An Exploration of Field-Station Partnerships: University-Operated Field Stations Located in US National Parks

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Field stations are important places for education and research that can broaden their influence through partnerships. Although the majority of field stations in the United States are operated by universities, we found only eight university-run field stations located inside US National Park System units. Nearly two-thirds of these field stations have opened since the year 2000. An online survey was sent to each of these stations that gathered data about their demographics, the opportunities and challenges of their partnerships, the details of their missions, and how they benefit their associated universities and national parks. The key opportunities of this type of partnership centered on education, research, and providing access to a national park, whereas the most commonly reported challenges included dealing with federal and university bureaucracies and obtaining necessary funding. The exploration of this unique type of partnership can inform other collaborative interactions between professional biologists and their allied stakeholders.

Keywords: field stations, national parks, National Park Service (USA), partnerships, universities

Even though the importance of field stations has been clearly delineated (e.g., Wilson 1982), many field stations today are underappreciated and underfunded (NRC 2014). The fact that field stations often operate independently (Lohr and Stanford 1996, NRC 2014) could limit the extent of their influence. To address this, both Lohr and Stanford (1996) and the NRC (2014) recommended that field stations network with each other, whereas the NRC (2014) specifically recommended partnerships between field stations and national parks.

Because 74% of field stations in the United States are run by universities or colleges (NAML and OBFS 2013), we were especially interested in studying field-station partnerships between universities and US National Park System units. These units include national parks, monuments, preserves, recreation areas, rivers, etc. From this point forward, we will refer to US National Park System units simply as *national parks*.

With this project, we sought to describe the nature and extent of a unique type of partnership: a field station operated by a university and located in a national park, which we will refer to as *U-NP field stations*. For example, we were interested in determining whether this type of partnership was expanding or contracting. Furthermore, along with the benefits of collaboration can come specific drawbacks, so we sought to explore the opportunities and challenges associated with U-NP field stations and ascertain effective strategies that field-station personnel used to maximize opportunities and minimize challenges associated with this type of arrangement. Finally, we explored the mission statements of U-NP field stations and how their missions supported the missions of their associated universities and national parks.

A survey of university-operated field stations located in US national parks

Our survey was designed to gather data from U-NP field stations defined as those (a) with facilities managed or owned by a university or universities and (b) located on land inside US national parks. Field stations that did not fit into both of these categories were excluded from this study. For instance, field stations located near, adjacent to, or even in inholdings surrounded by a national park were not included in our study. Our specific selection criteria present some limitations to the extent to which our results can be generalized, but our primary interest was to explore a particular type of

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Table 1. University-operated field stations in US National Park System units (n = 8).

Name of field station(s)	US National Park System unit(s) where field station(s) is/are located	University/universities involved in field-station management or ownership
Capitol Reef Field Station	Capitol Reef National Park	Utah Valley University
Desert Studies Center	Mojave National Preserve	California State University consortium, including Fullerton (lead campus), Dominguez Hills, Long Beach, Los Angeles, Northridge, Pomona, and San Bernardino
George Harp Environmental Field Station	Buffalo National River	Arkansas State University
La Kretz Center Field Station	Santa Monica Mountains National Recreation Area	University of California, Los Angeles
Santa Rosa Island Research Station	Channel Islands National Park	California State University, Channel Islands
Sierra Nevada Research Stations	Sequoia and Kings Canyon and Yosemite National Parks	University of California, Merced
The University of Wyoming-National Park Service Research Station	Grand Teton National Park	The University of Wyoming
Virgin Islands Environmental Resource Station	Virgin Islands National Park	University of the Virgin Islands

field-station partnership. The survey gathered basic demographic information about each field station and probed university employees associated with field stations on the opportunities and challenges brought about by their field station's partnership with a US national park and strategies they used to maximize opportunities and minimize challenges. Furthermore, the research participants were asked about their field station's mission and how their station benefited their university and its associated national park. The survey was face-validated and piloted by employees of Capitol Reef Field Station.

We sought to identify all U-NP field stations by (a) emailing the Organization of Biological Field Stations' (OBFS) listserv and asking members to identify their own or other field stations that fit our criteria, (b) attending the annual OBFS meeting and talking directly to members about possible U-NP field stations, and (c) conducting internet searches. From our list of potential U-NP field stations, we used email to invite one representative from each station to fill out a 24-question, anonymous, online survey and to identify additional field stations that met our search criteria. We concluded that our search had been exhaustive when we had contacted or determined the ineligibility of all potential U-NP field stations suggested by our survey participants. The survey was completed by field-station directors (n = 6) or administrative assistants (n = 2), who received a $50 gift card as compensation for their efforts.

This study was envisioned as a descriptive study of U-NP field stations and not as a means of statistically testing formal hypotheses. To analyze open-ended questions, we used grounded theory (Glaser and Strauss 1967) such that two researchers independently examined all the responses and determined emergent themes. We then discussed the emergent themes and generated categories for coding. After the coding categories were determined, we independently coded responses into the categories. We calculated interrater reliability (IRR) by dividing the number of scoring agreements by the total number of scoring decisions. The categories presented in the results are those that include responses from more than 20% of the respondents and with IRR values of more than 90%.

U-NP field stations: Their demographics, opportunities and challenges, and missions

We found a total of eight U-NP field stations (table 1) located in Arkansas (n = 1), California (n = 4), US Virgin Islands (n = 1), Utah (n = 1), and Wyoming (n = 1). Two former U-NP field stations were also found in our search: the Woodlake Environmental Field Station in Cuyahoga Valley National Park and run in cooperation with Cleveland State University and John Carroll University and the Purdue University North Central Biology Field Station located in Indiana Dunes National Lakeshore. Of the eight U-NP field stations that have persisted, more opened in the most recent 15-year period (n = 5) than in the previous four 15-year periods combined (60 years; n = 3; figure 1). In other words, the number of U-NP field stations has increased by 167% since the year 2000.

The staff of the eight U-NP field stations included 0-3 full-time equivalent employees, with an average of 1.69 full-time equivalent employees per station (median = 1.5). The annual operating budget of these stations ranged from $1500 to $360,000 and averaged $127,063 (median = $125,000).

The number of people who visited each U-NP field station during 2014 (or the most recent 12-month reporting period) ranged from 128 to 2800 and averaged 1043 visitors (median = 822). Of those, 31-2240 were undergraduates, with an average of 568 undergraduate visitors per year per station (median = 299). User days (calculated by multiplying the number of visitors by the number of days they spent at the station) ranged from 450 to 10,672 and averaged 4037 user days (median = 3381). U-NP stations can accommodate from 16 to 70 people overnight, with an average overnight capacity of 42 (median = 38.5).

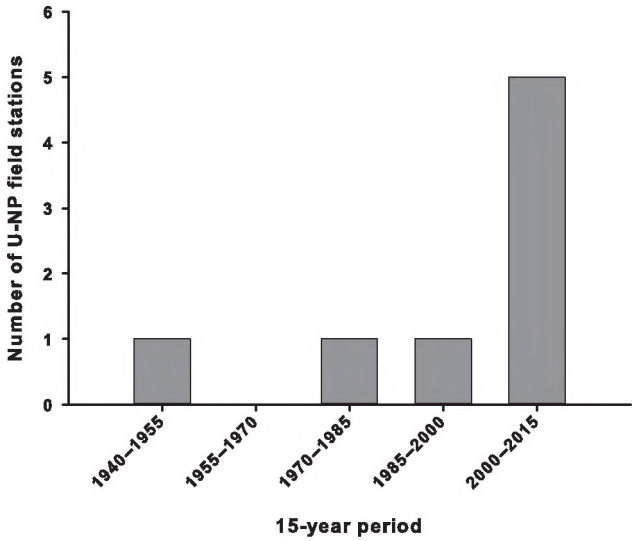

Figure 1. The number of currently operating university-run field stations located in US National Park System units (U-NP field stations) that opened during each of the previous 15-year periods. Note that the number of U-NP field stations increased by 167% in the most recent 15-year period.

Field-station employees indicated the top three greatest opportunities associated with national park-university partnerships (table 2). Overall, the top two categories of opportunities shared by 100% of the respondents were (a) offers a venue for undergraduate and/or graduate education and (b) provides an excellent location for research. The next most common responses were the following: gives access to a national park (88%) and allows for the sharing of resources with a national park (75%). Fifty percent of the respondents reported opportunities associated with (a) prospects for networking with National Park Service employees and (b) possibilities for outreach to local communities.

When asked about the three most effective strategies to maximize these opportunities, 75% of the respondents mentioned (a) attracting a variety of disciplines and user groups and (b) facilitating research and the research permitting process. Fifty percent of the participants mentioned (a) supporting programs for the public and local community and (b) maintaining and improving facilities. Thirty-eight percent of field-station employees highlighted the importance of (a) communicating effectively and building relationships, (b) helping groups with planning, and (c) garnering financial support (table 3).

The three greatest challenges of national park-university partnerships commonly mentioned by the respondents included dealing with policies and timelines of the federal government (88%), being under the jurisdiction of two different organizations instead of just one (63%), and obtaining necessary funding (63%). Other challenges included maintaining effective communication (50%), providing adequate facilities and space (38%), and accessing field-station locations (25%; table 4).

Strategies to minimize these challenges included communicating with interested parties (71%); staying current on park policies, events, and issues (57%); and building relationships with park employees (57%). The next most common strategies mentioned by 43% of the respondents included (a) actively pursuing the lease renewal, (b) working with the park on joint projects, (c) looking for outside funding, and (d) fostering committed leadership at the university and national park (table 5).

Seven of eight U-NP field stations (88%) indicated that they had a mission. Of those, 100% of the respondents stated that their field station supports research and special projects. Eighty-six percent of those respondents said their mission included the promotion of teaching and learning, whereas 71% highlighted (a) fostering a partnership with a national park or (b) encouraging appreciation and awareness of the local environment as part of their field station's mission (table 6).

There were three primary ways in which U-NP field stations benefited their associated university or universities. Seventy-five percent of the respondents indicated that their field station (a) presented opportunities for curriculum enrichment or (b) provided access and facilities off campus in a unique environment. Fifty percent of the respondents

Table 2. "What are the three greatest opportunities associated with your national park-university partnership?" (n = 8).

Category	Sample opportunities	Percentage
Offers a venue for undergraduate and/or graduate education	Undergraduate and graduate education achieved by visiting field courses in natural and social sciences.	100
Provides an excellent location for research	A . . . field station with access to the entire [park] for education and research activities.	100
Gives access to a national park	Based especially on the [national park] location, the . . . station provides a base camp from which groups can explore the natural world outside the classroom to engender a love of nature and a wish to protect it.	88
Allows for the sharing of resources (data, funding, maintenance) with a national park	A shared-maintenance program of the site	75
Prospects for networking with National Park Service employees	Connections and networking that would not otherwise be had.	50
Possibilities for outreach to local communities	NPS elementary-school program for local school systems.	50

Table 3. "What are the three most effective strategies you employ to maximize these opportunities?" (n = 8).

Category	Sample strategies	Percentage
Attracting a variety of disciplines and user groups	Marketing efforts to show the endless possibilities	75
Facilitating research and permitting	The . . . station serves as a liaison between researchers and the park, helping researchers to obtain permits and understand both research needs of the park and guidelines for working within a national park.	75
Supporting programs for the public and local communities	Support of local K-12 teaching efforts by NPS.	50
Maintaining and improving facilities	Financial support of infrastructure improvements.	50
Communicating effectively and relationship building	Continuing conversation and involvement with the park to keep relationships strong.	38
Helping groups with scheduling, planning, and appropriately using resources	[The field station] has control of the operation of the site on a day-to-day basis. We do all the scheduling of the users.	38
Garnering financial support	Seeking, obtaining, and maintaining major support (financial and otherwise) from the university and the National Park Service	38

Table 4. "What are the three greatest challenges associated with your national park-university partnership?" (n = 8).

Category	Sample challenges	Percentage
Dealing with policies and timelines of the federal government	Limitations of the special-use-permit process. The five-year term limits the university's willingness to make significant capital investments and to attract donors.	88
Being under the jurisdiction of two different organizations (National Park Service and the university) instead of just one	The NPS and the university are two very large and complicated organizations that have extensive processes, policies, and procedures.	63
Obtaining necessary funding	Funding. Limited park budgets and the annual challenge of university funding for the station.	63
Maintaining effective communication	Communication with the [park] personnel is vital. Keeping everyone "in the loop" to coordinate activities and needed work.	50
Providing adequate facilities and space	Space is becoming an issue. As more people become aware of the [field station's] facilities, our use has increased rapidly. We are now having to turn away researchers during the summer.	38
Accessing field-station locations	Usage is influenced by external policies and events, such as government shutdown, bad weather, etc.	25

Table 5. "What are the three most effective strategies you employ to minimize these challenges?" (n = 7).

Category	Sample strategies	Percentage
Communicating with interested parties	Communicate to users prior to events happening and working with them to reschedule if needed.	71
Staying current on park policies, events, and issues	Staying aware of current issues and regulations, reviewing policies on a regular basis to make sure we are in compliance.	57
Building relationships with park employees	Perseverance and personal relationships have been able to overcome most bureaucratic obstacles.	57
Actively pursuing lease renewal	Strive to renew the lease every 5 years.	43
Working with the park on joint projects	Take an interest in what is happening in the [park] and assist when possible.	43
Looking for outside funding	We recently were forced to increase use fees to more fully actuate cost recovery. We are also looking for outside funding and grants to provide scholarships.	43
Fostering committed leadership at the university and national park	Institutional commitment—both the university president and park superintendent are committed to the success of the station and have found ways to provide adequate resources.	43

mentioned that their field station benefited their university by offering research opportunities (table 7).

Field-station employees of U-NP field stations mentioned benefiting their host national park in four main ways. Eighty-eight percent highlighted supporting research that informs park management, whereas 50% mentioned (a) providing a facility and staff that can be used by the park or (b) offering educational opportunities to a variety of students.

Table 6. "What is your field station's mission?" (n = 7).

Category	Sample mission statements	Percentage
Supports research and special projects	Provide opportunities for both management-oriented and basic research in the [local] ecosystem, especially [in the national park]. Research projects may include social, physical, and biological sciences.	100
Promotes teaching and learning	Foster "ecology-in-place" opportunities in research, teaching, and education in environments associated with the [national park].	86
Fosters a partnership with a national park	[Field] Stations are intended as portals for research and teaching in the national parks and adjacent local national forest.	71
Encourages appreciation and awareness of the local environment	We provide students, faculty, researchers, and our local community with the resources and opportunities to engage in natural and cultural resource based research and education via a partnership between the US National Park Service and [the university].	71

Table 7. "How does your field station benefit your college/university or help it fulfill its mission?" (n = 8).

Category	Sample benefits to college/university	Percentage
Presenting opportunities for curriculum enrichment	Provides a place off campus to allow students to learn and get engaged with the curriculum.	75
Providing access and facilities off campus in a unique environment	It provides access to unique resources and experiences that would otherwise be unavailable to our students and faculty.	75
Offering research opportunities	We provide a site with housing, laboratory, and equipment, as well as a competitive research funding program, needed by faculty, undergraduate, and graduate students to complete relevant research in the . . . ecosystem.	50

Table 8. "How does your field station benefit the National Park System unit in which it is located or help the NPS fulfill its mission?" (n = 8).

Category	Sample benefits to NPS	Percentage
Supporting research that informs park management	We support the inventory and monitoring programs. Many of our faculty are pursuing research that helps inform park management or science initiatives.	88
Providing a facility and staff that can be used by the park	Responsible activities and management in part of the park that is difficult for rangers to get to.	50
Offering educational opportunities to a variety of students	Our station helps bring individuals from underserved communities into the park. By providing a location to use as a base camp, we also encourage use by university classes, thereby exposing students to the beauty of [the national park] and inspiring a lifelong appreciation for the natural world.	50
Promoting the park and the mission of the National Park Service	Everything has to be related to the [region] that the park is part of. In addition, we promote and teach conservation and Leave-No-Trace principles to preserve park resources. Research done through our visitors aids the park with information they may need or want.	38

Thirty-eight percent said that their field station promoted their host national park and the mission of the National Park Service (table 8).

Discussion

Our explorations revealed a substantial increase in the number of U-NP field stations in recent years and could highlight increased interest in field-station partnerships in general. U-NP field stations are minimally staffed and funded but accommodate large numbers of visitors each year, including many undergraduates. The greatest opportunities associated with U-NP partnerships focused on education, research, and access to a national park, whereas their greatest challenges included negotiating federal and university bureaucracies and obtaining funding. U-NP field stations benefit their associated universities by providing for curriculum enrichment and off-campus facilities in a novel environment and benefit their national park by supporting research that informs park resource management. Below, we discuss our findings in more detail.

Demographics of U-NP field stations. We note the increase in the number of U-NP field stations in recent years, especially since the year 2000 (figure 1). In the mid-1960s, Arvey and Riemer (1966) reported only one field station in a national park, currently called The University of Wyoming-National Park Service Research Station, in Grand Teton National Park, established in 1953. Only two other currently operating stations were established between 1953 and 2000, the Desert Studies Center in the Mojave National Preserve and the Virgin Islands Environmental Resource Station in Virgin Islands National Park, so what

is driving the near tripling of U-NP field stations since the year 2000?

Three of the five U-NP field stations established after the year 2000 are associated with recently founded universities (California State University, Channel Islands, in 2002 and University of California, Merced, in 2005) or by institutions that have recently been designated as universities (Utah Valley University in 2008). Perhaps in the difficult financial times that have occurred since 2000, universities lack the resources to open field stations without partnering with other large organizations, such as the National Park Service. On the other hand, these partnerships may be driven by recent interest in tapping into the synergistic nature of partnerships in general (Wagner 2008). Although we found two U-NP field stations whose partnerships have been dissolved, there are universities and national parks that are currently seeking to establish such field-station partnerships.

Staffing at the eight U-NP field stations is minimal, averaging 1.69 full-time equivalents, but is in line with data from the NAML and OBFS (2013) survey of 227 field stations and marine laboratories (FSMLs), in which the majority (60%) of field stations reported being staffed by 1-10 employees. This small number of employees facilitates the interactions of a large number of visitors, many of whom are undergraduates. In fact, U-NP field stations were visited by an average of 568 undergraduates per year. Further, 88% of U-NP field stations reported serving more than 100 undergraduates per year. This shows that U-NP field stations have a much larger focus on serving undergraduates than do field stations in general, as was evidenced by a survey of 78 FSMLs by Hodder (2009), who reported that only 53% of FSMLs served more than 100 undergraduates per year. The high percentage of U-NP field stations serving large numbers of undergraduates speaks to their universities' commitment to undergraduate education and the National Park Service's interest in connecting with a younger and more diverse population of visitors (Gramann 2003).

Even with the large number of visitors served by U-NP field stations, their average annual operating budget ($127,063) is below the most commonly reported category in the NAML and OBFS (2013) survey, which was $250,001 to $5,000,000, and below the average annual budget reported for 66 tropical biological field stations ($323,811; Whitesell et al. 2002). The smaller operating budget of U-NP field stations could be related to the cost-saving efficiencies of their synergist partnerships or could simply mean that U-NP field stations are underfunded compared with a larger cohort of field stations. The NRC (2014) highlighted the vulnerability of field stations with limited financial support; thus, the influence and longevity of U-NP field stations could be extended by increased funding from their university and national park partners.

Opportunities of U-NP partnerships and ways to maximize them. All the respondents agreed that their U-NP field station is a venue that offers opportunities for undergraduate and/or graduate education (table 2), which suggests that students may learn more from staying at a U-NP field station than by simply visiting the park in which it is located. The most commonly mentioned strategy for maximizing this opportunity was to bring in a variety of user groups to benefit from using the space (table 3). Supporting a wide range of disciplines is a strong suit of field stations at large. In fact, increased recognition has lately been given to the importance of interdisciplinary interactions, and field stations are an ideal place for this to happen (Schubel 2015). Using the field station as a venue to support the convergence (Schubel 2015) of a variety of disciplines and user groups can benefit not only the hosting university and national park but also the scientific community at large.

All the respondents indicated that U-NP field stations are excellent places for research (table 2), with opportunities to collaborate with park research staff and use research conducted previously. In addition, the NRC (2014) highlighted how national parks often have research needs that outstrip the capacity of their staffs and could benefit from university partnerships. The universities involved with U-NP field stations are granted special access to national parks that preserve intact ecosystems and large tracts of land (NRC 2014). However, securing permits for research and collection has historically been difficult (Parsons 2004). Even with the great opportunities for research in US national parks, some have claimed that the National Park Service passively neglects or is even actively hostile toward research (Kaiser 2000). In recent years, the National Park Service has worked to change this perception (NRC 1992, Kaiser 2000, Parsons 2004, NRC 2014), and the creation of field-station partnerships could be viewed as a proactive step in this direction. In fact, the proliferation of U-NP field stations since the year 2000 (figure 1) could be in response to the National Park Service's increasingly positive attitude toward research, including manipulative experimentation within park boundaries. To maximize research opportunities in national parks, a majority of U-NP field stations recommended facilitating the research activities and the permitting process for their visitors (table 3).

It is not surprising that the majority of the respondents cited access to a national park as an opportunity stemming from their partnership (table 2). Because the National Park Service was founded to protect natural resources and "leave them unimpaired for future generations" (National Park Service Organic Act 1916), U-NP field stations are located in relatively pristine environments and can provide valuable baseline data at a time when human activities are altering the world at an unprecedented rate (NRC 2014). Those who learn in nature often develop a strong personal commitment to its preservation (Eisner 1982), and those learning at U-NP field stations have a unique opportunity to develop a connection to nature within a specific national park where there is a mission-level focus on conservation.

A majority of the respondents agreed that the sharing of resources is an opportunity afforded to U-NP field stations

(table 2). Both organizations benefit from the field station's presence, and many of the respondents mentioned the benefits of having two organizations interested in maintaining the field-station facilities. Facility maintenance is a common concern among most field stations and rose to the top of a list of priorities in a survey of 227 FSMLs in the United States (NAML and OBFS 2013). Further, basic maintenance at field stations is often deferred as a result of limited funding (Baker 2015). For U-NP partnerships, the sharing of resources means that both organizations can contribute staff, equipment, and funding for maintenance. Our survey participants offered other ways to maximize this opportunity through communicating with park personnel to develop site maintenance plans and by garnering additional financial support by using both university and National Park Service channels (table 3).

Visitors staying at U-NP field stations have exceptional opportunities to network with National Park Service employees—opportunities that would be difficult to orchestrate under other circumstances (table 2). A U-NP field station provides a venue where members of the public, the media, elected officials, and students of all ages have the chance to see science in action and interact with those doing it (Baker 2015). National parks employ a variety of employees, such as scientists and resource managers, who can interact with field-station visitors in a more sustained way than is possible at a visitor center or in a ranger program. These interactions with park employees can be particularly valuable, because field-station visits have been shown to affect young students' future career endeavors (Gladfelter 2002, Klug et al. 2002, NRC 2014) and allow students to explore careers related to natural and cultural resources. Furthermore, these novel interactions can make scientific discoveries more likely (Michener et al. 2009). Opportunities for field-station visitors to network with park employees can be enhanced when the university and national park employees focus on relationship building and effective communication (table 3).

Although the nature of a university partnership with a national park would extend benefits primarily to university students, half of our survey participants stated that outreach to local communities is an opportunity associated with such a partnership (table 2). Field stations in general often include outreach in their missions and develop programs for a wide range of audiences and ages (NAML and OBFS 2013).

Challenges of U-NP partnerships and ways to minimize them. The most frequently mentioned challenge of the U-NP field-station partnership is working with policies and timelines of the federal government (table 4). A key issue is the limitation of the 5-year special-use permit or lease that allows these stations to operate on federal land. This challenge was also highlighted at a panel discussion at the 2015 George Wright Society Conference on Parks, Protected Areas, and Cultural Sites in Oakland, California (Wakelee et al. 2015). In almost all cases, the land and buildings associated with U-NP field stations are property of the federal government. Field stations in general typically facilitate research and education on property that they own (NAML and OBFS 2013). The short timeframe of the 5-year lease means that some universities are hesitant to make significant capital investments and attract donors for field-station buildings that would become property of the federal government rather than of the university. A longer-term lease would make this aspect of the U-NP partnership more attractive to universities and their potential donors. Furthermore, longer-term commitments are important for successful collaborations in general (Wagner 2008). Given the short-term nature of the current lease agreements, station managers should actively pursue lease renewal to avoid lapses (table 5).

Another challenge associated with the policies of the federal government centered on research activities. Researchers at U-NP field stations must navigate the research permit process of the National Park Service. Wakelee and colleagues (2015) previously described the challenge of conducting manipulative research in areas where the mission of preservation is paramount. Field-station personnel can minimize this challenge by helping with the permitting process and serving as liaisons between the researchers and park resource managers. Staying current on park policies, events, and issues can prevent setbacks and make researchers' time at the field station more productive (table 5).

Most of the survey participants agreed that it is challenging to be under the jurisdiction of two organizations instead of just one (table 4). The creation of partnerships often presents difficulties when the merge involves integrating two distinctly different cultures (Schubel 2015). To exacerbate the challenges typical of collaboration, both universities and national parks have extensive regulations and complex organizational structures. The participants agreed that each organization's leadership was crucial to the successful operation of a U-NP field station and suggested that fostering committed leadership could help minimize challenges. Relatedly, Wakelee and colleagues (2015) described difficulties in handling changes in university and national park leadership. Further, this mirrors the results of the NAML and OBFS (2013) survey, which reported that support of the administration was crucial to the long-term sustainability of field stations in general.

Just as the lack of adequate funding threatens the livelihood of a variety of field stations (Hodder 2009, NRC 2014), U-NP field stations worry about obtaining necessary funding (table 4). U-NP field stations can minimize financial challenges by relying on their partnership to accomplish joint projects (table 5). Collaborating to share the financial burden of field-station necessities will benefit both the university and the park. Even with the advantages of a partnership, it is wise for field stations to seek external financial support by actively demonstrating their value to society (NRC 2014, Baker 2015).

Being under two organizations and obtaining necessary funding are two separate challenges that can both be addressed by collaboration and communication. However,

this solution presents a challenge of its own. Half of the survey participants find it challenging to maintain effective communication within the U-NP partnership (table 4). Taking an active effort to communicate was the most commonly cited way of minimizing relevant challenges and is in line with recommendations from Schubel (2015). Similar to suggestions by Baker (2015), the participants also suggested that relationship building was a helpful strategy, because positive relationships help make effective communication easier (table 5). Actively pursuing a renewal of the field station's lease further ensures that both the university and the park are committed to the continuing success of their joint effort. Working cooperatively on shared projects helps keep both organizations engaged and communicating. These suggestions from field-station personnel are in line with Pentland's (2014) "rules of engagement" that include interaction, cooperation, and trust.

Just over one-third of our participants mentioned the challenge of providing adequate facilities and space for visiting groups (table 4). Some stations struggle more than others and have needed to raise user fees to help maintain their site. U-NP field stations look for outside funding and opportunities for joint projects to improve their operations and make their facility more affordable and accommodating for their visitors. Similar to our findings, just over one-third of field stations in general mentioned that investments in infrastructure would help them to better fulfill their missions (NAML and OBFS 2013).

Field stations are often considered valuable because they provide access and logistical support in remote locations (Billick et al. 2013). Access can be influenced by bad weather or, in the case of U-NP field stations, government shutdowns (table 4). When access is an issue, effective communication with visitors is essential (table 5). However, it is somewhat surprising that only 25% of the participants cited difficulty of access as a challenge for their field station. It is possible that being located in a national park provides better infrastructure for access and allows for cooperation with the park to help keep access roads open and well maintained. Better access is a benefit to U-NP field stations because stations in remote locations can be especially vulnerable to budget cuts during difficult financial times (NRC 2014, Schubel 2015).

The missions of U-NP field stations and how they help both universities and national parks fulfill their missions. The vast majorityof U-NP field stations had mission statements and those that did had very similar missions. We found that 100% of U-NP field stations with mission statements support research and special projects (table 6). This high level of support for research is in alignment with field stations in general, as was reported in the NAML and OBFS (2013) survey of 227 FSMLs, in which 97% of them indicated that they serve academic researchers. Universities benefit from the unique research and project opportunities presented to their students (table 7). Two U-NP field stations specifically mentioned involving undergraduates in inventory and monitoring projects for the park. The national park benefits through the capacity of on-site research to inform park management (table 8). This fits with the National Park Service's mission to protect resources by applying sound scientific knowledge (NRC 1992) and with their recent interest in being supportive of research occurring within park boundaries (Parsons 2004).

The next most common theme of U-NP field-station mission statements was the promotion of teaching and learning (table 6). This theme certainly aligns with the goals and mission of universities by offering opportunities for curriculum enrichment (table 7). Integrating hands-on research with formal and informal education is an important endeavor for field stations in general, and 87% of them included educational programs in their missions (NAML and OBFS 2013). Unique learning experiences can shape a student's academic future and are considered to be important in generating interest in the fields of science, technology, engineering, and mathematics (NRC 2014). One U-NP field station specifically mentioned teaching classes for underserved youth communities. These educational objectives fit with the mission of the National Park Service and with its goal to engage a diverse group of visitors (table 8; McCown et al. 2011).

A majority of the U-NP field-station mission statements mentioned fostering a partnership with a national park (table 6). In doing so, the university gains access to a unique environment off campus (table 7). Students benefit not only from accessing the natural and cultural resources of the national park but also by interacting with park personnel through visitor centers, ranger programs, and/or mentored internships. The national park substantially benefits from this partnership as well. The U-NP field station promotes the park itself and the mission of the National Park Service (table 8). In addition, field-station staff become intimately familiar with a specific area of the park and can be "eyes on the ground" to identify changes or problems that might otherwise go unnoticed. Park employees can use the field-station facility for meetings or for outreach programs, as well as for logistical support as they access a specific (often remote) area of the park.

A similar majority of U-NP field-station mission statements mentioned cultivating appreciation for, and awareness of, the local environment (table 6). More than one-third of the field stations in general had mission statements that included elements of resource management and conservation (NAML and OBFS 2013). A university benefits from the ability to hold courses in the specific environment surrounding a field station (table 7). In the case of a U-NP field station, the local environment is encompassed by the national park in which it is located. These field stations are engaging visitors in a national park and either directly or indirectly promoting the mission of the National Park Service (table 8).

Conclusions

In the future, partnerships will become increasingly important for the establishment, persistence, and expansion of

field stations. Our in-depth analysis of one type of field-station partnership will benefit field-station personnel working under other types of partnerships or seeking to establish partnerships. Beyond field-station employees, our findings will benefit a variety of professional biologists seeking to forge working relationships with other stakeholders interested in research, education, conservation, and/or outreach. Understanding existing partnerships, particularly those between organizations that are large and complex, can be especially informative. Being made aware of some of the potential opportunities of collaboration could spur on the formation of partnerships, while understanding potential challenges in advance can help partnering organizations to more effectively work through difficulties as they arise.

The U-NP field-station partnership model offers many benefits to both partners and to a variety of field-station visitors. The major impediment for U-NP field stations is the short-term nature of the lease typically offered to universities by the National Park Service. There are examples of longer-term leases between government agencies and other parties. For example, the US Fish and Wildlife Service has offered a 20-year lease to a conservation foundation's marine laboratory, and the National Park Service itself offers 60-year leases to farms under their Countryside Initiative Program. Extending the length of the commitment between universities and the National Park Service is perhaps the key step in strengthening U-NP field-station partnerships. As more data are shared about the success of this type of partnership and the number of such partnerships increases, the National Park Service may become more open to longer-term leases for field stations.

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