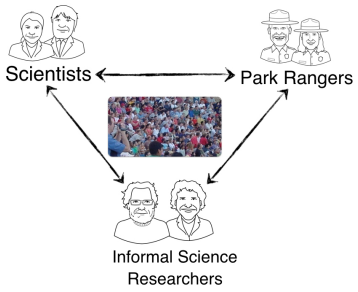
Shaping Outreach and Education Collaborations with National Park Interpreters

The Point. The iSWOOP project aims to forge connections between scientists and park interpreters to make science an interactive part of visitors' experience. Too often opportunities to engage the public in learning about and discussing park-based science are missed. Recognizing that 1) scientists who engage the public, once looked upon with suspicion by their peers, are increasingly applauded for strengthening the link between the research enterprise and society (Lohwater and Storksdieck 2017), and 2) funding agencies often require scientists to justify their research in terms of broader impacts, and 3) national parks offer a willing workforce of interpretive rangers and a range of relevant science, we set out to understand scientists' opinions better in order to shape the structure and invitations to collaborate on outreach and education.



Background. Risien and Storksdieck (2018) argue that a systematic approach to broader impacts can yield benefits. Their recommendations rely upon individual researchers developing an impact identity based on five critical elements: 1) personal identities and intrinsic motivators 2) capacities and skillsets; 3) approach to research and scholarship; 4) institutional mission and support 5) disciplinary norms. For university-based scientists, workplace expectations are commonly barriers to systematically addressing broader impacts as an integral part of research design (Risien and Storksdieck, 2018). Despite the availability of resources to assist scientists in expanding or improving their broader impacts work, such as training through National Alliance for Broader Impacts (NABI), Portal to the Public, and science communication workshops, as well as support from university staff whose mission is to support broader impacts, many scientists still tend to rely on limited networks and traditional formats like lectures to develop their broader impacts (Risien and Falk, 2013; NABI, 2018; Risien & Storksdieck, 2018). Yet scientists who conduct research in parks often find their way to engage with park staff members and the public. By consulting on exhibits,

giving talks about implications for policy, and explaining their studies to interested park visitors, they break the stereotype that the only thing that matters in science is full dedication to research itself at the expense of all other considerations. National parks offer rich opportunities for scientific study and engagement with the public (Watkins, Miller-Rushing, & Nelson, 2018). In articulating lessons learned for positioning science in the public eye, Park Service staff and others emphasize the importance of planning and the matching of goals, audiences and methods (Merson, Allen, Hristov, Pfeiffenberger, Super, Everitt, Teel, & Watkins, 2017; Watkins, Miller-Rushing, & Nelson, 2018).

The Sample.

iSWOOP staff sent email invitations to complete an online survey (Appendix A) to 2,189 investigators who had submitted an annual report to the NPS Research and Permitting Reporting System (www.irma.nps. gov) on permitted research conducted in 2016. More than 3,000 reports were filed, but some investigators submit multiple reports (one for each site where they have active research). After eliminating "out of office" and bounce notifications, the valid sample was 2,097, resulting in a response rate of 17%. We report on surveys from 354 respondents, which we analyzed using latent class analysis, exploratory analysis, and descriptive statistics.

Our Hunches. We had two hypotheses that we report on.

Hunch 1: Prior experience with education and outreach collaborations is mixed, leading to the need to tread carefully with new requests for collaboration. ***On the contrary,*** prior experience is positive for 88% of respondents.

Hunch 2: A desirable outcome for scientists of collaboration with NPS is the opportunity for thousands to hear about their research. ***True, but not exclusively so.*** We found that inspiring others is the most highly rated response in terms of potential outcomes of outreach.

Researchers' Preferences. Park-based scientific researchers:

✓Are more likely to consider giving informal talks (62%) compared to formal talks (48%).

✓ Give high importance to being able to prepare for and control what happens.

✓ Were more likely to rate taking on a new challenge as highly important—if they held fewer than three permits.

✓ Rated reaching thousands of people or even advancing their own research as less important than inspiring others and influencing policy.

✓Indicated that funds for such things as travel limit their outreach efforts.

✓ Rated lack of clarity about the process for initiating outreach as somewhat limiting their outreach activities.

✓ Were less likely to choose contributing to a teacher workshop, consulting on an exhibit, or setting up a citizen science project as a top choice compared to giving an informal talk (62% of the time giving informal talks was a top choice, whereas these three formats were rated among the top three 27%-32% of the time). However, these options were more popular than participating in online chats (selected just 8% of the time).

See Appendix B for results for specific items.

So what does it mean for initiating collaborations?

We identified three different profiles that corresponded to researchers' approaches to outreach planning. The latent variable "outreach planning behavior" was correlated with preferences for outreach collaborations and

activities and perceptions of limiting factors (like funds for travel or public interest). We first calculated the percentage of respondents who chose each approach to planning outreach. Then we compared and contrasted their answers to other items. This analysis allowed us to predict the types of outreach activities that might fit the priorities, work styles, and activities of three different groups of researchers. (See Appendix B for the variation in responses by class.)

Class 1 (Proactive and Positive), includes 31% of the researchers who responded. They reported budgeting seriously for outreach. Scientific researchers in this group seriously planned outreach while designing their research plan. Proactive and Positive types will likely be receptive to an offer of assistance of more than a few hours to explore funding, design a new program, or increase the visibility of the research.

Class 2 (Neutral), is 12% of the researchers who responded budgeted not at all or minimally for outreach. They responded that they plan not at all or minimally for outreach even once findings are in. On all items they tended to select "somewhat important" (the neutral category) rather than "highly important." Many members of this group labeled their prior experience with park outreach as mixed. In spite of this, among the neutral category, there were scientists interested in promoting their own research and collaborating with citizen scientists. None or a few hours might be acceptable for collaborating unless the project clearly advances the scientists' work.

Class 3 (Potential Allies), more than half (58%) of the researchers surveyed are in the third group. Like the first group, they say it is highly important to them to inspire others to do science as well as to influence management or policy, and rate their most recent experience leading or contributing to an educational experience as positive. This group hovered in the middle space between seriously and not at all budgeting and planning for outreach. Potential Allies preferred just a couple hours of assistance with collaborative outreach projects. They were most likely to want to spend a few hours exploring funding, designing a new program, or increasing the visibility of the research. For several, increasing the visibility of the outreach could spark interest in collaborating for more than a few hours.

In preparing for this survey and in previous conversations, authors spoke to many park staff who expressed interest in collaborating with scientists. While Park staff could often be more forthcoming with a clear point of contact and process for jumpstarting outreach collaborations, scientists should know they can ask to consult with a lead interpreter or the chief of interpretation. The rangers who work in the division of interpretation and education or as the education or science coordinator of a regional learning center are often keen to collaborate. They can tailor opportunities to suit individual researcher's availability and priorities. In fact, the earlier the planning for outreach begins, the more creative and targeted it can be. The universe of possible collaborations is larger than a one-hour talk or a long-term monitoring project with citizen scientists. If neither the park staff nor the scientist has ideas immediately for how to collaborate, there can be a conversation about how others have contributed and what sorts of presentations or written products have been helpful. Researchers can be explicit about the time commitment they can make, off-site or on-site. Researchers can also be forthright with their priorities, such as

✓ inspiring others to do science

✓ influencing policy, and

✓ deriving visibility for the research or for the outreach effort.

Risien and Storksdieck (2018) offer two examples of seasoned scientists who integrated the many dimensions of their identities in order to develop outreach and engagement activities that fit their interests, capacities, societal needs, and research. They both started with modest projects built out of initial partnerships. Those modest beginnings gave rise to a series of increasingly impactful projects, each growing out of the success of the previous. This pattern is explicitly echoed in three of four interviews with scientists permitted to conduct research in national parks. Proximity led to joint presentations and invitations to interact with staff or the public. Over time, the researchers and park staff began to plan intentionally, giving increasing visibility to the park-based researchers and their studies.

> The initial involvement of people in the field research came through EarthWatch Action in the late [19]80s. The other things in the park

> just kind of evolved slowly out of occasional evening talks. We keep doing those, but then we enlarged upon the opportunities for people to stop by the research field base. Once we realized people are very interested in that, we started just trying to facilitate us being there when tour boats come through. It just grew very slowly over the years.
>
> As we did more, word got out. …

Researchers acknowledged that readily available resources for researchers about opportunities in education and outreach collaboration with NPS are "not just sitting there waiting." One seasoned researcher recommended being bold. She found names on the park website. In addition to filling out a form online, she recommended:

> Just write to someone and ask them. … Contact a person and tell them about your interest.

Scientists who lived adjacent to the park where they also conducted research recognized they had extensive possibilities for collaboration.

> Biggest benefit to me that I enjoy most is the networks that exist around park. I've met so many people through this watershed project but also going to meetings being on the … science symposium organizing committee. I do a professional development program for science students. Various park personnel have volunteered to come into my class. … Awesome. Definitely two-way. It's because I live here… I'm not from a college two hours away.

The barriers are clear:

> Most scientists are not in the park for extended amounts of time as we are. It's not that easy. They come in for one or two weeks of field work, and then take right away for the field and they don't come back until the night before they leave. … It's not that easy to get them involved [with ed/outreach].
>
> Park staff … aren't always receptive to external researchers, for whatever reason. They lose some control over the message. I suppose they are concerned about quality of talks. I've heard some lousy scientists talks. They [interpreters] want to make sure they don't inflict those on visitors.
>
> I doubt interpreters even know about half the research that's happening in the park. There's no direct way of them finding that out.

However, the potential to enhance the public's experience and increase their knowledge was also obvious to researchers:

> The public values the up-to-date and informed information directly from scientists. It's hard for new interpreters to pick up everything in a week of training.

Conclusion

In this summary of survey results, we looked at the first two aspects of an impact identity as delineated by Risien and Storksdieck (2018), 1) personal identities and intrinsic motivators and 2) capacities and skillsets. Among permitted park researchers, we found patterns in intrinsic motivation for fostering interest in science. Further, we found preferences related to capacity to take on a task, prepare for and execute it with a high degree of control. Given a set of park-specific outreach opportunities, respondents favored outreach options like informal and formal talks. While we concur with Risien, Storksdieck, and others who propose that establishing and nurturing impact identities in concert with articulating impact specific goals and developing long-term plans is critical to broader impacts success, we also advocate initiating contact early and often with park educators and interpreters who can help expand researchers' universe of options, offer a menu of opportunities, and tailor them to researchers' capacity and preferences.

Acknowledgments

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Appendix A

Education and Outreach Opportunities 2018 Survey

Parks are outstanding venues for SCIENCE and for LEARNING. Collaborations are a win-win and we'd like to see more of them that benefit the public, the parks and scientists like YOU.

By responding to this survey, you agree that the iSWOOP project can use your responses when we share findings with others online, through print publications, and in conference presentations. No attributions will be given. We expect to report findings in aggregate.

At the end of the survey you can opt to be entered into a drawing for a gift certificate. Thank you for helping out!

1. How likely is it that you will lead or be part of research on protected lands in the coming years?

Fill in the % likelihood.

Comments?

2. How many research permits have you applied for?

Enter estimate.

Priorities and Outreach *Please respond to the following questions with respect to research you are currently involved in. If you are not currently leading or participating in research on protected land, answer hypothetically.*

3. How important to you are these aspects of doing outreach?

Rank the following from 1 to 3 with 1 being not at all important and 3 being highly important.

Making a one-time or time-limited commitment

Committing to something I can prepare for and control

Taking on a challenge or trying something new

Comments?

4. To what extent do these factors limit your educational outreach Efforts?

Rank the following from 1 to 5 with 1 being not at all important and 5 being extremely important.

Limited funds to support expenses like travel

Discomfort speaking to public audiences

Belief that the research holds limited interest for the public

Lack of clarity on the process for collaborating with park educators

Other comments?

Future Possibilities

5. How important to you are these potential outcomes of outreach?

Rank the following from 1 to 3 with 1 being not at all important and 3 being highly important.

Advancing my research

Finding others who will care about my research

Inspiring others to do science

Influencing management or policy

Getting the word out to thousands

Increasing my effectiveness as a science communicator

Comments? Any specific audiences you hope to reach?

6. Which of these would you consider doing *in collaboration with* park staff?

Pick your top three.

Being Interviewed

Giving an informal talk

Being part of an online chat

Consulting an exhibit design

Contributing to curriculum or a teacher workshop

Giving a formal talk

Setting up a citizen science project

7. Would you like to collaborate with park staff on educational outreach for the public?

In terms of hours, how many hours of assistance would you like with ...

Rank the following 1 to 3 with 1 being none and 3 being more than a few hours

Funding educational outreach activities

Collecting visuals for education

Designing an educational experience

Increasing visibility of the research

Increasing visibility of the outreach

Your Background

8. When undertaking a research project, do you ...

Rank the following from 1 to 5 with 1 being not at all and 5 being seriously.

Budget for outreach

Plan an outreach component while designing the research plan

Consider a plan for outreach once findings are in

9. If applicable, on a scale of 1-5, how would you rate your most recent experience leading or contributing to an educational experience for others in a park setting?

1 being negative, 3 being neutral/mixed, and 5 being positive

Comments? In as much detail as you like, please share any thoughts you have on what made your experience a positive one or what could have made it better.

10. Would you be interested in ...

Being entered in a drawing for a gift certificate

Speaking with us in more depth about outreach and education in national or state parks

If you checked either option above, please record your full name and an email address here or email us under separate cover (to keep your responses and name separate): martha_merson@terc.edu

Appendix B

Data Summary & Analysis

Researchers Surveyed

The survey respondents are researchers whose information were collected through the National Park Services. The researchers' names and email addresses were gleaned from the publicly available Research and Permitting Reporting System (RPRS) (https://irma.nps.gov/rprs/). We collected 2,189 researchers' names, email addresses, research titles, and research permit numbers. 354 investigators took the online survey.

Likelihood Participation of Research on Protected Lands in the Future

When asked the likelihood of participation for research on protected lands in the coming years, there was an average of 87.6% likelihood.

Affiliations

Of the 365 investigators who took the survey, 204 provided contact information to be used to reach them. Analyzing the .edu and .gov domain, 113 had educational affiliation and 19 had government affiliation. The rest were personal emails from common domains such as Gmail, Yahoo or Comcast.

Number of Permits Applied for

Among the responses, the average number of permits applied for was 5.7 with a median of 2.5 and a mode of 1. 70% of researchers have applied for 0-5 permits. There is an outlier: one respondent had applied for more than 100 permits.

Report on Selected Items for the Total Sample from Surveys

(#3) How important to you are these aspects of doing outreach?

Rating scale is a 3 point scale: 1 = not at all important, 2 = somewhat important, 3 = highly important

	Making a one-time or time-limited commitment (n=348)	Committing to something I can prepare for and control (n=348)	Taking on a challenge or trying something new (n=349)
Average	2.2	2.5	2.3
Median	2.0	3.0	2.0
Mode	2.0	3.0	2.0

Researchers were asked to rate the importance of different aspects of doing outreach on a scale of 1 to 3. Overall, researchers value being able to prepare for and control their outreach the most rather than taking on a new challenge or making a one-time or time-limited commitment. Researchers indicate a preference for outreach collaborations with park staff that they could prepare for and control.

(#4) To what extent do these factors limit your educational outreach efforts?

Rating scale is a 5 point scale: 1 = not at all limiting, 3 = somewhat limiting, 5 = highly limiting

	Limited funds to support expenses like travel (n=348)	Discomfort speaking in public spaces (n=351)	Belief that research holds limited interest for the public (n=349)	Lack of clarity on the process for collaborating with park educators (n=346)
Average	3.8	1.4	1.7	2.9
Median	4.0	1	1	3.0
Mode	5.0	1	1	3.0

Limited funds to support expenses like travel are the highest factor in limiting educational outreach efforts. With a mode of 5, it is the highest concern for most researchers compared to discomfort with public speaking and the belief that the research holds limited interest for the public. The next most common limiting factor is the lack of clarity on how to collaborate with park educators. While it makes sense for funds to be the primary concern, it is interesting to note that lack of clarity on how to do outreach as the second highest concern.

(#5) How important to you are these potential outcomes of outreach?

Rating scale is a 3 point scale: 1 = not at all important, 2 = somewhat important, 3 = highly important

	Advancing my research (n=351)	Finding others who will care about my research (n=352)	Inspiring others to do science (n=351)	Influencing management or policy (n=348)	Getting the word out to thousands (n=348)	Increasing my effectiveness as a science communicator (n=351)
Average ratings	2.3	2.4	2.7	2.6	2.3	2.4

On average, all aspects of outcomes for outreach are important. However, the top two highly-rated potential outcomes are to inspire others about science and to influence management or policy regarding science. Researchers were slightly less concerned with advancing their own research and getting the word out to thousands.

(#6) Which of these would you consider doing *in collaboration with* park staff?

Choose top three choices from seven options.

	Being interviewed	Giving an informal talk	Being part of an online chat	Consulting on exhibit design	Contributing to curriculum or a teacher workshop	Giving a formal talk	Setting up a citizen science project
Number of times response is in the top 3 (n=350)	169 (48%)	216 (62%)	28 (8.0%)	101 (29%)	113 (32%)	168 (48%)	95 (27%)

Respondents were presented with a list of seven different ways ranger could collaborate with park staff, and were asked to indicate their top three choices. The most popular choice was giving an informal talk, selected by slightly more than half of the scientists (62%). The next two most popular choices — selected by slightly less than half the scientists — were being interviewed (48%) and giving a formal talk (48%). Less popular forms of collaboration — a little more than a fourth of scientists — expressed interest in

contributing to a teacher curriculum or workshop (32%), consulting an exhibit design (29%), and setting up a citizen science project (27%).

(#7) Would you like to collaborate with park staff on educational outreach for the public?

In terms of hours, would you like assistance with…

1 = no hours, 2 = a few hours, 3 = more than a few

	Funding educational outreach activities (n=297)	Collecting visuals for education (n=322)	Designing an educational experience (n=328)	Increasing visibility of the research (n=335)	Increasing visibility of the outreach (n=323)
Average ratings	1.9	2.1	2.2	2.5	2.3
No hours	94 (31.6%)	60 (18.6%)	53 (16.2%)	21 (6.3%)	25 (7.7%)
A few hours	132 (44.4%)	174 (54.0%)	152 (46.3%)	141 (42.1%)	176 (54.5%)
More than a few hours	71 (23.9%)	88 (27.3%)	123 (37.5%)	173 (51.6%)	122 (37.8%)

Overall, roughly half of respondents (42%-54%) would like assistance for a few hours in each of these aspects of outreach. More so, half of respondents (51.6%) specifically would like more than a few hours of assistance with increasing visibility of the research.

(#8) When undertaking a research project, do you ...

Rating scale is a 5 point scale: 1 = not at all, 3 = somewhat, 5 = seriously

	Budget for outreach (n=327)	Plan outreach component while designing the research plan (n=330)	Consider a plan for outreach once findings are in (n=333)
Not at all—1	104 (31.8%)	78 (23.6%)	41 (12.3%)
2	74 (22.6%)	59 (17.9%)	67 (20.1%)
3	65 (19.9%)	62 (18.8%)	89 (26.7%)
4	45 (13.8%)	75 (22.7%)	78 (23.4%)
Seriously—5	39 (11.9%)	56 (17.0%)	58 (17.4%)

Of the respondents, those who seriously (rating of 4 & 5) plan for outreach do so while designing the research plan (39.7%) or once findings are in (40.8%). However, only about a quarter (25.7%) seriously plan the budget for outreach. A little more than half of the respondents (54.4%) report minimal seriousness (rating of 1 & 2) when budgeting for outreach. 41.5% and 32.4% plan for outreach while designing the research plan or after the findings are in. There seems to be equal parts of respondents who seriously plan for outreach and not seriously plan at all. However, budgeting seems to be the aspect of outreach that is lacking overall with 54.4% of respondents reporting minimal seriousness.

(#9) If applicable, on a scale of 1-5, how would you rate your most recent experience leading or contributing to an educational experience for others in a park setting?

1 being negative, 3 being neutral/mixed, and 5 being positive

Ratings	1	2	3	4	5
Count (n=235)	3 (1.3%)	3 (1.3%)	36 (15.3%)	67 (28.5%)	126 (53.6%)

More than half (53.6%) of respondents rate their experience with educational experience as being extremely positive while more than a quarter (28.5%) rate their experience as somewhat positive. Only 2.6% rate their experience as negative and 15.3% are neutral. Overall, respondents have a positive experience working with others in a park setting.

Latent Class Analysis

In this situation, LCA identifies three subgroups of researchers based on their outreach planning behaviors. The latent variable 'outreach planning behavior" is correlated with preferences for outreach, attitudes toward limiting factors (like funds for travel or perceptions of public interest).

This analysis allows us to predict the types of outreach activities that might fit the priorities, work styles, and activities that will appeal to different three different types of researchers.

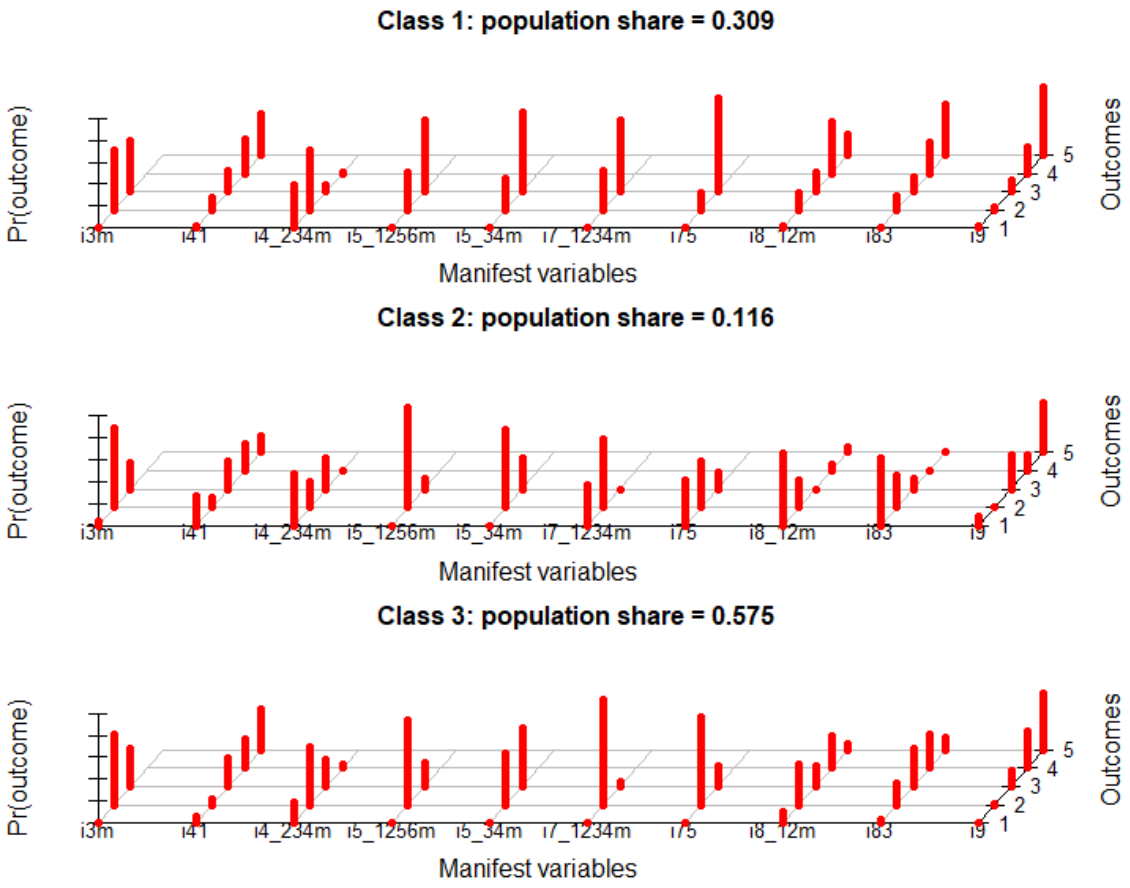

Figure 1: Latent Class Analysis Results

Notes on Figure 1: To make the results easier to read, subitems based on results from correlations between each pair of items and exploratory factor analysis are combined. For

example, items 3a, 3b, and 3c are relatively correlated, so the mean of these 3 items (labeled i3m in the plot) is represented in the model. Similarly, the mean of items 4b, 4c, and 4d (labeled i4_234m), the mean of items 5a, 5b, 5e, and 5f (labeled i5_1256m), the mean of items 5c and 5d (labeled i5_34m), the mean of items 7a, 7b, 7c, and 7d (labeled i7_1234m), and the mean of items 8a and 8b (labeled i8_12m) are used in the latent class analysis model.

Three types of researchers

The first group of researchers consists of 31% of the researchers being surveyed. They tend to select 4 and 5 in answering items 8a, 8b, and 8c (Note: i8_12m is the mean of i8a and i8b, i8c is labeled i83), and select the highest category in all other items except items 4b-4d. Thus they budget seriously for outreach, seriously plan outreach while designing their research plan, and seriously consider a plan for outreach once findings are in. They give a positive rating to their most recent experience leading or contributing to an educational experience for others in a park setting. Their low ratings are confined to three of the four factors that might impede their educational outreach efforts. Discomfort speaking to public audiences; belief that the research holds little interest for the public; and lack of clarity on the process for collaborating with park educators are minimally or not at all a factor. We call Group 1 Proactive and Positive.

The second group of researchers is the smallest of the three, which consists of 12% of the researchers being surveyed. Different from the first type of researchers, they tend to select 1 and 2 in answering item 8, indicating that they budget not at all or minimally for outreach, nor do they plan outreach while designing their research plan. They also say that they plan not at all or minimally for outreach once findings are in. They also tend to select the middle categories of the rest of the items. (Even in item 9 — They give a neutral or mixed rating to their most recent experience leading or contributing to an educational experience for others in a park setting, whereas most researchers chose 5. A relatively large proportion of researchers in this group chose 3, the middle category.) We call these researchers in Group 2 Neutral. Since they appear not to find much of high importance, their focus may be elsewhere.

More than half (58%) of the researchers being surveyed are in the third group. Like the first group, they say it is highly important to them to inspire others to do science as well as to influence management or policy (5c, 5d), and rate their most recent experience leading or contributing to an educational experience for others in a park setting as positive (item 9). Yet they tend to select the middle categories of almost all items (except items 4a for which they say that limited funds to support expenses like travel extremely limit their efforts to do educational outreach. With goals that align with outreach and education, this group is hovering in the middle space between seriously and not at all for budgeting and planning for outreach. This group seems poised to become more engaged. Group 3 we call Potential Allies.