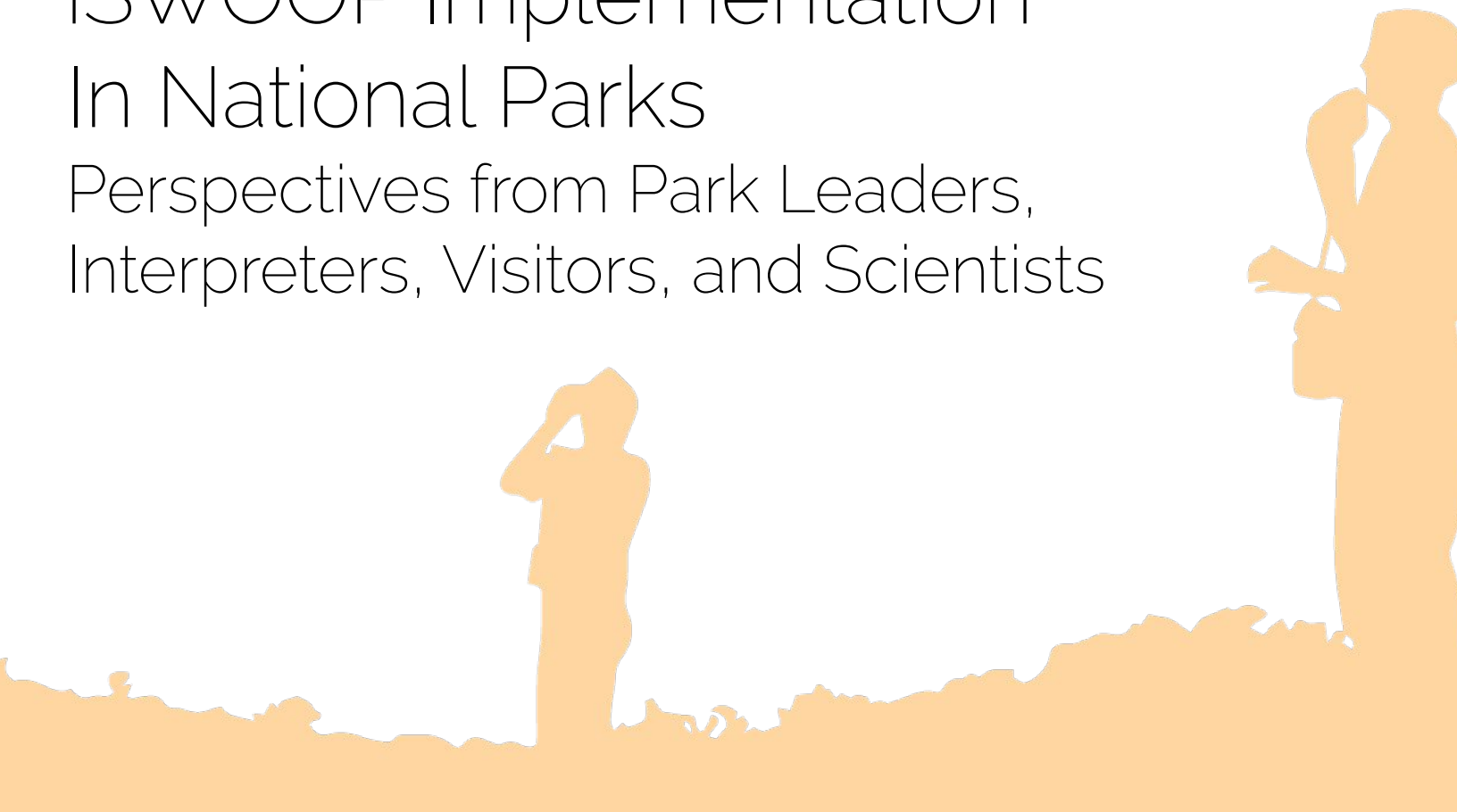
January 2020

iSWOOP Implementation In National Parks

Perspectives from Park Leaders, Interpreters, Visitors, and Scientists



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Overview

"Having the interpreters work side-by-side with scientists has made a difference in the interpreters' comfort level. I feel that it has also made the interpreters more credible to the visitors. They are not just repeating something they read – they lived it!"

Char Associates conducted an evaluation of the four-year, NSF-funded project, *Interpreters and Scientists Working on Our Parks* (iSWOOP). The project brought interpreters and scientists together in multi-day professional development sessions at five national parks with the purpose of showcasing scientific research that usually goes unseen and unappreciated by park visitors. iSWOOP coordinated the development and delivery of digital libraries including animations, still photos, thermal and high-speed videos, and maps to give visual support to explanations of particular scientific studies. In interpreters' hands, visualizations were a jumping off point for observations, predictions, and speculation during ranger-led interactions with park visitors.

At national parks and preserves: Acadia, Indiana Dunes, Jean Lafitte, Carlsbad Caverns, and Joshua Tree, iSWOOP leaders encouraged park staff to highlight park-based research in an interactive and memorable way, with an emphasis on the questions driving scientific research, the challenges researchers face, how scientists come to know what they know, and the relevance of the research.

Those who took part in iSWOOP (beginning in 2014, 2016, 2017, or 2018) were part of an ambitious endeavor. Infusing current, park-based, scientific studies in an inquiry-oriented way into their interactions with visitors required creativity, experimentation, revision, and reflection. Surveys, questionnaires, and interviews reveal the ways interpreters, supervisors or park leaders, scientists, and visitors experienced the impact of iSWOOP.

Future park leaders and interpreters can benefit from the groundwork that the five iSWOOP parks laid. In this report, based on four evaluation memos by Char (available on iswoopparks.com/about/reports), we include dozens of findings, quotes, and recommendations from park leaders, interpreters, scientists, and visitors. The project is grateful for the opportunity to learn along with and from them. We hope national park visitors and the field of informal science education continue to reap benefits from iSWOOP's model, evaluation findings, and research.

iSWOOP's Origins

Carlsbad Caverns—On summer evenings at dusk, visitors gather in the amphitheater outside the natural entrance to Carlsbad Caverns. Hundreds of people wait expectantly for thousands of Brazilian free-tailed bats to emerge. In the mid-2000s, two bat biologists set up thermal cameras and computers in order to count the bats. Intrigued, members of the public would approach the researchers and ask about the equipment and their study. But the explanations were technical and the bat biologists realized they would quickly lose their audience—unless a ranger standing by jumped in to translate for them.

Meanwhile, for the first time, researchers could be quite confident of their estimates, yet interpreters regularly imparted facts about the Carlsbad Caverns bat population that were dated, sidestepping the story of the current research. Missed opportunities to increase public understanding of the scientific breakthroughs nagged at the researchers.

They realized a formalized and funded partnership could raise the profile of current science and the role of parks as outdoor laboratories. Thus, they approached the National Science Foundation (NSF) for funds to support direct contact between park rangers and scientists for the benefit of public audiences.

NSF saw the parks as a promising venue for STEM learning. Dedicated park rangers have thousands and thousands of opportunities to talk with public audiences about the significance of natural and cultural resources. Showcasing park-based science opens conversations on how scientists know what they know, what it takes to figure it out and why their findings are relevant in the park and beyond the park boundaries.

Moving from One Site to Many

Based on a successful pilot at Carlsbad Caverns, iSWOOP principal investigators worked with staff at four parks to implement elements of its model:

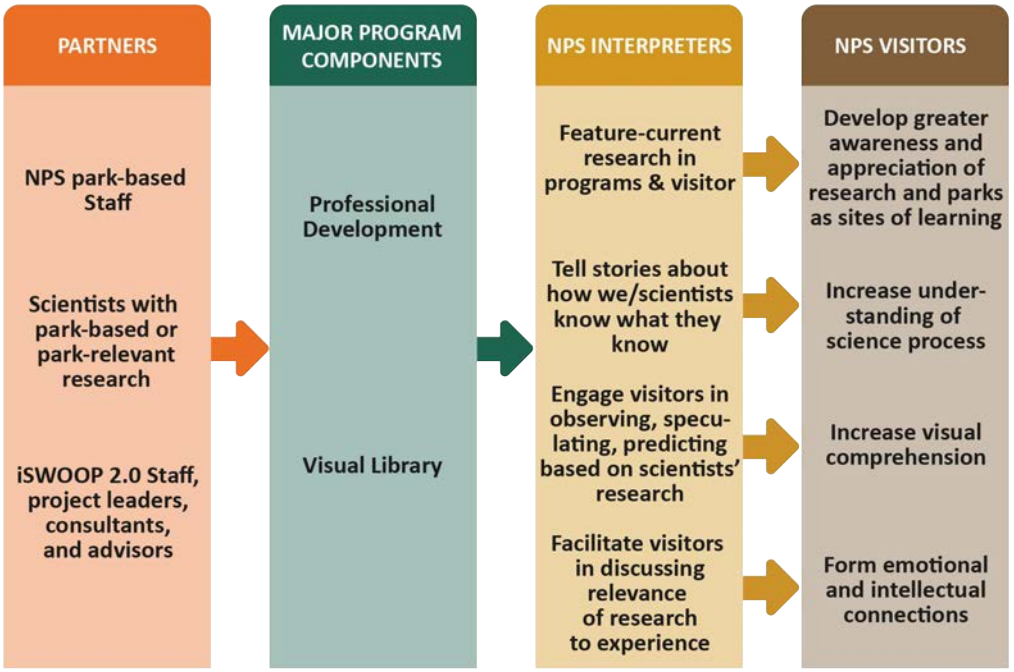
- Direct contact between interpreters and scientists.
- Guided experiences in the field by scientists and their students for interpreters.
- Support for interpreters integrating inquiry into interactions with visitors.

iSWOOP's model relies on contributions from scientists. iSWOOP requests that scientists:

- be present for one to three days on-site
- contribute visual material based on data collected;
- co-develop this material into visualizations appropriate to ranger-led interactions; and
- pitch in, as needed, with support for new interpretive programs.

Park leaders committed to scheduling professional development for key staff. Their scheduling of interpreters' assignments influenced iSWOOP-informed interactions with visitors. Over time we found that interpreters' initiative and enthusiasm for implementing new content and approaches could be leveraged or dampened by supervisors' decisions (Char, 2019).

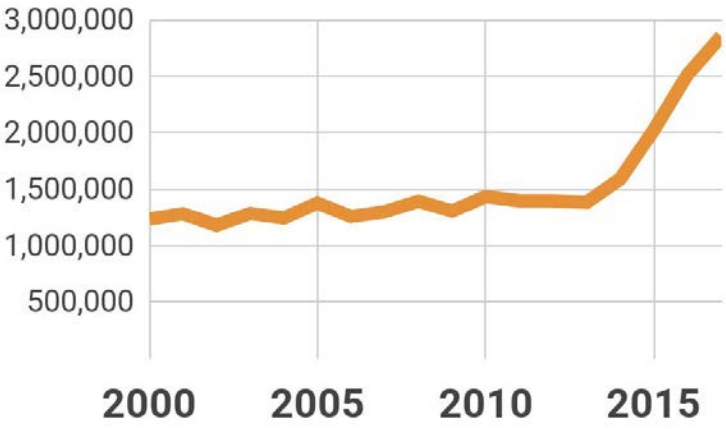
iSWOOP Program Model



Context

A mix of parks was chosen to represent destination parks and parks close to diverse, urban populations. When iSWOOP2.0 was proposed in the fall of 2014, parks were experiencing an uptick in visitation.

Example: Annual park visitation at Joshua Tree sets new records



Social media contributes to parks' popularity. Interpreters hope their online presence can lead to responsible park use. Scientist and artist Juniper Harrower takes up the challenge with HeyJtree.com.

In 2015 Joshua Tree reported nearly two million visitors for the first time. Acadia estimated a record-setting 1.2 million visitors. Since that time, two of the iSWOOP parks have had double or triple those numbers of visits on an annual basis.

Close to three million visitors passed through Acadia and Joshua Tree National Parks annually, and Indiana Dunes added a million visitors, serving 1.7 million annually, which puts pressure on operations.

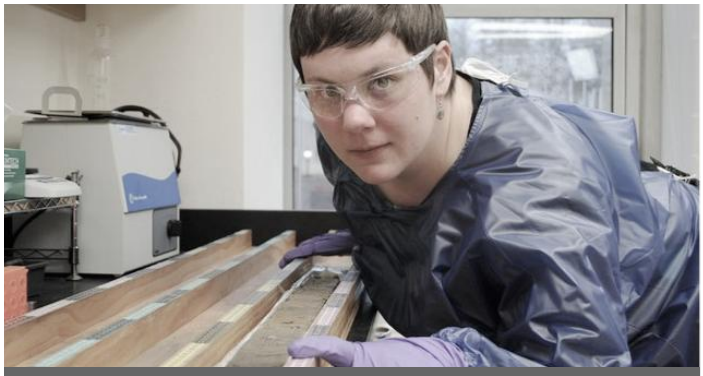
Skeletally-staffed parks like Jean Lafitte National Historic Park and Preserve struggle to release interpreters from basic visitor center functions. Leaders in divisions of interpretation are conservative with their requests for support from their in-house resource managers (who usually are familiar with park-based scientific studies, but are similarly stretched).

iSWOOP represented an opportunity for parks to take on topics of interest that could benefit from additional resources. Several park leaders were drawn to interpreting the effects of changes in seasonal weather patterns.

Selecting Scientists and Topics

Acadia National Park, *Maine*

Acadia offers plant-lovers variety, like blueberry bushes on granite cliffs and moss-covered boulders in damp spruce forests. It hasn't always looked exactly like this. Tiny grains of pollen in lake sediment can help scientists like Jacquelyn Gill and Caitlin McDonough MacKenzie reconstruct past landscapes. Scientists have helped rangers piece together this complex story. The plant communities of the past can help managers plan for the next century.



Dr. Jacquelyn Gill • Paleoecologist

Joshua Tree National Park, *spans two desert ecosystems, 130 miles east of Los Angeles*

Climbing rock formations under a desert sky is one of the joys of visiting this park. The Joshua trees bring a Dr. Seuss-like quality to the landscape. Artist and scientist Juniper Harrower has investigated Joshua tree survival, revealing the benefits Joshua trees derive from its sole pollinator, the Yucca moth, and water-sourcing fungal networks.

Indiana Dunes National Park, *along Lake Michigan, close to Chicago*

Indiana Dunes visitors enjoy the park's beaches and dunes, but the park also offers many other types of habitats. In 2016 Indiana Dunes staff chose to highlight Dr. Bob Brodman's research on "Amphibian Response to Climate Change."

In subsequent years, Indiana Dunes staff capitalized on visitor interest in Mt. Baldy with a focus on geologists' studies of dune movement. Erin Argyilan, Todd Thompson and others at the Indiana Geological and Water Survey helped interpreters adopt new ways to explain the dynamics of dune movement and tree decomposition.

Carlsbad Caverns in the Chihuahuan desert, *near the southern Texas/New Mexico state line*

Carlsbad Caverns visitors spend much of their time underground, though the park protects desert habitat as well. A visit in the summer months often culminates with the bat flight program. Bat biologists Nickolay Hristov and Louise Allen researched the fluctuating colony dynamics as well as stress and reproductive success of the bat population. They can answer questions that are on visitors' minds, e.g., how many bats live here? Hristov and Allen use long-range laser scanners—for modeling bat caves—and portable thermal cameras—to capture bat-life in remote parts of caves. Their video in the hands of rangers roving near the passage to bat cave gave visitors a virtual peek into the roost. Interpreters also can use figures, photos, and animations to talk about the dynamics of bat flight and the challenges mother bats face in nurturing their young.

Jean Lafitte National Historic Park and Preserve, *outside of New Orleans*

Visitors are a mix of locals and tourists who enjoy walking trails and a boardwalk through the iconic cypress swamp. Katie Percy, avian biologist, of Audubon Louisiana/National Audubon Society installed nesting boxes, and banded birds in 2017, 2018, and 2019. The Prothonotary warblers that Percy studies are vocal and visible from March through July at Barataria Preserve. Nanotags are a breakthrough technology. Percy and her colleagues now have a better understanding of the birds' travel routes and resting times when they leave the Louisiana breeding grounds for the fall and winter in Columbia. Scientists are hoping conservation efforts in favorite habitats and along the warblers' route will help halt the population decline.

Leaders' Perspectives

"I saw interpreters seeking out park scientists to add information to programs and discuss the importance of park science in their programs. It increased communication across divisions."

To launch iSWOOP at each park, the project team worked closely with one or more supervisory interpreters to schedule professional development and to manage logistics. Across parks, the point person varied. At times Research Learning Center staff were very involved, at times a front-line interpreter (GS5) carried the program. Park leaders with responsibility for education programs were helpful liaisons and advocates although the intent was to highlight park-based research for family and friend groups rather than school groups. Data gathered through a questionnaire sent to 12 supervisors and an interpretive coach at five parks (response rate 10 out of 13, 77%), confirmed that iSWOOP has benefitted participating parks. Survey responses from participating interpreters, scientists, and a convenience sample of visitors provide more detail on iSWOOP's success engaging visitors in park-based research.

Char Associates asked questions about the perceived benefits/value added, changes in interpreters' practice, advice for others implementing iSWOOP in their park units, which aspects of the model were difficult to implement (and therefore would benefit from external support) and leaders' plans vis à vis iSWOOP. In the following synopsis, we report themes and insightful comments with the purpose of increasing the success of future implementation.

Findings

> *At the most basic level, it has changed how our staff thinks about program development. They are now looking at how science can be incorporated into their programs.*

Appeal and Benefits of iSWOOP

Supervisors confirmed that:

- ➔ They were attracted to iSWOOP because it fit the mission of their park (7 leaders) or offered new opportunities for interpreters (6 leaders).
- ➔ As leaders, they observed positive changes in park programming and visitor experiences that resulted from iSWOOP, such as the creation of new science-focused programs, more interactive methods for engaging visitors, and greater public interest in science.

Interpreters' Growth Attributed to iSWOOP

- ➔ Participating interpreters demonstrated increased skills and capacity (see table below). In selecting particular locations and programs for featuring iSWOOP science and interpretive techniques, a grass-roots approach, consulting with interpreters and looking for a close connection between the scientific research and the current park offerings and locations already popular with visitors was helpful.

iSWOOP Impact on Co-workers/Supervisees	Low	Med	High
Increased confidence in communicating park-based research (e.g., obstacles scientists face, their questions, and methods)	0	3	7
Closer relationships with scientists (within or outside NPS)	1	2	7
Increased attention to science storytelling skills to make park-based science engaging and memorable	0	5	5
Increased confidence and skill with strategies that promote audience-centered interpretation	1	5	4

n=10, from 5 parks (3-pt rating scale: low, medium, high)

Needed Actions by Supervisors

The supervisor's role is critical. Of eight targeted actions presented, leaders thought it was most important to:

- ➔ Set expectations for featured science to be incorporated into formal programs;
- ➔ Allow interpreters the time to experiment with and implement new techniques; and
- ➔ Make continuing training a priority.

> ***In a hectic schedule, if no one is assigned to be accountable for doing iSWOOP-style interpretation, it is likely that most interpreters will fall back on techniques that they have used successfully in the past instead of experimenting with new interpretive principles. Until iSWOOP becomes common, I think it is necessary to identify specific settings where it will be used, clearly communicate the expectation that interpreters will use it in that setting and hold them accountable for doing so.***

Implementation

Supervisors thought a clear overview of the iSWOOP program and how it aligns with park themes and objectives of a particular park would be useful.

Leaders reported that it was relatively easy to choose a scientist, select programs and locations in which to feature iSWOOP, and to routinely feature the work of particular scientists. Supervisors offered dozens of helpful suggestions for the iSWOOP team and peers who might implement iSWOOP approaches in the future. They made recommendations on managing:

- ➔ Selection of staff to participate;
- ➔ Selection of science topics;
- ➔ The timelines for implementation and visual development;
- ➔ Technology for use with visitors; and
- ➔ Turnover.

They urged that leaders be clear from the outset on their commitment to the training and expectations for implementation in the park. Finally, they imagined arranging staff support and infrastructure across participating parks for guidance and information sharing.

The thoughtful comments supervisors made are a reminder that even if staff can't be completely faithful to the iSWOOP model by adopting all of its elements, those close to implementation will distill and implement elements of a new approach that make sense given their constraints and parameters.

Leaders' Recommendations for Implementing iSWOOP

Getting Buy-in

- *Find the alignment* between the park themes and objectives, and the ways iSWOOP is likely to benefit the park.
- *Establish a plan* with branch chiefs or division supervisors to commit to the program.
- *Identify specific individuals* that have approval from their supervisors to work with the iSWOOP team.

Choosing Scientists

- *Encourage input* Ask for opinions from staff on what topics visitors are interested in or what types of science research would enhance their programs.
- *Check for relevance* Make sure that the research is related to questions visitors ask and are curious about.
- *Select scientists who are very interested* They need to be passionate about their research, but also in sharing it with the public through interpreters.
- *Pick scientists who are readily available to work with staff*
- *Start with one or two research projects* Figure out how to make those work before adding more.

> ***"It does take some time. I don't believe most of our staff was really comfortable really incorporating iSWOOP into programming until after the second year of the program.***

Allowing Time

- *[Look for] opportunities within the schedule to offer programs which include the science/research topic highlighted ...*
- *Schedule time for interpreters to develop those programs*
- *Be patient* Some results will not be evident until the second year of the program.

Placing iSWOOP Programs

- *Choose popular locations* with scientific significance where ongoing research is being conducted.
- *Try a variety of settings and program formats*
- *Start with small modifications to existing programs and expand from there*

Selecting and Supporting Interpreters

- ➔ *Involve all interpreters in the meetings and trainings*
  Provide hands-on opportunities for staff to before familiar with content and approaches.
- ➔ *If you have to choose, select those who have used facilitated dialogue techniques*
  These rangers were comfortable getting creative with visitors.
- ➔ *Encourage interpreters to use different techniques.*
  Encourage all staff to use at least some of the materials in their programs.
- ➔ *Make continuing training a priority*
  Many people who were nervous about using the techniques in the beginning loved them in the end.

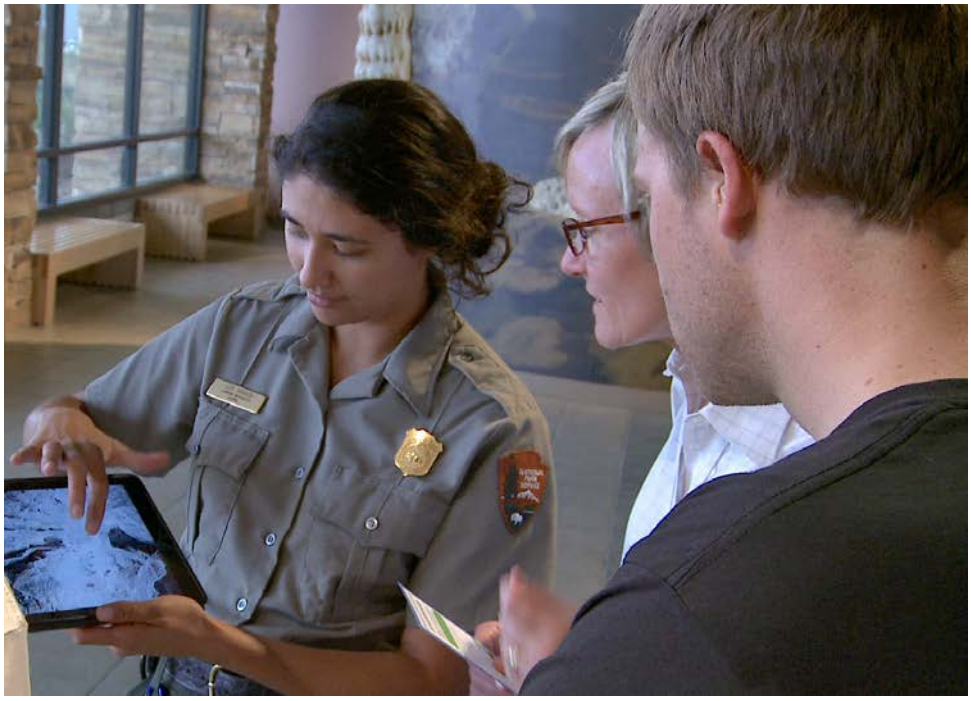
Interpreters' Perspectives

"I would introduce the fact that we can look at a changing landscape, [and] people would ask or start to hypothesize themselves about some of the other information like fire history or other things they thought might end up in a pond or a bog and would settle in the sediment.

... Many times I was complimented ..., two times I remember specifically ... where I was told these were the best visuals anyone had ever seen on a ranger program."

The complex task of science communication is shared by rangers across the Park Service, with those in the division of interpretation taking responsibility for making intellectual and emotional connections between visitors and the cultural and natural resources of their sites. To be credible in their role as interpreters of science in the parks, interpreters need to feel knowledgeable (Stern and Powell, 2013).

The approaches to visitor interaction and expectations of iSWOOP programs dovetail with 21st century interpretation.



The following table makes some of the distinctions clearer.

iSWOOP is ...	iSWOOP is NOT ...
Personal and interactive: an approach to personal interpretation that makes science in parks an interactive and visible part of the public's park experience	Primarily using waysides, social media, exhibits, or print media to show park-based science
Audience-centered, two-way conversations that allow time for visitors to engage with each others' ideas	Information out
A way to talk about science as a process that starts from questions, involves revision, and has the potential to matter to all of us	A way to remind visitors that science is largely a collection of facts about how the world works
Science in parks that is inherently interesting and full of good stories—both first person from interpreters' experiences and about the researchers and what they are studying	Facts strung together and offered in an engaging way
Technology and innovative methods that are key to understanding how we know what we know	Facts shared without attention to who figured it out and how
Images sequenced to reveal something about the resource, but also as a starting point for inquiry and discussions of relevance	Images primarily shown to illustrate a place
Programs, formal and informal, that invite visitors to predict, observe, and speculate	A replacement for the strategies and know-how interpreters possess already
Comfortable with silence and reflection	Pre-scripted and pre-determined
Possible because interpreters and scientists spend time together in the field and in the classroom.	Minimal or limited direct contact between interpreters and scientists, such as a 1 hour bag-lunch or fieldwork encounter without follow-up

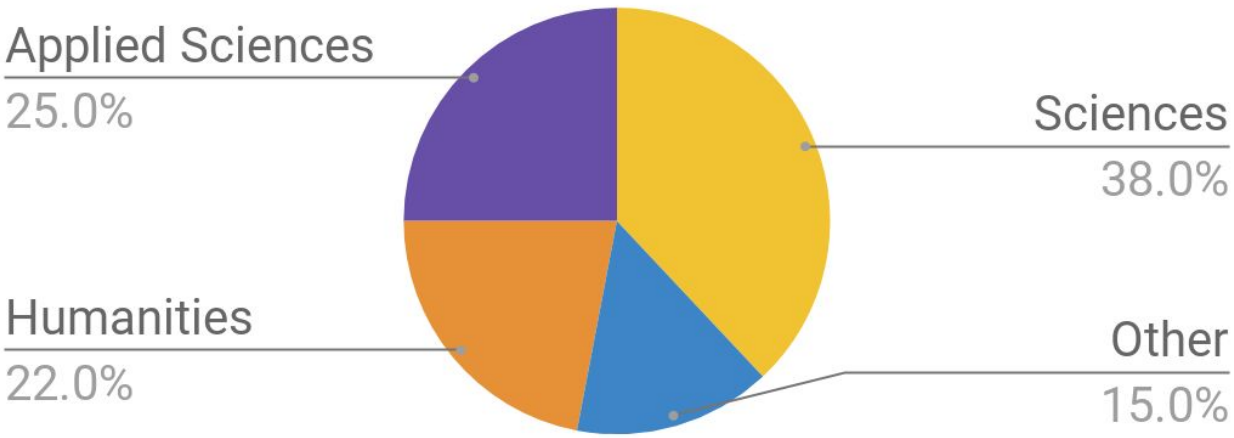
For many, iSWOOP was a catalyst for professional growth, stretching their skills, offering opportunities to learn from scientists, to tell new stories. iSWOOP asked interpreters to shift their interactions with visitors to promote prediction, and asked them to reflect on their interactions with visitors. iSWOOP evaluators and project staff interviewed, surveyed, and observed rangers at five parks. Below we draw primarily on three different data sets (a final day professional development (PD) evaluation form, a post-implementation survey, and reflection forms interpreters logged on their programs) to show the impact of iSWOOP on participating interpreters.

iSWOOP professional development included participants ranging from their early twenties to their late sixties, and at every stage of career (early-, mid-, and late). Of the survey respondents (n=38), just under 40% had formal training in the sciences,, with a fourth of interpreters in either the applied sciences (e.g., natural resource management) (25%), or in the humanities (22%).

Evaluation findings presented in this report focus largely on results from the post-implementation survey. Feedback on professional development, materials and resources were reported to iSWOOP leaders and project staff and used to inform implementation and training. Here, we focus on the experience of interpreters and their interactions with visitors.

While iSWOOP has provided professional development to over 200 park staff (including interpreters, administrators, and volunteers and resource managers) over the four-year project, the program implementation survey captures the impact of 38 interpreters at five parks. These interpreters had the opportunity to implement iSWOOP-influenced programs multiple times and were employed and available to complete surveys at the end of their park's peak season (which might or might not have coincided with their seasonal employment) during three years of the project. The 38 interpreters completing surveys were out of a total of 43 interpreters who were sent surveys (88% response rate).

Interpreters' Formal Training



Findings

Appeal and Benefits of iSWOOP

Across the nation, in parks from Acadia to Death Valley, we heard interpreters express the need for access to the scientists conducting research studies in their parks.

> *I have found there is a disconnect ... It seems that often research being done is being kept for the scientists while the interpreters are left with the public domain information.*

Simultaneously they acknowledged that access to articles, reports, or briefs would not suffice.

> *Hearing about research from the people doing it, meeting them and talking to them brings the science to life in a way that is impossible when reading a peer-reviewed article. People don't talk the way articles are written.*

84%

31 out of 37 of interpreters reported finding iSWOOP valuable. They valued:

Access to:

- ➔ relevant featured research;
- ➔ the visuals, technology and 3D props developed to illustrate and showcase the park-based research,

Opportunities to:

- ➔ increase their scientific knowledge;
- ➔ gain interpretive skills;
- ➔ and form new partnerships and relationships with scientists, fellow rangers, and resource managers.

Findings from professional development sessions

Participants filled out a short, anonymous evaluation form on the final day of iSWOOP in-person professional development. Forms were collected at three national parks, from a total of 37 participants. The vast majority were front line interpreters. The 9-item survey consisted of five rating scales and four open-ended questions. Interpreters were asked about aspects of the PD that were most valuable, program elements they recommended be maintained or improved, and ideas for ongoing support.

> *I thought this was valuable professional development, especially in the life of interpreters. There's always a disconnect between scientists/academic way of speaking and my tendency to "over-simplify" research. iSWOOP is a means by which we can truly meet visitors on their level.*

> *Getting to know the scientists and their work gives me new information and confidence discussing information and findings.*

Written feedback confirmed that:

78%

29 of 37 interpreters indicated that they either **agreed or strongly agreed that training had given them new knowledge to apply in their work.**

62%

23 of 37 agreed that the training had given them **new skills with which to engage visitors** in observing, examining, speculating, and predicting based on scientists' visualizations.

54%

20 of 37 cited **working with, interacting with, and speaking directly with the scientists** as the most valuable aspect of the professional development. Interpreters valued contact over time (beyond the professional development workshops), and requested more time for informal exchanges.

Findings from Implementation

Following interpreters across the five parks who were actively assigned and incorporating iSWOOP into their work with the public, Char Associates was able to conduct retrospective surveys with 38 interpreters about their experiences. Interpreters filled out the 19-item survey at the end of their park's peak season, after having used iSWOOP. All 38 interpreters had used the iSWOOP materials and approaches with visitors for at least several days, with about a third (13 out of 36, or 36%) having used iSWOOP for ten or more days.

Interpreters' accounts revealed the many ways iSWOOP affected them. Changes for the majority included:

- ➔ Deeper understanding of specific research studies;
- ➔ Greater awareness of the breadth of scientific research;
- ➔ Increased attention to incorporating research into visitor interactions;
- ➔ Expanded repertoire of techniques useful for engaging visitors with science; and
- ➔ An increased conviction that visitors will find park-based science interesting.

83%

31 of 37 indicated that their **understanding of scientific research** taking place at their park had changed as a result of iSWOOP. This occurred in two important ways. iSWOOP both increased interpreters' awareness of the research being conducted in their parks, and led to a deeper understanding of the research featured.

> ***I was really challenged to dig deep into the science to understand the information being presented enough to simplify it for my audience.***

> ***I had no idea that so many research permits were issued every year and that there was a wealth of information available. I think it is amazing to be able to state a fact about the park and follow that up with why we know what we know – the research!***

In retrospect, interpreters highly valued opportunities afforded by the iSWOOP professional development. Consulting iSWOOP featured scientists was rated as the most valuable area of professional support and deemed as valuable by 80% of interpreters. Consulting with the park's resource managers was deemed as valuable by 63% of interpreters. Interpreters especially appreciated opportunities to play an active role in the research, when iSWOOP professional development sessions included fieldwork with featured scientists.

68%

25 of 37 reported that they looked at **visitor engagement** at their park differently now, compared to before their involvement with iSWOOP. Interpreters reported an increased focus and intentionality to incorporating science in their interactions with visitors. They expressed greater conviction that visitors could and would find science engaging.

> ***I loved being able to talk about Acadia's foundation through the Champlain society (science/research) and how that is continuing today. People were really excited to think of Acadia as a science lab versus just a place for recreation.***

As recommended in SWOOP professional development, interpreters described an audience-centered approach in their work with the public.

> ***I think I had a really passive approach in the past to sharing park research (i.e., a visitor will eventually ask about it and then we'll give them a really truncated answer about the research). But now I see this as a dialogue with visitors, and welcome the extended conversations.***

Confirming park leaders' observations, the majority used techniques to give greater prominence to scientific research. Interpreters reported making scientific research prominent and interactive in visitor programs. When asked about techniques, over half the interpreters reported that they often:

- Shared stories about specific researchers and their methods;
- Employed visualizations related to scientists' questions;
- Explored how we know what we know based on scientists' research; and
- Facilitated visitor discussions of the relevance of park-based research to their lives and to society.

Interpretive Techniques	Used Often or Very Often
Sharing stories about specific researchers and their methods	66%
Showing visualizations related to scientists' questions and findings	62%
Using scientists' research questions, data collection strategies and findings to explore how we know what we know	57%
Positioning themselves as learners and stakeholders in scientific research	54%
Facilitating visitor discussions of the relevance of park-based research to their lives or society	52%

n=26-29, varied by item, from 4 parks (5-pt scale: not at all, seldom, occasionally, often, very often)

> *I think iSWOOP is a long-needed shift in interpretive thinking. I think it's effective at showing how science is important, exciting, and relevant. I think it has personally benefited me by making me a stronger interpreter. It has stressed the benefits of active listening and engaging questions- and how these lead to rewarding visitor interactions that benefit both the visitor and the interpreter...I've gained a much greater understanding of current science research being performed in the park. I have also had many skills reinforced and grown such as conversational learning, using science with narrative, and relating research back to visitors' own past experiences.*

iSWOOP increased interpreters' skill sets

The vast majority of interpreters reported increased skills in using park-based research in their programs to foster visitors' connections to the parks.

82%

18 out of 22 interpreters reported greater skills in basing interpretive programs on park-based scientific research.

91%

21 out of 23 interpreters reported greater skills in using park-based research to foster visitors' emotional and intellectual connections to park resources.

73%

16 out of 22 interpreters reported greater skills in incorporating scientists' visualizations into programs.

Park-based Science and Interpreters' Choices: Capacity and Frequency of Use

Park-based Research	Skills Improved Some/A lot	Use Increased Some/A lot
Basing interpretive programs on park-based scientific research	82%	74%
Using park-based research to provoke visitors' emotional and intellectual engagement with park resources	91%	70%
Encouraging visitors to express their personal interests in the park and park-based science	64%	52%
Incorporating scientists' visualizations into programs	73%	44%

n=23 (5-pt rating scale: decreased, stayed the same, improved/used a little, improved/used some; improved/used a lot)

Interpreters factor in the needs and interests of their audience as well as the time available when incorporating park-based science into the wide range of visitor programs they are expected to lead and facilitate. Thus, being skilled in using a particular interpretive technique did not necessarily translate into using that technique frequently. About a quarter of the interpreters reported that they had not increased their use of programs based on park-based scientific research. Roughly half had not encouraged visitors to express personal interests more frequently.

A similar pattern emerged related to interpreters' capacity and use of more audience-centered interactions. Roughly three-fourths of interpreters reported that they had improved their skills in involving visitors in making observations or in making predictions, while closer to half reported increased use of those techniques (see table on the next page).

So while interpreters felt more skilled and comfortable with the techniques that iSWOOP encouraged, they may have needed more coaching to make the most of opportunities to integrate park-based research and audience-centered approaches into their interactions OR have park assignments that lent themselves to such interactions.

Audience-centered Interactions: Capacity and Frequency of Use

Audience-Centered Interactions	Skills Improved Some/A lot	Use Increased Some/A lot
Involving visitors in making observations	77%	61%
Involving visitors in making predictions	73%	48%
Encouraging visitors to build on each other's ideas and perspectives	59%	30%
Leaving visitors' questions unanswered to promote suspense or encourage further thinking	59%	45%

n=23, 4 parks (5-pt scale: decreased, stayed the same, improved/used a little, improved/used some; improved/used a lot)

iSWOOP interpreters increased visitors' engagement with park-based research according to another data set. iSWOOP staff asked interpreters in 2017 and 2018 to report on iSWOOP programs they had conducted. In their reports, interpreters listed visitors' questions and described their reactions to the visualizations interpreters displayed.

In two-thirds or more of the iSWOOP influenced programs, interpreters indicated that they:

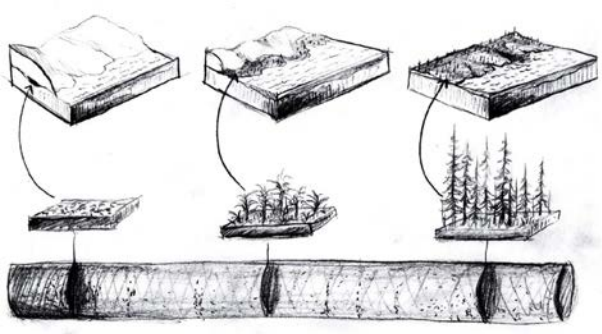
- ➔ Talked about the questions driving park-based scientific research
- ➔ Discussed the technology scientists are using to answer questions
- ➔ Invited visitors to make observations or predictions

iSWOOP Feature

iSWOOP Feature	Percentage of Programs
Talked about the questions driving park-based scientific research	85.4%
Talked about the technology scientists are using to answer questions	77.1%
Invited visitors to make observations or predictions	68.8%
Had a 2-way conversation about the relevance of park-based research	61.8%
Talked about how scientists know what they know	58.3%
Talked about scientists' stories, obstacles, and breakthroughs	55.6%
Looked at scientists' data or other visualizations to answer their questions	51.4%
Learned something from visitors to research at parks	20.1%

n = 144 program entries, submitted by 37 interpreters from five parks

In sum, iSWOOP equipped interpreters to showcase park-based research in several ways, by deepening their knowledge, expanding their repertoire of techniques for discussing park-based research, and by making props and visualizations available as a jumping off point for discussions. In post-season interviews, interpreters acknowledged the benefits of iSWOOP.



> ***I had a lot of people come up after the program and thank me for talking about climate change. They were like, "It's really nice to be in an area where this is addressed," and it was nice for me as an interpreter to have that background of research to talk about climate change in a manner that I could point to specific examples. I think that made it a little bit more effective, and made that message a little bit stronger.***

Interpreters' Recommendations

Do real science in the field. Provide opportunities to accompany scientists in fieldwork and to getting direct experience with the tools and techniques of scientists' research.

Offer informal time with scientists. Spread out time with scientists

- ➔ Real questions would come out of a more informal session. It would help people digest material.
- ➔ Interpreters benefit from direct contact over time so that they can digest new information, experiment, and then consult with scientists again.

Allow time for two-way learning related to managing the visuals and displays

- ➔ Solicit feedback on drafts of the visualizations. Visualizations improve with input from interpreters.
- ➔ Allocate time for interpreters to get experienced and comfortable with using new devices and visualizations, for example, managing the logistics of using an iPad on a sunny day (settings, where to stand, etc.)
- ➔ Offer time for technology-challenged rangers to have a breakout session where they could have help with iPad- and laptop-based visuals. Building confidence in advancing videos, and switching among visualizations presented a learning curve that was steeper than anticipated.

Align content and format to specific locations in the park and the audiences there.

Experiment to find the program formats that work best, given the importance of responding to visitors' interests and respecting their time constraints.

Stay close to visitors' interests.

Some topics are a hard sell, especially when trying to engage visitors coming to the park mainly for recreational reasons or spiritual renewal. Use of visuals/props and featuring of charismatic species can mitigate some of those challenges.

Be ready to adjust for different ages, science backgrounds, and languages.

Integrate featured science into programs for adults, activity tables for youth, and have props and visual imagery available to speak to different aspects of the research, assuming more and less familiarity with the discipline or tools scientists use.

Build in time for iSWOOP interpreters to experiment with iSWOOP techniques and materials, and to share what they are doing with each other. Include time to brainstorm as a group about ideas for engaging visitors. Together interpreters could brainstorm solutions for the challenges they encounter, such as:

- ➔ Adapting to the wide range of ages and visitors' varying levels of science interest and understanding
- ➔ Accommodating visitors' priorities or motivation, e.g., for recreational rather than educational experiences
- ➔ Meeting needs of visitors with certain personal interests in mind (e.g., birding).

"We often aspire to interpret current research, but often fall back on more general information and/or synthesize research for visitors. The focus on actually engaging visitors with the data has great potential both for making current science more accessible to the visitor and in contributing to helping the public to become more scientifically literate.

Show examples

Give interpreters clear examples of what iSWOOP should look like, by having interpreters with iSWOOP experience model their programs, by watching video clips from programs, or by reviewing interpreters' program outlines. (See iswoopparks.com/about/resources for outlines. Video clips are available on vimeo.)

Set goals and follow up so there is accountability in meeting them

It takes enthusiasm and the willingness to both try and learn new things. Setting goals would be helpful (e.g., I will develop three new programs using the material)

Supervisors need to be supportive and engaged, to help set and meet goals

Ensure that supervisors are fully on board and supportive of the iSWOOP initiative. Supervisors should set clear expectations that iSWOOP be a main part of a program, schedule specific iSWOOP programming times, encourage interpreters to learn from one another, and make continuing training a priority.

"It gave me license to focus on science interpretation. ... That's the thing I'm the most excited about. ... It was getting the green light from not just from my supervisor, but from the whole interpretive team – to devote energy and time to science interpretation, ... And it was very rewarding because I had the chance to allow myself to fail. And also had the chance to see people walk away just electrified about continuing to follow what's happening.

Visitors' Perspectives

"I loved the story from her childhood. All real nature lovers have a story to connect to, not just facts. I genuinely appreciate that."

Millions of visitors spend time in national parks each year. The national parks are thus uniquely poised to foster public engagement with and interest in science (Watkins, Miller-Rushing, & Nelson, 2018). To assess visitor receptivity and impact of iSWOOP, members of the evaluation team and iSWOOP project team members used a variety of methods to gather information on visitor engagement in iSWOOP-influenced offerings. Information on the visitor experience was gathered via surveys, interviews, observations, comment cards, and program reflection forms.

During the launch and implementation of iSWOOP, park staff and scientists were enthusiastic about the potential for iSWOOP to increase awareness and appreciation for scientific research. At the same time, many of those involved— iSWOOP leaders, interpreters, their supervisors, and scientists—wondered how strong an appetite the public would have for hearing about scientific studies. Glazed-over looks often greet detailed information. Sometimes visitors interrupt rangers with personal stories, non-sequiturs, questions, or jokes, which may derail an exchange about scientists' work, climate change, or species loss. Visitors are on vacation.

While visitors whom iSWOOP staff encountered were open to learning, especially on topics that enhanced their experience of a place, other researchers have found lecturing leads to attrition and is correlated with lower visitor satisfaction (Stern and Powell, 2013). Some rangers questioned the appropriateness of focusing on scientists and their stories. After all, their mission is to forge connections with *natural and cultural resources*. Related questions included:

- ➔ Are visitors interested in the park-based scientific research? A park visit is not a science class.
- ➔ Would stories and visualizations support ongoing visitor engagement and inspire new plans to further explore science and the parks?
- ➔ How do visitors perceive rangers who represent scientific research? Are rangers competent and credible in this role?

The Char Associates evaluation team created an interview intercept protocol to deepen understanding of visitors' reactions to iSWOOP programs. The protocol was used at two parks (Indiana Dunes and Acadia) after advertised programs in Summer 2018. The programs varied in topic, duration and format, such as ranger-led hikes, stops on a self-guided walk, and a junior ranger activity station. During their interactions with a ranger, visitors heard about a focus of scientific study, e.g., the formation and movement of the famous Mt Baldy dune, amphibian life in the wetlands of Indiana Dunes, or landscape change as informed by Acadia's pollen record.

Rangers illustrated their stories and informative comments with visualizations, sounds, or props to increase understanding of the phenomenon or as a jumping off point for discussion.

After the programs, a member of the evaluation team 1) invited visitors to talk with them; 2) handed out a version of paper surveys to anyone who would take them, or 3) approached visitors who were lingering in the area. Fifty-two visitors answered versions of five questions orally or in a simplified written version of the interview. Visitor responses were analyzed according to a priori codes, based on previous analysis of entries of visitor reactions collected from interpreters during iSWOOP's pilot phase at Carlsbad Caverns National Park in 2014.

Findings

Appeal

Park visitors regarded park-based research as extremely important. In surveys and interviews with iSWOOP visitors at two parks, we asked visitors to respond to a question about the importance of park-based research, using a 5-point rating scale, where 1 was "not important at all" and 5 was "extremely important."

76%

32 out of 42 of visitors regarded park-based science as "extremely important." Many visitors saw a purpose to park-based science. One expressed the importance this way: "How else would you successfully preserve the park? You need to know what's going on around you, even at the scientific level."

> ***I was surprised by the amount of research taking place, considering all you hear about government funding cuts. I was surprised to see that there is still stuff going on in national parks...I read some of the cards over there to my five year old, it sounds like there's a large variety of research taking place here.***

Visitors were asked what their reactions were to the park-based research they had heard about. Responses were coded as to whether their reactions were emotional, focused on factual information, or focused on the purposeful nature of research, such as for managing public lands.

> ***Amazing that there are holes in the dunes.***

> ***It blew my mind [the dune is] so much different since 1956.***

84%

31 out of 37 expressed an emotional reaction to the research, using such terms as "amazing,", "cool", "excited", "surprised", and "fascinating." Rather than regarding the scientific research as overly serious or dry, the vast majority had an emotional reaction.

Implementation

77%

37 out of 48 of visitors indicated that they had heard about park-based research during their visit.

Immediately following their participation in a ranger-led interaction, visitors were asked what was most interesting or what struck them about their interactions with interpreters. Most visitors mentioned natural history and landscape of the park.

From your interactions with the park ranger today, what struck you/what did you find most interesting?	Total Visitors
Natural history or landscape connections	35 (72.9%)
Ranger competence	16 (33.3%)
Facilitating others' learning	7 (14.5%)
Science process	6 (12.5%)
Place-based connections	3 (6.25%)
Technology	1 (2.1%)
Other	11 (22.9%)

n=48, 2 parks

73%

35 out of 48 of visitors mentioned being struck by something they had heard about the park's natural history, such as amphibian songs, dune formation and movement, chimneys in the sand created by decomposing oak trees, or the use of pollen cores to tell about a landscape's history. Interestingly, in a separate study by Forist which asked Indiana Dunes visitors what they remembered 3-8 months later, visitors recalled details about the dune movement, the interaction of sand, wind, human intervention, and fungal action that resulted in holes in the Mt. Baldy sand dune, and scientists' documentation of spaces in the dunes after a boy disappeared into a hole in the dune (Forist, 2019).

During iSWOOP professional development, interpreters were encouraged to focus on science process, to invite observation, prediction, and conversations about relevance. Clearly taking this approach did not overshadow the natural history that rangers shared. Visitors were able to deepen their understanding of the changes in Mt. Baldy, as well as form new ideas and plans for their continued learning and enjoyment of protected lands.

33%

16 out of 48 of visitors commented on the competence, skills and commitment of the rangers leading the programs. This aligns with the preferred outcome of appreciating the National Park Service (14%) found in the Stern and Powell study.

> *I'd say many of the Junior Ranger Programs we've attended, both in the park and outside of it, have contained information that my wife and I didn't know. If you spend the time to help your kids out with the activities instead of just standing back, you find there's a lot to learn.*

A number spoke about the deep interest and passion interpreters had for the research conducted at the park.

> *[I was struck by] How knowledgeable our park rangers are.*
>
> *[I was struck by] His take on the value of science in parks. And to evaluate data and use it to predict for future evolving environmental trends - those that may be valuable for future generations.*

Effects on Visitors' Actions

After experiencing an interaction featuring park-based research, park visitors reported having curiosity questions (Renninger, 2010). Visitors were asked if there was anything they wanted to come back to ("Is there something you might read up on or look into more, do or talk about with others?")

46%

23 out of 50 of visitors indicated that there were particular topics they were interested in learning more about.

30%

15 out of 50 expressed interest in learning more about the biological, ecological and/or geological aspects and history of the park.

24%

12 out of 50 visitors reported being curious to learn more about the impact that humans have on the environment.

Those [iPad based visualizations] were really cool, sharing information. I thought she was just holding a clipboard. I love the contrast, using technology to talk about the wild—merging those two worlds.

I didn't even know the frog noises besides spring peepers, what they sound like. Even in the middle of nowhere, people are out here doing cool stuff. It makes you realize how close you are to nature, and everyone has a story.

Rather than describing a topic they wished to know more about, roughly a fourth (23%, or 12 out of 52) offered place-based plans, such as a hike or a place they wished to visit in the park. The experience of interacting with the ranger led to new plans.

I'd love to hike Cadillac [Mountain] and think about different rocks that are there."

Checklist for Increasing Visitors' Appreciation of Science

- ➔ Trust that visitors will connect emotionally and intellectually to ranger-led interactions based on park-science.
- ➔ Treat all visitors as potentially interested in the science behind the scenes. Strike up conversations with visitors regardless of race, ethnic background, age, etc.
- ➔ Build on visitor interest to increase the likelihood visitors will recall details later. Elicit interests with questions and/or an activity about motivations for their visit to the park.
- ➔ Treat conversations about science in parks as part of the tapestry of a lifetime of learning. Making space for visitors to make connections will help them cement new knowledge and find new ideas for pursuing long-term interests.
- ➔ Tell how we know what we know. Visitors are keenly interested in gadgets, tech breakthroughs, are impressed by innovation and appreciate knowing more about how scientists are using cutting-edge (expensive!) technology.
- ➔ Personal details and the enthusiasm of the interpreter matter to visitors. Give science a face. Tell a story. Use the landscape.

Scientists' Perspectives

"Most importantly I am interested in correcting misconceptions about the site [of my research]. I would like the interpreters to feel confident that they understand the extent of the scientific information that we have about this site so they can better communicate with the public. This is especially important since our site hosts potential risks for park visitors."

Scientists conducting park-relevant scientific research constitute a critical partner of iSWOOP. The iSWOOP model asks scientists to spend time with park staff both in the field and in a seminar-type setting. This level of direct contact is unusual (Char, 2015; Merson, Char, Hristov, and Allen, 2017). iSWOOP featured scientists have generously given their time. They've met with interpreters to explain their lines of research, answered questions about how they came to their research questions, provided (sometimes edited) figures, photos, videos, props, and pointed out sources for related research and visualizations, have led field work, and have consulted on the design of professional development sessions.

Project leaders have posited that to be sustainable, scientists should also benefit from their participation in a variety of ways they deem valuable and meaningful. iSWOOP leaders expected that benefits could include acquiring new ways to visualize their work, new techniques to communicate about their work in informal settings, exposure to larger audiences than they could reach independently by leveraging the parks' extensive visitorship, and the satisfaction of building public understanding of scientific research.

Char Associates designed a survey for the research scientists involved in the iSWOOP project to learn about the reasons scientists might choose to become involved, the potential professional benefits and outcomes of the project, and suggestions of how the project model could be improved.

Quantitative data yielded from rating scales were analyzed using frequency distributions. Prose responses to open-ended questions were coded by a member of the evaluation team, using a grounded theory approach (Charmaz, 2006; Patton, 2002). Thematic categories were aligned with the main features and goals of the project.

The questionnaire was sent to twelve different research scientists who have been involved in the iSWOOP project, each working with one of the five National Parks actively using iSWOOP. All twelve scientists (100% return rate) responded to the questionnaire. The set of scientists was quite diverse, representing seven different universities and one non-profit organization, a variety of scientific departments (e.g., biology, geology, paleoecology, earth/climate sciences, environmental science), and a range of positions (two assistant professors, three associate professors, three retired (emeritus) professors, one research fellow, one post-doc, one PhD candidate, and one staff scientist.)

The scientists' respective roles and levels of participation in the iSWOOP project varied considerably. Participation ranged from mainly being involved in presenting at a training workshop and giving input and feedback to the visual library (3 scientists), to attending planning meetings, assuming an active role in training, and having their research featured in the visual library (7 scientists), to serving as one of the co-principal investigators of the project (2 scientists).

> ***"I enjoy working with iSWOOP to be connected to the great team of people involved, to get feedback on my visual storytelling approaches, to better connect my research to the public, and to be more closely connected to park personnel, which leads to a better understanding of park goals and space for collaboration.***

Findings

Appeal and Benefits of iSWOOP

iSWOOP offers a viable collaborative model for scientists and interpretive staff to work together.

Scientists confirmed that they benefited from their participation.

> ***It certainly helped and gave me some ideas about how to break down my research to digestible levels, relating it to everyday experiences that make it more understandable, fun and interesting.***

> ***I have long promoted and engaged in these relationships, but iSWOOP makes it possible for the information to move beyond my personal participation and makes it more available for the public and for long-term educational programs.***

Scientists offered a variety of reasons for why they were attracted to iSWOOP and were taking the time to be part of it.

- ➔ Interest in supporting the park staff, visitors and surrounding communities with up-to-date information
- ➔ Respect for the park mission and staff
- ➔ Fair exchange for the opportunities to use the park to advance scientific research and understanding
- ➔ Interest in greater public outreach of their research
- ➔ Heightening the public's understanding of research taking place in the parks
- ➔ Developing their own science communication skills

In addition to reaching the public, a theme that emerged was the desire to give back to the park. iSWOOP, and parks generally, can capitalize on scientists' existing positive feelings about their park research sites and the positive relationships they have with staff.

> ***I love the idea of increasing the accessibility of my science with the public, but I also love the idea of highlighting science that is going on in our parks right now. To me, it seemed like a win-win – I get to get my message out there, and the park gets to tell stories about the "what" and "how" of science. It's also important for people to know that parks aren't just beautiful or fun; they're also important natural resources, and a lot of research is happening in them on an active basis. I also appreciated the opportunity to have visualizations of my research made.***

Implementation

Benefits for Scientists: Eleven of the twelve scientists (92%) indicated that they had gained something professionally valuable from the project. Benefits described by the scientists included: an increased professional network of scientist colleagues and park settings, improved communication skills, including storytelling and visual techniques, a deeper understanding of working with parks and park interpreters, and greater appreciation of visitor perspectives and the importance of out-of-school learning.

Eight out of the twelve (67%) identified three different areas in which they reported the project had impacted them either "moderately" or "extremely." These areas were:

- ➔ Broadening their impact by reaching new or larger audiences for their work;
- ➔ Changing how they see visitors' or interpreters' perspectives on their work; and
- ➔ Increasing the ways they will work with NPS or interpreters in the future.

Scientists' Views of iSWOOP's Professional Benefits	Not at all/ A little/ Not Sure	Somewhat	Moderately/ Extremely
Broaden your impact by reaching new or larger audiences for your work	3	1	8
Change how you see visitors' or interpreters' perspectives on your work	1	3	8
Increase the ways you will work with NPS or interpreters in the future	3	1	8
Add to your repertoire of teaching strategies	3	2	7
Add to your repertoire of strategies for explaining your research	4	2	6
Enrich the visual language you use to illustrate your work	4	2	6
Add to a shared bank of visuals you might use in teaching or outreach	5	1	6

n=12 (6-pt rating scale: not at all, a little, somewhat, moderately, extremely, and not sure)

> *I've gained a better understanding of the challenges parks face in terms of what interpreters are able to do, and the kinds of interactions they can have with the public. I've also developed a better relationship with [the park] overall ...*

> *I have a closer relationship with park staff and interpreters and I am extremely grateful for their continued assistance with public outreach and education, as it relates to my research.*

Scientists were also asked whether iSWOOP had specifically influenced the ways they approach science communication.

Seven of the twelve (58%) described efforts and strategies to make their research more accessible.

- *It made me appreciate the idea of a HOOK and how you start the story and get people interested in hearing more. How do I start off presentations? ... For a Garden Club talk I gave, I opened with an Obituary of a plant as the first slide. People were into it. Usually I give an overview. It made a big difference in terms of energy in the room.*
- *The storytelling workshop was very useful in my classes as well as outreach. Faculty often tell stories, but now I think more about the story structure and make sure that I talk about how I got interested and why I think that the projects are important.*
- *I definitely think more about my story and the science story. Unless I'm presenting at a strictly scientific conference, I try to include some coverage of the highs and lows of scientific research.*
- *[I've gained an] Understanding of some of the misperceptions and misunderstandings about my research. An understanding about how important story is for getting the public to care about science. I have learned a lot from my interactions with the informal STEM education experts and have "borrowed" much of what I have learned and used it in my higher ed classrooms.*

iSWOOP benefitted from a team approach to visualizations. The team often included skilled science communicators, illustrators, and educators with a design background. This kind of support may be difficult for divisions of interpretation to pull off, though many interpreters and communications staff have graphic design expertise.

> *The visual library made me appreciate good figures. Even in papers, [it's good to have visuals that are] more accessible and able to stand on their own. And to get more of story out of it.*

Needed Actions

In several cases, it took a while for collaborations to find their footing. Extended timelines allowed for more collaborative work. Scientists requested frequent communication and recommended setting realistic expectations for the collaboration.

Scientists who played an active role in the professional development for interpreters and in ongoing development of the iSWOOP visual library felt the impact on their own science communication efforts.

iSWOOP featured scientists—particularly those early in their careers—wanted greater "credit" or recognition for their involvement.

Scientists were sensitive to the time commitment of their involvement and recommended clear timelines, descriptions of their role, and requested they be involved after the initial professional development sessions.

The ideas and requests for involvement included: reviewing the final set of visual material; being consulted on how their research was interpreted; and hearing how the programs were received by visitors.

Scientists' Recommendations for Implementing iSWOOP

Describe expectations for involvement

Recommend styles of facilitating the learning of interpreters in professional development (e.g., using interactive and hands-on formats, as well as traditional lecturing or presentations)

Clearly communicate their expected roles, contributions to the project and to their park, and the duration for their involvement.

Set a timetable for involvement

Acknowledge that the tangible fruits of their labors may take some time to materialize.

Agree on products and/or benefits

Spell out possibilities. For example, iSWOOP potentially offers new pedagogical experiences, ideas for facilitating STEM learning, access to new sites, new relationships among park staff, increased visibility for the work, and new visualizations.

Discuss ways to give credit or recognition for scientists' involvement and contributions. The research can be promoted on the park's webpage and social media. The scientists' preferred landing page or communication tool can be the default (e.g., a twitter handle, blog, or academic profile.

Keep in contact

Scientists requested communication following training, so that they had a better sense of the types of visuals that ended up being produced for the visual library, how interpreters incorporated their research in visitor programs, and a chance to observe, review, or consult on programs and materials that portrayed their research.

> ***Humbling and gratifying to see what the interpreters are doing with the work and hear how the public is interacting. This summer's training I saw [one ranger] present the program that talks about my research. I am a character in the story! ... I appreciated how much work goes into scientific communication. So I see how to use these strategies with the public.***

Conclusion

I may look a bit more into how the island was formed. Its beauty is a real wonder.

I found the bat research to be interesting, I want to look more into why they [the bats] are having difficulty surviving. I also want to look more into areas with high light pollution.

iSWOOP brought together educators, scientists and National Park Service interpreters to incorporate site-based science into formal and informal interactions with the public. The project increased direct contact between interpreters and scientists, equipping park interpreters with the skills and knowledge to facilitate conversations about park-based science in order to increase STEM learning opportunities for visitors.

Science communication and interpretation are both science and art, a constellation of skills and a practice that are honed during a career, rather than acquired in a one-time workshop. Featuring park-based science in an interactive way is complex. Many layers of purposes, meanings, and means of expression (gesture, voice, word choice, imagery) are at play in any conversation. In park settings, conversations occur between strangers. They touch on emotionally charged issues like extinction. In assessing the impact of iSWOOP, we both wanted to show its effect on interpreters, its potential for achieving science communication goals that are a priority for the National Park Service, and its viability in terms of positive reception by the audiences it promised to benefit: visitors, interpreters, and scientists.

The National Park Service staff are regularly stretched to cover the work of lost positions (https://www.hcn.org/articles/national-park-service-loved-to-death-or-just-in-need-of-some-love). Thus a new project/initiative like iSWOOP introduced from outside the system not only has to capture the attention of staff, but serve the existing mission. iSWOOP was helpful to interpreters looking for content and ideas to populate new audience-centered experiences (e.g., pop-up programs). Visitors' responses after an iSWOOP-influenced interaction or program were very much in line with the preferred outcomes rangers traditionally listed for their visitor programs. In a study by Stern and Powell (2013), most interpreters (79.5%) mentioned wanting visitors to have increased understanding of the program topic and just over half (56%) wanted visitors to have an increased appreciation for the park.

Conclusion

In *Taking Charge of Change*, Hord, Rutherford, Austin, and Hall (1987), perceptively note that change is a highly personal experience, even when the change is undertaken by a work unit or system.

> ***Concerns do not exist in a vacuum. Concerns are influenced by participants' feelings about an innovation, by their perception of their ability to use it, by the setting in which the change occurs, by the number of other changes in which they are involved and, most of all, by the kind of support and assistance they receive as they attempt to implement change (Hord et al. 1987. p. 43).***

Interpreters and supervisors spoke to the importance of support and gave numerous examples of what support should look like. We found that interpreters' initiative and enthusiasm for implementing new content and approaches could be leveraged or dampened by supervisors' decisions .

Furthermore, they emphasized the need to align the featured scientific studies with visitors' interests, appropriate locations, and park themes. Where these concerns were addressed or were not relevant, the reception to and implementation of iSWOOP were extremely positive.

iSWOOP professional development was able to increase interpreters' skills and knowledge, as reported by supervisors and interpreters themselves. iSWOOP evaluators found equipping interpreters to be confident, both in their knowledge and skilled at facilitating conversations about park-based research, is an important foundation for 1) implementation and 2) visitor satisfaction.

In the literature on interpretation, exemplified by a recent study of interpreters' programs, Stern and Powell (2013) found rangers' knowledge played a critical role. When interpreter confidence was perceived as low, it stood out as one of the characteristics associated with participants leaving ranger-led programs before the program's conclusion. The authors argued that presenters who are comfortably familiar with their topics generally can project more confidence. However, too much knowledge could be a liability as the perception of someone as a "walking encyclopedia" also surfaced as a characteristic associated with visitor attrition.

Conclusion

Park leaders from across all five parks attested to the beneficial impact iSWOOP had on its staff, visitors, and park.

> ***At the most basic level, it has changed how our staff thinks about program development. They are now looking at how science can be incorporated into their programs. I hear staff saying they are figuring out "how to iSWOOP their program."***

> ***Our division was able to offer more creative programs, with better props and audience-centered activities. We were able to have the audience think about and discuss more detailed information based on new research, and to introduce audiences to current park science.***

Even if scientists are already a resource for park staff in some ways (presenting on their research or participating in events with the public), scientists still recognized they had much to gain from a longer-term collaboration. Though the expectations were seen as time-consuming, the pay-off in terms of closer relationships with the park, reaching new audiences, and expanding their own repertoire for communicating with others (in some cases students, in other cases peers or public audiences) made the effort worthwhile.

Char Associates' four-year iSWOOP evaluation encompassed a diverse set of data representing multiple perspectives from participating park leaders, interpreters, visitors and scientists. The date indicated that iSWOOP offers a promising, viable model of professional development that can increase the prominence of ongoing scientific research in visitor programs and build visitors' understanding of science at National Parks.

> ***It is difficult to package the importance and culture-changing influence that iSWOOP has had on me as a scientist, researcher, designer, educator, mentor, park visitor and advocate.***

> ***I think about science communication, about conversations, about engagement, equality, fair place in a dialog, letting go of things before gaining others (e.g., control vs. trust, proximity, authenticity) etc. I am a different and much better, I would like to think, teacher in the classroom and a ferocious advocate for importance of learning outside of it.***

Call to Action

The opportunities to use open-ended questions about scientific topics were grand. Most of my trainings in ACE (audience-centered experience) techniques have centered around social topics. This was a comfortable way to practice using those same techniques to tackle science—by making the researchers and the research process as much of the story as the scientific findings.

We seek connections with parks interested in showcasing current park-based or park-relevant research in an interactive way. The iSWOOP project seeks to support opportunities for interpreters to learn alongside scientists, to share observations, to give visitors new visual ways to appreciate parks.

During and after the project's NSF-funding, we hope park leaders, scientists, visitors, and interpreters find value in

- ➔ iSWOOP videos featuring scientists, interpreters, and filmmakers in action in iconic places, available on iSWOOPparks.com and the STEM multiplex;
- ➔ Guides and resources available on iSWOOPparks.com; and
- ➔ Articles, reports, and publications, available on iSWOOPparks.com.

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Learn more about iSWOOP

Resources, videos, and other publication are available at iswoopparks.com. For questions, contact martha_merson@terc.edu.

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