involved: for example, one participant declared, “the scientists were great and fun to listen to,” while another praised, “the girl who came from National Geographic was VERY VERY good! She was so friendly, outgoing, helpful, and clearly happy about her job.”

In contrast with students, who expressed different reactions to their experience depending on whether they attended a festival, inventory, or both, the public showed no similar patterns and reported equal engagement in the activities regardless of which they attended.

Curiosity and Self-Reported Engagement

A number of factors predicted different levels of engagement, some of which were related to implementation of the events, and others which were related to individual preferences and proclivities. For example, curiosity levels, described below, predicted reported engagement for both students and the public.

National Geographic, in thinking through the theory of change for BioBlitzes, wondered what attitudes or dispositions might influence a participant’s experience and outcomes. In particular, it was hypothesized that someone’s initial level of curiosity might be related to outcomes.

Curiosity is one of the key dimensions of the Learning Framework. Using the Curiosity and Exploration Index (CEI), developed by Todd B. Kashdan at George Mason University², levels of curiosity were used as explanatory variables in the evaluation.

² J Res Pers. 2009 Dec 1; 43(6): 987–998. The Curiosity and Exploration Inventory-II: Development, Factor Structure, and Psychometrics. Todd B. Kashdan, Matthew W. Gallagher, Paul J. Silvia, Beate P. Winterstein, William E. Breen, Daniel Terhar, and Michael F. Steger

Participants responded to 10 questions about their curiosity and exploration, such as “I am the kind of person who seeks out unfamiliar people, events, and places.” They gave responses on a 1-5 scale, where 1 corresponded with “Strongly Disagree” and “5 with “Strongly Agree.” Curiosity and exploration inventory (CEI) scores of students and members of the public were positively associated with their self-reported engagement (as described in the previous section). In Figure 2 below, students and members of the public were divided into three CEI levels, based on their scores and divided into three roughly equal tri-tiles. (Those below an average of 3.50 across the 10 items were considered low, while those with averages from 3.51 to 4.24 were mid, and those above 4.25 were high CEI.) These groups were then compared based on their mean responses across the engagement and intention questions. Those with higher CEI were more likely to report high levels of engagement in BioBlitz.

Figure 2. Mean Self-Reported Engagement Ratings by CEI Levels for Student and Public Participants

	Students ^a		Public ^b	
	<i>N</i>	Mean (<i>SD</i>)	<i>N</i>	Mean (<i>SD</i>)
Low CEI	206	3.35 (0.68)	37	4.19 (0.80)
Mid CEI	303	3.87 (0.63)	81	4.28 (0.59)
High CEI	234	4.29 (0.59)	52	4.71 (0.34)

a. All three CEI Levels of students showed significant differences at $p < 0.05$ level.

b. High and low CEI Levels of the public showed significant differences at $p < 0.05$ level.

TEACHER AND INVENTORY LEADER ENGAGEMENT

Teachers

Compared to students and the general public, teachers participated in BioBlitz in a different way. Most teachers assumed a more supervisory role and worked alongside experts to engage students in the BioBlitz activities. Nevertheless, teachers reported high satisfaction with the event. The vast majority (89%) of teachers strongly agreed or agreed that BioBlitz was a good teaching tool, and 86% of teachers strongly agreed or agreed it was a good use of their teaching time. Many enjoyed seeing their students very engaged in interacting with nature. As one teacher recounted, “After the second stand at the festival one of my students remarked ‘This is the best field trip I have ever been on.’” A few negative responses were related to pedagogy: one teacher who attended the festival felt the activities were too lecture-like, and some others would have preferred more hands-on activities.

Because of their positive experiences at the BioBlitz events, the majority of teachers reported that the experience increased their likelihood of using parks to teach (91%), conducting future

field trips in nature (91%), and bringing future classes to a national park (83%). Many shared stories of how they had revisited at school what they had learned at BioBlitz. For example, one teacher reported “Following BioBlitz we took a trip to our school garden to observe the diversity of foods another class had previously planted.”

Inventory leaders

Inventory leaders and Pro-Observers generally had positive and pleasant experiences, and 70% said they would participate in another BioBlitz in the future. Most reported enjoyable, well-coordinated events. Inventory leaders and Pro-Observers emphasized how rewarding it was to see people appreciate nature: “I enjoyed people of all ages finally looking closely at plants and appreciating them in a new way.” This sentiment was especially true for those who worked with students; one reflected how “Several of the young people I worked with had a real interest in what I was showing them. They were clearly interested in learning more, which could lead to some potential career choices in the natural sciences down the road.” For a small but non-negligible number, (which includes many of the 30% who said they were unlikely to volunteer for another BioBlitz), some difficulties in publicity, communication, and logistics at BioBlitz events detracted a bit from the overall positive experience of BioBlitz. Several commented that publicity was limited, leading to a small public turnout. In addition, more than one inventory leader reported receiving minimal information leading up to the event (such as confusion over where to report on the day of the inventory), and one was unaware (s)he would be working with special needs students.

Q2B. WHAT WAS PARTICIPANTS’ LEVEL OF BEHAVIORAL ENGAGEMENT?

While affective engagement related to either inferences of participants’ feelings or their own self-reports of how engaged they felt, behavioral engagement focused on what the participants were actually doing. Behavioral engagement was assessed through observations and was classified as:

1. Active: Participants were considered actively engaged if they were actively doing something observable to contribute to the experience, such as raising their hand, asking a question, writing notes, or observing a specimen.
2. Passive/positive: Participants were considered passive/positive if they were ready to learn and participate but were not physically doing something, such as waiting with attention or listening.
3. Passive/negative: Participants were considered passive/negative if they were distracted or disinterested, such as not paying attention or giving up on a task.
4. Disruptive: Participants were considered disruptive if their actions interfered with either their own or another’s learning.

Both public and student groups were actively engaged when they were presented with opportunities to participate in science practices. Additionally, both groups were often passive/positive while listening to the inventory leaders' lecture, or walking. The few instances of being passive/negative while listening to the inventory leaders' lecture, or when walking, were made by students. There were no observed instances of disruptive engagement.

Q2C. WHAT WAS PARTICIPANTS' LEVEL OF COGNITIVE ENGAGEMENT?

Cognitive engagement focused on the types of thinking in which BioBlitz participants were engaging. Cognitive engagement was assessed through the observations and was classified as:

1. Higher-order thinking: Participants were considered to be engaging in higher-order thinking if they were predicting, making connections across concepts, or discussing cause and effect.
2. Lower-order thinking: Participants were considered to be engaging in lower-order thinking if they were discussing procedures or fulfilling basic activity requirements without talking about deeper concepts.
3. Unrelated thinking: Participants were considered to be engaging in unrelated thinking if they were uninvolved in the activity or discussing unrelated content.
4. Unknown thinking: Participants were considered to be engaging in unknown thinking if the observer could not infer their thought processes.

The most common type of cognitive engagement observed was lower-order thinking. This type of cognitive engagement often occurred when groups were walking, observing species, or listening to the inventory leader explain something. Higher-order thinking was also observed, albeit somewhat less frequently. Higher-order thinking typically occurred when either an individual asked the inventory leader a question, or the inventory leader posed a question to the group. The occasional instance of unrelated thinking typically occurred when a participant was talking or laughing with friends or family about an unrelated topic. Frequently, given the difficulty of inferring cognitive states, thinking was classified as unknown.

In addition to the observations, the teacher survey also provided some additional information on students' engagement, particularly relating to the extent to which BioBlitz provided an engaging learning experience. Teachers were asked seven questions about how effective BioBlitz was at engaging their students using a 3-point scale. Their average answer was 2.51 (out of 3, from "Not effective" to "Very Effective") across the seven items. Seventy-nine percent said BioBlitz was "very effective" at giving their students an opportunity to interact with park staff, and 74% said BioBlitz was "very effective" at involving their students in conservation and appreciation of nature. Interestingly, no teachers (0%) said

*I was inspired
to keep learning
more about the
natural world.*

-Public adult

BioBlitz was “very effective” at exposing their students to new experiences, but 91% thought it was “effective.”

Q3. WHAT DID PARTICIPANTS LEARN ABOUT SCIENCE (PRACTICES AND CONTENT) FROM BIOBLITZ?

Through engaging participants in the practices of science, BioBlitz sought to help participants learn about the practices of science and scientific content. These practices and content areas included asking questions, understanding the purpose and process of science, learning about new species, and appreciating the role of national parks in preserving biodiversity.

Q3A. HOW DID PARTICIPANTS ENGAGE IN ASKING QUESTIONS?

One goal of BioBlitz was to engage participants in asking questions about the natural world. Overall, participants were very curious by nature. As previously described, the public and student surveys contained 10 questions assessing each person’s curiosity and exploration traits, the Curiosity and Exploration Inventory (CEI). Questions included “I try to learn as much information as I can in new situations” and “Everywhere I go, I am looking for new things or experiences.” Responses were on a 1-5 scale, where 1 corresponded with “Strongly Disagree” and 5 corresponded with “Strongly Agree.” Across the ten items, students averaged 3.9 ($SD = 0.66$) and the public averaged 4.0 ($SD = 0.63$). For the public, this curiosity likely motivated their decision to participate in BioBlitz. For both groups, curiosity was reflected in their engagement with inventory leaders and Pro-Observers. Participants asked leaders a multitude of questions about the species being inventoried, the national parks, and science practices in general.

One of the main ways in which experts and public engaged with each other was through question and answer. Common questions posed by participants to inventory leaders were centered on identification of the taxa encountered during the inventory. Participants asked about common names and Latin names, particularly when trying to upload data to iNaturalist. Other questions pertained to the specific function of the species within the ecosystem, both related to, and unrelated to, humans. Among the most common questions were: “What is this?” “How can you tell?” “Is this poisonous?” “Is this edible?” Questions often also related to the data collection process, such as “How do I use this equipment?” or “How do I catch the insects?”

Some participants were able to engage inventory leaders and experts in longer conversations. One member of the public said, “I enjoyed talking to park staff about their thoughts on control measures for the goose overpopulation.” From inventory leaders, we learned that having access to an iNaturalist Pro-Observer on the trail freed them to focus more on deeper conversations with the public, rather than answering questions about how to upload data.

The questions posed to participants by inventory leaders and Pro-Observers ranged in content and cognitive demand. Some required lower levels of cognition to address, such as questions with yes or no answers, or recall questions such as “Do you know what species this is?” or “What do we call it when birds fly from their summer home to their winter home?” Many of these questions were asked before a brief (often one or two minutes only) description of some aspect of organism structure or behavior. In many cases, this information was new and, judging from some reactions, interesting to participants, even if it did not require their active learning. Responses to surveys showed that some people retained some of the facts because they found the information fascinating. For example, one public survey respondent recalled how they learned that snakehead fish can breathe air and migrate short distances on land by wriggling their bodies. Others recalled more troublesome facts, including one student who commented, “there is less than 1% of drinkable water left,” and a public participant who lamented that “16 non-native/invasive plants are considered to be invasive within [Cuyahoga Valley National Park].”

Some questions asked by inventory leaders required higher cognitive thinking because they encouraged participants to connect their observations to their current life experiences or recap their experience with BioBlitz in a meaningful way. For example, when working with adults, inventory leaders found ways to engage them in sensemaking (the process by which people give meaning to their experience) by asking them to “tell a story” about what they had learned or connect various facts together to explain a phenomenon. In addressing students, inventory leaders asked questions such as, “Does this make you think of a story or experience you have had?” and “Can you put together a story from your experience so far?” or “How can we educate other kids about this?”

This story, from one of the inventory leaders, demonstrates one approach to sensemaking:

One of the girls from [an urban school] looked across the lake to see a bird fly and land in the tree. She said, "What a pretty bird! It has a red wing. What kind of bird is it?" I responded, "Let's work this out. Okay, you just noticed a distinct characteristic about the bird. What was it?" She said, "It has a red wing." I then asked, "What color is the bird's body?" She said, "It looks kind of black." My last question was, "What organism is it?" which was greeted with a look of you've-got-to-be-kidding and the exasperated answer, "it's a BIRD!" Then I said, "Okay now let's put it all together," and prompted her to say the answers again, one after another. Slowly she said, "Red wing black bird, OH!" and instantly her face brightened with enlightenment.

Q3B. HOW DID BIOBLITZ CHANGE PUBLIC PERSPECTIVE ON SCIENCE AND SCIENTISTS?

Another goal of BioBlitz was to expose the public (particularly students) to the practices of science, to help them understand the types of activities scientists engage in, where they work, and what roles they play in different organizations. We know from the research literature that many youth still believe scientists only work in labs, wearing white coats, surrounded by test tubes. Letting them see that scientists engage in collecting data outdoors and educating the public may change their impression of scientists and the practice of science.

BioBlitz seemed to be successful in meeting this goal. One leader wrote, “After each BioBlitz I ask people what they thought was the most impressive thing about their experience. The first answer was always ‘I had no idea that scientists were so cool!’” Survey responses also provided evidence that some students might be more interested in becoming a scientist after participating in BioBlitz. As one leader said, “I think my student group had some excellent participants that might not have felt like they could be scientists [before], but saw how fun and easy it was.” That science is “fun” and can be done outdoors or around the world was appealing to students. One expert wrote, “Several students were very interested in my travel experiences as a scientist and they seemed to want to do that someday themselves.” Overall, it seems that “students were excited to share their knowledge and help the scientists. By seeing researchers in the field, these students gained a better understanding of what [scientists] do and became more enthusiastic towards science as a career.” BioBlitz certainly helped dispel some negative connotations associated with careers in science and made the prospect of becoming a scientist much more appealing to younger students. For instance, one student wrote, “I used to think scientists worked all day but BioBlitz taught me that they can have fun.” Similarly, in response to a prompt about what they learned about scientists, another student wrote “That they do more than study!”

I think other people learned to look with "scientist" eyes at things they might not otherwise notice
-Inventory leader

The public also learned more about what scientists and park rangers do. One recurring theme from the public indicated that they felt what scientists do is difficult but important work. Many of the public came into BioBlitz with a good sense of what scientists do, and a common feeling was that “BioBlitz simply reaffirmed my respect for good scientists and their passionate curiosity.”

Inventories that provided opportunities for participants to ask questions, access the tools of science, and figure out the tools relate to the science were more engaging because they enabled participants to learn about science, science practices, and to have fun. One parent wrote, “Thank you for patiently answering the seemingly endless questions of [my son]. Thank you for sharing

your equipment and stepping back so we could figure it out. Thank you for helping [my son] see that science is so much more than worksheets and lectures. Science is FUN and relevant.”

Overall, inventory leader/Pro-Observer survey respondents generally felt they were able to provide a meaningful experience for students and the public during BioBlitz, and most of these experiences revolved around exposing the adults and children to new experiences in nature or with science. In the inventory leader feedback survey, one question asked inventory leaders and Pro-Observers to describe how BioBlitz may have had a meaningful impact on an individual or group. A major theme in these responses was the description of introducing something new to participants. Some participants were exposed to a new scientific practice or tool. For example, one inventory leader responded, “We were lucky enough to have a group ... help build field microscopes with participants. The microscopes seemed to have a big impact on participants, and everyone was really enjoying collecting specimens on their inventories, and then making slides to view under the microscope that they had just constructed. It was a very cool experience.”

Inventory leaders also enjoyed seeing participants exposed to a new species, such as two young women: “The weather prevented much Lepidoptera activity, but two girls spotted a roosting moth and a wandering caterpillar, both quite attractive species. They will remember this.” A number of public survey respondents were excited to have seen new plants and animals within the park. One person was fascinated by “a slime mold. It was unlike anything else we saw that day, and we learned that there is still some question as to whether a slime mold is plant or animal.” Frequently, they reported that they saw species they were unaware lived in that area. For instance, one member of the public said it was amazing “seeing birds that were rare to the area near the White House oval, because it is in a big city, and you wouldn't expect to see rare creatures in an area with so many people,” while another was impressed that “wild turkeys live in the park near my house.”

Students in particular seemed very excited to see different species of animals up-close for the first time. A large number of responses to the student survey question “What was the most amazing thing you did or saw?” revolved around their experiences interacting with new organisms and phenomena. One student wrote, “I saw many different sized turtles, that was amazing because I've never seen that before.” Many students also recounted being fascinated with bats, another organism to which they had not previously been exposed. One student wrote about seeing a dragonfly in a jar; another wrote about seeing birds diving for fish; and many others wrote about their experiences seeing ducks or snakes for the first time. Some students were also amazed to learn about the extent of biodiversity within taxonomic groups upon being exposed to them for



*There are many
areas close to
home to explore*

the first time. One student remembered being amazed at seeing some insects because he/she “never realized all of the types of insects.”

For some participants, it was their first time to visit that particular park. One inventory leader reflected, “I met people who had never been to Dyke Marsh before so it exposed them to a new park. I also got to educate over 30 people about bats, including many enthusiastic children.” Finally, some participants learned about new ways to protect the environment: “Working with the macro invertebrates, this gave the opportunity for folks to see and appreciate some life samples of some of the species that determine the water quality in streams. This has led to folks volunteering for the local water-quality monitoring program. The BioBlitz created more public awareness.”

Q3C. HOW DID BIOBLITZ FOSTER APPRECIATION OF NATIONAL PARKS?

Additionally, the National Park Service hoped that BioBlitz would foster appreciation of national parks. Participants came to BioBlitz with a range of experience with the national parks, with some excited to visit a park for the first time, and others excited to contribute to and learn more about the local parks they frequently visit. Whether it was their first time, or they were frequent visitors, participants had many opportunities to learn something new about the parks. Many participants were surprised by the extent of biodiversity within the parks and came away with a new appreciation for the role of the national parks in preserving biodiversity. One member of the public marveled, “I think over 90 species of birds were identified within Cuyahoga Valley National Park. I had no idea there were that many in Ohio!” In fact, many members of the public expressed interest in further volunteer activities in the park, whether that be additional BioBlitz events or other opportunities to simply “volunteer to help protect parks.”

ATTITUDES TOWARDS NATURE, BIODIVERSITY, AND THE ENVIRONMENT

Another aspect of the goals of the BioBlitz events was the extent to which participation led to measurable and lasting changes in participants’ relationships with nature. Specifically, the three primary constructs of interest were appreciation of biodiversity, environmental advocacy, and comfort being in nature. Though long-term follow-up measures of these constructs were beyond the scope of this evaluation, short-term outcomes were measured at the end of participation for both student and public participants. Participants completed 16 questions related to these three constructs. To assess change through participation, they were asked first to rate how they felt before the BioBlitz and then were asked to rate how they felt after the BioBlitz. Both students and the general public reported significant changes in all three constructs.

Q4. HOW DID PARTICIPANTS’ APPRECIATION OF BIODIVERSITY CHANGE?

Participants’ appreciation of biodiversity was measured through four questions, including “My life is better because there are a lot of different kinds of plants and animals” and “It is important

to protect a wide variety of plants and animals.” Responses were on a 1-5 scale, where 1 corresponded with “Strongly Disagree” and 5 corresponded with “Strongly Agree.” The full frequency tables can be found in Appendix B.

Both students and the general public showed increased appreciation for nature and biodiversity following their experiences with BioBlitz. The public generally expressed higher appreciation for biodiversity before attending the BioBlitz than students reported. Students, however, showed more growth in appreciation after participating, possibly because they were starting with lower levels of appreciation and thus had more room to grow.

Figure 3. Means and Paired Samples T-tests of Appreciation for Biodiversity Scores for Student and Public Participants Before and After Participating in BioBlitz

	Mean (SD) Before	Mean (SD) After	Paired Samples <i>t</i>
Students	3.85 (0.88)	4.22 (0.76)	14.86**
General Public	4.61 (0.53)	4.71 (0.47)	3.84**

** $p < 0.01$; N = 670 for Students; N = 150 for Public

After assessing how much participants gained in their appreciation for biodiversity through their BioBlitz experiences, additional analyses considered which factors, including starting levels of appreciation for biodiversity, reported engagement in the activities, and CEI scores, were related to participants’ appreciation for biodiversity after BioBlitz. As might be expected, prior appreciation for biodiversity/nature was by far the strongest predictor of appreciation afterwards for both students and members of the public. For students, both curiosity and reported engagement of the event predicted greater gains, while only engagement predicted gains for the public. It is interesting that curiosity helps predict – for the public – gains in comfort in nature but not for Appreciation of Biodiversity. It may be that, for students, biodiversity was a new concept and thus their curiosity was triggered, while, for adults, this was less new and thus curiosity did not influence increased appreciation of biodiversity.

Figure 4. OLS Regression Results Predicting Appreciation of Biodiversity After Participating in BioBlitz for Student and Public Participants

	Students		Public	
	B (SE)	β	B (SE)	β
Appreciation before	0.49 (0.03)	0.56**	0.65 (0.05)	0.74**
Curiosity	0.24 (0.04)	0.20**	0.02 (0.04)	0.02
Engagement & Intentions	0.20 (0.03)	0.19**	0.12 (0.04)	0.15**
R ²	0.61		0.65	

** $p < 0.05$, ** $p < 0.01$; $N = 641$ for Students; $N=148$ for Public

A number of additional factors were related to gains for students. Elementary-aged students showed greater gains in appreciation for biodiversity than middle school students. Moreover, teacher preparation before the event was related to changes in appreciation of biodiversity. Specifically, when teachers attended professional development sessions ahead of time, and when they taught students how to use iNaturalist ahead of time, students showed greater growth in appreciation of biodiversity. Importantly, though whether teachers had taken the students outside before was not related to gains made through BioBlitz, this prior experience outdoors was strongly predictive of how much students appreciated biodiversity before attending the BioBlitz events.

Extent of biodiversity. In their open-ended survey responses, many of the participants remarked on the variety of species they were able to see. Some of these comments, particularly those from Washington, DC, were surprised by the extent of biodiversity within urban parks. One public participant described it as amazing that “a national park surrounded by urban population centers can have so much diversity!” Student survey respondents too, seemed amazed at the extent of biodiversity around them. One such respondent wrote about being amazed that “there are a lot of different plants just in Delaware!” Still others learned more about the diversity within a particular taxonomic group; as one member of the public shared, “I never knew how diverse and fascinating fungi could be on a rainy day!”

Others reported that the experience opened their eyes to seeing the world around them in a different way. One person admitted that the experience made him/her realize “how much is all around me that I never even noticed before,” and another described a change in him/herself going forward: “I will be more attuned to the diversity around me instead of just concentrating on the path in front of me.”

I will be more attuned to the diversity around me instead of just concentrating on the path in front of me.

Importance of biodiversity. Another recurring theme in the survey responses was an increased understanding of the importance of biodiversity. Many participants remarked on the co-dependence of many different species in complex ecosystems: as one member of the public phrased it, “We are a web, interdependent on each other.” A related theme frequent in responses was the idea of balance, and how “there's no way to predict how things change if just one link is lost.” One public participant recounted these ideas of interdependence and balance in detail:

“Diversity is a reflection of the health of an ecosystem. The greater number of plant species present allows a great number of animal species to exist because they have access to food, habitat, and places to raise young. Less diversity is an indication of stress on a system, indicating that the ebb and flow of nutrients had been disrupted. This can result from natural forces or human incursion.”

Finally, a recurring subtheme related to the importance of biodiversity was that humans rely on and benefit from the diversity of our environments. For example, some commented on how we currently rely on the resources of our environment for food, fuel, and shelter, and that it is important to our survival that we protect and conserve these resources. Many survey responses reflected students recognizing that plants and animals “give us things to survive” and “play a big role in the community.” Others noted how we have no way of knowing whether we may find future uses for currently untapped resources, such as medicinal properties of plants or other relevant information for research on medical cures; thus, it is critical that we maintain as much biodiversity as possible.

Q5. HOW DID PARTICIPANTS' INTEREST IN ENVIRONMENTAL ADVOCACY CHANGE?

Individuals' willingness to be environmental advocates and stewards was assessed through seven questions, including “I want to be involved in protecting and taking care of natural areas,” “I would spend my free time on a project to protect plants and animals in nature,” and “I want to give some of my own money to help protect wild plants and animals.” Responses were on a 1-5 scale, where 1 corresponded with “Strongly Disagree” and 5 corresponded with “Strongly Agree.” The full frequency tables can be found in Appendix B.

There were similar patterns in environmental advocacy as seen with appreciation for biodiversity. Both students and the public showed increased interest in environmental advocacy following their experiences with BioBlitz. Again, the public generally expressed higher advocacy before attending the BioBlitz than students, but students showed more growth in advocacy after participating.

Figure 5. Means and Paired Samples T-Tests of Environmental Advocacy Scores for Student and Public Participants Before and After Participating in BioBlitz

	Mean (SD)	Mean (SD)	Paired Samples <i>t</i>
	Before	After	
Students	3.41 (0.95)	3.78 (0.92)	14.70**
General Public	4.11 (0.67)	4.28 (0.62)	5.45**

** $p < 0.01$; $N = 648$ for Students; $N = 148$ for Public

When considering the factors related to participants’ interest in advocacy, once again, an individual’s’ openness, willingness, and motivation to be an advocate and steward for the environment after his/her participation in BioBlitz was most strongly predicted by predispositions to do so beforehand. In addition, both curiosity and reported engagement predicted greater gains in advocacy for students, while just engagement predicted greater gains for the public.

Figure 6. OLS Regression Results Predicting Environmental Advocacy After Participating in BioBlitz for Student and Public Participants

	Students		Public	
	B (SE)	β	B (SE)	β
Advocacy before	0.56 (0.03)	0.59**	0.72 (0.04)	0.78**
Curiosity	0.20 (0.04)	0.14**	0.06 (0.05)	0.06
Engagement & Intentions	0.32 (0.04)	0.25**	0.11 (0.05)	0.11*
R ²	0.69		0.71	

** $p < 0.05$, ** $p < 0.01$; $N = 622$ for Students; $N = 146$ for Public

As with appreciation for biodiversity, gains in environmental advocacy were greater for elementary school students than middle and high school students. Teacher prep was related to changes in environmental advocacy. Specifically, when teachers attended professional development sessions, taught students how to use iNaturalist, and/or taught about biodiversity before attending the BioBlitz, students showed greater growth in environmental advocacy. Again, though whether teachers had taken the students outside before was not related to gains made through BioBlitz, this prior experience outdoors was strongly predictive of how much students felt motivated to be advocates for the environment before attending the BioBlitz events.

MOTIVATION TO MAKE CHANGES IN THEIR COMMUNITIES

I believe humans have the responsibility to protect [biodiversity] and be good stewards

Many participants felt empowered by the experience to implement changes in their everyday lives to be better advocates and stewards for the environment. Some initiated efforts to preserve or protect aspects of their local ecosystems³. One person planned to get more involved in zoning/building decisions in his/her community. Another participant felt “galvanized...to take action in my own neighborhood. My friend who accompanied me and I are actively working on invasive species control in our own areas. We have made huge strides [...] and plan to expand our reach when we are done there.” Students too, seemed motivated to make changes in their daily routines to protect the environment. Many student survey respondents wrote that they would “use less water,” “recycle more,” “ride bikes more,” and “stop littering.”

EDUCATING OTHERS

Another common theme related to environmental advocacy was the intention to educate others about the environment. Many participants planned to teach their children about the importance of biodiversity and caring for the environment. Others wanted to broaden their reach; one participant wrote an article for a local magazine, and a few were determined to reach out to youth in their neighborhood to educate the next generation of naturalists and scientists.

DESIRE TO VOLUNTEER FOR NATIONAL PARKS

Finally, many participants felt compelled to be advocates for the national parks. A desire to learn more about their local national park was a primary motivation for many participants’ involvement in the BioBlitz activities, and multiple individuals expressed an interest in finding additional ways to volunteer in the park in the future. One such student respondent wrote, “I want to learn about more so I can join BioBlitz when I grow up.”

Q6. HOW DID PARTICIPANTS’ COMFORT IN NATURE CHANGE?

Finally, participants’ comfort spending time in nature/outdoors was assessed through 5 survey questions asking them how comfortable they were engaging in particular activities, including “Sitting on the ground” and “Encountering spiders and insects.” Responses were on a 1-5 scale, where 1 corresponded with “Very Uncomfortable” and 5 corresponded with “Very Comfortable.” The full frequency tables can be found in Appendix B.

There were similar patterns of results compared to the other two constructs. Both

Most amazing was seeing young children getting excited about exploring nature

³ The bulk of the surveys were distributed in June 2016, meaning that most participants received the survey approximately one month after participating in BioBlitz. A few were provided the link to the survey at BioBlitz and could have responded within a day or as long as two months after the event.

students and the public showed increased comfort following their experiences with BioBlitz. Again, the public generally expressed higher comfort beforehand, but students showed more growth in comfort. BioBlitz also helped facilitate activities that students had never previously participated in, which increased their appreciation for nature and being outdoors. One student wrote, “I liked being outdoors because I had a few new experiences.” Another such student recounted enjoying having a picnic outside for the first time.

Figure 7. Means and Paired Samples T-Tests of Comfort Being in Nature Scores for Student and Public Participants Before and After Participating in BioBlitz

	Mean (SD) Before	Mean (SD) After	Paired Samples <i>t</i>
Students	3.22 (0.91)	3.58 (0.98)	13.56**
General Public	4.36 (0.72)	4.44 (0.62)	3.51**

** $p < 0.05$, ** $p < 0.01$; $N = 691$ for Students; $N = 150$ for Public

In terms of explaining gains, tolerance/comfort showed similar patterns as those above. The strongest predictor of how comfortable individuals felt being in nature after participating in BioBlitz was how comfortable they felt beforehand. Once again, both higher curiosity and higher reported engagement of the event predicted greater gains in comfort for students. For the public however, curiosity predicted gains, while reported engagement did not. This was a different pattern than seen with the other two constructs.

Figure 8. OLS Regression Results Predicting Comfort in Nature After Participating in BioBlitz for Student and Public Participants

	Students		Public	
	B (SE)	β	B (SE)	β
Comfort before	0.65 (0.03)	0.58**	0.77 (0.03)	0.89**
Curiosity	0.29 (0.05)	0.18**	0.09 (0.03)	0.09*
Engagement & Intentions	0.22 (0.04)	0.16**	0.03 (0.04)	0.03
R ²	0.63		0.86	

** $p < 0.05$, ** $p < 0.01$; $N = 651$ for Students; $N = 147$ for Public

Elementary-aged students showed greater gains in comfort than both middle school and high school students, and teacher preparation predicted greater gains. Specifically, when teachers attended a PD session or taught about biodiversity ahead of time, their students showed greater gains in comfort being in nature. As with the other two constructs, how comfortable students felt being in nature before attending the BioBlitz was also predicted by whether the teacher had taken them outside before.

EMBRACING THE ELEMENTS

Part of being comfortable in nature is the acceptance that elements, such as dirt and weather, may be beyond control. A number of participants mentioned how it was fun for them to “get dirty” outside. One member of the public reflected on how enjoyable it was seeing her granddaughter “enjoy getting wet and muddy and putting her hands in the muck.” Participants’ experiences in the outdoor activities inevitably was influenced by the weather. A handful of events took place on rainy days. While some participants voiced some complaints (e.g., a need for more tents at the festival, better communication regarding cancellation in the event of inclement weather), others learned to embrace the rain. As one public survey respondent stated, “I learned that I can spend 2 hours in the rain looking and not seeing, but hearing lots of birds and still have fun.” Student respondents too expressed that they enjoyed the event despite it being “hot and muddy.”

One other thing I learned as I held a turtle for a teenager to photograph is why it was called a stinkpot!

BECOMING MORE COMFORTABLE WITH PARTICULAR SPECIES

BioBlitz exposed participants to an array of new species, and a few remarked that the experience made them change their views on particular taxa. For example, one public respondent, who admitted that she/he previously was afraid of insects, commented that though the experience did not completely dispel this discomfort, “I appreciate their role in the ecosystem more.” A student survey respondent reported realizing that “people are scared of bats for no reason.” Another student wrote that BioBlitz helped dispel the fear that “it was not safe to go outside because of the animals.”

Q7. WHAT WAS THE IMPACT ON SCIENCE RESEARCH IN NATIONAL PARKS?

SCIENTIFIC RIGOR AND PUBLIC PARTICIPATION

BioBlitz had multiple goals, including both engaging the public and contributing to science. A subset of inventory leaders/Pro-Observers commented on the challenge of engaging the public while collecting data in a scientifically rigorous manner. The importance of citizen science was acknowledged and recognized by many as a goal of the event, yet there were still significant concerns regarding the quality of data collected. As one inventory leader said, “Public education is the only reasonable goal for a short blitz with invertebrates, the inventory is woefully incomplete, even of the few species that would be mature on the one day blitz, so a general education goal is a good one, but the limited data collected is not very useful or indicative of the true diversity.” Only 27.2% of inventory leaders and Pro-Observer survey respondents planned to use data collected by iNaturalist in the future, and just 20% planned to use the data generated through the BioBlitz. Indeed, several scientists expressed concerns about the message that

public participants and students might take away from BioBlitz about the nature of the scientific process. One leader remarked:

The fundamental goal of the BioBlitz was unclear. On one level it was billed as a science tool to aid park management and scientific understanding; however, it was not approached or organized as a scientific study would have been. It was organized and planned more as an environmental awareness, public media event, using biodiversity as the "hook." I fully understand both "sides" and I understand that many (if not most) of BioBlitzes are often a little of both...It is also important not to oversell the scientific merits of such an event, if the project does not have the scientific credibility as claimed in the media."

Despite concerns regarding the quality of inventory data collected, a few inventory leaders/Pro-Observers described ways in which BioBlitz had already begun to have an impact on their research. One said, presumably about data collected in prior BioBlitzes, "We have published a new species, have another we are working on. We plan a consolidated paper about the [species] in national parks." Others noted ways in which BioBlitz *could* affect their work. In general, the

data themselves were seldom a focus of future research (although at least one scientist did indicate how they would use the data from the observations), and others found the identification of new or rare species a benefit. One wrote, "I will know where certain species are located, and I will be able to study those species better." Finally, some inventory leaders indicated that this BioBlitz was a start to a larger project. One said, "If I'm able to complete a park-wide lichen survey I will be able to incorporate the data into my botany college-level course. We will use the data to examine lichen distribution and their habitat preferences."

The camaraderie, support, opportunity to network with other scientists, and organizations made it so much fun to be a part of

EXPERTS NETWORKING WITH OTHERS (MULTIDISCIPLINARY, CROSS-REGIONAL)

Several inventory leaders and Pro-Observers noted that they felt the opportunity to meet and work with others from both the same field as well as those with different expertise was very beneficial to their work, as well as personally enjoyable. One scientist wrote, "BioBlitz allowed me to work with researchers from fields I wouldn't have engaged with otherwise, and I hope that research collaboration will continue."

When asked what the most valuable aspect of the BioBlitz event was for inventory leaders and Pro-Observers, a common response was the networking opportunities for experts. As one said, "I really enjoyed getting to meet other experts and discuss research and projects with them at the

dinner -- it was a lovely time and I just want to say thank you for providing us all that opportunity.” These responses aligned with one of the large-scale goals of BioBlitz: to build community. Although one might be initially inclined to think of community among the public participants, the community of scientists, naturalists, park rangers and other experts was also nourished through the opportunity to work together. In particular, at the Crater Lake event, entomologists from around the state of Oregon lived and worked together for two days, enabling sharing of information, research, and strategies.

LEARNING MORE ABOUT COMMUNICATING WITH THE PUBLIC

In the inventory leader/Pro-Observer feedback survey, 38.9% of respondents indicated having professional experience or training on how to communicate with the public about science. Some of the participating inventory leaders and Pro-Observers indicated that they work at least periodically with the public, and a few said they felt the experience improved their ability to communicate with the public. One inventory leader said, “It will help me to assemble information that can be understood and appreciated by a public audience,” while another remarked, “I learned a lot from the attendees of my sessions, how little people know about lichens and how I need to adapt to teach about this group of generally not known group of composite organisms.”

While not all inventory leaders or Pro-Observers indicated their skills in communicating with the public about science had improved, several mentioned an increased awareness of the importance of these communications and of including the public in their scientific endeavors. One said, “I’ll try to envision new ways to involve the public in research so that they have a larger investment in the amazing treasures within our parks.”

CONCLUSIONS AND RECOMMENDATIONS

We found that BioBlitz was fun, engaging, and educational for almost all participants. Students enjoyed being out in nature, seeing organisms in the wild, manipulating tools, and meeting scientists. The public, who, in general, had come to BioBlitz already comfortable in nature, enjoyed working with scientists and learning about biodiversity and their local park. We also learned that some elements can increase the likelihood of a very successful event.

A wide range of models or formats can be successful. We found that the effectiveness of the BioBlitz experience did not seem to be related to the model or structure of the event. Both large events – with hundreds of visitors and many inventories – and small events – with a handful of visitors and only a few inventories – could be successful in meeting their goals. Some events were focused on a single taxon, while other events collected data about many different taxa; events from both categories were engaging and effective. The key element that made for successful programs was that activities were aligned with goals and then communicated effectively with participants.

Define goals and align activities to those goals. BioBlitz, like many citizen science projects, provides a great opportunity to address many goals simultaneously: to get the general public into natural areas, to help them be comfortable in nature and learn about biodiversity, and to increase their interest in advocating for the environment. It also allows scientists access to a workforce that can collect data that can be used to answer scientific questions. It is important that the goals be clearly defined, however, so that activities can be aligned to those goals, and then the entire package can be communicated to all participants. Parks (or other organizers) need to identify research questions that realistically can be addressed through BioBlitz events. If a park opts to focus on getting the public into the park and out of doors, then the event should not be marketed as contributing to science, unless that goal is also intentionally addressed. If the goal is data collection for purposes of scientific research, then it is critical that inventory leaders understand the goals and that those protocols be followed.

If data collection is important, specify mechanisms to record data. Goals of BioBlitz can range from getting people outdoors into nature to ensuring high-quality data for analysis about biodiversity within a park. No matter the goals, however, most parks told the public that this was a chance to help collect data about biodiversity. While there were some instances of parks collecting and using data from BioBlitz, expectations, procedures, and goals for data collection were not always clearly defined. In addition, some participants without smartphones, tablets, or cameras indicated that they did not have a way to collect, record, or share data. They observed, for example, salamanders in the creek, but they were not able to take photos or upload. They enjoyed the experience, but they were not part of a data collection event. If the data are

important, then the organizers need to ensure that there are ways that the data are collected and transmitted effectively, and that the public's contribution is acknowledged.

Ensure that public access is meaningful but that the environment is protected. The goal to protect natural and cultural resources has been and will continue to be a key part of the mission of the National Park Service. If working with intermediary organizations, it will be important that park personnel communicate the balance between access and protection. BioBlitz has ambitions to expose new visitors to the natural world, but it is essential that the right balance be found in order not to damage the very ecosystems being explored. Parks need to decide if they want to bring in as many visitors (and new visitors) as possible or if their limited resources, low accessibility, and fragile environments preclude large-scale access. Some parks have fragile environments or limited access, so they cannot advertise widely and bring in too many new visitors. Other parks are the home to endangered species, so the data collected there need to be masked so that the rare organisms can be protected. Park personnel (or managers of other natural environments) should weigh their different options before designing BioBlitz activities.

Access to tools of science increase engagement. While most participants seemed to enjoy BioBlitz, levels of cognitive engagement appeared to be greatest when participants were using tools of science – nets, beat-sheets, binoculars, aspirators, and other tools. Figuring out how to use the tools and using the tools to capture or explore organisms created fun challenges for participants and encouraged their deeper engagement in the process.

Festivals can be educational. The festivals ranged in size and scope, and the specific content of the booths varied. Many participants indicated that they found the activities in the booths educational and learned a lot from their experiences at the festival. Some festival booths included hands-on activities that educated students and the public about science, culture, and history. These experiences provided an opportunity for learning for those that could not participate or were not aware of inventories.

Communication is key. Some participants and inventory leaders noted that improvements could be made to ensure better publicity and communication of logistics. Parks that worked with community partners, who handled these aspects, were more likely to have well-attended events with fewer instances of logistical miscommunications. Some parks might find it helpful to partner with an outside organization to handle the publicity and recruiting participants (and other logistics).

Teachers can help make the most of the experience. Students of teachers who had participated in professional learning experiences prior to BioBlitz showed greater gains, suggesting that their teachers were able to provide a more complete experience by tying what they did in the field to what they did in the classroom. We also found that students who had been taken out of doors by their teachers prior to BioBlitz showed greater appreciation for biodiversity, interest in

environmental advocacy, and comfort in nature. The more the BioBlitz experience is integrated into other classroom activities, the more effective being in the field can be.

Having an iNaturalist expert along increases effectiveness of inventories. Many scientists expressed appreciation for having an iNaturalist Pro-Observer along on the inventory. Inventory leads were able to focus on communicating the science or information about the organisms, while the Pro-Observer was focused on dealing with any technical questions that arose. We also recommend, however, that certain features of iNaturalist be explained more clearly to scientists and experts. For example, several scientists thought that sounds could not be recorded in iNaturalist, making it less functional as a repository of bird sightings. Others thought that the location of endangered species was made public, thus providing additional endangerment to those species. The affordances of iNaturalist need to be communicated fully with the inventory leaders and scientists.

Appendices

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APPENDIX A: IMPLEMENTATION

One strength of BioBlitzes is that they can be implemented in a wide variety of ways and tailored to meet the needs or the goals of a particular park. Some of the variations include the goals of the event, the design of the inventories, whether a festival is included, the desired and expected number of participants, and the role of experts such as scientists. Parks varied in features of organization and implementation, such as extent of communication leading up to the events, organization the day of, and resources dedicated to the event. This section explores the range of ways in which BioBlitzes were implemented in the 2016 NPS-wide event.

INVENTORIES

BioBlitz scientific inventories are events where a group (sometimes school groups, sometimes the general public) explores an area with the purpose of finding and identifying the different types of species there. Each group was led by an inventory leader and some had additional support from park rangers. Many of the inventories had a specific focus, ranging from “Culturally Valuable Species” to “Reptiles and Amphibians.” Most inventories involved a combination of nature walk and data collection.

Across the observations made by the evaluation team, the average amount of time spent for each inventory was 81 minutes. Public inventories tended to be a bit longer, averaging 99 minutes in length. School inventories were shorter, averaging 37 minutes in length. On average, the inventories we observed had 13 participants. In public inventories, the average number was 10 participants while the school groups averaged 19 participants (including teachers and chaperones). Most inventories included the public, but, of the ones we observed, a small subset (9%) were designed for experts only.

Information on public inventory participants was collected through a survey. Of the public participants who responded to the survey, most attended in the company of other people, primarily family. Fifteen percent attended with their children, and 26% attended with other family members. The majority of public respondents (75%) were female and white/Caucasian (88%). Most were either employed full-time (54%) or retired (23%), and overall they were very highly educated, with 83% having a master’s degree or higher. Public participants who completed the surveys ranged in age from 18 to 78, and averaged 48.3 ($SD = 14.87$) years (though only those who were above 18 were allowed to complete the adult survey). Most public respondents

reported attending one inventory (59%), but others reported attending zero (8%), two (22%), or more than two (10%) inventories.

Structure of an Inventory

While inventories varied, one common structure begins with participants meeting at a designated location. A park staff is present at the meeting site to take names and make certain all participants have completed safety waivers. The inventory leader steps forward and introduces him/herself, offering name, organization, and position within the organization. He/she may briefly talk about research focused on the particular taxon or taxa being inventoried and also provide a brief overview of the inventory to help orient participants: “We will walk from here down the trail to the river, where we have nets and pans that we will use to capture some of the macroinvertebrates. You can take pictures of them, and post the pictures on iNaturalist. Let’s go see what we can find.” Along the trail, the leader might turn over a rock to reveal a salamander or cicada and offer a few facts about the organism in view. In general, the participants listen with some interest, and one or two may ask a question. Then the group moves on, walking slowly towards the river, until something else catches their attention or the attention of the inventory leader. Eventually, they reach the river. The inventory leader demonstrates how to use a small net, where macroinvertebrates are most likely to be found, and encourages participants to take photos of their finds and post their observations to iNaturalist. For 30 minutes, participants wade in the river or walk along the bank, turning over rocks, sifting through the mud, looking for organisms. As cries of, “What’s this?” and “Oh, I found something!” ring out, the inventory leader moves through the area, answering questions, providing advice, and ensuring that no organisms (including the participants!) are harmed. When time is up, the inventory leader says, “That was fun. Can you tell me about something you saw that surprised you?” After a brief reflection, the group heads back to the meeting site, thanks the inventory leader, and goes on to their next activity.

According to the surveys of public and inventory leaders, most inventories focused on a single taxon, although the range of the species covered by different inventories was wide. Among taxa covered were invertebrates, amphibians, birds, bats, fungi, and plants. For instance, one inventory held at Crater Lake National Park focused on identifying species of beetles, while an inventory at Rock Creek National Park in Washington, DC, focused more broadly on amphibians, including different species of salamanders and newts.

According to the data from observations of the inventories, most inventories consisted of two main activities: 1) the inventory leader provided information about the taxa of focus or the environment. Sometimes the inventory leader focused on where the species might be found or how to collect that species. Sometimes, the inventory leader provided information about other species found during the inventory; 2) participants explored the territory, searching for species, and recording their observations via iNaturalist or other means.

For most inventories, inventory leaders would ask some questions of participants but the bulk of their interactions consisted of the inventory leader providing information to participants. There were a few participants who were very engaged and asked a lot of questions, but most participants would only ask for occasional clarification or verification. Common questions focused on how to use iNaturalist or whether a specimen they were viewing was the same as one in their reference book. A lack of probing questions is not indicative of lack of interest in the activities, however. Most accounts are of very engaged participants who were excited to collect data and listened attentively to the descriptions and explanations by the experts but did not necessarily ask many questions. One notable exception to this trend was a school group whose participants had been chosen based on their interest in science. This was a very talkative and inquisitive group.

ROLE OF INVENTORY LEADERS

Scientists and other experts participated in BioBlitz events through multiple roles, including leading inventories; acting as “iNaturalist Pro-Observers,” (responsible for recording observations on iNaturalist and helping participants), and through providing logistical support for the event as needed. Not all inventory leaders or iNaturalist Pro-Observers were professional scientists, and others who filled these roles were park staff, naturalists, or various experts invited by the host park or National Geographic. In a feedback survey, inventory leaders and Pro-Observers were asked a series of questions about their experience in the event, their interpretation of the goals of the event, and how the event may have had an impact on their work. One question asked the role of the experts during the event, and found that 56% of respondents participated as inventory leaders, 27% of respondents participated as iNaturalist Pro-Observers, and 5% did not participate in either of these roles, but self-described their role during the event as “scientist,” “researcher,” or “expert.” Other comments made throughout the survey indicated that some of the experts were expecting to have more of a role interacting and teaching the public, but instead were needed for various logistical tasks (more information to be provided later in the report).

The role of the inventory leader is inherently complex with many unpredictable factors—weather, number of participants, presence or absence of the species of focus, challenging terrain—so it is understandable that not everything worked perfectly. Even for inventories with successful outcomes for the participants and/or scientific inquiry, there are likely improvements that could be made. The inventory leaders who responded to the survey (typically those with the most positive or negative feedback) provided constructive comments that will be useful for future events. This report highlights a cross-section of inventory leaders’ comments.

The feedback survey demonstrated a range of inventory leader and Pro-Observer understandings of specific individual goals of BioBlitz, with emphases on either engaging people (the public) with nature or producing meaningful scientific data. For example, summaries of the inventory leader/Pro-Observer perception of BioBlitz goals that focused specifically on producing data included responses such as “a focused effort to identify as many species as possible in a specific area,” “to document biodiversity,” and “identify species in an ecoregion.” Interpretation of the BioBlitz goal of engaging the public included responses such as “Inspire and engage the public” and “To engage the community in citizen science.” Fewer respondents saw both of these goals as intertwined or connected, but one participant eloquently described BioBlitz goals as twofold, to both inventory species and engage the public in nature:

I think the BioBlitz goals were simple. I think the NPS wanted to use true scientific inquiry and data-finding to create more complete species lists for each park. But just as equally, I think the NPS wanted to create community outreach in the form of teaching the general public (and especially school children) the importance of our national parks, their role in nature, and giving them reasons to want to protect our public lands.

PLANNING AND LOGISTICS

National Geographic and NPS provided guidance, training, marketing assets, and technical assistance to all NPS units that hosted a BioBlitz in 2016. However, the units were given autonomy to select their own protocols, schedules, and areas of focus for each event.

National Geographic’s Network of Alliances for Geographic Education collaborated with NPS on at least 102 of these events. Resources created by National Geographic for the DC event, including educational materials, tutorials, promotional materials,

and signs, were shared throughout the NPS and Network of Alliances to support other BioBlitzes.

In total, 129 park units planned at least one BioBlitz for the NPS centennial year. Many of these BioBlitzes used marketing resources created by the NGS Brand Marketing team, leading to a cohesive look and feel. Each of these BioBlitzes had an associated iNaturalist project, which all featured National Geographic branding. (See the [Acadia BioBlitz Project](#) as an example.)

The National Parks BioBlitz Webinar Series featured presentations about the components commonly encountered in BioBlitz planning. Park staff, partners, and members of the general public, totaling more than 550 people, joined this eight-part series every Thursday during January and February 2016. Topics included: an introduction to the 2016 National Parks BioBlitz, using iNaturalist, planning a biodiversity festival, implementing use of the Institutional Animal Care and Use Committee, collections management, and general BioBlitz health and safety protocols.

Notwithstanding available planning resources, effective organization of the events varied widely, at least from the perspective of the inventory leaders. While some found the events well-run, others felt that the event did not meet its potential. One inventory leader who had participated in BioBlitz events in the past found this year's event to be especially well-organized. "I loved all of the planning involved -- I have attended some BioBlitzes where there was not much planning, and the results (public participation and observations identified) were majorly lacking. The planning on these BioBlitzes definitely paid off! AWESOME job to all." However, inventory leaders and Pro-Observers from several different events felt that the marketing and outreach was too limited or not well-handled. One said that the "outreach and marketing could've been broader or more far reaching to expand participation. [I] felt the attendance was low for an area in [our state] that has high tourist visitation." When trying to figure out why attendance was so low, another leader felt that the lack of publicity held more explanatory power than the rain: "Being such a large event for this region. More time should have been spent on planning. The weather wasn't the best, but our park had very little participation in terms of the number of volunteers." At a different park, one inventory leader mused that, "This particular BioBlitz had virtually no publicity so 'the public' didn't show up. Therefore the public education aspect was not met, with the exception of a couple of students who came with one of the bat researchers and learned more about bats."

It should be noted that some parks opted not to publicize the event widely, mostly because of concerns about the impact of crowds on the environment or because of limited infrastructure available. One expert wrote, “At one point I had 50 students to myself at President's Park. This is far too many and it wreaked havoc on the landscape! Thank goodness the Park Ranger was able to point out a stump that was scheduled to be removed so we could contain the damage to one area.” Another said “I suspect that besides the public outreach benefits, BioBlitzes may be a viable approach for quick intensive inventories on poorly or incompletely surveyed sites. I'm not sure how that meshes with the public teaching / outreach approach.”

Some inventory leaders noted improvements could be made in relaying logistics and expectations and a contingency plan for notification in instances of inventory cancellation. A number of inventory leaders who responded to the survey, expressed uncertainty regarding their expected role in the experience or would have liked more information. Other instances of logistical confusion due to unclear communication included lack of notice when events were rained out, unclear understanding of where event check-ins were located, and unclear understandings of transportation from inventory to inventory.

BRINGING THE CLASSROOM TO NATURE

Two main goals of the 2016 BioBlitzes were 1) to reach people who may not otherwise visit a national park; and 2) to educate the public about the benefits of biodiversity. One way to meet both of these goals was to bring school groups - - teachers and students -- to participate in BioBlitz. Many of the BioBlitzes intentionally reached out to and included school groups. We surveyed 35 teachers who participated in BioBlitzes in eight different states. The students associated with those teachers came from all grade levels: 41% were from elementary schools (grades K-5); 37% were from middle schools (grades 6-8); and 22% were from high schools (grades 9-12). The teachers taught a range of subjects, including general education; humanities; social science; general science; biological, chemical and physical science; and environmental sustainability.

Teachers came to BioBlitz having completed a range of preparatory activities with their students. About half (47%) of teachers who completed the teacher survey reported attending a professional development session ahead of time. In Washington DC these sessions were conducted by staff from National Geographic and the National Park Service and focused on preparing teachers for the BioBlitz activities, including the use of iNaturalist.

BioBlitz was wonderful, it was a classroom outside

In addition to the official professional development sessions, teachers prepared their students for BioBlitz in a number of ways. The most common preparatory activity teachers implemented was talking to their students about biodiversity, which 76% of teachers reported doing. Additionally, almost half of teachers (45%) practiced using iNaturalist ahead of time. The least commonly reported activity was taking their students outside. While only 18% of teachers reported taking their students outside prior to BioBlitz, these outdoor experiences had a big impact. Students of these teachers reported significantly higher starting scores on appreciation for biodiversity, interest in environmental advocacy, and comfort being in nature compared to students whose teachers had not taken them outside prior to BioBlitz.

USING THE TOOLS OF SCIENCE

Another goal of BioBlitz was to help the public (especially K-12 students) understand more about where scientists work, how they work, and the tools they use. Many inventories included the use of the tools of science, partially to enable data collection and partially to allow participants to experience being scientists. By holding, using, and experimenting with tools, the hope is that participants will be more engaged and more active learners.

In addition to iNaturalist and smartphones, the public reported using nets, magnifying glasses, microscopes, bat monitors, and binoculars. The particular tools used depended on the nature of the inventory. For example, binoculars were often used for bird inventories, while macro lenses and magnifying glasses were often used for plants and insects. Frequently, inventories incorporated multiple tools. For instance, as one leader described, “We used the nets to catch things. We used the vials to handle things for close inspection and we used the magnifiers to see details.”

Inventory leaders and Pro-Observers perceived binoculars and cameras to be two of the most useful tools for participants. However, the majority of inventory leader/Pro-Observer survey respondents found tools and resources that were not listed on the survey to be most useful to participants. Tools/resources included items such as field guides, light attraction equipment, bug boxes, first aid kits, sonar detectors, recordings of frog/toad or bird calls to attract animals, microscopes, and the availability of experts were all listed as very valuable tools for participants.

Bat monitors were a particular favorite among participants. One public participant reflected, “We loved the bat sonic detectors, particularly that you can now identify the species of bat from their echolocation!” Another wrote, “Using the bat monitors to ‘hear’ their echolocation. It was really cool to hear them coming in from behind us

and swooping overhead. Being able to hear that added a completely different dimension to the experience of just watching them swoop around.”

iNATURALIST

A common tool used by many parks was iNaturalist, an app and website that allows users to upload geotagged photos of organisms that may then be identified by a network of experts. While not all parks opted to encourage their participants to use iNaturalist, most did. A glimpse of the iNaturalist data demonstrates the extent and reach of the BioBlitz events. Figure 9 presents the number of observations, species observed, and user accounts from the Cornerstone and Regional events.

Figure 9. iNaturalist Data from Cornerstone and Regional Events*

BioBlitz Name	Observations	Species	User accounts
National Totals	132,659	12,584	6,285
Washington, DC Capitol Region	7,777	1,192	483
Cuyahoga Valley, Ohio	7,509	1,505	404
First State, Delaware	303	126	73
Bandelier, New Mexico	635	337	44
Congaree, South Carolina	1,064	282	71
Santa Monica Mountains, California	1,626	329	61
Olympic, Washington	709	343	66
Bering Land Bridge, Alaska	337	106	46

**as of November 14, 2016*

It should be noted that this information does not necessarily reflect the total number of participants; it only demonstrates the number of species and observations recorded by users of iNaturalist. Take, for example, Cuyahoga Valley. While 318 user accounts contributed to iNaturalist data, some individuals attended multiple inventories. We know this because 540 tickets to inventories were distributed to 230 individuals. People often registered for other members in their party as well: while 124 people only requested one ticket, 87 requested two tickets (which might have been for multiple events or for two people to attend the same event), and 50 request 3 or 4 tickets. One person requested 12 tickets.

As a tool, iNaturalist received generally positive, though mixed, reviews. Many participants and experts found it a useful tool. One expert called it, “a game-changer” while another thought that “everyone should join iNaturalist” and “do observations

year-round.” S/he argued that this is because “the best observations come during quiet moments alone in the woods, not during hectic, competitive Blitzes.” Another expert believes iNaturalist was a good learning tool, saying, “When a participant of one of the BioBlitzes takes the tool of iNaturalist home or elsewhere -- I think they become aware of biodiversity all around them. These BioBlitzes introduced them to this nature awareness and appreciation.” Another said, “The use of the iNaturalist app links a modern and heavily used technology (smartphones) with nature and biodiversity inventories in a citizen science platform that is accessible to anyone. It will help connect people to nature and to be better stewards of the lands and waters.”

Other experts felt that iNaturalist had a potential for a tool for science, with one describing a possible use: “I realized that if more people make an effort to find bats and post data on iNaturalist, it may be possible to detect migration patterns for multiple species which until now have been poorly understood.”

Non-expert users frequently found iNaturalist fun and easy to use. One user wrote, “The iNaturalist community makes it really fun to take pictures with my iPhone and post them. It's great to have people identify plants and animals in my area based on my pictures.” Students, in particular, were very excited about using iNaturalist, although many were disappointed they didn't get more time with it. One student wrote, “I wish I could have used iNaturalist more.” This sentiment was echoed by many others in the student survey responses collected.

On the other hand, several individuals, both public users and experts, struggled with iNaturalist. One issue that was raised several times was the confusing and complicated species identification processes. One expert said, “If I did this again, I would be sure participants put the scientific name with the photo and I would talk to the participants about what makes a good quality photos that can be used for identification.” Similarly, a public user wrote, “Some things [about iNaturalist] required too much explanation (like how to categorize something as mammal, plant, then the species, etc). I'd make that easier for anyone to use, without any explanation.” Especially as the app is designed for non-experts to upload photos that can be identified by experts, placing photos into a category for easy sorting by experts is a critical feature. Additional research on how users approach the current functionality would be useful.

Some participants and experts did not use iNaturalist for a variety of reasons. One common reason was that the weather prevented use. For example, one participant wrote, “I had planned to take many pictures/use iNat, but it rained all day so the

camera did not come out at all.” Another common issue was that people did not have the requisite technology. One said, “I wanted to use iNaturalist but don’t have an iPhone I’m also unable to load it on my computer.” Still others reported that their phones ran out of battery quickly, and consequently they were unable to use iNaturalist for the duration of the inventory.

In addition to problems with functionality or access, other raised questions about the role of iNaturalist in BioBlitzes. One expert, who focuses on birds, said that requiring iNaturalist was not useful for data collection. Several participants were on bird inventories and said that, while they and an expert were able to identify species by viewing a bird through binoculars and listening to its sound, they had no evidence that could be uploaded to iNaturalist. One expert suggested allowing a different app called “iBird” while another thought that allowing the uploading of sound files, in addition to photos and videos, would make iNaturalist more useful for birders. While iNaturalist does indeed allow sounds to be uploaded and to register as observations (<https://www.inaturalist.org/posts/1860-recording-sounds>), this is not widely known. For species such as frogs and birds, it is important to ensure that inventory leaders are aware of the sound-capture function.

Finally, several teachers commented that using a phone or tablet outdoors, even in the interest of science, seemed anathema to the goal of getting kids out of the classroom, away from technology, and enjoying nature. A similar idea was echoed in one inventory leader/Pro-Observer’s survey response, in which she/he commented, "Using a phone app to observe things is a double edged sword though- people get caught up in difficulties using their phone, the app, the camera, etc., instead of focusing on the organism."

FESTIVALS

Although not a required component of a BioBlitz, a festival provides an opportunity to attract the public, to offer them fun activities and entertainment, and make the event more appealing and more exciting. The festivals were generally placed in central locations in the park, and featured, food, entertainment, booths with activities, giveaways, and learning experiences.

In total, a little over half (56%) of public survey respondents attended a festival. According to the public surveys, half (50%) of public participants attended both a festival and an inventory, slightly less than half (44%) attended an inventory only, and the remaining 6% attended a festival only. (Some parks may not have offered festivals, so this number does not indicate the percentage people who had the

opportunity to attend a festival and did so.) Those who attended a festival reported a range of time spent there, from less than an hour through up to three days. Students and teachers, on the other hand, were more likely to attend a festival, whether in conjunction with an inventory or in isolation. Slightly less than half (41%) of the classroom teachers reported attending both a festival and an inventory; and another 41% attended festival only; the remaining 19% attended an inventory only.

There were also some areas for potential improvement in the festivals. For example, weather had a large influence over the extent to which participants were able to enjoy the festivals, and a few suggested that organizers should have had contingency plans in place in the event of inclement weather such as a tent and chairs for the closing ceremony. There were other recommendations for improved implementation, particularly related to communication and publicity including clarifying that, in most cases, participants could attend the festival and/or an inventory and not have to choose between them.

For the majority of respondents however, the festivals elicited praise. Many members of the public were enthusiastic about the variety of exhibits and opportunities to learn more background information for the inventories and about biodiversity in general. For some, the explicit focus on education was engaging and satisfied their eagerness to learn; as one member of the public put it, “I liked the festival more because I love learning.” Others reported that they found information presented at festivals to be interesting and useful, with implications for their daily lives: “I stopped at a nursery on the way home and bought some wildflowers for my yard that were recommended at the festival.” In addition, those who also participated in inventories reported that the festivals served as a nice complement to their work in the field, or as “a great way to top off the participants’ experiences.” Open-ended student survey responses too showed significant enthusiasm for the festival. A lot of students found it entertaining, with many writing that they enjoyed the band and dancing. The festivals also served as a good respite after the inventory. One student wrote, “I liked the festival better because I could sit on the grass and it was funny seeing the park rangers dance.”

APPENDIX B:

FREQUENCY AND SUPPLEMENTARY TABLES

Table B1. Student Engagement & Intentions

Engagement & Intentions item	Disagree strongly	Disagree	Neither	Agree	Agree strongly	Mean	n
a. I liked BioBlitz (BB).	2%	3%	11%	36%	48%	4.26	736
b. I learned new things about nature/biodiversity from participating in BB.	2%	4%	10%	45%	40%	4.18	734
c. After participating in BB, I want to learn more about nature/biodiversity.	4%	9%	27%	31%	29%	3.72	703
d. <i>I thought BB was boring.</i>	<i>41%</i>	<i>29%</i>	<i>16%</i>	<i>8%</i>	<i>7%</i>	<i>2.12</i>	<i>728</i>
e. <i>BB was too long.</i>	<i>34%</i>	<i>29%</i>	<i>19%</i>	<i>11%</i>	<i>7%</i>	<i>2.27</i>	<i>720</i>
f. BB was entertaining.	2%	5%	15%	40%	38%	4.05	726
g. BB was educational.	1%	3%	9%	37%	50%	4.31	724
h. I want to participate in more events like BB.	4%	7%	18%	31%	40%	3.95	727
i. I have talked or will talk with my friends about BB.	6%	15%	21%	33%	25%	3.55	724
j. I have talked or will talk with my family about BB.	7%	11%	17%	36%	29%	3.67	717
k. I plan to read something about nature or biodiversity this week.	13%	21%	29%	21%	16%	3.05	715

Italics: reversed coded

The Engagement and Intentions Scale was developed by Dr. Joe Heimlich at COSI in Ohio. The 11 items of the Engagement and Intentions scale from the student survey showed high internal reliability, with a Cronbach's alpha of $\alpha = 0.88$. (A satisfactorily large alpha—typically, $\alpha > .80$ —implies that individuals responded similarly across the items within a scale.) Some of the items were adapted from preexisting scales and others were created originally for this evaluation. To investigate whether the 11 items functioned as a single scale or as two subscales (Engagement and Intentions), an exploratory factor analysis was conducted. Exploratory factor analysis (EFA) is used to identify the underlying structure, or factor(s), among the measured items in the scale. Essentially, the technique is used to determine whether particular items tend to group together. An EFA of the 11 items, using Varimax rotation, revealed two factors, with adequate model statistics to support factoring ($KMO = .907$; Bartlett's Test of Sphericity $\chi^2 = 2914.17$, $p < 0.001$) and all factor loadings $> .50$. As shown in Table B2 below, 9 of the 11 items loaded more strongly on Factor 1, and 2 items loaded more strongly on Factor 2. These loading patterns did not reflect the expected factors of Engagement and Intentions, however; instead, they corresponded with responses to positive items (Factor 1) and responses to (reverse-coded) negative items (Factor 2). Therefore, given the high internal reliability of the 11 items, and the lack of empirical justification for using Engagement and Intentions subscales separately, all items were treated as a single scale for all analyses.

Table B2. Exploratory Factor Analysis of Engagement & Intentions Items from the Student Survey

Factor 1	Factor 2
a. I liked BioBlitz.	d. I thought BioBlitz was boring.
b. I learned new things about nature/biodiversity from participating in BioBlitz.	e. BioBlitz was too long.
c. After participating in BioBlitz, I want to learn more about nature/biodiversity.	
f. BioBlitz was entertaining.	
g. BioBlitz was educational.	
h. I want to participate in more events like BioBlitz.	
i. I have talked or will talk with my friends about BioBlitz.	
j. I have talked or will talk with my family about BioBlitz.	
k. I plan to read something about nature or biodiversity this week.	
<i>Eigenvalue = 4.23</i>	<i>Eigenvalue = 2.13</i>

Table B3. Public Engagement & Intentions

Engagement & Intentions item	Disagree strongly	Disagree	Neither	Agree	Agree strongly	Mean	n
a. I liked BioBlitz.	2%	1%	2%	25%	70%	4.61	175
b. I learned new things about nature/biodiversity from participating in BioBlitz.	2%	1%	5%	32%	60%	4.46	174
c. After participating in BioBlitz, I want to learn more about nature/biodiversity.	1%	1%	15%	30%	53%	4.32	174
d. <i>I thought BioBlitz was boring.</i>	64%	25%	6%	2%	2%	1.53	174
e. BioBlitz was educational.	2%	1%	2%	38%	56%	4.45	175
f. I want to participate in more events like BioBlitz.	1%	1%	7%	30%	62%	4.51	174
g. I have talked or will talk with my friends about BioBlitz.	1%	1%	5%	43%	50%	4.39	174
h. I have talked or will talk with my family about BioBlitz.	2%	2%	6%	40%	50%	4.34	174
i. I plan to read something about nature or biodiversity this week.	2%	5%	28%	29%	36%	3.91	172
j. I have used or will use iNaturalist.*	5%	14%	21%	31%	29%	3.65	175
k. I have shared or will share photographs.*	7%	11%	17%	32%	33%	3.71	175

Italics: reverse coded

* These items were omitted from the scale for all analyses.

The 11 items of the Engagement and Intentions scale from the public survey showed high internal reliability, with a Cronbach’s alpha of $\alpha = 0.87$. (A satisfactorily large alpha—typically, $\alpha > .80$ —implies that individuals responded similarly across the items within a scale.) As with the scale from the student survey, some of the items were adapted from the Engagement and Intention Scale and others were created originally for the BioBlitz evaluation. After data were

collected, it was determined that items j (“I have used or will use iNaturalist”) and k (“I have shared or will share photographs”) are heavily dependent on a number of factors not necessarily related to the BioBlitz experience, including individuals’ access to technology and whether they chose to take photographs; consequently, these items were dropped from the scale. The remaining 9 items showed even higher internal reliability, with a Cronbach’s alpha of $\alpha = 0.90$.

To investigate whether the 9 items functioned as a single scale or as two subscales (Engagement and Intentions), an exploratory factor analysis was conducted. Exploratory factor analysis (EFA) is used to identify the underlying structure, or factor(s), among the measured items in the scale. Essentially, the technique is used to determine whether particular items tend to group together. An EFA of the 9 items, using Varimax rotation, revealed two factors, with adequate model statistics to support factoring (KMO=.888; Bartlett’s Test of Sphericity $\chi^2 = 907.84, p < 0.001$) and all factor loadings $>.50$. As shown in Table B4. below, 6 of the 9 items loaded more strongly on Factor 1, and 3 items loaded more strongly on Factor 2. Moreover, these factor loadings did reflect the hypothesized subscales of Engagement and Intentions.

Table B4. Exploratory Factor Analysis of Engagement & Intentions Items from the Public Survey

Factor 1 (“Engagement”)	Factor 2 (“Intention”)
a. I liked BioBlitz.	g. I have talked or will talk with my friends about BioBlitz.
b. I learned new things about nature/biodiversity from participating in BioBlitz.	h. I have talked or will talk with my family about BioBlitz.
c. After participating in BioBlitz, I want to learn more about nature/biodiversity.	i. I plan to read something about nature or biodiversity this week.
d. I thought BioBlitz was boring.	
e. BioBlitz was educational.	
f. I want to participate in more events like BioBlitz.	
<i>Eigenvalue = 3.98</i>	<i>Eigenvalue = 2.32</i>

To follow-up on these results, all analyses in the main body of this report were also conducted using these as two separate subscales, rather than combining them into a single Engagement and Intentions scale. Results from these supplementary analyses revealed that the Engagement subscale followed the same patterns as the Engagement and Intentions total scale, while the

Intentions subscale was never significantly related to anything outcomes. This pattern of results is unsurprising, given the moderately high correlation between means on two subscales ($r(170) = 0.56, p < 0.001$). Therefore, given the high internal reliability of the 9 items, all items were treated as a single scale for all analyses for the sake of simplicity.

The Curiosity and Exploration Index was developed by Dr. Todd Kashdan at George Mason University. It was modified slightly for the student/youth age group.

Table B5. Student Curiosity and Exploration Index

CEI item	Disagree strongly	Disagree	Neither	Agree	Agree strongly	Mean	n
I try to learn as much information as I can in new situations.	2%	5%	19%	42%	32%	3.97	716
I really enjoy the uncertainty of everyday life.	4%	5%	29%	33%	30%	3.79	719
I am at my best when doing something that is difficult or challenging.	4%	7%	23%	34%	33%	3.86	726
Everywhere I go, I am looking for new things or experiences.	3%	6%	21%	35%	35%	3.94	719
I view challenging situations as an opportunity to grow and learn.	2%	4%	19%	42%	33%	3.99	716
I like to do things that are a little risky.	5%	7%	19%	31%	38%	3.90	723
I am always looking for experiences that challenge how I think.	4%	8%	21%	39%	28%	3.80	698
I prefer to do things that are both exciting and unpredictable.	3%	4%	17%	37%	40%	4.07	693
I often look for ways to challenge myself so I grow as a person.	3%	5%	19%	38%	37%	4.00	691
I am the kind of person who seeks out unfamiliar people, events, and places	7%	10%	29%	31%	23%	3.52	690

Italics: reverse coded

Table B6. Public Curiosity and Exploration Index

CEI item	Disagree strongly	Disagree	Neither	Agree	Agree strongly	Mean	n
I try to learn as much information as I can in new situations.	1%	0%	6%	41%	53%	4.45	174
I really enjoy the uncertainty of everyday life.	1%	11%	30%	37%	22%	3.68	171
I am at my best when doing something that is difficult or challenging.	1%	2%	30%	46%	22%	3.85	172
Everywhere I go, I am looking for new things or experiences.	1%	4%	8%	48%	40%	4.23	172
I view challenging situations as an opportunity to grow and learn.	1%	0%	11%	52%	36%	4.22	172
I like to do things that are a little risky.	2%	12%	32%	35%	19%	3.57	173
I am always looking for experiences that challenge how I think.	1%	2%	18%	49%	31%	4.06	174
I prefer to do things that are both exciting and unpredictable.	1%	6%	34%	38%	22%	3.75	173

I often look for ways to challenge myself so I grow as a person.	1%	1%	12%	48%	37%	4.19	172
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I am the kind of person who seeks out unfamiliar people, events, and places	2%	9%	31%	35%	23%	3.69	173
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Italics: reverse coded

Table B7. Public Appreciation for Biodiversity - Pre and Post

Appreciation item	Disagree strongly		Disagree		Neither		Agree		Agree strongly		Mean		n
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	
My life is better because there are a lot of different kinds of plants and animals outdoors.	0%	0%	1%	1%	8%	5%	27%	23%	65%	72%	4.55	4.66	150
It is important to protect a wide variety of plants and animals.	0%	0%	0%	0%	3%	3%	16%	11%	81%	86%	4.79	4.83	150
It matters to me how many different types of plants and animals there are.	0%	0%	1%	0%	10%	5%	25%	21%	65%	73%	4.53	4.68	150
Plants and animals play an important role in life in my state.	0%	0%	1%	0%	7%	7%	27%	18%	65%	75%	4.57	4.69	150

*Only members of the public who were included in the pre-post t-test analyses are included. This included 86% of public survey respondents.

Table B8. Public Environmental Advocacy - Pre and Post

Advocacy item	Disagree strongly		Disagree		Neither		Agree		Agree strongly		<i>Mean</i>		<i>n</i>
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	
I want to be involved in protecting and taking care of natural areas.	0%	0%	1%	1%	14%	10%	35%	27%	51%	63%	4.36	4.52	148
I want to give some of my own money to help protect wild plants and animals.	1%	1%	3%	3%	36%	27%	32%	39%	28%	30%	3.81	3.92	148
I am interested in taking care of natural areas in my neighborhood.	1%	0%	1%	1%	19%	14%	32%	30%	47%	55%	4.24	4.39	148
I want to participate in other activities to protect plants and animals at this park.	1%	0%	3%	3%	20%	15%	39%	32%	37%	51%	4.08	4.28	148
I would spend my free time on a project to protect plants and animals in my community.	1%	1%	1%	1%	22%	15%	30%	32%	46%	51%	4.20	4.33	148

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I think I can protect plants and animals in my own backyard.	0%	0%	1%	1%	20%	12%	32%	31%	48%	56%	4.27	4.43	148
I am interested in volunteering with the National Park Service to protect plants and animals.	3%	2%	1%	1%	37%	26%	30%	27%	29%	44%	3.82	4.09	148

*Only members of the public who were included in the pre-post t-test analyses are included. This included 86% of public survey respondents.

Table B9. Public Comfort Being in Nature - Pre and Post

Comfort item	Very Uncomfortable		Uncomfortable		Neither		Comfortable		Very Comfortable		<i>Mean</i>		<i>n</i>
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	
Sitting on the ground	0%	0%	6%	4%	9%	8%	26%	29%	59%	59%	4.37	4.43	150
Touching pants when walking	0%	0%	3%	3%	11%	9%	22%	22%	64%	67%	4.47	4.53	149
Spending a full day in nature/ outdoors	0%	0%	0%	0%	7%	3%	19%	20%	75%	76%	4.68	4.73	148
Getting hot/ tired/ thirsty/ sweaty	1%	0%	5%	3%	11%	11%	27%	30%	55%	56%	4.29	4.39	150
Encountering spiders and insects	2%	0%	14%	10%	9%	15%	32%	30%	43%	46%	3.99	4.12	148

*Only members of the public who were included in the pre-post t-test analyses are included. This included 86% of public survey respondents.

Table B10. Student Appreciation for Biodiversity - Pre and Post

Appreciation item	Disagree strongly		Disagree		Neither		Agree		Agree strongly		<i>Mean</i>		<i>n</i>
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	
My life is better because there are a lot of different kinds of plants and animals outdoors.	6%	4%	10%	4%	30%	19%	29%	30%	25%	43%	3.59	4.04	661
It is important to protect a wide variety of plants and animals.	3%	2%	5%	2%	11%	7%	33%	27%	49%	63%	4.19	4.46	666
It matters to me how many different types of plants and animals there are.	6%	3%	11%	5%	23%	15%	31%	32%	30%	45%	3.68	4.11	666
Plants and animals play an important role in life in my state.	3%	2%	6%	2%	20%	13%	33%	31%	38%	51%	3.97	4.27	659

*Only students who were included in the pre-post t-test analyses are included. This included 88% of student survey respondents.

Table B11. Student Interest in Environmental Advocacy - Pre and Post

Advocacy item	Disagree strongly		Disagree		Neither		Agree		Agree strongly		<i>Mean</i>		<i>n*</i>
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	
I want to be involved in protecting and taking care of natural areas.	5%	4%	11%	6%	30%	21%	26%	27%	28%	42%	3.59	3.97	640
I want to give some of my own money to help protect wild plants and animals.	12%	7%	12%	8%	32%	28%	23%	28%	21%	30%	3.28	3.66	635
I am interested in taking care of natural areas in my neighborhood.	7%	3%	13%	6%	30%	23%	26%	32%	26%	36%	3.51	3.90	640
I want to participate in other activities to protect plants and animals at this park.	6%	4%	10%	5%	26%	20%	31%	29%	28%	42%	3.64	4.00	644
I would spend my free time on a project to protect plants and animals in my community.	10%	6%	17%	12%	30%	24%	22%	28%	21%	30%	3.28	3.65	643

Evaluation of 2016 National Park BioBlitz Events

I think I can protect plants and animals in my own backyard.	7%	4%	12%	9%	24%	16%	29%	34%	28%	38%	3.59	3.94	643
I am interested in volunteering with the National Park Service to protect plants and animals.	19%	14%	21%	15%	26%	23%	15%	20%	20%	29%	2.97	3.35	644

*Only students who were included in the pre-post t-test analyses are included. This included 88% of student survey respondents.

Table B12. Student Comfort Being in Nature - Pre and Post

Comfort item	Very Uncomfortable		Uncomfortable		Neither		Comfortable		Very Comfortable		Mean		n*
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	
Sitting on the ground	14%	10%	20%	12%	21%	18%	28%	29%	18%	31%	3.15	3.58	690
Touching pants when walking	6%	7%	9%	6%	23%	15%	32%	33%	30%	38%	3.70	3.90	689
Spending a full day in nature/ outdoors	7%	5%	10%	6%	18%	13%	28%	27%	38%	50%	3.79	4.11	687
Getting hot/ tired /thirsty/ sweaty	24%	19%	21%	14%	22%	20%	17%	22%	16%	25%	2.79	3.18	685
Encountering spiders and insects	32%	23%	19%	13%	18%	17%	14%	19%	18%	28%	2.67	3.12	689

*Only students who were included in the pre-post t-test analyses are included. This included 86% of student survey respondents.

Table B13. Teacher Ratings of BioBlitz Efficacy

Efficacy item	Not effective	Effective	Very Effective	n
Engaging my students in something I think is important.	3%	32%	65%	34
Engaging my students in activities in the field.	9%	29%	62%	34
Engaging my students in authentic learning.	3%	32%	65%	34
Engaging my students in scientific research with scientists or other experts.	13%	34%	53%	32
Satisfying standards and curricular requirements.	10%	45%	45%	31
Involving my students in the conversation and appreciation of nature.	3%	24%	74%	34
Exposing my students to new experiences	9%	91%	0%	34
Giving my students an opportunity to interact with NPS staff	6%	15%	79%	34
Advancing my career	20%	35%	45%	20

Table B14. Teacher Ratings of Quality of BioBlitz Experiences

Quality of experience item	Poor	Satisfactory	Excellent	Did not experience	n
Interacting with scientists in the field during the inventory	3%	15%	53%	29%	34
Engaging in hands-on science in the field during the using inventory	9%	9%	59%	24%	34
Using iNaturalist to submit species observations	15%	18%	32%	35%	34
Interacting with scientists in the field at the festival	3%	18%	71%	9%	34
Engaging in hands-on science at the festival	6%	18%	65%	12%	34

Table B15. Teacher Ratings of Quality of Educational Materials and Support

Quality item	Poor	Satisfactory	Excellent	Did not experience	<i>n</i>
Evaluation of pre-BioBlitz professional development	12%	53%	35%	0%	34
Evaluation of online educational resources at natgeoed.org	24%	53%	24%	0%	34
Evaluation of pre-BioBlitz interactions with BioBlitz organizers and/or hosts	3%	15%	59%	24%	34
Evaluation of congruency between BioBlitz program content and students' curriculum	3%	35%	50%	12%	34

Table B16. Teacher Ratings of How Participation in BioBlitz has Affected their Teaching

Effect on Teaching Item	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree	<i>n</i>
BioBlitz increased my likelihood of bringing future classes to a park	0%	3%	12%	32%	53%	34
BioBlitz increased my likelihood of future field trips in nature	0%	0%	6%	35%	59%	34
BioBlitz increased my likelihood of using parks to teach	0%	0%	6%	41%	53%	34
BioBlitz was a good use of my teaching time	0%	0%	12%	32%	56%	34
BioBlitz was a good teaching tool	0%	0%	9%	32%	59%	34

APPENDIX C: CASE STUDIES

C.1: Crater Lake National Park BioBlitz Case Study

C.2: Cuyahoga Valley National Park BioBlitz Case Study

C.3: Jean Lafitte National Historical Park and Preserve BioBlitz Case Study

**Crater Lake National Park, Oregon
BioBlitz July 23, 2016**



Crater Lake National Park, OR

1

Crater Lake National Park in southwest OR, features the deepest lake in the US, created by a collapsed volcano about 7,700 years ago. The park attracts mainly out-of-state visitors interested in seeing the immense, pristine blue volcanic lake. The surface of the lake is at approximately 6,000 feet and the ridge closer to 7,000 feet. There is one path that leads down to the water, 700 feet below the road, a number of other paths, some of which have views of the lake, and a ring road that circles the lake. The average visit is a half-day. Oregonians typically go to nearby Diamond Lake for recreation because the water is more accessible.

BioBlitz by the Numbers

(these counts include all 3 BioBlitz week events)

<u>iNaturalist Observations</u>		
77 Observations ²	35 Species	19 beetles
<u>Participants</u>		
· 45 public adults	· 25 public children	· 8 K-12 teachers
· 20 university students	· 8 scientists	· 3 digital assistants

¹ Photos included in the report were taken by NGS staff. Additional photos are available on the NPS website: <http://focus.nps.gov/SearchResults/?allFields=crater+lake+bioblitz&submit=Search&allFieldsFormat=Phrase&view=list>

² This is just the number of observations entered into iNaturalist and does not reflect the hundreds of beetle specimen taken for in-depth study and identification.

Past BioBlitzes

Crater Lake has held 4 previous BioBlitz inventories which focused on sphagnum bog ('07), amphibians ('10), lichen (08), and Lepidoptera ('14). The park's experience hosting BioBlitzes was evident from the organization and planning throughout the event. Locations were well-signed, inventory maps were printed for everyone, food and water were available, etc. For this BioBlitz, they created a more structured online registration, had an education table for opportunistic interaction with park visitors not registered for the event, had a more organized BioBlitz HQ, and strongly encouraged the use of iNaturalist.

Event Description

Crater Lake National Park's held several related events including a one-day public beetles-focused BioBlitz, a week-long university field course on beetles, and a 3-day workshop for K-12 teachers from southern Oregon. The events were organized by park staff and a professor from Oregon Tech who was also the Crater Lake National Park Science and Learning Center coordinator.

The BioBlitz's primary goals were

1. Scientific study of park beetle species
2. Learning opportunity for participants.
3. Public and student learning about biodiversity.
4. Introduce students (college/university) to the park

Teacher Professional Development

The week before BioBlitz, Crater Lake held its [annual K-12 teacher](#) workshop which teaches about environmental stewardship, place-based education, etc. This summer, the teacher PD was focused on "citizen science as a way to teach authentic scientific methods while engaging students in meaningful scientific endeavors. All activities were integrated with the BioBlitz, discovering beetle diversity within the park.

BioBlitz Evening Session

The park held an evening session the night before the BioBlitz that was attended primarily by scientists, students from the field course, and a few members of the public. There were talks by 3 beetle experts, a park representative and a National Geographic representative who talked about NGS' partnership with NPS and gave a quick introduction to iNaturalist.



Figure 1: Community House Overlooking Crater Lake

Day of BioBlitz

While the inventory was open to the public, recruitment of public participants through media happened shortly before actual event and on-site. Because the park is visited primarily by people from out-of-state, it was difficult to invite public participation in advance. Engaging new and returning visitors was a low priority. There were signs throughout the park pointing visitors to the BioBlitz location where they could join an inventory or participate in the activities at several BioBlitz 2 education tents staffed by NPS. Unfortunately, the tents were in the woods behind the Community Building(?) and hidden from view.



The scientists who came for BioBlitz to lead inventories and collect specimens were from Oregon State University and the Oregon Department of Agriculture. These scientists were invited by the park's Science Coordinator.

BioBlitz Inventories

A NGS observer was able to participate in part of 2 BioBlitz inventories (all were held at the same time). The BioBlitz day started early with light breakfast and all-day snacks provided by NPS. After a short opening session, the participants split up according to how long they wanted to spend and the level of difficulty of the walk.

There were 8 inventory locations most of which were accessible by foot or a short drive. One required a couple hour drive and then a couple hours of hiking into the location. The inventory locations showcased a number of different park habitats.

Each inventory leader was given a number of bug nets and bug boxes, and they usually brought their own gear as well. The park was looking for as complete a beetle inventory as possible and the scientists had an NPS permit allowing for the collection of beetles which were then taken back to Oregon State University for identification. Beetles can look so similar that DNA analysis is required to distinguish between species.



Figure 2: Inventory Gear Laid Out By Location

The first inventory had 3 public participants, a young man about 20 who was interested in insects, and his parents. In

addition to the scientist leading the inventory was a graduate student taking notes on the species found and labeling the bug boxes. The second inventory had a family with 2 children about 10-12 years old. Both families were recruited onsite. The first inventory leader had a very engaged group who were good at spotting beetles and helpful in collecting specimens. They asked good questions and were clearly learning from the experience. By the time the observer got to the second inventory they had already been in the field for about 3 hours. The participants were wandering on their own, using nets to try to capture flying insects and the inventory leader was mainly focused on finding beetle larva

Highs and Lows

- The opportunity for scientists to interact and discuss research issues, face-to-face for 2 days was a very valuable outcome that was not seen in many other BioBlitzes.
- Participants who have an interest in the park and or the species of interest find BioBlitz especially engaging but all participants were engaged in exploring the park, learning about biodiversity and looking for beetles and other wildlife and plants.
- Inventory leaders have limited bandwidth and there is often a trade-off between focusing on the participants' experience and accomplishing the scientific goals of the inventory.
- Small inventory groups allow for more individual attention to the participants by the inventory leader but less participants can be reached this way.



Figure 3: Inventory at Garfield Peak



Scientific Outcomes: Identification and Networking Activities

The scientists stayed in an NPS staff house which had many advantages. There were several common areas where the scientists met to discuss inventory locations and specimen collection techniques, and discuss their research projects. A very powerful component of this BioBlitz was the opportunity for many of the scientists from Oregon State University and the Oregon Department of Agriculture to meet their colleagues face-to-face.

There were workspaces in the house where everyone naturally gathered to talk, compare notes and procedures, and where they worked after BioBlitz to organize and preserve several hundred beetle specimens. (see photos).



Figure 4: Scientists Preserving Specimens

They used their time together in morning, evenings, and at meals for extended discussions about their projects and priorities. Many commented about this unique opportunity to meet their counterparts and many conversations had to do with current and future research projects and potential collaborations.

The majority of the beetle specimens collected are still being analyzed at this time.



Figure 5: Post BioBlitz & Still Looking for Beetles

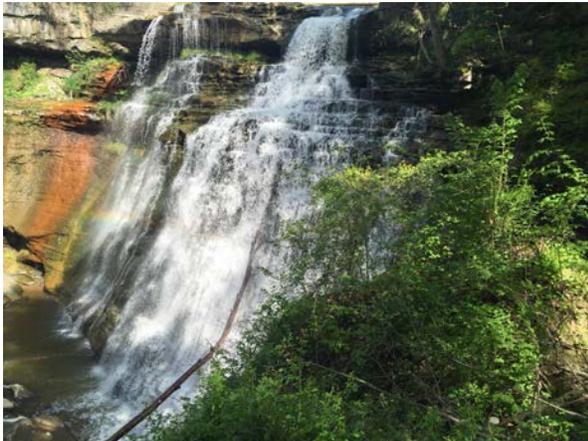
iNaturalist

Crater Lake, year-to-date 324 iNaturalist observations of 131 species

Despite significant effort in getting participants to install iNaturalist on their smartphones in advance and offering a tutorial the night before the BioBlitz, only 77 observations were uploaded. This is in part a function of the limited number of participants and is also a result of the beetles being preserved and taken offsite for identification which would likely take weeks to complete. The beetle community is not using iNaturalist as its primary data repository in part because it is very difficult to identify beetle species in the field.

The NGS observer at BioBlitz gave a number of iNaturalist demos to the scientists and park staff including how to upload observations, how to be an *Identifier*, and how to create species guides. The entomologists were impressed with its capabilities, especially the ability to post multiple color photos and to create species guides. The scientists who had not seen iNaturalist before, were excited about the opportunities.

Cuyahoga Valley National Park, Ohio BioBlitz May 20, 2016



1

Cuyahoga Valley National Park, OH

Cuyahoga Valley National Park in central Ohio and lies along the Cuyahoga River between the Ohio cities of Cleveland and Akron. The Ohio and Erie Canal Towpath Trail is a restored section of the canal's original towpath. In the park's north, the Canal Exploration Center details the 19th-century waterway's history. Towering Brandywine Falls is one of several waterfalls. The Cuyahoga Valley Scenic Railroad runs through the park.

BioBlitz by the Numbers

<u>Observations</u>		
4,990 Observations	811 Species	
<u>Participants</u>		
• 515 public adults	• 400 students	• 15 K-12 teachers
• 70 scientists from 22 institutions	• 65 digital assistants	• 60 Park staff
• 200 festival attendees	• 20 festival exhibitors	

Event Description

This was the Park's first BioBlitz. Cuyahoga Valley conducted over 120 inventories of 25 major taxa of plants and animals in the park – from salamanders and frogs to birds and lichen, mosses, and algae. The inventories occurred in over six locations throughout the park. The Park also offered a Biodiversity Festival, with educational exhibits, music, crafts, and food.

¹ UC Berkeley staff took photos included in the report.



Day of BioBlitz

The Park had marketed the BioBlitz through local communities, schools, academic institutions, and environmental agencies, which generated interest in the event. Over 500 people participated in inventories, and over 2,000 people attended the Biodiversity Festival.

On the morning of May 20, over 400 students, many from Cleveland schools, participated in the Festival and Inventories. Student groups included middle school students who were selected by their teachers because of their ongoing interest in science as well as special education students who were provided with an opportunity for in-the-field learning. Most students collected butterflies with professors from local universities.

The afternoon and evening of May 20 and the morning of May 21 were dedicated to public events. Participants could choose from a wide range of inventories, as over 120 inventories were scheduled. Inventories included focus on pollinators, plants, mammals, insects, reptiles, amphibians, birds, fungi, macroinvertebrates, and many other taxa. The Park focused their priorities on taxa for which they had little or no information, such as mosses, lichens, mussels, and bees.

BioBlitz Inventories

At each of the six sites throughout the park, participants arrived and were checked in. All of the locations were easily accessible from the main roads of the park. After checking in, participants then met with the inventory leader, who would lead them to the selected location for data collection. An observer from UC Berkeley (working in collaboration with NGS) was able to participate in part of four inventories: mosses & lichens, spiders, macro invertebrates, and amphibians.

For the mosses & lichens inventory, there were 23 adult participants and two inventory leaders, one with a specialization in mosses and the other in lichens. The inventory began with a short description about mosses, including where we might find mosses throughout the hike, and how we might identify their variety. Similarly, the second inventory leader described lichens and talked about where lichen might be best found. Both leaders discussed the difficulties of identifying some varieties in the field, noting that they would take specimens of some of what we found back to the laboratory for final identification. They also noted that they had a permit to do the collection, and that we should not remove any material from the park. For the next hour, the group hiked a short distance on a trail, pausing to look at, learn about, photograph mosses and lichens. One rare species of lichen was found during the inventory.



For the macroinvertebrate inventory, a group of 12 people, including one young boy of about 7 years old, hiked about half a mile from the trailhead to the river. The inventory leader provided the group with nets and trays and showed them where they might find macroinvertebrates and how best to photograph them. As participants found species, the inventory leader would talk about that organism and how it relates to the habitat of the river. Participants asked a number of questions about the river (such as – why does it have a silvery sheen on top of the water?

Is that pollution?) and the organisms themselves (why do they cling to the underside of the rock?). The inventory leader provided answers and resources for further research.

Highs and Lows

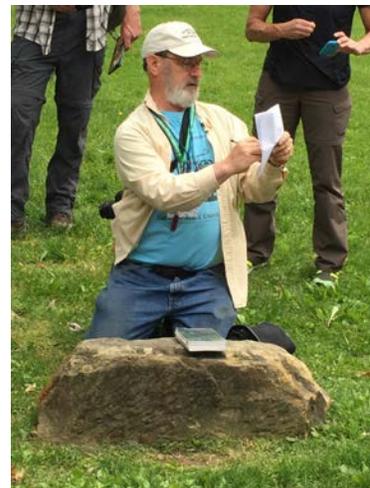
- The enthusiasm of the inventory leader had an impact on engagement. Inventory leaders who spent time interacting with and addressing questions from the group also encouraged participants to post their observations on iNaturalist.
- Questions tended to be fairly straight-forward and basic, such as “What is this?” and “What does that eat?” Some inventory leaders managed to bring in more information about biodiversity and how climate change is impacting biodiversity in the park.

- Small inventory groups – or larger groups with multiple inventory leaders who were also experts in the appropriate taxa -- allowed for more individual attention to the participants by the inventory leader.



Scientific Outcomes: Identification and Networking Activities

Scientific outcomes were a lower priority for the park. That said, they did record a species of butterfly that is not usually found in the park in May. They also identified an uncommon bird species, the black-billed cuckoo. Fish inventories recorded an uncommon species, the black bullhead catfish. A rare species of lichen was also recorded.



iNaturalist

The Park was successful in getting leaders and participants to use iNaturalist. While they were not required to use it, inventory leaders received training and were also encouraged to offer help and training to public participants. In observed inventories, all leaders encouraged participants to upload photos to iNaturalist. Most inventories included digital ambassadors who helped the public upload their photos. This allowed the scientists to concentrate on their inventories and on the group's participants (as well as upload their own observations). Almost 5000 observations were uploaded from more than 300 observers.

Jean Lafitte National Historical Park and Preserve (JELA)



Figure 1: iNaturalist Outcomes http://www.inaturalist.org/projects/6457/stats_slideshow

BioBlitzes can be classified along a spectrum from a focus on scientific to a focus on participant learning and/or engagement with the park. Jean Lafitte National Historical Park and Preserve's (JELA) identified their priorities as follows:

1. Have students learn about biodiversity
2. Introduce students to the park
3. Scientific study of park species
4. Introduce students to the park

JELA had a strong interest in learning more about the invertebrates in the park however, they felt that the BioBlitz should be focused first and foremost on public engagement and learning. They were excited about the BioBlitz outcomes and feel they were successful in meeting all their goals.

BioBlitz by the Numbers

<u>Participants</u>		
• 376 students	• 29 teachers	• 17 schools
• 53 Public adults	• 23 scientists	• 5 digital assistants
• 7 Volunteers in Parks	• 714 festival attendees	• 13 Festival booths
<u>Inventories</u>		
• 30 Inventories schedule	• 23 Inventories held	
<u>Inventory leaders</u>		
• 7 park staff	• 11 researchers	• 3 naturalists
<u>Observations</u>		
• 304 Observations	• 116 Species	

BioBlitz Event

The park was well-prepared to handle the buses and students. In 2013, JELA held a BioBlitz for students and the public in partnership with National Geographic so staff had previous BioBlitz experience. In addition, the park holds programs for up to 2,500 students at a time so the 500 students at this event were easily managed. School bus parking was well-marked, paths had rope stanchions, and student meeting places were marked by big placards. In addition to park staff, the BioBlitz event had numerous volunteers helping out. The day started with a meeting for all staff and volunteers reviewing safety, goals and schedules.



Figure 2: Staff & Volunteer Briefing

JELA recruited school groups by sending and hand-delivering save-the-date cards, and sending mass emails to teachers and principals. Morning news show segments were aimed at attracting both public and school audiences. Scientists and exhibitors were predominantly partners the park had worked with previously and were notified by “word-of-mouth” about the May BioBlitz.

From 9 am to 2 pm, the focus was primarily on students; public participants were invited to participate in afternoon inventories. Most of the student groups brought their lunch and ate at the festival location. Half of the 17 schools had not visited the park before so this event was highly successful from the perspective of introducing students to the park.



Figure 4: Park Schedule Poster

Teacher Resources and Preparation

The park has two sets of lesson plans, designed for grades 1-3 and the other for grades 4-7.

The World Beneath Our Feet: Bugs and the Barataria Preserve is designed for use in science, English and language arts. This resource has pre- and post-visit activities, information about fieldwork, and maps to the Common Core and literacy standards. The park also created an 8-minute video for teachers and students about safety and techniques for collecting aquatic and land-based “critters”. Resources can be accessed here:

<https://www.nps.gov/jela/learn/education/index.htm>

In addition, students were each handed a workbook with basic information about the park and insect species, and space to take notes about their own observations.

Biodiversity Science Festival

The 2 big tents housed 13 booths. Students had the opportunity to visit the festival before and/or after their inventories. Exhibitors had a wide range of hands-on science and art projects for students and the students appeared highly engaged doing various activities and talking to the exhibitors. The projects all focused on invertebrates, which was the focus of this BioBlitz. In addition, park rangers provided live musical performances.



Figure 5: BioBlitz Festival



BioBlitz Inventories

The park has created a fairly comprehensive inventory with the exception of invertebrates, (not only insects, but arachnids, annelids, etc.) fungi and bacteria. Since they did not have the expertise to work with bacteria, and since the target audience was students, the decision was to focus on invertebrates. Students participated in either land-based or aquatic inventories. The NGS staff person observed segments of each type of student inventory but not the afternoon public inventories so only student inventories are described in detail.

Land BioBlitz Inventory

The weather was sunny and relatively cool, ideal for being outside except it had rained heavily in the days prior to BioBlitz and the walking paths were very muddy. The land-based inventory group were distracted by walking and slipping in the mud. Unfortunately, with the exception of arachnids, the students on this inventory found few invertebrates.

The inventory leader met with the group of 10 students and 1 teacher, and explained what they would be doing, described poison ivy, and explained why food was not permitted on the trails. He then handed the students a variety of tools to carry (screens, trays, bug boxes, etc.) Most of the students had smartphones and they were eagerly taking photos of all the specimens that were found. A few had their own magnifiers and were adept at taking close-up photos. Students had projects related to BioBlitz and were encouraged to ask questions about them.

The inventory leader described where and how to look for bugs and how to use the tools. He stressed the importance of not turning over rocks or logs or other insect habitats so as not to disturb life hiding there. He had a running conversation with students about the park environment and the insects they were, and were not, finding. Students were attentive a lot of the time but did lapse into conversations with their peers, and were clearly frustrated about their shoes getting covered with mud despite the teacher's warning them in advance to wear appropriate shoes. The students were finding few invertebrates aside from spiders but appeared to be learning about invertebrates and their habitats nevertheless.



Figure 6: Invertebrate Inventory



Figure 7: Aquatic Inventory

[Aquatic BioBlitz Inventory](#)

This inventory had about 20 students and 3 teachers/adults. By the time the observer reached them, they had been out for about 15 minutes working from a dock, learning to use nets and buckets to sweep/scoop up water and bugs from the swamp. They were also finding few specimens and the park inventory leader explained how the water environment changes with temperature. This group seemed a little too big for one inventory leader to manage.

Future BioBlitzes

The park is a firm believer in BioBlitz and is hoping to hold future BioBlitzes about every three years depending on budgets and staffing. They also felt that 500 students were a more manageable size than their 2013 BioBlitz.

Scientific Outcomes

The park was pleased by the number of species observed during their BioBlitz. "From a science perspective, the park entomologists are still cataloging and identifying the captured invertebrates, continuing to add to the park's large species list and body of knowledge." (JELA Park Ranger)

Use of iNaturalist

All park staff, inventory leaders and Digital Ambassadors were trained on using iNaturalist and were encouraged to upload their observations. Since BioBlitz, the park has used iNaturalist to upload additional observations and identify the species. iNaturalist was not used on either of the observed student inventories. The majority of observations were uploaded by naturalists, not students or teachers. National Geographic provided 2 tablets to the park to use during and after BioBlitz to record observations and these continue to be used. The park was excited to receive them and staff feel they could easily use more smart devices to be able to use iNaturalist.

APPENDIX D: INSTRUMENTS

D.1 Public Participant Survey

D. 2 BioBlitz 2016 Student Survey

D.3 BioBlitz 2016 Educator Survey

D.4 BioBlitz 2016 Scientist/Inventory Leader Survey

D.5 BioBlitz 2016 Observation Protocol

Appendix D.1: BioBlitz 2016 Public Participant Survey

National Geographic Society 2016 BioBlitz Public Participant Survey

Conducted by National Geographic Society and the Lawrence Hall of Science



**NATIONAL
GEOGRAPHIC**



THE LAWRENCE
HALL OF SCIENCE
UNIVERSITY OF CALIFORNIA, BERKELEY

About this Questionnaire

You are invited to contribute to this survey because you participated in BioBlitz in May 2016. The purpose of this survey is to understand how people engaged in BioBlitz and how they benefit from participating. Please only complete this survey if you are 18 years or older.

If you led an inventory, please complete this survey: <http://tinyurl.com/BioBlitzscientist>

Note: If you are under 18, you can get your parents to give you permission to use the survey by clicking [here](#).

Are you 18 years of age or older?

- Yes
 No

Your participation in this survey is completely voluntary, and you may opt not to answer any question or may stop at any time. Your responses on this questionnaire will be kept confidential, collected by UC-Berkeley and de-identified using a unique code. No personally identifiable information will be shared with anyone outside the evaluation team. The results of the survey will be used to improve

the content and quality of BioBlitz program. This questionnaire should take no more than 30 minutes to complete.

Thank you for your time and participation! If you have any questions about this survey, or about the project evaluation in general, please contact Ardice Hartry of The Research Group at the Lawrence Hall of Science, at hartry@berkeley.edu.

Section 0

1. Did you participate in BioBlitz 2016?

- Yes
- No

Section A:

2. How much time did you spend at the Festival (If you did not visit the Festival, enter 0)?

3. How many inventories did you participate in?

Where was the BioBlitz you attended? (Name of park or nature site, and state.)

4. Did you attend BioBlitz with any of the following **(mark all that apply)**?

- My children (less than 18 years old)
- My adult children
- My grandchildren
- My parents or guardians

- Other family
- A school group
- An after-school group such as Scouts or Science Club
- Volunteer organization, including faith-based
- Tour group
- None of the above

Section B: Your Experience with BioBlitz

Section B: Your Experience with BioBlitz

5. What were your main reasons for participating in BioBlitz? What did you hope to gain or be able to contribute?

6. How did BioBlitz help you meet those goals? How could the activities be better designed to help you meet your goals?

7. Please tell us how strongly you agree or disagree with the following statements. For each item, choose the option that best matches what you think and feel:

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
a. I liked BioBlitz.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. I learned new things about nature/biodiversity from participating in BioBlitz.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

c. After participating in BioBlitz, I want to learn more about nature/biodiversity.	<input type="radio"/>				
d. I thought BioBlitz was boring.	<input type="radio"/>				
e. BioBlitz was educational.	<input type="radio"/>				
f. I want to participate in more events like BioBlitz.	<input type="radio"/>				
g. I have talked or will talk with my friends about BioBlitz.	<input type="radio"/>				
h. I have talked or will talk with my family about BioBlitz.	<input type="radio"/>				
i. I plan to read something about nature or biodiversity this week.	<input type="radio"/>				
a. I have used or will use iNaturalist	<input type="radio"/>				
b. I have shared or will share photographs	<input type="radio"/>				
c. I try to learn as much information as I can in new situations.	<input type="radio"/>				
d. I really enjoy the uncertainty of everyday life.	<input type="radio"/>				
e. I am at my best when doing something that is difficult or challenging.	<input type="radio"/>				
f. Everywhere I go, I am looking for new things or experiences.	<input type="radio"/>				
g. I view challenging situations as an opportunity to grow and learn.	<input type="radio"/>				
h. I like to do things that are a little risky.	<input type="radio"/>				
i. I am always looking for experiences that challenge how I think.	<input type="radio"/>				
j. I prefer to do things that are both exciting and unpredictable.	<input type="radio"/>				
k. I often look for ways to challenge myself so I grow as a person.	<input type="radio"/>				
l. I am the kind of person who seeks out unfamiliar people, events, and places.	<input type="radio"/>				

8. Please tell us how you feel about biodiversity and environmental advocacy. We would like to know **how your thoughts BEFORE BIOBLITZ might be different from your thoughts TODAY:**

BEFORE BIOBLITZ						TODAY				
Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree		Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	a. My life is better because there are a lot of different kinds of plants and animals outdoors.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	b. It is important to protect a wide variety of plants and animals.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

<input type="radio"/>				
<input type="radio"/>				
<input type="radio"/>				
<input type="radio"/>				
<input type="radio"/>				
<input type="radio"/>				
<input type="radio"/>				
<input type="radio"/>				
<input type="radio"/>				
<input type="radio"/>				

c. It matters to me how many different types of plants and animals there are.

d. Plants and animals play an important role in life in my state.

e. I want to be involved in protecting and taking care of natural areas.

f. I want to give some of my own money to help protect wild plants and animals.

g. I am interested in taking care of natural areas in my neighborhood.

h. I want to participate in other activities to protect plants and animals at this park.

i. I would spend my free time on a project to protect plants and animals in my community.

j. I think I can protect plants and animals in my own back yard.

k. I am interested in volunteering with the National Park Service to protect plants and animals.

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

9. Please tell us how comfortable you are with these things that might happen when spending time in nature/outdoors. We would like to know **how your thoughts BEFORE BIOBLITZ might be different from your thoughts TODAY:**

BEFORE BIOBLITZ							AFTER BIOBLITZ	
Very uncomfortable	Uncomfortable	Neither uncomfortable nor comfortable	Comfortable	Very comfortable		Very uncomfortable	Uncomfortable	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	a. Sitting on the ground	<input type="radio"/>		
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	b. Touching plants when walking	<input type="radio"/>		
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	c. Spending a full day in nature/ outdoors	<input type="radio"/>		
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	d. Getting hot/tired/thirsty/sweaty from hiking outside	<input type="radio"/>		



Section C: Question 1

Section C: Reflective Statements

10. What is something amazing you learned from participating in BioBlitz? It could be what you learned about nature, science, yourself, or anything else.

Section C: Reflective Statements

10. What was the most amazing thing you did or saw? Why was that most amazing?

Section C: Reflective Statements

10. What are three things you learned from participating in BioBlitz? It could be what you learned about nature, about science, about yourself, or about anything else.

Section C: Question 2 [focus on biodiversity or nature]

11. How did you like being outside in nature during BioBlitz? What did you like or not like?

11. How did BioBlitz change your feelings about being outside in nature?

11. Why do you think it is important to have many different kinds of plants and animals?

Section C: Question 3 [focus on what they will do differently]

12. Because of BioBlitz, what do you want to learn more about?

12. What did you (or will you) tell your family or friends about BioBlitz?

12. What will you do differently to protect nature?

12. Did BioBlitz make being a scientist or park ranger seem more interesting? If so, how?

12. How did BioBlitz change your idea about what scientists do?

Section C: Question 4

13. What did you do during the inventory (e.g., take pictures, use iNaturalist, look at bugs)?

13. What did you like about the inventory? What did you like about the Festival? If you did both, which did you like better and why?

Section C: Question 5

14. Is there anything else you want to tell us about your BioBlitz experience?

Would you be willing to participate in a 30 minute interview about your experience with BioBlitz? If so, please provide email address here:

Section D: Information about You

Section D: Information about You

15. What is your sex/gender?

- Female
- Male
- Other
- Prefer not to answer

16. What year were you born?

17. What is the highest level of formal education you have completed?

- Less than high school
- Some high school
- High school graduate
- Vocational/trade school certificate
- Some college
- Two-year college degree
- Four-year college degree
- Master's degree
- Ph.D. M.D. J.D. or equivalent

18. Are you presently?

- Employed outside the home (full-time) – Occupation:
- Employed outside the home (part-time) – Occupation:
- Unemployed - looking for work
- Unemployed by choice - (but not retired)
- Retired – Previous occupation:
- Full-time homemaker
- Student (full-time)
- Student (part-time)
- Other

19. What is your race/ ethnicity? Please select one or more.

- American Indian or Alaska Native
- Asian
- Black or African American
- Native Hawaiian/ Pacific Islander
- White
- Hispanic or Latino

Reasons for not attending

2. We are sorry you were not able to make it. Please provide a brief description of the reason you could not attend.

END

Thank you for completing our survey!

If you would like to be entered into a drawing for a \$50 gift certificate, please provide your email address here:

Thank You for Your Time and Input!
This Will Help Us Improve Our Work with Participants in the Future

Appendix D.2: BioBlitz 2016 Student Survey

BioBlitz Student Survey

We would like to know about your experiences at BioBlitz. Please answer these questions as honestly as you can. We will not share your responses with your teacher or your school. Thank you so much for your time and input!



1) Please tell us how strongly you agree or disagree with the following statements. For each item, choose the option that best matches what you think and feel:

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
a. I liked BioBlitz.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. I learned new things about nature/biodiversity from participating in BioBlitz.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. After participating in BioBlitz, I want to learn more about nature/biodiversity.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. I thought BioBlitz was boring.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. BioBlitz was too long.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f. BioBlitz was entertaining.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
g. BioBlitz was educational.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
h. I want to participate in more events like BioBlitz.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
i. I have talked or will talk with my friends about BioBlitz.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
j. I have talked or will talk with my family about BioBlitz.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
k. I plan to read something about nature or biodiversity this week.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
l. I try to learn as much information as I can in new situations.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
m. I really enjoy the uncertainty of everyday life.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
n. I am at my best when doing something that is difficult or challenging.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
o. Everywhere I go, I am looking for new things or experiences.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
p. I view challenging situations as an opportunity to grow and learn.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
q. I like to do things that are a little risky.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

2) Please tell us how comfortable you are with these things that might happen when spending time in nature/outdoors. We would like to know **how your thoughts BEFORE BIOBLITZ might be different from your thoughts TODAY:**

	BEFORE BIOBLITZ					TODAY				
	Very uncomfortable	Uncomfortable	Neither uncomfortable nor comfortable	Comfortable	Very comfortable	Very uncomfortable	Uncomfortable	Neither uncomfortable nor comfortable	Comfortable	Very comfortable
a. Sitting on the ground	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Touching plants when walking	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Spending a full day in nature/outdoors	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Getting hot/tired/thirsty/sweaty from hiking outside	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. Encountering spiders and insects	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

3) Please tell us how strongly you agree or disagree with the following statements:

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
a. I am always looking for experiences that challenge how I think.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. I prefer to do things that are both exciting and unpredictable.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. I often look for ways to challenge myself so I grow as a person.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. I am the kind of person who seeks out unfamiliar people, events, and places.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

4) Please tell us how you feel about biodiversity and environmental advocacy. We would like to know **how your thoughts BEFORE BIOBLITZ might be different from your thoughts TODAY:**

	BEFORE BIOBLITZ					TODAY				
	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
a. My life is better because there are a lot of different kinds of plants and animals outdoors.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. It is important to protect a wide variety of plants and animals.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. It matters to me how many different types of plants and animals there are.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Plants and animals play an important role in life in my state.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. I want to be involved in protecting and taking care of natural areas.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f. I want to give some of my own money to help protect wild plants and animals.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
g. I am interested in taking care of natural areas in my neighborhood.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
h. I want to participate in other activities to protect plants and animals in natural areas.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
i. I would spend my free time on a project to protect plants and animals in my community.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
j. I think I can protect plants and animals in my own backyard.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
k. I am interested in a career with the National Park Service to protect plants and animals.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

5) What were three things you learned from participating in BioBlitz? It could be what you learned about nature, science, yourself, or anything else.

6) How did you like being outside in nature during BioBlitz? What did you like or not like?

7) Because of BioBlitz, what do you want to learn more about?

8) What did you do during the inventory (e.g., take pictures, use iNaturalist, look at bugs)?

BioBlitz Student Survey

We would like to know about your experiences at BioBlitz. Please answer these questions as honestly as you can. We will not share your responses with your teacher or your school. Thank you so much for your time and input!



1) Please tell us how strongly you agree or disagree with the following statements. For each item, choose the option that best matches what you think and feel:

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
a. I liked BioBlitz.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. I learned new things about nature/biodiversity from participating in BioBlitz.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. After participating in BioBlitz, I want to learn more about nature/biodiversity.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. I thought BioBlitz was boring.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. BioBlitz was too long.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f. BioBlitz was entertaining.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
g. BioBlitz was educational.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
h. I want to participate in more events like BioBlitz.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
i. I have talked or will talk with my friends about BioBlitz.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
j. I have talked or will talk with my family about BioBlitz.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
k. I plan to read something about nature or biodiversity this week.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
l. I try to learn as much information as I can in new situations.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
m. I really enjoy the uncertainty of everyday life.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
n. I am at my best when doing something that is difficult or challenging.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
o. Everywhere I go, I am looking for new things or experiences.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
p. I view challenging situations as an opportunity to grow and learn.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
q. I like to do things that are a little risky.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

2) Please tell us how comfortable you are with these things that might happen when spending time in nature/outdoors. We would like to know **how your thoughts BEFORE BIOBLITZ might be different from your thoughts TODAY:**

	BEFORE BIOBLITZ					TODAY				
	Very uncomfortable	Uncomfortable	Neither uncomfortable nor comfortable	Comfortable	Very comfortable	Very uncomfortable	Uncomfortable	Neither uncomfortable nor comfortable	Comfortable	Very comfortable
a. Sitting on the ground	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Touching plants when walking	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Spending a full day in nature/outdoors	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Getting hot/tired/thirsty/sweaty from hiking outside	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. Encountering spiders and insects	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

3) Please tell us how strongly you agree or disagree with the following statements:

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
a. I am always looking for experiences that challenge how I think.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. I prefer to do things that are both exciting and unpredictable.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. I often look for ways to challenge myself so I grow as a person.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. I am the kind of person who seeks out unfamiliar people, events, and places.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

4) Please tell us how you feel about biodiversity and environmental advocacy. We would like to know **how your thoughts BEFORE BIOBLITZ might be different from your thoughts TODAY:**

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	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
a. My life is better because there are a lot of different kinds of plants and animals outdoors.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. It is important to protect a wide variety of plants and animals.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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e. I want to be involved in protecting and taking care of natural areas.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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g. I am interested in taking care of natural areas in my neighborhood.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
h. I want to participate in other activities to protect plants and animals in natural areas.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
i. I would spend my free time on a project to protect plants and animals in my community.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
j. I think I can protect plants and animals in my own backyard.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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5) What was the most amazing thing you did or saw? Why was that most amazing?

6) How did BioBlitz change your feelings about being outside in nature?

7) What did you (or will you) tell your parents or friends about BioBlitz?

8) Is there anything else you want to tell us about your BioBlitz experience?

BioBlitz Student Survey

We would like to know about your experiences at BioBlitz. Please answer these questions as honestly as you can. We will not share your responses with your teacher or your school. Thank you so much for your time and input!



1) Please tell us how strongly you agree or disagree with the following statements. For each item, choose the option that best matches what you think and feel:

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f. BioBlitz was entertaining.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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j. I have talked or will talk with my family about BioBlitz.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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c. Spending a full day in nature/outdoors	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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e. I want to be involved in protecting and taking care of natural areas.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f. I want to give some of my own money to help protect wild plants and animals.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
g. I am interested in taking care of natural areas in my neighborhood.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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i. I would spend my free time on a project to protect plants and animals in my community.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
j. I think I can protect plants and animals in my own backyard.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
k. I am interested in a career with the National Park Service to protect plants and animals.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

5) What is something amazing you learned from participating in BioBlitz? It could be what you learned about nature, science, yourself, or anything else.

6) What do you think it is important to have many different kinds of plants and animals?

7) What will you do differently to protect nature?

8) What did you like about the inventory? What did you like about the Festival? If you did both, which did you like better and why?

BioBlitz Student Survey

We would like to know about your experiences at BioBlitz. Please answer these questions as honestly as you can. We will not share your responses with your teacher or your school. Thank you so much for your time and input!

Examples:  Wrong  Wrong  Right

1) Please tell us how strongly you agree or disagree with the following statements. For each item, choose the option that best matches what you think and feel:

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
a. I liked BioBlitz.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. I learned new things about nature/biodiversity from participating in BioBlitz.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. After participating in BioBlitz, I want to learn more about nature/biodiversity.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. I thought BioBlitz was boring.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. BioBlitz was too long.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f. BioBlitz was entertaining.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
g. BioBlitz was educational.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
h. I want to participate in more events like BioBlitz.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
i. I have talked or will talk with my friends about BioBlitz.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
j. I have talked or will talk with my family about BioBlitz.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
k. I plan to read something about nature or biodiversity this week.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
l. I try to learn as much information as I can in new situations.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
m. I really enjoy the uncertainty of everyday life.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
n. I am at my best when doing something that is difficult or challenging.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
o. Everywhere I go, I am looking for new things or experiences.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
p. I view challenging situations as an opportunity to grow and learn.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
q. I like to do things that are a little risky.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

2) Please tell us how comfortable you are with these things that might happen when spending time in nature/outdoors. We would like to know **how your thoughts BEFORE BIOBLITZ might be different from your thoughts TODAY:**

	BEFORE BIOBLITZ					TODAY				
	Very uncomfortable	Uncomfortable	Neither uncomfortable nor comfortable	Comfortable	Very comfortable	Very uncomfortable	Uncomfortable	Neither uncomfortable nor comfortable	Comfortable	Very comfortable
a. Sitting on the ground	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Touching plants when walking	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Spending a full day in nature/outdoors	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Getting hot/tired/thirsty/sweaty from hiking outside	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. Encountering spiders and insects	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

3) Please tell us how strongly you agree or disagree with the following statements:

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
a. I am always looking for experiences that challenge how I think.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. I prefer to do things that are both exciting and unpredictable.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. I often look for ways to challenge myself so I grow as a person.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. I am the kind of person who seeks out unfamiliar people, events, and places.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

4) Please tell us how you feel about biodiversity and environmental advocacy. We would like to know **how your thoughts BEFORE BIOBLITZ might be different from your thoughts TODAY:**

	BEFORE BIOBLITZ					TODAY				
	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
a. My life is better because there are a lot of different kinds of plants and animals outdoors.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. It is important to protect a wide variety of plants and animals.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. It matters to me how many different types of plants and animals there are.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Plants and animals play an important role in life in my state.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. I want to be involved in protecting and taking care of natural areas.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f. I want to give some of my own money to help protect wild plants and animals.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
g. I am interested in taking care of natural areas in my neighborhood.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
h. I want to participate in other activities to protect plants and animals in natural areas.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
i. I would spend my free time on a project to protect plants and animals in my community.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
j. I think I can protect plants and animals in my own back yard.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
k. I am interested in a career with the National Park Service to protect plants and animals.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

5) What was the most amazing thing you did or saw? Why was that most amazing?

6) How did BioBlitz change your feelings about being outside in nature?

7) Did BioBlitz make being a scientist or park ranger seem more interesting? If so, how?

8) What did you do during the inventory (e.g. take pictures, use iNaturalist, look at bugs)?

BioBlitz Student Survey

We would like to know about your experiences at BioBlitz. Please answer these questions as honestly as you can. We will not share your responses with your teacher or your school. Thank you so much for your time and input!



1) Please tell us how strongly you agree or disagree with the following statements. For each item, choose the option that best matches what you think and feel:

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
a. I liked BioBlitz.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. I learned new things about nature/biodiversity from participating in BioBlitz.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. After participating in BioBlitz, I want to learn more about nature/biodiversity.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. I thought BioBlitz was boring.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. BioBlitz was too long.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f. BioBlitz was entertaining.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
g. BioBlitz was educational.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
h. I want to participate in more events like BioBlitz.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
i. I have talked or will talk with my friends about BioBlitz.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
j. I have talked or will talk with my family about BioBlitz.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
k. I plan to read something about nature or biodiversity this week.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
l. I try to learn as much information as I can in new situations.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
m. I really enjoy the uncertainty of everyday life.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
n. I am at my best when doing something that is difficult or challenging.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
o. Everywhere I go, I am looking for new things or experiences.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
p. I view challenging situations as an opportunity to grow and learn.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
q. I like to do things that are a little risky.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

2) Please tell us how comfortable you are with these things that might happen when spending time in nature/outdoors. We would like to know **how your thoughts BEFORE BIOBLITZ might be different from your thoughts TODAY:**

	BEFORE BIOBLITZ					TODAY				
	Very uncomfortable	Uncomfortable	Neither uncomfortable nor comfortable	Comfortable	Very comfortable	Very uncomfortable	Uncomfortable	Neither uncomfortable nor comfortable	Comfortable	Very comfortable
a. Sitting on the ground	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Touching plants when walking	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Spending a full day in nature/outdoors	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Getting hot/tired/thirsty/sweaty from hiking outside	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. Encountering spiders and insects	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

3) Please tell us how strongly you agree or disagree with the following statements:

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
a. I am always looking for experiences that challenge how I think.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. I prefer to do things that are both exciting and unpredictable.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. I often look for ways to challenge myself so I grow as a person.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. I am the kind of person who seeks out unfamiliar people, events, and places.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

4) Please tell us how you feel about biodiversity and environmental advocacy. We would like to know **how your thoughts BEFORE BIOBLITZ might be different from your thoughts TODAY:**

	BEFORE BIOBLITZ					TODAY				
	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
a. My life is better because there are a lot of different kinds of plants and animals outdoors.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. It is important to protect a wide variety of plants and animals.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. It matters to me how many different types of plants and animals there are.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Plants and animals play an important role in life in my state.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. I want to be involved in protecting and taking care of natural areas.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f. I want to give some of my own money to help protect wild plants and animals.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
g. I am interested in taking care of natural areas in my neighborhood.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
h. I want to participate in other activities to protect plants and animals in natural areas.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
i. I would spend my free time on a project to protect plants and animals in my community.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
j. I think I can protect plants and animals in my own backyard.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
k. I am interested in a career with the National Park Service to protect plants and animals.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

5) What is something amazing you learned from participating in BioBlitz? It could be what you learned about nature, science, yourself, or anything else.

6) How did you like being outside in nature during BioBlitz? What did you like or not like?

7) How did BioBlitz change your idea about what scientists do?

8) What did you like about the inventory? What did you like about the Festival? If you did both, which did you like better and why?

Appendix D.3: BioBlitz 2016 Educator Survey

National Geographic Society 2016 BioBlitz Educator Survey

About this Survey

The National Geographic Society seeks your help to improve school programs associated with BioBlitz. The purpose of this survey is to learn about your experiences, and those of your students, related to participation in BioBlitz activities and use of resources. It will take about 20 minutes to complete the survey.

Thank you for your help in improving school programs!



Section A: BioBlitz Involvement

Before you tell us about your most recent BioBlitz experience with your students, please answer a few questions about your previous experience taking students to parks or other nature sites.

1. Have you previously participated in a BioBlitz event with your current or previous students, other than the one you just attended?

No

Yes

If yes, where (for example, a local or schoolyard BioBlitz or species inventory)?

If yes, how many times?

2. Have you taken your current students to a park or other nature site?

No

Yes

If yes, how many times?

--

3. If you attended a pre-BioBlitz educator professional learning experience, please indicate location and date of event.

Location:	Date:
-----------	-------

4. In which ways did you support students in BioBlitz?	With my class or my students	With another class or another educator's students	Did not do this
a. Took students outside in preparation for BioBlitz	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Taught students how to use iNaturalist	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Taught students about biodiversity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Accompanied students to BioBlitz	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

The remaining questions ask about your recent experience with BioBlitz.

5. Where was the BioBlitz you attended? (Name of park or nature site, and state.)

6. What is your school's ZIP Code?

7. Please check which activities you participated in with your students.

- Festival
- Species inventory

8. Please describe the BioBlitz activities that you and your students engaged in.

9. Describe the weather or other conditions that might have impacted your BioBlitz experience.

10. How did you first hear about this BioBlitz?

- School district
- Principal
- Another educator
- State Alliance
- Other (please describe):

11. For each statement below, please choose the option that best reflects how you would **rate your experience with the species inventories and festival** at BioBlitz.

	Poor	Satisfactory	Excellent	Did not experience
a. Interacting with scientists in the field during the inventory	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Engaging in hands-on science in the field during the inventory	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Using iNaturalist to submit species observations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Interacting with scientists in the field at the festival	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. Engaging in hands-on science at the festival	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

12. If you rated any of the items in Question 11 as “poor,” please explain why.

13. Please describe an experience that was especially meaningful to you during BioBlitz and why.

14. For each statement below, please indicate your evaluation of the **educational materials and support** provided before BioBlitz.

		Poor	Satisfactory	Excellent	Did not experience
a.	Pre-BioBlitz professional development (workshop or materials)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b.	Online educational resources at NatGeoEd.org/BioBlitz	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c.	Pre-BioBlitz interactions with BioBlitz organizers and/or hosts	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d.	Congruency between BioBlitz program content and my students’ curriculum	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e.	Other (please specify and rate):	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

15. If you accessed materials or a workshop prior to BioBlitz, how was it helpful? If you did not, what information and resources would have been helpful in advance?

16. If you attended any professional development to prepare you for BioBlitz, how effective was it? What other ways did you prepare for BioBlitz?

17. How did you prepare your students for BioBlitz? If you did any activities with your students to prepare them for BioBlitz, please describe them.

18. What else did you do to help prepare yourself and your students for BioBlitz?

19. Below is a list of potential benefits of participating in a BioBlitz. Please indicate **how effective** BioBlitz was at achieving each of the benefits below for you and your students.

	Not effective	Effective	Very effective	N/A
a. Engaging my students in something I think is important	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Engaging my students in activities in the field	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Engaging my students in authentic learning	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Engaging my students in scientific research with scientists or other experts	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. Satisfying standards and curricular requirements	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f. Involving my students in the conservation and appreciation of nature	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
g. Exposing my students to new experiences	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
h. Giving my students an opportunity to interact with National Park Service staff	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
i. Advancing my career	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
j. Other (please specify and rate):	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

20. Please provide any comments. If you rated any of the items in Question 19 as "Not effective," please explain why.

21. Please choose the option that best represents your level of agreement with each statement below.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
My participation in BioBlitz:					
a. ...increased my likelihood of bringing future classes to a park again	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. ...increased my likelihood of future field trips in nature	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. ...increased my likelihood of using parks to teach	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. ...was a good use of my teaching time	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. ...was a good teaching tool	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

22. If you indicated “disagree” or “strongly disagree” with any of the statements above, please explain why.

23. Please describe an example of how BioBlitz was meaningful to your students.

Section B: Information About You and Your Classroom

24. What grade level are the students you brought to BioBlitz?

25. How many students attended BioBlitz with you?

26. How many other educators/aides/parents attended BioBlitz with your class?

27. Describe the roles you and the other adults played (behavior monitoring, species identification, etc.)?

28. What technology did your class bring to BioBlitz (smartphones, tablets, etc.)?

29. Did you use iNaturalist?

No Yes

30. If yes, how many observations did you upload to iNaturalist?

In the field

Back in your classroom

31. Is your school a Title I or have a high proportion of students receiving free/reduced price meals?

No Yes

32. If you have any other comments about your BioBlitz experience or recommendations for future BioBlitzes, please feel to write them below.

33. What is your gender?

- Female
- Male
- Other
- Prefer not to answer

34. What subject(s) do you teach?

35. At the end of this school year, how many years will you have been teaching?

36. If you would like to become more involved with National Geographic Education, please provide your email address. We will add you to our newsletter and send you an introductory email regarding the free programs and resources we have available for you and your students.

Email Address for Educator Newsletter*	<input type="text"/>
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*Your email address will not be added to the rest of the data on this survey to preserve the anonymity of the data.

37. Is there any information that you would like to tell us about your experience before, during, or after BioBlitz that we have not asked you about?

Thank You For Your Time And Input!
This Will Help Us Improve Our Work With Educators And Students In The Future

Appendix D.4: BioBlitz 2016 Scientist/Inventory
Leader Survey

National Geographic Society 2016 BioBlitz Scientist/Inventory Leader Survey

Conducted by National Geographic Society and the Lawrence Hall of Science



**NATIONAL
GEOGRAPHIC**



THE LAWRENCE
HALL OF SCIENCE
UNIVERSITY OF CALIFORNIA, BERKELEY

About this Questionnaire

Thank you for being part of BioBlitz! Your time and talent inspired countless people and helped park staff better understand the natural resources that they care for. You can see up-to-date species counts at <http://nationalgeographic.org/projects/bioblitz/impact>.

You are invited to contribute to this survey because you participated in BioBlitz in May 2016 as an inventory leader (scientist, expert, etc.) or Pro-Observer. The purpose of this survey is to understand the impact of BioBlitz on people like you, as well as science more broadly, and to understand how BioBlitz could be further improved.

Note: If you were a participant rather than an inventory leader or Pro-Observer, please click here to be taken to the participant survey.

Your participation in this survey is completely voluntary, and you may opt not to answer any question or may stop at any time. Your responses on this questionnaire will be kept confidential, collected by UC-Berkeley and de-identified using a unique code. No personally identifiable information will be shared with anyone outside the evaluation team. The results of the survey will be used to improve the content and quality of BioBlitz program. This questionnaire should take no more than 20 minutes

to complete.

Thank you for your time and participation! If you have any questions about this survey, or about the project evaluation in general, please contact Ardice Hartry of The Research Group at the Lawrence Hall of Science, at hartry@berkeley.edu.

Questions 1)

1. Were you a: (please check all that apply)

- BioBlitz inventory leader or co-leader
- iNaturalist Pro-observer
- Other (please specify):

2. How many BioBlitzes have you participated in before this?

3. In which park(s) did you participate in BioBlitz?

4a. Which groups of people went on your inventory/inventories? (please check all that apply)

- Students
- Public
- Experts Only
- Other (please specify)

4b. Is there anything that we could have done to better prepare you to work with or help you manage the students?

5. What was the focus of your inventory (or inventories)?

6a. What resources were most useful for your participants?

- Species guides
- Binoculars
- Magnifying glass
- Camera
- Macro lens
- Ruler
- Specimen boxes/vials
- Bug net
- Pipette
- Other (please specify):

6b. Please describe how they used one of the resources:

7. Thinking about your experience during, as well as after BioBlitz, please check off any of the following activities you did:

- Submitted observations in iNaturalist for the BioBlitz from your own account
- Submitted observations in iNaturalist for the BioBlitz using a shared account
- Worked with an iNaturalist Pro-Observer during an inventory to add observations

- Helped BioBlitz participants use iNaturalist
- Helped people take better photos for submission to iNaturalist
- Used or created a species guide in iNaturalist
- Added identifications to other people's BioBlitz observations on iNaturalist
- Looked at the BioBlitz results
- Other (please specify):

8. In the future, do you plan to: (check all that apply)

- Attend another BioBlitz
- Organize a BioBlitz
- Use data from BioBlitz
- Use data from iNaturalist
- Use iNaturalist in the classroom
- Continue using iNaturalist
- Other (please specify):

Questions 2)

9. From your perspective, what were the goals of BioBlitz?

10. In your opinion, in what ways did BioBlitz achieve those goals? In what ways did it fall short of meeting those goals?

11. How do you think your **research, teaching, or other work** will change as a result of the BioBlitz?

12. What were the most valuable aspects of BioBlitz for you?

13. Please give us one or two examples of how BioBlitz had a meaningful and potentially long-term impact on an individual or group of participants?

14. Are there results/statistics from BioBlitz that you would like to see highlighted?

15. Based on your experience participating in inventories, what were the benefits of having a Pro-Observer or Pro-Observers? If there were two or more Pro-Observers on your inventory, how did

that work out?

16. What could we have done differently to make BioBlitz better for you?

17. Is there anything else you would like to tell us that we have not asked you?

Demographic information

18. Which of the following is or has been a part of your training or employment:

- Scientific Research
- Natural Resources Interpretation
- Teaching
- Science Communication
- Other (please specify):

19. How many years of professional experience do you have?

Would you be willing to participate in a 30 minute interview about your experience with BioBlitz? If so, please provide email address here:

END

Thank you for completing our survey!

If you would like to be entered into a drawing for a \$50 gift certificate, please provide your email address here:

Thank You for Your Time and Input!
This Will Help Us Improve BioBlitz in the Future.

Powered by Qualtrics

Appendix D.5: BioBlitz 2016 Observation Protocol

Notes/Comments

Participant Sheet (to be completed after the observation is done)

1. **Write (or draw) a brief reflection.** Provide a brief summary of this part of the event. Were the participants engaged? Did they seem to enjoy what they were doing? What was the overall feel and tone of the experience for the group?
2. **Map, draw or describe** where the Inventory Leader **and** participants spent time during the experience. Include the spatial aspects of where the leader spent time (near water, with bugs, along periphery etc.), and whether the leader or participants determined when/where participants went.
3. What **concerns about the natural environment**, or particular aspects, did participants mention and/or respond to? What did participants comment on or wonder about the species they saw, nature or the environment?
4. Overall, **how engaged were the participants?** What did they appear to be learning? What makes you think they were learning?