

NATIONAL PARK SERVICE

INVENTORY AND MONITORING PROGRAM USE AND USER STUDY

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LIST OF ABBREVIATIONS

I&M Inventory and Monitoring Program

NPS National Park Service

UVM University of Vermont

COVER PHOTOS

Left cover photo: Monitoring harbor seals at Point Reyes National Seashore, NPS/J. Weinberg McClosky
(<https://www.nps.gov/im/monitoring.htm>).

Right cover photo: Soil sample collection in Alaska, NPS photo
(<https://www.nps.gov/im/inventories.htm>).



1.0 INTRODUCTION

The National Park Service (NPS) Inventory and Monitoring Program (I&M) is intended as the primary means for understanding natural resources in park settings, informing evidence-based park management and decision-making, collaborating with other resource management agencies, and communicating the state and nature of park resources with the public. The program was initiated in the early 1980s and currently collects natural resource inventories and implements monitoring protocols at over 270 national park units organized as 32 ecoregional networks. The program's inventory and monitoring activities are designed to provide information on the status and trends of natural resources specific to the unique ecosystems and needs of each network. While I&M was designed to provide NPS with information and services vital for science-based management (Fancy et al. 2009), the extent that I&M products and services have been applied in the context of park management has yet to be examined.

The goal of this study is to deliver an empirical understanding of the range of applications of I&M products and services, and the dimensions of values that NPS staff associate with I&M. In addition, this study will provide a better understanding of how I&M could improve to better serve the needs of park staff and management. The results of this study will be important to inform strategic program decision making, including updates and enhancement to I&M, and to inform potential subsequent phases of work.

This study was designed to assess the characteristics of internal users and uses of I&M data and expertise, the range of application of I&M data and expertise, and the values associated with the I&M Program. The following research questions were developed in collaboration with NPS, RSG, and the University of Vermont (UVM) to guide the qualitative inquiry for this study:

1. Who uses I&M data and expertise?
2. How do they use these data?
3. Do these uses accurately reflect I&M program goals?
4. What value do users place on these data?
5. How are I&M data being used to support park management?

This memo provides a summary of the qualitative inquiry effort, which consisted of qualitative interviews that were conducted from May through August 2018, and subsequent results. The memo is organized into sections that describe participant selection, the development of the interview guide, the interview process, and summarize study results and conclusions.

2.0 METHODS

This study used a qualitative inquiry approach, which included a series of phone interviews conducted with a range of NPS staff during May through August 2018. Based on scoping calls with NPS, key criteria were identified to guide the selection of potential participants, who were ultimately identified by NPS. The interview question guide was developed in collaboration between RSG, UVM, and NPS to address key research questions identified for this study. RSG worked with UVM to schedule and conduct the series of phone interviews. The interviews reflected the range of participants' experiences with I&M products and services based on the variety of positions held by participants across different park settings.

2.1 PARTICIPANT SELECTION

Key criteria were developed by RSG and UVM in collaboration with NPS to ensure comprehensive coverage of the range of park settings, park types, and staff positions during participant selection. These criteria were organized as the following two categories:

1. PLACE

- a. NPS region
- b. Park type
 - i. Historic
 - ii. Natural
 - iii. Recreation
- c. Size of natural resource staff at park
 - i. Small (0–2 staff)
 - ii. Medium (3–5 staff)
 - iii. Large (6–15 staff)
 - iv. Very large (>15 staff)

2. PEOPLE

- a. Position
 - i. Natural resource management
 - ii. Superintendent
 - iii. Planning
 - iv. Cultural resource management
 - v. Maintenance
 - vi. Law enforcement

The above criteria were subsequently organized as a set of selection matrices. RSG and UVM populated each matrix cell with a set of park names, which NPS used to generate a list of potential interview participants that provided coverage across park settings, park types, and staff positions (more detail was provided in the project's Final Study Plan). Due to the qualitative nature of this inquiry, the goal of participant selection was to provide comprehensive coverage across a range of NPS park settings and staff positions (see Appendix A for an overview of final participant characteristics). By design, the final list of potential interview participants provided by NPS ensured that comprehensive coverage was achieved.



NPS provided a list of 46 potential interview participants which RSG and UVM used to recruit and schedule phone interviews. Participants were confirmed for an interview based on their response to an initial invitation and two follow-up reminders to participate. Confirmed participants were scheduled for an interview based on their availability for predetermined interview times and dates. A final check was conducted to ensure that at least one participant from each NPS region was included in the series of interviews.

2.2 INTERVIEW QUESTION GUIDE DEVELOPMENT

The interview question guide was developed and finalized in collaboration between RSG, UVM, and NPS, and included an introduction section followed by a series of interview questions that probed the participant's familiarity, experiences, and assessment of I&M (see Appendix B for a copy of the final interview guide). The introduction section included an orientation to the study, provided a brief overview of topics, and informed the participant that interviews would be recorded for notetaking purposes only. Participants were asked to provide verbal consent to the recording, were informed that recordings would not be shared and were for notetaking purposes only, and were offered the opportunity to stop recording at any point in the interview. The interview questions were designed using the study's established research questions as a guide to assess characteristics of internal (NPS) I&M data users, the range of uses of I&M data and expertise, and values associated with the availability and utility of I&M data and expertise (see Introduction for a full list of research questions).

The discussion guide included 17 multi-part, open-ended questions that were consistently asked of all interview participants. The interview guide allowed for "skips" based on previous answers indicating that specific questions were not relevant during a specific interview. Participants were encouraged throughout the interview to provide answers based on their current and previous positions at various NPS units, and to differentiate their answers according to position and NPS unit. The final question allowed the participant to provide any final comments that were not otherwise captured during the interview (see Appendix B for a copy of the final interview guide).

2.3 INTERVIEW PROCESS

RSG received the list of potential interview participants from NPS in four waves and invited each wave of participants to select an interview date and time according to a predetermined Doodle poll. The poll included a range of times and dates from May 3 through July 9, 2018, and limited participants' ability to select only one available time and date. The Doodle poll was later extended to include additional participants identified by NPS to ensure comprehensive coverage of park settings, park types, and staff positions was achieved. The extended Doodle poll included times and dates through August 10, 2018. Each interview was scheduled for two hours, but in practice most interviews lasted only 45–60 minutes. Beyond the initial invitation, participants were sent two reminders to respond to the Doodle poll to schedule an interview time

and date. RSG and UVM worked with participants to identify a time and date that accommodated differences in time zones and emerged park priorities.

Interviews were conducted remotely by a UVM¹ facilitator with an RSG notetaker and used a Skype conference line. Each interview was recorded, and the recordings were used as a reference to confirm electronic notes. Recordings were not transcribed, and notetaking did not reflect participant's verbatim comments. Interview notes were a close approximation of the content of the interview, and do not include interpretation by the facilitator or notetaker. A final set of notes was compiled and "de-identified," such that all identifiable information was replaced with generic text in brackets in order to protect the identity of the participant. The final set of de-identified notes was included as a deliverable for this study.

2.4 THEME DEVELOPMENT AND SATURATION

Each interview was followed by a debrief session between the facilitator and notetaker, which included a discussion of themes that were observed in each interview as either emergent, or as corroborating existing themes. These themes were ultimately assessed for theme saturation. The term "theme saturation" is often used to describe a stopping point for collecting qualitative data based on the indication that a sufficient degree of data has been collected, and that collecting additional data would not reveal substantively new themes or findings (Guest et al. 2006, Burmeister and Aitken 2012). Following the Guest et al. (2006) approach to assessing theme saturation, a theme analysis was conducted after the 29th interview to assess the rate of theme emergence. Results indicated that a majority (70%) of the 53 themes emerged during the first six interviews, and the latest theme emerged during the 23rd interview (Figure 1). Beyond the 23rd interview, participants continued to corroborate themes and perspectives expressed by previous participants, without adding substantively new themes or findings. Despite the above evidence of saturation, interviews were continued until 37 interviews in total had been conducted. No new themes emerged during the remainder of the interviews. Thus, it is reasonable to conclude theme saturation was achieved.

¹ The final two interviews were conducted by an RSG facilitator due to scheduling constraints.



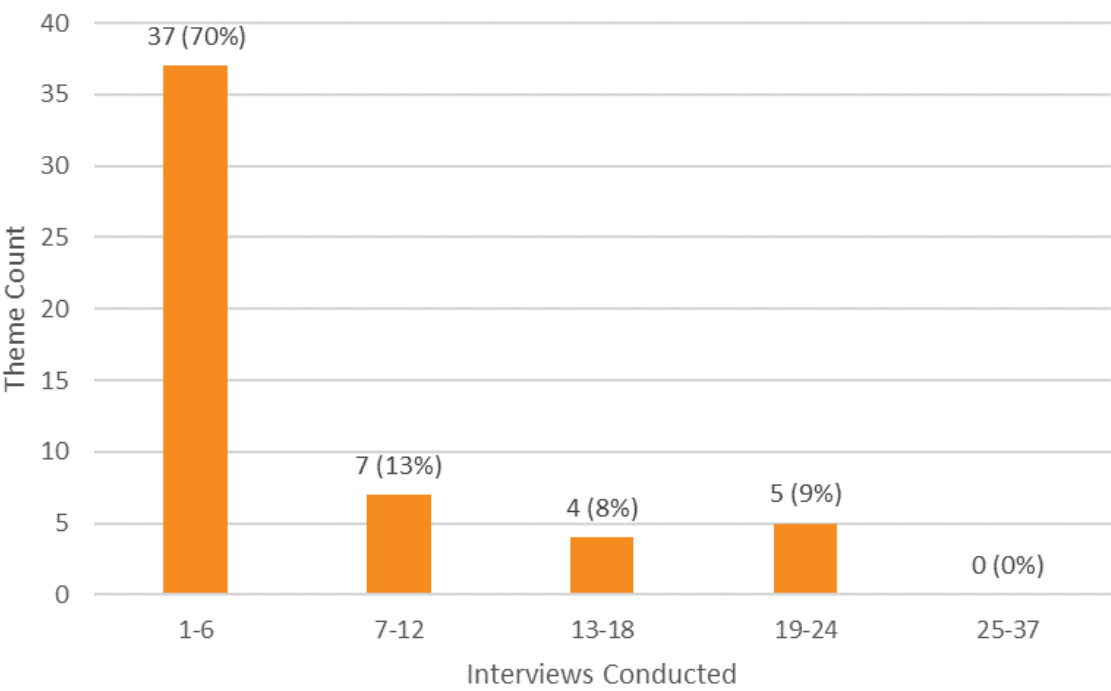


FIGURE 1: THEME EMERGENCE DURING THE SERIES OF INTERVIEWS

3.0 RESULTS

This study was designed with a series of anticipated outcomes in mind to address specific research questions specified by NPS about the uses and users of IM products and services. Correspondingly, the presentation of results in this section is organized according to anticipated outcomes and supporting research questions, as identified below:

END USERS OF I&M DATA

Anticipated Outcome 1: Identification of characteristics of internal (NPS) and external end users

Research Question 1: Who uses I&M data?

APPLICATIONS OF I&M DATA

Anticipated Outcome 2: Detailed understanding of user applications of I&M data

Research Question 2: How do they use these data?

Research Question 3: Do these uses accurately reflect program goals?

Research Question 5: How are data being used to support park management?

THE VALUE OF I&M DATA

Anticipated Outcome 3: Identification of values and valuations associated with the availability and utility of data

Research Question 4: What value do users place on these data?

EVALUATION OF I&M AND ENHANCEMENTS TO THE OVERALL PROGRAM

Anticipated Outcome 4: Evaluation of the I&M program by key end-user stakeholder groups

The results section includes references that highlight examples of the key findings. These references are not exhaustive of all examples of each finding. These references include the interview number and question range, which corresponds to the final set of de-identified interview notes included as a deliverable for this study. As an example, [I2, Q4-5] refers to second interview, question block 4-5. In some cases, the finding was supported throughout the interview, therefore the reference does not include the question range.

3.1 SUMMARY OF KEY FINDINGS

End Users of I&M

Natural resource managers are the primary users of I&M products and services, although results indicate that NPS staff in a range of positions benefit from I&M products, and use I&M services. Participants identified key opportunities for non-natural resource staff to use I&M products and services as part of their primary positions, and expressed the desire for I&M to be more relevant and useful to these positions. Participants also expressed the desire for I&M products and services to be more well-known across all divisions. Results further indicated that parks and positions utilized I&M in different ways based on park type, size, and I&M Network.

- I&M is an important resource used by participants from a range of divisions across NPS parks and I&M Networks, but particularly by natural resource staff. Participants indicated that all park staff wear the same uniform and work together to address the needs of the public and to better understand the park, often by leveraging I&M products and services [I15, Q6-8; I17, Q9-11; I26, Q6-8].
- Participants indicated that construction, interpretation, law enforcement, and maintenance divisions have a high potential to benefit from I&M products and services. This perspective was expressed by participants from within these divisions, as well as from other NPS divisions. Examples of potential applications of I&M data include: protecting cultural sites [I19, Q12-16], preventing poaching [I21, Q6-8], informing construction schedules and projects [I2, Q6-8], and informing mowing regimes [I19, Q12-16].
- Natural resource managers are often the gatekeepers of I&M products, in that other park staff rely on natural resource managers to access I&M products and services [I4, Q4-5; I16, Q6-8; I25, Q4-5]. In addition to accessing I&M products and services indirectly by contacting park-based natural resource staff, participants also discussed accessing I&M directly by contacting I&M staff or visiting the I&M website [I1, Q9-11; I12, Q9-11]. I&M products were also accessed indirectly by reviewing past I&M reports and newsletters [I4, Q4-5], or contacting other park staff within their network.
- End users of I&M utilize annual plans and presentations, newsletters, and reports in addition to accessing the I&M website and data portals to access and apply I&M products and services to park management and decision-making [I4, Q4-5; I8, Q9-11; I26, 9-11].
- NPS units characterized by significant natural resources tend to utilize I&M to inform park management and achieve park goals, and tend to work closely with I&M staff. NPS units characterized by significant cultural and historic resources require additional, non-natural resource-based data to inform park management decisions and goals. Staff at these NPS

units are less likely to rely on I&M products and services to inform all park management decisions and goals [I8, Q12-16; I17, Q6-8; I36, Q6-8].

- NPS units with small to medium-sized natural resource staff, parks that are geographically dispersed as multiple land units, and cultural and historic resource parks are more likely to rely on I&M for information on significant natural resources due to limited natural resource staff and expertise [I17, Q12-16], and alternative priorities established at the park level and based on staff duties [I36, Q6-8]. I&M builds capacity at these parks, which tend to benefit more from the range of products and services offered by I&M that are not offered at the park level. Key areas of expertise include GIS [I6, Q6-8; I14, Q12-16] and communication [I17, Q4-5].
- NPS units were aggregated in the I&M network structure in order to implement an efficient and cost-effective program while meeting the most critical information needs for each park (Fancy et al. 2009), therefore some degree of “lack of fit” could be expected. Researchers characterized parks as outliers based on evidence of “lack of fit” according to participant responses. Participants in these outlier parks indicated that vital signs, protocols, or sample locations were not well-suited to their parks and were therefore not informative or comprehensive for informing management and decisions at the park-specific scale. Therefore, these outlier parks are less likely to benefit from I&M products and services provided by the I&M Network. Researchers characterized outlier parks according to the following dimensions, which describe “lack of fit” with other parks in their I&M network structure:
 - Type: I8
 - Geography: I8, I9, I20, I24
 - Scale: I8, I20, I24
 - Resource composition: I20, I24

These references identify the four parks characterized by researchers as outliers within an I&M Network based on participant responses.

Applications of I&M

I&M products and services are used to achieve a range of I&M Program goals, including: to assess the nature and status of park-based natural resources, to inform and support park planning, management, and decision-making, to foster partnerships, and inform the public. Participants indicated that I&M products and services are fundamental for fulfilling the NPS mandate to protect natural resources, and that they would be ‘flying blind’ without the support of I&M.

- I&M products and services are accessed for many reasons related to I&M Program goals, including the following examples:
 - To learn more about park resources (e.g., bird lists [I4, Q 4-5])
 - To inform management plans (e.g., deer management [I22, Q6-8])
 - To inform maintenance decisions (e.g., battlefield mowing protocol [I25, Q4-5])
 - To inform construction projects (e.g., limit impacts on nesting birds [I2, Q4-5])
 - To examine spatial and temporal trends impacting park resources (e.g., invasive species monitoring and management [I28, Q4-5])
 - To substantiate controversial decisions and management actions and meet compliance standards (e.g., preserve water resource rights and protect nesting habitat [I13, Q4-5])
- I&M products and services are also used to track changes in conditions over time and changes due to external influences such as natural disasters or land use change, such as shoreline change due to hurricane activity [I20, Q9-11], coral reef conditions following a bleaching event [I6, Q4-5], vegetation restoration in historic grazing areas [I27, Q4-5]. These activities are made possible by the long-term datasets and protocols maintained by I&M.
- I&M products and services are used to established partnerships with federal, state, NGO, and private entities [I8]. Universities also function as a partner with parks and I&M, often adding capacity by implementing I&M protocols or using I&M data to address research needs or questions related to I&M data [I1, I6, I10, I31], including collecting and analyzing vegetation data [I30, Q4-5].

The Value of I&M

Participants described I&M as vital for informed park management and decision-making. Participants also identified a range of additional values related to I&M products and services. These values were both direct and indirect, and are also in-line with I&M Program goals. I&M was identified as particularly valuable in certain contexts, the most notable of which were documenting and providing strong evidence climate change and responding to threats from invasive species.

- Participants agreed that resource knowledge is imperative to making sound management decisions, as directed by the NPS mandate, and the majority of information available on park-based natural resources is a direct result of I&M products and services [I10, Q12-16; I18, Q12-16].
- The following list provides examples of management plans and decisions mentioned by participants that were directly informed by I&M products and services:
 - Deer management plan [I22, Q4-5]
 - Riparian restoration funding allocation [I31, Q6-8]
 - Invasive plant and insect species management [I28, Q4-5]
 - Weed treatment based on I&M data [I31, Q9-11]
 - Coral monitoring after a bleaching event [I6, Q4-5]
 - Managing flow regimes and fish populations [I13, Q4-5]
 - Large coastal restoration [I16, Q4-5]
 - Bat monitoring with the advance of white nose syndrome [I4, Q12-16]
- Participants noted the following direct benefits and values related to I&M products:
 - Long-term and robust datasets that document park resources, establish scientific baselines, and inform planning and management decisions [I8, Q6-8; I21, Q12-16].
 - Datasets and products that are collected in a reliable, repeatable way, that involve QA/QC standards, and that have been vetted and reviewed [I11, Q6-8; I16, Q9-11].
 - I&M staff that are viewed as trusted subject matter experts and are relied on as an extension of park staff [I6, Q4-5; I23, Q17].
 - I&M staff that are viewed as niche experts [I13, Q12-16] and can provide on-the-ground training and assistance with research design and grant writing, statistical analyses, communicating scientific findings to park staff and the public, and data management and storage [I1, Q6-8; I5, Q6-8; I27].

- Participants noted the following indirect benefits and values related to I&M products:
 - Opportunities that inspire NPS staff, provide personal enrichment, professional development, and foster an internal community by way of formal annual I&M Network meetings, informal social gatherings among staff, and opportunities to share park science across divisions [I11, Q9-11; I15, Q12-16; I26, Q6-8].
 - I&M staff that are collocated in NPS units and integrated with NPS staff, which fosters collaboration, promotes efficiency and accessibility, and facilitates cross-sharing of information [I1, Q12-16; I7, Q12-16; I11, Q9-11; I22, Q12-16; I23, Q9-11].
 - Partnerships with federal, state, and private agencies and organizations, particularly universities, that enhance capacity to manage park resources. These partnerships may supplement I&M inventory and monitoring protocols and often focus on shared resources of interest such as water quality, migrating species, and land use impacts [I1, I6, I8, I10, I30, I31].
 - Sustained institutional knowledge that results from long-term and robust datasets, and an external organization not subject to turnover at the park-level [I10, Q17; I31, Q12-16].
 - Overall datasets, products, and services that contribute to basic scientific discoveries and debates, such as climate change [I23, Q4-5; I28, Q12-16].
- I&M consists of a range of long-term datasets collected at the landscape-scale across the NPS system; thus, I&M is particularly situated to address the following large-scale, complex threats to natural resources:
 - Invasive plant and insect species [I28, Q4-5]
 - Spread of disease [I10, Q4-5]
 - Adjacent land-use change [I13, Q12-16]
 - Climate change [I5, Q12-16]
- The primary goals of the I&M Program include contributions to basic science, as well as direct application to park management. However, participants perceived that I&M protocols were designed to prioritize the collection of scientific information over its application to park-specific management decisions [I29, Q12-16]. The I&M Program's overall value at the park level depends on the applicability of the inventories and monitoring protocols to management decisions, regardless of the contributions to basic science. Some suggestions for enhancing the value of I&M include: collocating I&M staff in NPS units [I5, Q12-16], responding to park priorities that fall outside I&M protocol and adapting protocols when necessary to address park-specific needs [I5, Q12-16; I33], and involving NPS unit staff in the update and revision of I&M vital signs and monitoring protocols [I20, Q17; I24, Q12-16].

- When asked to imagine that the I&M Program disappeared, participants commented that they would be ‘flying blind’ by making uninformed decisions across a range of responsibilities [I22, Q12-16; I25, Q12-16; I31, Q12-16. These decisions could put natural resources at risk through reactive instead of proactive management. Participants clearly indicated I&M is extremely valuable, and necessary for achieving the best park management.

Evaluation of I&M

Participant responses to I&M ranged from neutral to enthusiastic, with participants voicing enthusiasm and appreciation for I&M as a resource and for its ability to build capacity within their park. I&M was described as a ‘critical resource’ for park management and decision-making, although key areas for improvement were identified.

- As indicated throughout this results section, participants understand the role of I&M and value the program as a vital resource for protecting natural resources and informing park management decisions. Participants identified the importance of having an external NPS entity focused on long-term questions, monitoring, and the general health of parks, whereas park staff are generally more focused on immediate, on-the-ground management [I3, Q17; I29, Q6-8].
- I&M affords additional benefits to NPS staff, such as building science literacy and data management skills [I3, Q12-16; I18, Q12-16]. Participants indicated they had received field training by working alongside I&M staff to collect data, attended training sessions in R, and had generally benefitted from exposure to I&M via formal presentations, conference calls, and informal conversations and interactions [I5, Q12-16; I15, Q12-16; I16, Q4-5; I18, Q4-5].
- Participants were generally appreciative of the extent of resources provided by I&M, despite limited staff and budgets. Participants offered the following suggestions for improving existing components of I&M:
 - Participants expressed the desire for a more flexible and adaptive I&M Program, that could address needs and priorities at the park-specific scale, particularly when these differ from the needs and priorities at the I&M Network scale [I3, Q12-16; I8, Q17; I11, Q17; I21, Q12-16].
 - Flexibility is particularly important for parks that are smaller, with less staff capacity, are characterized by cultural or historical resources, or parks that are outliers in their I&M Network (see End Users of I&M section above for definition of outlier and examples). Participants recalled that I&M was unable to address requests for park-specific inventories and monitoring protocols, or variations on existing inventories and monitoring protocols that were a better ‘fit’ to their park and natural resource composition and dynamics [I8, Q12-16, Q17; I9, Q12-16; I20, Q12-16; I24, Q6-8; I33, Q4-5].
 - Participants identified the opportunity to enhance I&M capacity by developing long-term partnerships with local universities. Such partnerships could increase focus on park-specific needs and research questions, by collaborating with I&M on products and services while also pursuing questions outside the scope of I&M [I30, Q17].

- Participants suggested the creation of cross training opportunities between I&M staff and various NPS divisions to better understand the specific needs and challenges in each role, and to enhance the application of I&M products and services for informing park management decisions across divisions. Specific suggestions include: learning about funding opportunities available through facilities management [I25, Q12-17], detail opportunities for I&M and park managers to exchange roles to better understand the needs of each position [I11, Q17; I28, Q17], and an orientation on how to inform park planning and management with I&M products and services [I35, Q12-16].

Enhancements to the Overall Program

Participants acknowledged that I&M scope and budget are key limiting factors that influence the degree and type of products and services offered by I&M. However, participants identified key opportunities for improvement, expansion, and partnership that would enhance the overall value of I&M and its relevance across the service. These opportunities were summarized as the following:

- Communicate science to the public
 - Participants identified smartphone applications and website content as important mechanisms for informing the public about NPS activities, accomplishments, and ongoing research. These applications could also be valuable tools for engaging the public in natural resource stewardship and increasing the public understanding of science in NPS settings [I1, Q12-16; I4, Q9-11].
 - One participant pointed out that I&M is the best example of how science is applied in NPS settings, and that the public should be more aware of I&M, its accomplishments, and its contributions to park science [I16, Q12-16].
 - Another participant identified the key role that I&M serves to legitimize and contextualize climate change in NPS settings [I22, Q12-16].
- Increase awareness of IM data products and services within NPS and the broader natural resource community
 - Some participants did not differentiate between data generated by I&M and by park staff, despite using that data to inform park management and decision-making [I2, Q4-5; I19, Q4-5]. Participants encouraged I&M to increase internal awareness of the various I&M products and services available to NPS, as well as awareness in the broader natural resource community [I16, Q12-16; I27, Q4-5]. This represents an opportunity for I&M to increase external awareness of products and services, by clearly communicating database ownership when sharing with external collaborators and partners.
 - Participants also requested that I&M generate different versions of reports that would be more digestible to a range of NPS staff, including those with little to no scientific background, and particularly for superintendents with limited time to review these products [I11, Q17; I29, Q9-11]. Participants specifically requested one-page summary materials that would be easy to digest and share among NPS staff [I27, Q9-11].
 - Some participants were unclear about the extent of I&M products and services available or leveraged at the park-scale, and suggested the value of an orientation on locating and applying I&M products and services to inform park management and decision-making [I35, Q12-16].

- Participants suggested maximizing the benefit of I&M by cross-referencing studies and projects within and across I&M Networks in a searchable database [I2, Q12-16].
- Participants felt they were lacking the bigger picture of I&M, and would benefit from more information on how I&M and NPS units can and do work together [I5, Q17; I25, Q12-16].
- Increase frequency, flexibility, and transparency of I&M
 - Participants indicated the need for more frequent inventories, reports, and updates to baseline data sources, such as vegetation maps which can become obsolete over time [I5, Q12-16; I9, Q4-5].
 - Participants indicated that monitoring protocol could be developed to consider a finer temporal and spatial resolution, particularly for smaller NPS units and NPS units with unique geographies such as shorelines [I9, Q12-16; I30, Q6-8].
 - Participants indicated that I&M inventory and monitoring protocols should be expanded to collect data on newly acquired park lands as they are added to the overall park footprint [I9, Q4-5; I37, Q12-16].
 - Participants advocated for park staff to have an enhanced role in:
 - Providing feedback on selecting the vital signs and designing and implementing protocols [I20, Q12-16; I33, Q12-16].
 - Adding species to inventory and monitoring protocols that are priorities at the park-specific scale [I9, Q12-16; I23, Q12-16].
 - Adding inventory and monitoring sample locations, particularly to include recent land acquisitions and expanding park footprints [I5, Q6-8; I9, Q4-5; I37, Q12-16].
 - Tailoring monitoring protocols to be specific to a given park within an I&M Network [I24, Q17; I33, Q12-16].
- Expand I&M protocols to include the following data types:
 - Spatial information [I30, Q9-11]
 - Specific species, as identified by park and I&M Network needs [I3, Q12-16; I31, Q12-16]
 - Cultural resources, including an inventory available for maintenance and law enforcement [I8, Q4-5; I27, Q6-8]. In many settings, natural resources overlap with cultural resources.
 - Social science, including visitor use information and impacts on resources [I29, Q12-16; I35, Q12-16]
 - Ecosystem contaminants [I23, Q12-16]
 - Fire ecology [I27, Q12-16]



- Threatened and endangered species [I10, Q12-16; I19, Q12-16]
 - Invasive species monitoring [I9, Q12-16; I12, Q12-16]
 - Datasets that cross park boundaries and include non-NPS lands to reflect the dynamic nature of natural resource management [I10, Q12-16; I36, Q12-16]
- Participants noted the limited scope of the I&M program, and focus on natural resources and protocols identified and developed at the I&M Network level. These participants expressed the desire for an expanded program scope that would include cultural resources, e.g., archeological site locations, and inform wholistic park management [I8, Q4-5; I25, Q12-16; I27, Q6-8, Q12-16]. Such an approach could also support the duties of multiple division including interpretation, maintenance, law enforcement, and cultural resource management.
- Despite the range of applications for I&M products and services, some participants noted the opportunity for improvements in I&M customer service [I6, Q12-16; I11, Q12-16]. This could include responding to park-specific needs by expanding or tailoring inventory and monitoring protocols, such as increasing the number of sample plots or tailoring the sample plot locations within a park. I&M could also develop a strategy for responding to emergent park needs and questions that deviate from established inventory and monitoring protocols, such as adjusting monitoring schedules following a natural disaster event or generating a new inventory to include invasive species.
- I&M products and services should be leveraged more to supplement additional inventory and monitoring needs at the park level, and to examine additional research questions related to I&M inventory and monitoring. This is often addressed through specific and focused partnerships with universities and others, that sometimes leverage personal or long-standing relationships between parks and universities [I31, Q6-8]. This study revealed an opportunity for I&M to proactively look for opportunities to institutionalize these partnerships [I30, Q17].
- Participants used their final remarks to suggest enhancing the budget and staff available to I&M [I1, Q17; I11, Q17; I10, Q17; I18, Q17]. By maintaining staff positions and building customer service within I&M, the overall program would be more sustainable and better able to support and respond to park needs for informed management and decision-making [I31, Q12-16].

4.0 POTENTIAL NEXT PHASES

The following section draws on the interview results from this study to inform potential subsequent phases of inquiry. Such phases could include:

Phase II: Quantitative NPS Personnel Inquiry

Phase III: Qualitative External Use/Stakeholder Inquiry

Phase IV: Quantitative External Use/Stakeholder Inquiry

This study was designed to assess the characteristics of internal users and uses of I&M data and expertise, the range of application of I&M data and expertise, and the values associated with I&M. Therefore, the results of this study are most applicable to a potential **Phase II: Quantitative NPS Personnel Inquiry**. The recommended approach to following a qualitative inquiry with a quantitative inquiry would be to design and implement a survey tool based on the results of the initial qualitative inquiry. The results of this study have the following implications on the design and implementation of such a tool:

- A survey should collect respondent characteristics, including but not limited to: current NPS position, years with NPS, park name. NPS personnel involved in Phase II should be allowed to self-identify their position title/description based on a predetermined list of categories, including a write-in response option. This approach would capture a wider range of respondent's positions and duties than the criteria used in this study (see Section 2.1 for a description of criteria used for participant selection).
- Results suggest that NPS personnel have often held multiple positions in various NPS settings. NPS should consider designing a survey to only solicit responses based on the respondent's current position to avoid an overly-complex survey structure and respondent fatigue.
- A survey should include all NPS staff positions and personnel. While results suggest that natural resource managers are the primary users of I&M products and services, results also indicate that I&M has broad applicability and potential to be used across NPS positions.
- This approach has the added benefit of promoting awareness of I&M products and services among NPS positions less-familiar with I&M.
- A survey should include informative text that describes I&M products, services, and overall structure in an effort to ensure responses are based on experiences with I&M, and not alternative research programs (e.g., park-based or university research programs).

- Survey analysis should compare responses within and across park type, park size, NPS division, and I&M Network.
- Results from this study suggest the survey could be organized to measure the following:
 - Relative prevalence of I&M users across NPS divisions in the context of different park units. This could result in the development of a typology of I&M users.
 - Relevance of various I&M applications across NPS divisions in the context of different park units.
 - Relative importance of the range of values associated with I&M products and services, as described in section The Value of I&M section.
 - Relative importance of enhancements to the overall I&M Program, as described in section Enhancements to the Overall Program section.

The results of this study provide a solid foundation from which to conduct a representative quantitative inquiry of the users and uses of I&M data and expertise, the range of application of I&M data and expertise, and the values associated with I&M across the park service. The implications outlined above provide the basis for designing and implementing a robust survey tool for a quantitative inquiry.

The results of this study have the following broad implications on potential **Phases III** and **IV**:

- Contact information was collected as a starting point for identifying and engaging participants for potential Phase III and possibly IV (see Appendix C for external user contact information provided during this study). Snowball sampling could be continued based on this initial list.
- Contact list can be expanded by considering known NPS partnerships with federal and state agencies, Universities, regulators, non-profit organizations, and other private entities.
- Contact list could also include known I&M staff collaborators.
- Interview and survey questions for external users/stakeholders should mirror the questions from the NPS personnel inquiry and should be adapted as needed for an external audience.

The results of this study have limited implications for potential phases of work with external users and stakeholders. The implications outlined above should be revisited if the Qualitative External Use/Stakeholder Inquiry phase is complete.

5.0 LITERATURE CITED

Burmeister, E., & Aitken, L. M. (2012). Sample size: How many is enough? *Australian Critical Care*, 25(4), 271-274.

Fancy, S.G., Gross, J.E., & Carter, S.L. (2009). Monitoring the condition of natural resources in US national parks. *Environmental Monitoring and Assessment*. 151: 161-174.

Guest, G., Bunce, A., & Johnson, L. (2006). How many interviews are enough? An experiment with data saturation and variability. *Field methods*, 18(1), 59-82.

APPENDIX A. PARTICIPANT CHARACTERISTICS

The following tables summarize participants according to selection categories and criteria. The number represents the count of participants interviewed, and the number in parentheses indicates the total count of participants included on the list of potential interview participants.

NPS REGION

NPS REGION	INTERVIEWS CONDUCTED
Alaska Region	3 (3)
Intermountain Region	4 (7)
Midwest Region	2 (2)
National Capital Region	3 (3)
Northeast Region	5 (6)
Pacific West Region	13 (18)
Southeast Region	7 (7)
TOTAL	37 (46)

PARK TYPE AND SIZE

PARKS INCLUDED	HISTORIC	NATURE	RECREATION	TOTAL
Small	10 (12)	5 (6)	3 (3)	18 (21)
Medium	2 (3)	5 (5)	2 (3)	9 (11)
Large	1 (1)	2 (4)	2 (4)	5 (9)
Very Large	–	2 (2)	3 (3)	5 (5)
TOTAL	13 (16)	14 (17)	10 (13)	37 (46)

PRIMARY POSITION

PRIMARY DUTY ²	INTERVIEWS CONDUCTED
Cultural Resource Management	2 (2)
Law Enforcement	1 (1)
Maintenance	3 (4)
Natural Resource Management	23 (29)
Planning	2 (2)
Superintendent	6 (8)
TOTAL	37 (46)

² Interview participants have held more than one position during their NPS career.

APPENDIX B. FINAL INTERVIEW GUIDE

Introduction:

Thank you for participating in this interview as a component of a project to evaluate the Inventory and Monitoring, or I&M, Program. The National Park Service staff in the I&M Program are interested in understanding how I&M data and expertise are currently being used, how users value the data and expertise that is currently provided, and how I&M data and expertise could better support park staff and management.

In the interview, when we refer to I&M data, we mean the information, analyses, reports, maps, etc. provided by the I&M program. When we refer to I&M data delivery formats, we are referring to both the process of accessing the data and the usability of the data once it is accessed. When we refer to I&M expertise, we mean technical expertise, skills, and other support or services provided by the I&M program. Your participation will ensure that your perspectives are represented in updates and enhancements to the I&M program and help strengthen partnerships between the I&M program and parks around the country.

This interview should last no more than one and a half hours. The questions we want to discuss were designed in collaboration with the I&M program, the Social Science Program of NPS, and consultants at RSG and the University of Vermont.

We will be recording the interview so that we can reference your comments and insights in order to write a report for I&M, but that recording will not be shared or used for any other purposes. All your comments in this interview are voluntary. Your name will not be included in the summary report, and your identity will not be linked in any way to your comments. Are you okay with us recording?

We are interested in everything you want to share with us. There are no right or wrong answers. Everything you say will be helpful to the I&M Program as they work to improve their program, including the quality, utility, availability, and accessibility of I&M data and expertise. Do you have any questions before we begin?

Interview Questions:

Great. We'll start with just a few questions about you.

1. What is your current position within NPS?
2. NOTE: ascertain both location and position
 - a. How long have you worked at NPS?

3. Can you provide a fairly brief overview of the different positions you've held at NPS and where those positions were located?
 - a. [If there is ambiguity] Okay, you describe working mostly at XX. Are you affiliated with any other parks or programs? What about other government agencies or NGOs?

Thank you so much. Now we'll dive into questions about the I&M program.

4. How familiar are you with the I&M program?
5. In what ways has the I&M program provided support to you in your current role either through data, expertise, or other forms of support?
 - a. [If YES] Can you share how you use the data or expertise? This might include information, analyses, reports, or other products and services.
 - i. [If not mentioned] Do you or your park incorporate I&M products (data, reports, consultation with specialists, etc.) into park planning, management, and decision-making at any scale?
 1. [If yes] Can you give me a few examples?
 2. [If no] Probe to determine possible reasons, including: 1) inability to access data/expertise, 2) data/expertise not relevant to park management/planning, 3) inability to apply and/or interpret data, 4) data/expertise quality questionable or insufficient.
 - ii. [If not mentioned] Do you or your park use I&M data or expertise for external purposes, like developing partnerships with other organizations, sharing accomplishments or information, or for something else?
 1. [If yes] Can you give me a few examples?
 2. [If no] Probe to determine possible reasons, including: 1) inability to access data/expertise, 2) data/expertise not relevant for external purposes, 3) inability to apply and/or interpret data, 4) data/expertise quality questionable or insufficient.
 - b. [If it hasn't provided support] Can you talk a bit about why you do not use I&M data or expertise in your current role?
 - i. Be sure to cover possible reasons, including: 1) inability to access data/expertise, 2) data/expertise not relevant to park management/planning, 3) inability to apply and/or interpret data, 4) data/expertise quality questionable or insufficient.
 - ii. **SKIP to Question 8**

OK, thanks. So now, zooming out a bit, I have a few more reflective questions.

6. We are curious to learn about when and why I&M products or services are used. Can you talk a bit about when and why you or your park use I&M data or expertise?
 - a. [If need for clarification]: We're curious about the reasons behind your or your park's use of I&M data and/or technical assistance. There are many possible reasons! Examples include: Do you choose to use it because it's the best available science? Is tailored specifically to your park's needs? Does your supervisor ask you to use it? Is it just common practice?
7. [IF APPLICABLE]: How does your current experience with I&M data or expertise relate to your experience with I&M data **at your previous positions at NPS**?
 - a. Did you make similar use of I&M data or expertise in your previous positions, or was the experience different?
 - b. [If not addressed in response]: OK, you've described how use was [similar or different]. Were the **reasons** for using I&M data or expertise the same or different?

Now I have a few questions about what you know of other peoples' use of I&M data.

8. Do you have any colleagues who you know use I&M data or expertise?
 - a. [If yes]
 - i. Are those colleagues in the same park as you?
 - ii. How do those folks use I&M data or expertise?
 - b. [If not addressed in previous response] Do you have a sense of whether your colleagues are using I&M data and expertise internally, externally, or both? Can you provide examples?

I want to hear your thoughts about a few different aspects of I&M data and expertise.

9. Overall, how do you feel about the I&M data and expertise that is available?
 - a. In general, how would you rate the quality of the data and expertise provided by the I&M program?
 - b. Was there a time when you really felt impressed by the quality of the data? What was it that impressed you?
 - c. Was there a time when you were unsure or skeptical about the quality of the data? What was it that made you skeptical?

10. Would you say that I&M data is easy or difficult to access? If “1” is extremely difficult to access and “10” is extremely easy to access, what rating would you give? What about I&M expertise or technical support?

11. Can you walk me through how you access these items?

- a. Now, how do you feel about the format in which data are delivered? [If confused] Is the format useful? Confusing? Too complex? Too simple?

Thanks. My final questions are about the role that the program plays in your work, broadly.

12. What aspects of I&M data, if any, do you find particularly valuable for you in your position? What about I&M expertise or technical support?

13. What might make I&M data more useful or more valuable for you in your position? What about I&M expertise or technical support?

- a. **** If clarification is needed: For example, if you could, would you change anything about what kinds of I&M data or expertise are provided? What about the process of accessing data and expertise? What might you change about data delivery format(s)? ****

14. Does the data provided by the I&M program help you achieve any goals, such as the goals of your position, your personal career goals, or goals of your park or program? What about I&M expertise or technical support? Can you describe how I&M data and expertise does that?

15. Let’s pretend for a moment that the I&M program were to disappear. How would this affect you, your work, and your park?

- a. What do you think the impact would be on your park/program?
- b. [If not mentioned] What do you think the impact would be on other users, such as your colleagues or external partners?

16. We’ve already asked you if you’d be willing to provide names of colleagues you think we should talk with. Would you be willing to share names of external folks who you think we should talk to about I&M data and expertise?

- a. [If yes] Why do you think we should talk to these people in particular?

17. Is there anything else you think we should know about I&M?

APPENDIX C. EXTERNAL USERS FOR POTENTIAL SUBSEQUENT PHASES

The following table includes contact information for external users of I&M. Contact information was provided by the NPS employees interviewed for this study. All NPS employees were encouraged to consult with the external user before providing their contact information.

NAME	AFFILIATION	CONTACT INFORMATION
Sue Bellagamba	Canyonlands Regional Director, The Nature Conservancy	sbellagamba@tnc.org
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