The Role of Science in National Park Service Decision-making

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In these challenging times, when allocations to parks are not increasing at a rate commensurate with costs, park managers are faced with difficult decisions about park priorities and staffing: which programs are going to grow, which are going to remain flat, which are going to be downsized, or even disappear? We also are making choices about resources and visitor-use issues in a complex context, and often in a divisive atmosphere. By mandate and necessity, science is a part of the decision-making equation. As decision-makers, our jobs are made much easier, and the results are better, when the science is relevant, readily available, and clearly communicated.

In keeping with the times, then, this essay addresses four key areas relating to the intersection of science and management in National Park Service units: the role of science in park decisions; science successes and science stalls in the National Park Service; the differences between science and resource management, and how to improve the way they work together; and, finally, the art of communicating science to park managers. These comments should be taken for what they are: a combination of information and advice, from a park manager's perspective, challenging scientists to keep working hard, keep getting better, and keep focusing their efforts on science that makes a difference to decision-makers in parks.

The role of science in park management

First, what role does science play in park management—in helping a superintendent to make decisions about park resources and issues? Science—even good science—does not replace good decision-making. Science is an important and even critical input into decision-making. Science helps us to decide where to focus our efforts. For instance, in the winter-use debate that has been going on in Yellowstone for almost 20 years, natural resource monitoring has helped us to determine that snowmobiling has greater impacts on air quality and the natural-sound environment than on water quality and wildlife populations.

Science also helps us to set reasonable thresholds for change, and tells us when we are close to those thresholds. The state of Wyoming, for example, has established a threshold of allowing no more than a 10-NTU (nephelometric turbidity unit) increase in sediment in Outstanding Natural Resource Waters. Science helps us to determine trends, and helps us to set priorities for resource programs. In Yellowstone, we have been counting fewer and fewer Yellowstone cutthroat trout (YCT) spawners in Yellowstone Lake. As a result, we have intensified our lake trout control efforts and begun to search for stream reaches where we might begin restoring populations of native YCT.

But scientific information is only one input into management decisions. As a park manager, I have to balance many issues and interests in every decision I make. Most of those issues and interests are based on values, rather than quantitative information. At the end of the day, I will never have all of the information I need to make a decision. I often have to do what Malcolm Gladwell, in his book *Blink*, calls "thin slicing": take a small amount of information, often just an impression, and make a quick decision. Having access to better information can mean making a better-supported decision. But I still have to weigh all of the information, including the science, and use my best judgment.

Science successes and science stalls

Second, what are our science successes, and where has our science stalled? In the National Park Service, our successes tend to be in the biological and physical sciences. In Yellowstone, an incredible network of scientists—at least 211, based on the number of research permits the park issues—gathers information about the park. There are scientists studying wolves, grizzly bears, elk, pronghorn, and bighorn sheep. Scientists study fire behavior and fire ecology. They study rare plants, exotic plants, willows, aspen, and whitebark pine. Twenty-two seismic stations and 12 GPS leveling stations help more than a dozen scientists to monitor the Yellowstone Volcano.

More than 40 microbiologists study the thermophiles in hot springs, for purposes ranging from cataloguing the life they find to trying to understand life on Mars. Scientists study fish; they monitor air and water quality. There's even a researcher studying the fungi in mammal scat. Based on all of this science, researchers have provided us with a reasonably clear picture of the status and trend of many of Yellowstone's highest-priority resources, and they have developed a context for identifying which biological and physical resources are most important to monitor. In fact, the Greater Yellowstone Inventory and Monitoring (I&M) Network's vital-signs development process, which engaged more than 250 scientists over a three-year period, has been instrumental in helping park managers decide what to monitor.

However, the most controversial and important decisions I make, as a superintendent, turn as much on people's values as on biology, geology, or ecology. In the case of winter use, for example, resource impacts are important, but the primary decision to be made is based on a value question: Are snowmobiles a proper mode of transportation for a national park? The same is true of bison management, wolf restoration, grizzly bear recovery—even the question of where and when we ought to enable people to use cell phones in Yellowstone. These questions are all about values.

Then there's the question of social science. In the National Park Service, we simply do not have the kind of science firepower in the social sciences that we do in the biological and physical sciences. In Yellowstone, in 2006, of 211 research permits, only three were for social science studies: that's 1.4%. There are simply not enough people out there helping us to understand our visitors. And yet we need that kind of information. The kinds of decisions I make as a superintendent every day demand it. Social scientists are equipped to give meaningful input into the values-based issues that we face. That input seems to be largely missing from the national parks, especially as it relates to value-based issues involving natural resources. Social science is our biggest "science stall." A stall that we cannot afford to let go on unaddressed.

Science and resource management

Third, although we do both in the national parks, there is a distinction between resource management and science. Resource management is roll-up-your-sleeves, get-down-in-the-dirt work. It needs to be informed by science, but is more oriented toward on-the-ground results, and often guided more by experience or intuition than by science. For example, controlling exotic plants is not science. It is typical of the work done in resource management: sweltering on a hot summer day in a Tyvek suit, mixing tanks of herbicide, walking along roadsides, and spot-spraying weeds. But knowing which herbicide to mix for which weed is the result of science—science that comes to us through private industries, universities, and the cooperative ecosystem studies units, as well as our own staff.

Science helps to improve the resource management performed in parks. Managing bison—hazing, capturing, shipping, holding—is not science. It is simply hard work, done by dedicated park rangers and resource staff in the bitter cold of winter, in the deep snows of West Yellowstone, the biting winds of Stephens Creek. Science—ecological monitoring, monitoring travel routes, and development of better vaccines and delivery systems—informs what we do and how we do it. Science especially helps us to come up with good adaptive management strategies.

Lake trout control—setting and pulling 13 miles of gill nets each week in Yellowstone Lake: not science. In fact, it can be backbreaking labor. It is dirty, smelly work, pulling fish that have been dead for almost a week from nets. Where science intersects with lake-trout control is in determining the best places and types of nets to set to catch the most lake trout with the least bycatch of Yellowstone cutthroat trout. Our staff is also working with outside scientists to determine how effective the program has been, to create models that predict where we will find new spawning areas, and to develop better methods of monitoring the population of YCT in the lake. Again, we adapt our program as we acquire new scientific information.

One of the challenges faced by scientists is translating discoveries into procedures and practices that can be implemented by resource managers—people who are not necessarily scientists. That is where the rubber meets the road in most parks. To be relevant to managers, scientists should always ask themselves: How can resource managers use the information that I am discovering? How can they use it in adaptive management? How can they use it to increase the focus and effectiveness of their programs? How can they use it to evaluate their programs, many of which are at least based partly on intuition?

The art of communication

Finally, none of these things are possible without good communication between scientists and managers. As a superintendent, I sometimes feel a bit like Mark Twain, who famously quipped, "Researchers have already cast much darkness on the subject, and if they continue their investigations, we shall soon know nothing at all about it." Think about it: the first thing scientists do, when they go to school to become scientists—no matter what field they go into—is learn a specialized language. This language helps them to communicate with other scientists in the field, but it does not help them to communicate with anyone else.

For instance, the gold standard for written science communication is the peer-reviewed manuscript—again, good for other scientists, not so good for the rest of us. The results of a survey recently published in the journal *Science* found that managers only used journal articles to gain information about 2% of the time. Again, necessary for scientific credentials, but not an ideal communication tool.

Finally, scientists tend to know (and communicate) too much. As a manager, my job requires that I be like the Mississippi River: a mile wide and an inch deep. There are simply too many issues on the table for me to be able to focus too deeply on just one. I read a lot of technical reports and scientific articles on the resource issues I am personally involved in, the ones with high complexity and high stakes: bison management, winter use, road construction. For everything else, I need the Cliff's Notes version as a primer.

Here are some pointers for communicating scientific information to the superintendent:

- **Use plain language.** If someone outside your area of expertise is not likely to understand a word, explain it. Or choose a more common word.
- **A picture is worth a thousand words.** Sometimes I just need to see it. That doesn't mean just charts and graphs. Real pictures, or at least good graphics that depict the situation, are always helpful.
- **Keep it short!** Synthesize. Explain what you know in 4–5 bullets. You might know more than anyone else in the world about the tapeworms in Yellowstone Lake, but I can't afford to. It is actually harder work to boil things down to a few bullets than it is to tell the "rest of the story." Do the work; the rewards, as far as communication, will be great.

On a final note, there are six principles of influence I have used successfully when trying to communicate and influence others. They also tend to work when others are trying to influence me:

- **Reciprocation.** Simply put, that means, You, then me, then you, then me. Or, put another way, it means you should be the first to give service, information, and concessions.
- **Scarcity.** The Rule of Rare. Simply emphasize genuine scarcity, share unique features, and always provide exclusive information.
- **Authority.** Showing is knowing. Establish your position through professionalism, industry knowledge, your credentials, and always admitting weakness first.
- **Commitment.** Always the place to begin. Start small and build over time. Where possible, start with emphasiz-

ing existing commitments, start from "public" positions (not personal ones), and start with what are voluntary choices, not mandates.

- **Consensus.** People proof and people power. Unleash that power by showing responses of many others (not just your own), sharing the past successes of others, and providing testimonials of similar others who share your views.
- **Liking.** Making friends to influence others. Uncover similarities between you and who you are hoping to influence, finds areas to provide genuine compliments, and always seek opportunities for cooperation and collaboration.

Case studies—yes, social science studies—have proven that these principles can and do work, but mostly they are just a good, common-sense approach to communicating needs in order to influence others. We, managers and scientists, have to make sure that we are working in sync and communicating well. The costs of failing to integrate science and management are simply too high.

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