



# Lost Ladybug Project: Year Three Formative Evaluation

**January 2011**

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## Executive Summary

The Lost Ladybug Project, led by Cornell University's Department of Entomology and funded by the National Science Foundation, is a citizen science project that uses ladybugs as a focal species in order to involve children, families, adults, and other groups in field science experiences to illustrate scientific concepts, including invasive species, biodiversity, and conservation. As a primarily web-based program ([www.lostladybug.org](http://www.lostladybug.org)), the Lost Ladybug Project empowers adults and children from across the United States to become citizen scientists by searching for ladybug species in their neighborhoods, photographing the ladybugs they find, and submitting them to the project scientists for identification, along with supporting data about the location and habitat where the ladybug was found. The program's intended impacts for children, adults, and families include that participants will:

- Demonstrate scientific inquiry skills.
- Demonstrate interest in doing more citizen science projects.
- Increase knowledge and understanding of ladybug ecology.
- Feel confident that they have contributed to scientific research.
- Participate in future outdoor, science, or citizen science activities.

In the project's third of four years, its activities included the refinement of online mechanisms for participation and submission of data, finalization of guides, curriculum materials, and tools for public audiences of youth groups, classrooms, individual children, and families. At the conclusion of this program year, the Institute for Learning Innovation (ILI) conducted formative evaluation to assess the strengths and weaknesses of the updated implementation, and to test measures of impact achievement. This report presents the findings of evaluation of adult participants in the Self-Directed Mode, which included individual adult participants and family/intergenerational groups. ILI used an online survey of all adult Year 3 participants, using open- and closed-ended measures. A total of 185 participants completed the survey, an overall 38% response rate to the survey. This was a convenience sample, which may indicate a bias in the sample due to self-selection of respondents. It is advised to consider results conservatively, as they may not fully reflect the experience of non-respondents.

The results of this formative evaluation provide insights into the motivations, participation, and learning experienced by participants in Year Three of the Lost Ladybug Project. Overall, participants enjoyed their experience, learned key science concepts about ladybug species and ecology, and were motivated to likely participate in future years. A finding throughout the study was that participants were motivated by and enjoyed that they were able to contribute to scientific research and/or conservation through this project. Along these lines, data suggested there is strong value in the ongoing communication by science staff about the findings, research directions, and real value of participants' contribution to science. Below is a summary of key findings from this formative study.

### Program Audiences

Within the Self-Directed mode (the target population for this study), formative evaluation results indicate that **the Lost Ladybug Project continues to have a broad audience reach, with participants responding from a broad range of education levels, geographic locations, and community sizes** (i.e., urban, rural, and suburban communities). This indicates that this breadth of audience has not been lost as the project has progressed over the years. Respondents to the study also tended to be first-year participants, with 70% reporting just one year of participation. This suggests that the project continues to draw new audiences to participation, despite its three-year history.



**The study confirmed the previous year's findings that the majority of participants within the Self-Directed mode are adults participating on their own. It continues to be recommended that the needs of this audience be considered in future efforts of program design, recruitment, and communication.** For example, the development of materials that are not as child-focused and advanced resources for developing science skills (such as ladybug species identification) may provide added value to this audience group. It is also recommended that the summative evaluation in the final project year place an emphasis on documenting the participation and learning of the individual adult audience.

## Motivation, Enjoyment, and Communication from Scientists

Results regarding participant motivations and enjoyment reinforced Year 2 findings, which showed that **participants are most strongly motivated to participate by their desire to contribute to a scientific study or conservation efforts; similarly, these are the same factors that most contribute to participants' enjoyment of the program.** This motivation is consistent across participants in different group-types and for first-time and repeat participants. In addition to this motivation, **all participants very much wanted to know more about the scientific findings that resulted from their contributions and all felt strongly that their contributions were taken seriously by project scientists. Further, repeat participants had significantly stronger positive attitudes about the value of their contribution to science and more frequently reported enjoying the community and communication fostered by the project.**

These results provide support for the emerging theory about the Lost Ladybug Project's design, which creates and continues to emphasize a communication feedback loop between participants and the scientists who are using the data submitted. Efforts were made by Lost Ladybug Project staff in the past year of the program to create communication avenues (i.e., annual newsletter emailed and posted on the website) to share new developments in the findings. The finding that repeat participants had stronger perceptions of the value of their contribution and of the community created suggest that these communication tools may be important for supporting and nurturing this network of citizen scientists.

As the program enters its final year, it is recommended that the project team continue their emphasis on communication with participants, **communicating about the value of their contribution, its relevance to the scientific community, and its impact toward larger conservation efforts. It is advised to share information about any findings, hypotheses, analysis, or publications from the project scientists' research with this data. Further, it may be beneficial to provide feedback about the process of science and concrete ways in which participants can further increase the scientific power of their data** (i.e., replication of methods, reporting of negative results, etc.). This type of messaging is valuable not only for retaining repeat participants, but also for recruiting new participants, highlighting the opportunity to further the scientific findings that have already resulted from participation.

## Usability

Overall, the usability of the website and materials were well understood by participants, who reported far fewer challenges and difficulties than in the previous year. This indicates that the website improvements have been successful. Greatest challenges tended to come from those who were contributing data from non-traditional or non-standard settings (who found the data fields in the submission form difficult to complete) or ongoing challenges with file size during upload. All of these challenges were reported with much less frequency than in the previous year. **Given the positive**



**feedback on usability, overall recommendations are for ongoing maintenance, oversight, and troubleshooting based on reported problems from users.**

## **Learning Outcomes**

Adults reported learning several key outcomes identified for the project. In terms of content, the core concepts of the project were communicated and learned by participants overall, including knowledge gained about the wide variety of species that exist, that there has been a loss of certain ladybug species, and that there are a number of invasive species in the United States. This content knowledge was reported as being learned through the project directly, with the strongest learning seeming to relate to the specific species that participants found and submitted to the project. **This may indicate that the personal experience with the species collected may be a strong conduit for developing the learning outcomes about ladybugs more generally, as people are focused on their participation.**

**Attitudinal outcomes were another target for adults, and it was found that participants reported strong, positive perceptions of both the value of their contribution to science in this project and in the value of citizen science more generally.** As noted previously, repeat participants reported even stronger positive attitudes regarding the scientific value and use of their participation in this project specifically, which may suggest a longer-term impact of continued participation. **As discussed above, continued support of the development of these positive attitudes through direct communication about scientific use and results of participant data is strongly recommended.**

The learning outcomes for children will be explored more thoroughly in the secondary study with children and group leaders from the Group Facilitated mode, but adults' reports of their children's experiences suggest that the intended content learning and skill development outcomes are being achieved. **In terms of content, learning seems to be based upon the characteristics of ladybugs, and attitudinally, around developing appreciation of nature. With scientific skills, this study indicates that, as anticipated, older children strongly demonstrate abilities across the spectrum of science inquiry skills, while younger children demonstrate strong abilities in a few areas, and beginning efforts in other areas of science.** This finding supports the development of different levels of science skill achievement for different age groups of children.



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# Introduction

## Project Background

The Lost Ladybug Project is a citizen science project led by Cornell University's Department of Entomology and funded by the National Science Foundation, which uses ladybugs as a focal species to involve children, families, and groups in field science experiences to illustrate scientific concepts, including invasive species, biodiversity, and conservation. In the project's third of four years, its activities included the refinement of online mechanisms for participation and submission of data, finalization of guides, curriculum materials, and tools for public audiences of youth groups, classrooms, individual children, and families.

The project is designed to empower these individuals and groups to participate in research as citizen scientists by searching for ladybug species in their neighborhoods, photographing the ladybugs they find, and submitting them to the project scientists for identification, along with supporting data about the location and habitat where the ladybug was found. Because ladybug species can generally be identified from a photograph of reasonable quality, the scientific staff of the Lost Ladybug Project is able to verify the species of submitted photographs, resulting in a large dataset from locations around the country that is increasing scientists' understanding of changing patterns in ladybug species populations. Program participants not only contribute data, but are able to see the results and identification of their specimens through tools on the Lost Ladybug Project website ([www.lostladybug.org](http://www.lostladybug.org)).

Overall, the project was conceived with three overarching goals:

- For children, their families, and community to feel more comfortable and familiar with doing science. By creating concrete connections between the children's cultural community and science, children will also realize they already do science.
- For children to directly experience authentic science, with opportunities for meaningful achievement and mastery, through active participation in a national survey of ladybugs.
- For children to increase their understanding of the importance of preservation through biodiversity and conservation through these activities.

The program was designed to engage participants through two primary mechanisms, which provided different experiences to scaffold learning. One route, called Self-Directed Mode, occurred via the project website, where participants could access project materials, instructions, and participate in the program on their own. As originally conceived, this route was expected to serve primarily families; however, formative evaluation (Sickler & Messick, 2010) revealed that a majority of participants in this mode were adults participating independently. Consequently, the audiences intended for impact were expanded to incorporate this unanticipated group. The other mechanism, called Group Facilitated Mode, was planned to create a network of youth group leaders (e.g., 4H, Boy Scouts, school teachers, etc.) who were trained to lead a group of children to participate in the program (using a train-the-trainer model) and who implemented the program with their classes or groups. These experiences were intended to be led by these group leaders, supported by the curriculum materials provided by the Lost Ladybug program staff. The outcomes for children participating through these two different mechanisms were envisioned to be similar, but because the project activities and infrastructure were somewhat different for each mode, they each need to be considered.



## Intended Impacts

The Lost Ladybug Project intends to impact three target audiences with the outcomes listed below. While the team anticipated that the general outcomes for children of different ages may be the same, that the indicators of learning achieved would be different for younger and older children, with older children able to demonstrate more complex science skill and/or knowledge development.

Children, ages 5-7 and 8-12 will:

- Demonstrate scientific inquiry skills.
- Demonstrate interest in doing more citizen science projects.
- Increase knowledge and understanding of ladybug ecology.
- Feel confident that they have contributed to scientific research.

Adults will:

- Demonstrate scientific inquiry skills.
- Demonstrate interest in doing more citizen science projects.
- Increase knowledge and understanding of ladybug ecology.
- Feel confident that they have contributed to scientific research.

Families will:

- Participate in future outdoor, science, or citizen science activities.

As the project completed its third year of public participation, there continued to be strong levels of participation within the Self-Directed Mode, with roughly 496 participants (either individuals or families) during the 2010 season. Additionally, 30 youth groups were identified as having participated during 2010.

For its Year Three implementation, the project team incorporated results and recommendations from the 2009 formative evaluation into their work and refinements of the program. For instance, as part of planned improvements for the project website, visitor feedback on the usability of the submission pages guided a number of changes to make the forms and process more user-friendly. Additionally, one of the most substantial findings from the 2009 evaluation was that participants most valued and were most motivated by the feeling of contributing to real, important scientific research. To support this, program staff provided clear communication with past participants about the scientific results from their data via their website and a first annual program newsletter (<http://www.lostladybug.org/newsletter2010-975.php>). This newsletter reported to participants some of the key scientific results coming out of their data and what science staff was doing in response to this data. With refinements such as these, the program continued on its course of recruiting and supporting participants' remote engagement in the program.

## Evaluation Questions

As the project completed this year of implementing and refining its activities, evaluation focused on formative assessment of how the program functioned, its strengths and its weaknesses, as well as beginning to test measures for summative evaluation of the degree to which learning outcomes were achieved. The evaluation sought to answer several key formative questions about the project's continued implementation, but to focus more explicitly on understanding what knowledge, attitudes, and skills participants took away from the program. Two studies were undertaken: one with





participants in the Self-Directed Mode (including adult facilitators of family groups and solo adults) and one with youth and adult participants in the Group Facilitated Mode.

This report addresses the study of the Self-Directed participants. The specific evaluation questions addressed in this study are:

- Who is participating in the Lost Ladybug Project (demographic s) and how are they participating (i.e., group composition, use of online resources, etc.)?
- What are participants' motivations for joining and continuing the project?
- Are there problems with the usability of the project website, interface, and instructional materials? How might the website be further improved?
- To what degree are participants (adults and children) achieving the anticipated outcomes?
  - Learning science content about ladybug ecology and conservation?
  - Demonstrating scientific skills?
  - Demonstrating positive attitudes toward the value of their individual participation and about citizen science in general?



## Methods

To address these evaluation questions with Self-Directed participants, ILI used a web-based survey of adults registered as the contact person from submission. As known from previous evaluation, this included both adults who had participated with family-based groups, adults who participated alone, and adults who participated in groups without children. Based on the evaluation questions, ILI developed a structured questionnaire to be administered to program participants as an online survey. The questionnaire consisted of multiple-response and Likert-type rating scale questions, but also contained a number of open-ended questions to explore participant feedback about particular aspects of the program. Demographic information about respondents and their participation in the program were also collected. (See Appendix A for survey questions.) The method of a web-based survey was appropriate for this audience, considering that the Self-Directed Mode was designed to be entirely web-based, participants were widely distributed around the country, and the only form of contact had between staff and participants was via email.

In October 2010, an invitation to participate in an online survey was sent out by email to all 496 addresses from the Lost Ladybug Project database of those who were current participants and had submitted data within the 2010 collecting season. A reminder email was sent two weeks following the initial invitation to those who had not yet responded, and a final reminder was sent a week later. In total, 223 participants clicked through to view the survey online (a 48% participation rate), and ultimately 83% of those individuals, 185 participants, completed the survey. This resulted in an overall response rate of 38%. Note that this method uses non-random, convenience sampling. Possible bias resulting from this technique is discussed below.

Data from closed-ended questions were analyzed quantitatively, with descriptive statistics presented and discussed in detail in this report. Data from open-ended questions were coded for themes and commonalities in the responses. Frequencies of common responses are reported. For some questions, sub-groups of participants were compared statistically (via SPSS) to identify trends or differences in motivations or outcomes. Statistics used are indicated in the results.

### Sample Bias

It is important to note the potential sources of bias inherent in this convenience sample. The web-based survey, by its nature, results in a sample that is self-selected by those who choose to click the link and complete the survey. The response rate of 38% suggests the results may have a sample bias toward those participants who felt strongly about the Lost Ladybug Project, or who felt a greater sense of investment in the program's continuation and success. While the demographic data collected seem to be representative of the known characteristics of the program participants overall, we cannot be certain that the data from these respondents fully represent the ideas or opinions of all program participants. Therefore, we suggest a conservative interpretation of the results, being cautious to conclude how the data represent participants beyond the present sample.



# Results

## Sample Description

In total, responses to the online survey were obtained from 185 Lost Ladybug Program participants. Table 1 shows the demographic characteristics of this sample, of which nearly two-thirds was female. Respondents were relatively evenly distributed across other demographic variables. In terms of education level, the sample was split rather evenly between those with less than a Bachelor's degree, a Bachelor's degree, and an advanced degree, although it was more heavily weighted to the latter two categories. Overall, the majority of lived in either rural or suburban areas. Respondents to the survey, like program participants, came from many states in the U.S., as well as some from Canada. In total, respondents reported being from 39 different states, with the most common states (reported by 10 or more respondents) being: New York, Florida, California, Rhode Island, and Virginia (Table 2).

Table 1. Demographic profile of survey respondents<sup>1</sup>

	Percentage	Count
<b>Sex (n=180)</b>		
Female	66	119
Male	34	61
<b>Education (n=173)</b>		
Some high school	4	6
High school diploma	13	23
Associate's degree	9	16
Bachelor's degree	36	63
Master's degree	28	48
Doctoral degree	10	17
<b>Region (n=181)</b>		
Suburban	49	89
Rural	29	52
Urban	22	39
Tribal lands	1	1

Table 2. States of survey respondents

	Percentage	Count
New York	11	20
Florida	9	16
California	9	15
Rhode Island	8	14
Virginia	5	9
Texas	5	8
Other States	59	94

<sup>1</sup> The demographic of age was inadvertently excluded from collection in the web survey.



The data about respondents' patterns of participation are presented in Table 3. As noted, this program has had an unexpected reach to adults who participate on their own, without a child or group; over half of respondents (58%, n=107) participated in this way. This was in stark contrast to the original design that anticipated families would be the primary Self-Directed participants. The next most common way of participating was with children from their family (27%, n=50), followed by few respondents from group-facilitated modes. It should be noted that individuals identified as organized youth group leaders were not the target audience for this survey; they were asked to participate in a separate study. Thus, it is not surprising that few respondents reported participating as part of a youth group. Although the program was unexpectedly reaching a large number of adult participants, the data did show that child participants tended to be between five and twelve years old, with 75% (n=46) of those who participated doing so with children within that age range, as was envisioned.

Over half of the participants (62%, n=112) reported submitting between 2-9 photos, and nearly a quarter (23%, n=42) reported submitting only one photo. Additionally, the majority of participants surveyed (70%, n=126) participated for only one of the past four years, and nearly a quarter (23%, n=41) participated for two of the past four years. Only one person reported participating all four years of the program (2007-2010).

Table 3. Participation profile of survey respondents

	Percentage	Count
<b>Participation* (n=185)</b>		
Just myself	58	107
Myself with children from my family	27	50
Myself with a group of adults	14	25
Myself with a group including children	6	11
<b>Ages of Children who Participated* (n=61)</b>		
0-4 years	26	16
5-7 years	51	31
8-12 years	54	33
13-17 years	11	7
<b>Photos Submitted (n=181)</b>		
0	1	1
1	23	42
2-9	62	112
10-19	8	15
20-29	2	3
30+	4	8
<b>Number of Years Participated (n=181)</b>		
1	70	126
2	23	41
3	7	13
4	1	1

\*Respondents could select more than one answer, so percents do not equal 100%.



## Motivations and Enjoyment of the Program

### Motivations for Participation

A key area of interest was to understand the motivations of self-directed participants – what led them to participate initially, what they enjoyed, and what might lead them to continue participation in future years. The evaluation explored this topic by using a rating question, scaled from one to seven, based on the results from last year’s findings. The results showed that the most powerful motivation for participation was the desire to contribute to a scientific study or conservation (see Table 4), with 70% or more of respondents indicating strong agreement (a rating of 6 or 7) with these statements. The next most common motivational factor was participants’ pre-existing content-based interest, in nature-related topics or insects/ladybugs, (rated 6 or 7 by 68% and 57% of respondents, respectively). Interest in learning more about ladybugs and that the project seemed easy to do were also moderately strong motivators.

Table 4. Reasons for participating in the program

	Percent of Respondents Rating*							Mean	SD	Count
	7	6	5	4	3	2	1			
I wanted to contribute to a scientific study (n=183)	45	29	14	8	2	3	0	5.99	1.22	183
I wanted to contribute to conservation (n=182)	45	25	16	7	2	2	3	5.88	1.42	182
I was interested in nature-related topics (n=183)	37	31	15	7	4	4	1	5.73	1.44	183
I was interested in insects and/or ladybugs (n=184)	35	22	15	13	7	4	4	5.35	1.73	184
I wanted to learn more about ladybugs (n=185)	28	23	15	16	8	4	6	5.06	1.80	185
The project seemed easy to do (n=180)	27	21	14	12	5	10	11	4.77	2.06	180
I was curious to try it out and see what it was like (n=182)	18	14	18	15	5	13	16	4.19	2.09	182
I was interested in photography and wanted to submit my photos (183)	19	14	12	12	9	11	24	3.92	2.24	183
I already looked for ladybugs and wanted to submit what I found (n=183)	19	8	8	14	9	12	29	3.62	2.27	183
I wanted to use the project to teach others (n=181)	15	12	10	8	12	10	30	3.54	2.25	181
I wanted an activity I could do with my family, friends, or group (n=181)	10	9	8	7	11	13	42	2.95	2.16	181

\*Where 7 = My main reason to participate and 1 = Not at all a reason to participate.

Interest in photography and socially-based motivations were not strong motivators for the vast majority of participants, receiving neutral or negative mean ratings. However, many of these items had high standard deviations and slightly bimodal distributions, indicating that while they were not motivating for most, they were highly motivating for a minority of participants. When comparing motivations by group type, the ratings given for the statements “I wanted to use the project to teach others” and “I wanted an activity I could do with my family, friends, or group” were both significantly different (Kruskal-Wallis one-way analysis of variance), with those participating in groups rating this as stronger motivating factors than lone adult participants (Table 5). No other significant differences in motivation were found.



Table 5. Mean ratings given to reasons for participating in the program, by group type

	Adult Only (n=104)		Group with Children (n=59)		Group with Adults (n=20)		P Value
	Mean	SD	Mean	SD	Mean	SD	
I wanted to contribute to conservation	6.07	1.3	5.76	1.36	5.3	2.03	0.074
I wanted to contribute to a scientific study	6.04	1.29	5.81	1.18	6.4	0.88	0.051
I was interested in nature-related topics	5.73	1.56	5.75	1.29	5.7	1.3	0.79
I was interested in insects and/or ladybugs	5.32	1.87	5.47	1.64	5.1	1.25	0.338
I wanted to learn more about ladybugs	4.97	2.06	5.32	1.42	4.75	1.33	0.312
The project seemed easy to do	4.63	2.12	5.12	1.85	4.45	2.31	0.343
I was interested in photography and wanted to submit my photos	4.22	2.28	3.32	2.13	4.15	2.25	0.06
I was curious to try it out and see what it was like	4.04	2.02	4.58	2.19	3.65	2.13	0.105
I already looked for ladybugs and wanted to submit what I found	3.7	2.42	3.47	2.13	3.7	2.13	0.93
I wanted to use the project to teach others**	2.63	1.88	5.19	2.05	3.16	2.03	0
I wanted an activity I could do with my family, friends, or group**	1.75	1.33	4.91	2.05	3.3	1.63	0

\*Significant difference:  $P < .05$  (Kruskal-Wallis one-way analysis of variance)

\*\*Significant difference:  $P < .01$

Nearly all respondents to this survey (99%,  $n=183$ ) indicated that they would probably or definitely participate again next year (Table 6). Due to the potential for bias in those who responded to the survey, this percentage is likely higher than it would be for the full population of past participants.

Table 6. Likelihood of participating again next year ( $n=185$ )

	Percent	Count
Definitely will	64	119
Probably will	35	64
Probably will not	1	2
Definitely will not	0	1

Three participants indicated that they were not likely to participate in the Lost Ladybugs project again. These individuals indicated that they did not feel they would add anything new to the program by participating again or that they were only interested in reporting sightings of rare, 9-spotted ladybugs.

### Enjoyment of the Program

Respondents were given a list of options to select what they enjoyed most about participating in this program, which was derived from participant responses to an open-ended question in 2009. While many enjoyable elements were selected, the large majority felt that contributing to a scientific study (82%,  $n=152$ ) was the most enjoyable. The next most enjoyable aspects included contributing to conservation efforts (68%,  $n=126$ ) and learning about ladybugs (62%,  $n=117$ ) also mentioned by more than half of respondents (Table 7). These data parallel the reports of the most motivating attributes of the program.



Table 7. What participants enjoyed most about the program (n=185)

	Percent	Count
Contributing to a scientific study	82	152
Contributing to conservation efforts	68	126
Learning about ladybugs	62	117
Searching for or finding the ladybugs	50	93
Photographing the ladybugs	50	93
Being out in nature	50	92
Seeing my submission(s) online	46	85
Feeling a part of a community of people with similar interests	37	68
Communications I received	29	53
Doing the project with my child, friends, or group	26	48
Nothing, I did not enjoy the project	0	0
Other	7	12

\*Respondents could select more than one answer, so percents do not equal 100%.

In a comparison of participant enjoyment by group type, chi-square analysis revealed significant differences for two areas of enjoyment: adults participating as a group were less likely to select enjoyment of contributing to a scientific study, and those who participated with children were more likely to select enjoyment due to participating with their children, friends, or a group (Table 8).

Table 8. Enjoyment by group type (n=183)

	Adult Only (n= 104)		Group with Children (n=59)		Group with Adult (n=20)	
	Percent	Count	Percent	Count	Percent	Count
Contributing to a scientific study*	88	91	80	47	65	13
Contributing to conservation efforts	74	77	59	35	60	12
Learning about ladybugs	66	69	59	35	55	11
Searching for or finding the ladybugs	47	49	59	35	45	9
Photographing the ladybugs	55	57	44	26	45	9
Being out in nature	49	51	46	27	65	13
Seeing my submission(s) online	45	47	49	29	45	9
Feeling a part of a community of people with similar interests	37	38	41	24	30	6
Communications I received	29	30	29	17	30	6
Doing the project with my child, friends, or group**	1	1	71	42	20	4
Nothing, I did not enjoy the project	0	0	0	0	0	0
Other***	8	8	7	4	0	0

\*Significant difference:  $P < .05$

\*\*Significant difference:  $P < .01$

\*\*\*Number of respondents insufficient to run chi-square analysis

In comparing adult enjoyment by number of years participating in the Lost Ladybug project, a chi-square analysis revealed significant differences between first-time and repeat participants, with repeat



participants more likely to indicate that they enjoyed 1) feeling a part of a community of people with similar interests and 2) the communications they received from the program (Table 9).

Table 8. Enjoyment by years participated in Lost Ladybugs program (n=183)

	First-year Participants (n=126)		Repeat Participants (n=55)	
	Percent	Count	Percent	Count
Contributing to a scientific study	80	101	87	48
Contributing to conservation efforts	68	85	67	37
Learning about ladybugs	60	75	69	38
Searching for or finding the ladybugs	52	65	51	28
Photographing the ladybugs	48	60	56	31
Being out in nature	47	59	58	32
Seeing my submission(s) online	44	55	53	29
Feeling a part of a community of people with similar interests **	31	39	53	29
Doing the project with my child, friends, or group	25	32	26	14
Communications I received**	21	27	46	25
Other***	6	8	7	4
Nothing, I did not enjoy the project***	0	0	0	0

\*Significant difference:  $P < .05$

\*\*Significant difference:  $P < .01$

\*\*\*Number of respondents insufficient to run chi-square analysis

## Communication with Project Staff

Following the 2009 evaluation, the Lost Ladybug program staff identified several key communication points that were important to respondents – primarily messages confirming that submissions were received and identified. For the 2010 study, the staff was interested in determining the extent to which these communications were received by respondents. The majority (62%,  $n=115$ ) reported that they had received an email confirming receipt of their submission; but far more respondents (83%,  $n=153$ ) reported that they had received an email confirming the identification of the photo they submitted (Table 10). This may have been due to respondent memory, or perhaps mechanisms for emailing receipt confirmations were not fully implemented in 2010. As for additional, non-required methods of communication, nearly three-quarters (68%,  $n=125$ ) saw their submission posted on the website, and a smaller, but substantial, proportion of respondents reported more in-depth communication such as having their questions answered by staff (23%,  $n=42$ ) or ongoing conversation with staff (16%,  $n=30$ ). This either indicates the high degree of personal, one-on-one communication maintained by the Lost Ladybug staff and/or an element of bias in the sample, with those who engaged in personal communication being more likely to respond to the survey.

Overall, participants reported high levels of satisfaction with the communication they received with 82% ( $n=152$ ) rating communication received as either a 6 or a 7 (mean=6.37,  $SD=0.997$ ).





Table 9. Types of communication received by respondents (n=185)

	Percent	Count
A message on the website that my submission was received	62	115
An email confirming the identification of the photo I submitted	83	153
I saw my submission posted on the website	68	125
Lost Ladybug staff answered my questions by email about submissions or data collection	23	42
Ongoing email communication with Lost Ladybug staff about my submissions or data collection	16	30
Other	7	13

\*Respondents could provide more than one answer, so percents do not equal 100%.

A few participants who marked “other” did not remember what types of communication they received. Those who did remember another type of communication mentioned the newsletter and the previous year’s survey. One participant noted receiving a message saying that the file could not be uploaded.

## Usability of Website

The Lost Ladybug website is a primary tool for transmitting information to participants and for the submission of all data. The evaluation sought to explore the overall ease of using the website, following the project guidelines, and participation for self-directed participants.

### Finding, Understanding, and Following Instructions

Respondents to the survey indicated that the website was the primary mechanism by which they located and accessed the instructions for Lost Ladybug data collection, with 64% (n=118) reporting the website as their source.

Table 10. Where participants received instructions (n=185)

	Percent	Count
Viewed/Printed instructions from the Lost Ladybug website	68	125
Read/heard instructions from a media story about the program	22	40
Received instructions in the Lost Ladybug brochure (obtained at an event)	4	8
Received instructions directly from Lost Ladybug staff at a fair, festival, or program	6	8
Received instructions from my program or group leader	0	0
Other	12	22

\*Respondents could provide more than one answer, so percents do not equal 100%.

Other responses included that they were already familiar with data collection procedures due to their profession or hobbies, various community resources such as libraries, as well as a specific mention of the media avenue in which they read the instructions including:

- Scholastic News
- Washington Post
- Google
- TFK magazine
- Denver Post



- A friend’s blog
- Providence Journal
- A link on Facebook

Respondents’ ratings of the ease of understanding and following the instructions for collecting and submitting data were very high, with average ratings all over 6.0 on a seven-point scale (Table 12) and a majority of respondents selecting a rating of 7 (“very easy”) for each of the statements. This indicates that the instructions provided are quite clear and understandable for most participants.

Table 11. Participant rating of ease of understanding and following instructions for collecting and submitting ladybugs.

	Percent of Respondents Rating*							Mean	SD	n
	7	6	5	4	3	2	1			
Overall ease of understanding and following the instructions	68	21	7	3	1	0	0	6.54	.79	180
How to photograph ladybugs	62	23	9	5	2	0	1	6.36	1.03	175
Where to look for ladybugs	59	24	7	7	2	1	0	6.31	.95	167
How to collect ladybugs	57	19	10	11	2	1	0	6.28	1.11	169
When to look for ladybugs	56	20	12	10	1	1	0	6.19	1.11	169
What information to write down when collecting ladybugs	56	26	11	7	1	0	0	6.17	1.16	170

\*Where 7=very easy to understand, and 1=very difficult to understand

In addition to these ratings, the respondents were asked to provide feedback on any aspects of the data collection instructions that were difficult. Just a few participants commented on difficulties related to data collection including questions about how to best “chill” the ladybugs. Others used this as an opportunity to share that they did not use directions, either because they already knew how to collect ladybugs, or because they didn’t realize there was a protocol.

### Submitting Ladybug Data

The large majority of the survey respondents reported (93%, n=169) successfully uploading their data via the online form, and only 7% reported emailing their submission(s) directly to the Lost Ladybug program. This is a high degree of success with the online format.

To better understand the ease of using the online submission, survey respondents were shown screen shots of each step of the Lost Ladybug online submission process and asked to comment on the usability of each, as well as any difficulties had with the questions or needs of that screen.

### Required Information and Additional Information Section

The large majority of participants navigated this section without any problems. Those who reported issues had difficulties due to the fact that they were unaware that they needed to collect this type of information. Others felt that the form did not encompass options which were relevant to their data collection search. For instance, some collected data at night, under a range of temperatures, or multiple habitats. Others had technology issues which included trouble attempting to print, or difficulties when pressing the “back” button.



In comparison to 2009, participants in 2010 reported fewer concerns regarding filling out the longitude and latitude section. There were also fewer concerns from those who have participated alone about how to fill out this section if not participating as part of a group.

**Ladybug Found In:**

\* STEP 1) Select your Country:

\* STEP 2) Select your State/Province:

\* STEP 3) Enter the County/Departamento:

\* STEP 4) Nearest City/Ville/Ciudad

**Collection Date / Host Plant:**

\* Year:  \* Month:  \* Day:

Enter the name of the host plant:

This field is optional.

**Habitat:**

\* Habitat found in:

Plant or surface where the ladybug was found.

Figure 1. Submission Process: Required Information Screen Shot

**Additional information:** (very helpful, but not required)

<p><b>Number of spotters:</b> <input type="text"/></p> <p><b>Spotters Ages:</b> <input type="text"/></p> <p><small>Separated by commas, and will not be publicly displayed.</small></p> <p><b>Length of time searching:</b></p> <p>Hours <input type="text" value="-"/></p> <p>Minutes <input type="text" value="-"/></p> <p><b>Method of searching:</b> <input type="text" value="Please Select..."/></p> <p><b>Weather:</b> <input type="text" value="Please Select..."/></p> <p><b>Temperature:</b> <input type="text" value="Please select a temperature..."/></p> <p><b>Site/Trail name and/or street address:</b> <input type="text"/></p> <p><b>Were you collecting on Tribal Lands?</b>  <input type="radio"/> Yes <input checked="" type="radio"/> No</p> <p><b>Additional comments:</b> <input type="text"/></p>	<p><b>Additional spotters names:</b> <input type="text"/></p> <p><b>Time of day:</b> <input type="text" value="please select..."/></p> <p><b>Position:</b></p> <p>Latitude: <input type="text"/> (degrees)</p> <p>Longitude: <input type="text"/> (degrees)</p> <p>Altitude: <input type="text"/> (meters)</p> <p><b>Group Name:</b> <input type="text"/></p> <p><b>Group leader's full name:</b> <input type="text"/></p> <p><small>Must be someone over the age of 13 yrs old.</small></p> <p><b>Group leader's email address:</b> <input type="text"/></p> <p><small>Must be someone over the age of 13 yrs old.</small></p>
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Figure 2. Submission Process: Additional Information Screen Shot



### Uploading Ladybug Photos

Difficulties with the upload process included not knowing the identity of the ladybugs submitted. One person suggested including a link to the field guide right from this window.

Others spoke of the difficulties trying to upload larger file sizes to the website, although the frustration regarding file size was much less apparent this year in comparison to 2009.

Upload your photos:

Ladybug #1: (at least 1 photo required)

photo 1:  Browse...

photo 2:  Browse...

What ladybug species do you think this is? (common or scientific name - your best guess):

Ladybug #2: (optional)

photo 1:  Browse...

photo 2:  Browse...

#2's identity (your best guess):

Ladybug #3: (optional)

photo 1:  Browse...

photo 2:  Browse...

#3's identity (your best guess):

Ladybug #4: (optional)

photo 1:  Browse...

photo 2:  Browse...

#4's identity (your best guess):

Ladybug #5: (optional)

photo 1:  Browse...

photo 2:  Browse...

#5's identity (your best guess):

Submit your data and photos >

Figure 3. Submission Process: Uploading Photos Screen Shot

Participants were asked to offer any additional suggestions to change the upload process. There were a variety of suggestions, most of which had to do with improvements to the ease of the submission process. Specifically, respondents mentioned:

- streamlining the photo submission process,
- having the ability to submit using a cell phone, and
- a returning ID so that individuals do not have to re-enter all of the information each time they submit.

See Appendix B for a full list of additional suggestions from participants.

### Additional Website Resources

In considering additional information and resources on the website, two primary features are currently available: informational resources about ladybug species and maps and lists of where ladybugs have been found by participants in the project so far. Results showed that, in fact, most of the responding participants had used these resources; 90% (n=167) reported reading the online information about ladybugs, and 79%, (n=139) had looked at maps and lists of where ladybugs have been found on the Lost Ladybugs website.

When asked to make suggestions about additional resources, most participants requested more information about how to collect ladybugs in non-traditional settings, better identification tools for common species of ladybugs, and other tips and tricks that would help them when they attempt to identify their ladybugs. See Appendix B for a full list of additional resources requested by participants.



## Learning Outcomes

One of the major objectives of this evaluation was to explore the types of learning outcomes that were being achieved with the various participants and test measures of those outcomes. These outcomes included topics of ladybug ecology that the team expected participants to learn, as well as additional affective and attitudinal outcomes that may have been experienced, and were slightly different for adult and youth participants.

### Adult Outcomes

Adults who participated in the Lost Ladybug program reported learning that there are a variety of different species of ladybugs (27%, n=31), that there is a “loss” or endangerment of certain ladybugs (25%, n=29), and specific characteristics of ladybugs (19%, n=22) (Table 13). Adult participant reports of learning outcomes were similar across all group types (adult only groups, groups with children, and groups with adults), as well as number of years participated (first-time, repeat participants).

Table 12. What adult participants reported learning personally due to participation. (n=117)

	Percent	Count
Variety of species	27	31
Loss of ladybugs	25	29
Characteristics of ladybugs	19	22
Invasive species	15	18
Science skills	11	13
How to distinguish between ladybugs	9	11
Identification of my ladybug	9	11
Ladybugs are beneficial	4	5
There is a community of people who like ladybugs/study ladybugs	3	3
Other	18	21

Adults reported on their learning about specific ladybug ecology topics (Table 14) and were asked to rate ten statements to show how they learned about each one by checking one of the following: “I learned this from participating in the Lost Ladybug Program,” “I knew this before I participated in the Lost Ladybug program,” or “I didn’t know that.” The main thing learned from participating in the project was specific information about the species of ladybug they found (76%, n= 32). Most of the participants (68%, n=121) also reported learning about the endangerment of some native ladybug species in the United States, and half of the participants (50%, n=90) reported learning that there are hundreds of species of ladybugs native to North America.

The survey found that several topics of ladybug ecology were familiar to a majority of participants prior to participating, especially that ladybugs help people by eating pest insects in gardens and on farms (92%, n=174), that there is more than one species of ladybug (69%, n=123), and that geographic locations will vary between species.



Table 14. Adult self-reported learning about specific ladybug ecology topics.<sup>2</sup>

	I learned this from participating in LLP	I knew this before I participated in LLP	I didn't know that	Count
Specific information about the species of ladybug I/we found.	76	8	16	176
Some species of ladybugs were common in the US but are now very rare.	68	18	14	179
There are hundreds of species of ladybugs native to North America.	50	25	25	181
There are scientists who study and care about ladybugs.	46	44	10	178
Some ladybug species that are commonly seen today are not native to the U.S.	45	40	15	180
There are thousands of species of ladybugs in the world.	41	26	33	180
Certain species of ladybug are found in certain geographic locations and not others.	37	52	11	181
A healthy environment requires a variety of types of ladybugs.	31	44	26	176
There is more than one species of ladybug.	24	69	7	179
Ladybugs help people by eating pest insects in gardens and on farms.	5	92	3	178

Regarding their attitudes about the value and impact of their individual participation to the larger field of science research, participants showed a strong sense that their participation in the Lost Ladybug project had a meaningful impact on science. When asked to rate their agreement with a variety of statements on a scale from 1 to 7 (where 1 indicated strongly disagree and 7 indicated strongly agree), participants rated relatively high agreement with most of the statements (all mean ratings were above 5 on a 7-point scale; Table 15). Notably, the strongest agreement related to interest in finding out more about what scientists are discovering because of the data they had submitted (mean=6.20, SD=1.20). Ratings also showed quite high agreement for statements indicating that participants felt part of the scientific process (mean=5.749, SD=1.22), that their contribution was taken seriously (mean=5.69, SD=1.22) and appreciated (mean=5.66, SD=1.33) by scientists.

In order to explore the question of whether ongoing participation in the project had any correlation with attitudes toward the value of contribution, the distribution of responses to these items were compared between first-time and repeat participants (using a Mann-Whitney U test). This comparison revealed significant differences between these groups on five of the statements (Table 16). In all cases, the repeat participants reported higher agreement that their contributions were appreciated, taken seriously, important, and would result in new scientific discoveries.

<sup>2</sup> Two items intended for the instrument were inadvertently omitted from the final online survey: *Certain species of ladybugs are found on certain plants and not others*, and *How to gather data according to a scientific protocol*.



Table 15. Participant attitudes about the value of their contribution to science research.

	Percent of Respondents Rating*							Mean	SD	Count
	7	6	5	4	3	2	1			
I would like to find out more about what scientists are discovering because of the data submitted	57	23	9	5	4	2	0	6.20	1.20	181
I feel that I was part of the scientific process because of my participation	36	28	20	9	4	1	0	5.79	1.22	179
I think my contribution was taken seriously by scientists	36	26	15	15	4	2	0	5.69	1.33	182
I think that the scientists appreciated my contribution of data	35	26	17	16	3	3	0	5.66	1.33	180
Scientists will make important discoveries because of the data submitted	32	24	18	19	4	1	2	5.50	1.41	180
Scientists will definitely use the data I submitted	29	22	16	19	10	3	1	5.29	1.52	180
The data I submitted will make an important contribution to real scientific research	24	25	16	19	10	4	1	5.14	1.54	182
I feel more confident about my ability to take part in the scientific world	24	22	13	24	8	4	3	5.04	1.65	178

\*Where 7=strongly agree, and 1=strongly disagree

Table 16. Mean ratings about the value of their contribution to science research, by length of participation.

	First-Time Participant (n=125)		Repeat Participant (n=55)		P Value
	Mean	SD	Mean	SD	
I would like to find out more about what scientists are discovering because of the data submitted	6.09	1.31	6.47	0.84	.103
I feel that I was part of the scientific process because of my participation*	5.66	1.28	6.13	1.00	.025
I think my contribution was taken seriously by scientists**	5.45	1.39	6.24	0.98	.000
I think that the scientists appreciated my contribution of data**	5.46	1.42	6.09	1.01	.007
Scientists will make important discoveries because of the data submitted	5.38	1.48	5.77	1.20	.127
Scientists will definitely use the data I submitted**	5.06	1.57	5.82	1.25	.003
The data I submitted will make an important contribution to real scientific research**	4.93	1.60	5.62	1.27	.009
I feel more confident about my ability to take part in the scientific world	4.92	1.71	5.33	1.45	.170

\*Significant difference: P<.05 (Mann-Whitney U Test)

\*\*Significant difference: P<.01



Participants were asked to rate their interest in participating in Citizen Science projects. Sixty-four percent (n=113) of participants were extremely interested (a rating of 7) in participating in Citizen Science projects (1 to 7 scale). Participants were also asked to rate their attitudes toward Citizen Science generally, using a pilot version of an attitudinal scale currently under development and testing by Tina Phillips in the Cornell Lab for Ornithology (Phillips, personal communication). This scale asks participants to rate their agreement with a variety of statements about citizen science on a 5-point Likert-type scale (where 1= strongly disagree and 5=strongly agree). Lost Ladybug Project participants had overall strong agreement with these statements about the positive value of Citizen Science (mean ratings were all above 4.3; Table 17). Their strongest agreement rating were around the impact that citizen science can have on participants; they felt that Citizen Science engaged people with nature and the outdoors (mean=4.68, SD=.605) and that it helped people gain a greater appreciation of the natural world (mean=4.62, SD=.663).

When comparing the ratings of first-time and repeat participants, no statistically significant differences were found in the distribution of their ratings (Mann-Whitney U).

Table 17. Participant attitudes about Citizen Science.

	Percent of Respondents Rating					N	Mean	SD
	Strongly Agree	Agree	No Opinion	Disagree	Strongly Disagree			
Citizen science engages people with nature and the outdoors.	72	26	1	0	1	178	4.68	.605
Citizen scientists gain a greater appreciation of the natural world.	69	28	2	1	1	178	4.62	.663
Citizen science is an effective tool for engaging people in the scientific process.	62	36	1	0	1	179	4.58	.635
Citizen scientists are active stewards of the environment.	51	36	12	1	1	177	4.34	.798
Citizen scientists contribute to scientific knowledge.	49	46	3	1	1	179	4.42	.686
Citizen science is effective at detecting large-scale patterns in nature.	49	42	7	1	1	179	4.37	.742
Citizen science data can address real-world questions.	46	43	9	1	1	177	4.33	.758
Citizen science is an efficient way to collect large amounts of data.	46	48	5	0	1	179	4.37	.687

### Child Outcomes

Those adults who participated with children were asked to report what the children they worked with learned due to participation in the Lost Ladybug program. One-third (34%, n=13) felt that children learned specific science skills, 29% (n=11) felt that children learned specific characteristics of ladybugs, and 21% (n=8) felt that children gained an appreciation or awareness for nature.





Table 18. Adult reports of what children learned due to participation. (n=38)

	Percent	Count
Science skills	34	13
Characteristics of ladybugs	29	11
Awareness/appreciation for nature	21	8
Variety of species	13	5
Loss of ladybugs	8	3
There is more than one species of ladybug	5	2
Ladybugs are beneficial	5	2
Other	13	5

\*Respondents could select more than one answer, so percents do not equal 100%.

Examples of adult comments regarding the specific ways that their children learned each of these main concepts included:

**Science skills**

“How to be more observant, part of the scientific process.” (Female adult participating with children ages 5-7 yrs)

**Characteristics of ladybugs**

“Ladybugs eat many different things. Ladybugs come in lots of colors. Some do not have spots.” (Female adult participating with children ages 8-12 yrs)

**Awareness/appreciation for nature**

“A respect for all of nature and all its beauty.” (Male adult participating with children ages 13-17 yrs)

The “other” category included responses related to children’s excitement of posting the submission online, learning about the whole project, and learning that there are scientists who study ladybugs.

Adults who participated with children were asked to rate the extent to which they felt their children were able to demonstrate specific scientific skills during or as a result of their participation in the Lost Ladybug project. It was expected that the skills used would be different for children of different ages, with older children being able to develop more skills to a greater extent than younger children. Consequently, data were examined separately for children aged 5-7 years old and children aged 8-12 years old. For the youngest participants, ages 5-7, the skills most strongly demonstrated were the ability to collect the ladybug data according to the protocol/instructions (43%, n=12 rated “to a great extent”) and asking questions about what they found in the investigation (41%, n=12 rated “to a great extent”). The skills young children generally did not demonstrate (or demonstrated very little) were suggesting new ways to conduct the investigation (54%, n=15 rated “not at all” or “a little”). Other skills were generally demonstrated at a moderate level (Table 19).



Table 19. Demonstration of science skills by children ages 5-7, as reported by adult facilitators.

	Percent Selecting				n
	To a great extent	Somewhat	A little	Not at all	
Were able to collect the ladybug data according to the protocol/instructions.	43	21	36	0	28
Asked questions about what they found in the investigation.	41	34	24	0	29
Were able to help plan the investigation.	37	40	17	7	30
Were able to understand the purpose of the study.	35	52	10	3	31
Identified patterns in what they found in the investigation.	34	38	17	10	29
Were able to use the tools needed for collecting the data.	29	50	18	4	28
Understood the importance of following the instructions carefully.	25	50	21	4	28
Suggested new ways to conduct the investigation (e.g., where to look, when to look, making comparisons, etc.).	21	25	29	25	28

Adults who participated with children ages 8-12 reported much stronger demonstration of science skills by these children, as was anticipated. In fact, a majority of adult respondents indicated that their children demonstrated these abilities “to a great extent” for all but one of the skills listed (Table 19). Most notably, 70% (n=21) adults indicated their children were greatly able to collect the ladybug data according to the protocol/instructions, 66% (n=21) that they were able to understand the purpose of the study, and 60% (n=18) that they understood the importance of following the instructions carefully. The skill of suggesting new ways to conduct an investigation was still the weakest of the science skills demonstrated, although it was reported more strongly for 8-12 year-old children than their younger peers (45%, n=14 reported it was demonstrated “to a great extent”) (Table 20).

Table 20. Demonstration of science skills by children ages 8-12, as reported by adult facilitators.

	Percent Selecting				n
	To a great extent	Somewhat	A little	Not at all	
Were able to collect the ladybug data according to the protocol/instructions.	70	17	10	3	30
Were able to understand the purpose of the study.	66	31	3	0	32
Understood the importance of following the instructions carefully.	60	27	13	0	30
Were able to use the tools needed for collecting the data.	53	30	13	3	30
Identified patterns in what they found in the investigation.	53	20	20	7	30
Were able to help plan the investigation.	52	31	14	3	29
Asked questions about what they found in the investigation.	52	35	10	3	31
Suggested new ways to conduct the investigation (e.g., where to look, when to look, making comparisons, etc.).	45	29	16	10	31



Overall, adults reported higher outcomes for each of the statements for children ages 8-12 than children ages 5-7 who participated in the Lost Ladybug program, which aligns with the project’s outcomes as stated in the logic model, which intended for children ages 8-12 to obtain a greater number of impacts due to their increased capabilities developmentally.

Those who reported participating as part of a family group were asked the likelihood of participating in additional activities including science activities, citizen science projects, and outdoor activities. Over half of the respondents responded “definitely” to each of the activities on a scale from 1 to 7 where 1=not at all likely and 7=definitely. Respondents were most likely to participate in science activities (mean=6.29, SD=1.08), and then Citizen Science projects (mean=6.25, n=1.09) (Table 21).

Table 21. Likelihood of participating in additional activities. (n=59)

	Percent Rating*							Mean	SD
	7	6	5	4	3	2	1		
Science Activities	63	15	12	8	2	0	0	6.29	1.08
Citizen Science Projects	61	14	19	3	3	0	0	6.25	1.09
Outdoor Activities	58	20	14	5	2	0	2	6.20	1.21

\*Where 7=definitely, and 1= not at all likely



## Discussion

The results of the Year Three formative evaluation demonstrate that the Lost Ladybug Project continues to have a broad audience reach, has made noticeable improvements to the web-based user interface, and is achieving a number of its intended learning impacts for adults and children. In terms of audience, the evaluation results demonstrate that the program is reaching a broad audience in terms of adult education level, locations across the country, and communities (i.e., urban, rural, and suburban). The findings support the previous year's evaluation results that the program has had a significant reach on adults, who are primarily participating on their own. This unanticipated audience, who make up a majority of the survey respondents, seems to provide an even greater breadth to the audience than originally anticipated. Within the anticipated family audience, the program seems quite successful at drawing participants within the target youth age range.

Although most respondents to the survey (70%) were first-time participants in the program, the results regarding motivations and enjoyment in the program reinforced the findings from the Year Two study. Participants are most strongly motivated to participate by their desire to contribute to a scientific study or conservation efforts; similarly, these are the same factors that most contribute to participants' enjoyment of the program. Following this desire to contribute were motivations based in interest in insects/ladybugs and a desire to learn; again, in parallel, learning was the next most prevalent factor of enjoyment.

Results from several dimensions of the study, including these motivation-related findings, highlight and clarify a trend that was first observed in the Year Two formative study, which is the strong relationship between participants' desire to contribute and the role of communication by scientists within the project. As noted above, the contribution to science and to conservation was what most motivated people to participate, equally across all participant types. Also, all participants very much wanted to know more about the scientific findings that resulted from their contributions. In response to questions about the value of their participation, feelings were strong that their contributions were taken seriously and appreciated by the Lost Ladybug Project scientists, and these attitudes were significantly stronger among repeat participants (those who would have received the annual newsletter and communication from the project team). Further, repeat participants also indicated more often that they enjoyed the program's like-minded community of people and the communication with program staff, suggesting that the communication between scientists and the participants is, at least among repeat participants, creating a network and community with value.

From the perspective of citizen science program design, it suggests the important role that communication between scientists and participants can be seen as a feedback loop – participants are motivated to make a meaningful contribution; they value that their contributions are taken seriously and are interested to know what results from their contribution; and by communicating this information back to participants, they may increase the sense of the value of their contribution and overall motivation to continue to participate. While the correlations in the data do not answer questions of causality (i.e., Do communications lead to more positive attitudes toward value, or do those predisposed to have positive attitudes tend to be repeat participants?), it does emphasize that these elements of the program design are important and valued by participants, particularly among those that return to participate repeatedly.

These data indicate that the website in its current design has very strong usability, with many positive improvements made during the past year. Participants gave very high ratings to overall usability, ease



of understanding data collection instructions, and communications and confirmations of their submissions. They reported very few problems with submitting data. Most are viewing the online lists of species and locations from ladybug spotters. Requests for additional resources tended to relate to a need for more data collection resources – new tools, tips, and techniques to improve their ability to identify the species they collect. This indicates an interest in furthering their knowledge and skills in the project, to be better at species identification, rather than leaving that to the Lost Ladybug Project experts.

Evidence from the survey also indicated that, in large part, learning outcomes are being achieved with adults, and that adults feel learning outcomes are being achieved by children participating with them. The main content learning for adults was around the target topics of ladybug ecology, including variety of species, the endangerment of certain species, and invasive species issues. Interestingly, data suggest that the learning seemed to occur around the experience with the specific insect(s) they spotted, as adults rated learning about “their” species as the item most often learned through the project.

Although the learning outcomes for children will be explored more explicitly in the secondary study of this phase (with children and group leaders), adults’ perceptions in this survey suggest that they are achieving the intended learning goals, with the main areas being developing science skills, learning characteristics of ladybugs, and appreciation of nature. When asked about specific skills and abilities demonstrated by children, adults reported that most 8-12 year-old children demonstrated the target science skills to a great extent, while 5-7 year-old children were most able to follow the scientific protocol and ask questions about the investigation.



## Conclusions and Recommendations

The results of the formative evaluation in Year Three of the project highlight that the project seems to be achieving a number of its audience reach and impact goals and has improved the overall usability of the website in the past year in a number of positive ways. The study confirmed the previous year's findings that the majority of participants within the Self-Directed mode are adults participating on their own. **The individual adult participant group continues to be highly motivated and enjoying the program. It continues to be advised that the needs of this audience be considered in future efforts of program design, recruitment, and communication.** For example, development of materials that are not as child-focused and advanced resources for developing science skills (such as ladybug species identification) may provide added value to this audience group. **It is recommended that the summative evaluation in the final project year place an emphasis on documenting the participation and learning of the individual adult audience.**

### Motivation, Enjoyment, and Communication from Scientists

As discussed above, the results of the evaluation provide support for the emerging theory about the Lost Ladybug Project's design, which creates and continues to emphasize a communication feedback loop between participants and the scientists who are using the data submitted. As emerged in the exploratory study in Year Two, the strongest motivating factor for participants was the desire to contribute, either to a scientific study or to conservation efforts. Similarly, this was the feature selected as enjoyable by most participants. Finally, participants across the board rated a strong desire to find out more about scientists' results, essentially requesting this type of communication from the scientists on the team. Further, the discovery that repeat participants (responding to the survey) had significantly more positive attitudes about the scientific value of their contributions and greater enjoyment in the project's community and communication suggested that this feedback loop may have even greater value in maintaining a strong network of citizen science participants.

As the program enters its final year in 2011, it is recommended that the project team continue their emphasis on communication with participants at an individual and a community level, **communicating about the value of their contribution, its relevance to the scientific community, and its impact toward larger conservation efforts. It is advised to share information about any findings, hypotheses, analysis, or publications from the project scientists' research with this data. Further, it may be beneficial to provide feedback about the process of science and concrete ways in which participants can further increase the scientific power of their data** (i.e., replication of methods, reporting of negative results, etc.).

It is also possible that this type of messaging is valuable not only for retaining repeat participants, but is useful for recruiting new participants through advertising, press releases, and other media campaigns. Such recruitment could position participation not only as a plea for help, but as an opportunity to further the scientific findings that have already resulted from participation. This may highlight the tangible benefit to be had from participating in the project.

### Usability

Overall, the usability of the website and materials were well understood by participants, who reported far fewer challenges and difficulties than in the previous year. This indicates that the website improvements have been successful. **Greatest challenges tended to come from those who were**



**contributing data from non-traditional or non-standard settings (e.g., collecting at night, collecting from multiple habitats), who found the data fields in the submission form difficult to complete.** The team may consider whether there is value in modifications to the form to allow participants to provide additional contextual information, or whether it is unnecessary due to the limited number of instances. In terms of photo upload, file size continued to cause trouble for some participants, but this issue was greatly reduced from the previous year's study. Continued monitoring and updating of this aspect, as appropriate, may be warranted. However, **given the positive feedback on usability, overall recommendations are for ongoing maintenance, oversight, and troubleshooting based on reported problems from users.**

## Learning Outcomes

Adults participating in the Self-Directed mode did report learning several of the key outcomes identified for the project. In terms of content-learning, the core concepts of the project were communicated and learned by participants overall, including knowledge gained about the wide variety of species that exist, that there has been a loss of certain ladybug species, and that there are a number of invasive species in the United States. This content knowledge was reported as being learned through the project directly, with the strongest learning seeming to relate to the specific species that participants found and submitted to the project. **This may indicate that the personal experience with the species collected may be a strong conduit for developing the learning outcomes about ladybugs more generally, as people are focused on their participation.**

**Attitudinal outcomes were another strong target for adults, and it was found that participants reported strong, positive perceptions of both the value of their contribution to science in this project and in the value of citizen science more generally.** It was hoped that the Lost Ladybug Project would support or develop these attitudes in adult participants, and the results suggest that this is the case, with repeat participants reporting even stronger positive attitudes regarding the scientific value and use of their participation in this project specifically. **As discussed above, continued support of the development of these positive attitudes through direct communication about scientific use and results of participant data is strongly recommended.**

The learning outcomes for children will be explored more thoroughly in the secondary study with children and group leaders from the Group Facilitated mode, but the adults' reports of their children's experiences in this survey suggest that the intended content learning and skill development outcomes are being achieved. **In terms of content, learning seems to be based upon the characteristics of ladybugs, and attitudinally, around developing appreciation of nature. With scientific skills, this study indicates that, as anticipated, older children strongly demonstrate abilities across the spectrum of science inquiry skills, while younger children demonstrate strong abilities in a few areas, and beginning efforts in other areas of science.** This finding supports the development of different levels of science skill achievement for different age groups of children.

