

Using the Minimum Requirement Concept to Manage Research in the Yosemite Wilderness

Mark Fincher

Abstract—Ninety-five percent of Yosemite National Park is designated wilderness. More than 30 million people live within a day's drive of the park, and visitation to the wilderness is more than 400,000 people annually. Yosemite is also popular with researchers. In recent years the park has received about 100 research permit applications per year, of which about 75 percent are in wilderness. While the existing permit application system considers the impacts of such proposals, it doesn't necessarily do so in the context of wilderness character. In the last 4 years, Yosemite wilderness managers have applied the minimum requirement concept to wilderness research. The large number of applications has led to the creation of a screening tool to identify the relative impacts of proposals. A tracking system is now being created to consider cumulative impacts, both temporally and spatially. Ongoing issues include the lack of consideration of wilderness values during project design, and lack of incentive for removing scientific installations from wilderness.

While Yosemite Valley is well known throughout the world, many people are unaware that beyond the valley stretches a vast mountain wilderness encompassing over 285,000 hectares (704,250 acres). Some are surprised to learn that 95 percent of the park is designated wilderness. Many Californians, however, are well aware of the "hidden Yosemite," and come to the wilderness in large numbers to hike, climb, ride horses, and ski. Over 35 million people live in California, most of them within easy driving distance of the park. Overnight use of the wilderness averages about 100,000 use-nights per year, while day use is conservatively estimated at 350,000 use-days per year.

Yosemite is also popular with researchers. The park receives an average of 100 research permit applications per year, with about 75 of them for research in wilderness. A research institute has just been established within the park, and these numbers will probably grow substantially as a result.

Our management of this area is guided by the Wilderness Act of 1964, which defines the values and conditions to be preserved. Given the popularity of the area, much of our effort goes toward limiting cumulative impacts, whether

they derive from recreational or administrative use. Much of our educational and regulatory focus is to convince people that certain impacts, which seem benign when considered individually, can have a significant deleterious effect on wilderness values collectively. This is as true for research as any other activity in wilderness.

The Wilderness Act stipulates that we manage for naturalness, wildness, freedom, and solitude, and lists scientific use as one of the public purposes of wilderness. It also prohibits certain uses: temporary roads, use of motor vehicles, motorized equipment or motorboats, landing of aircraft, other forms of mechanical transport, and structures or installations "except as necessary to meet minimum requirements for the administration of the area" (Section 4 (c)). While some may perceive scientific inquiry to be merely observational, virtually all research in the Yosemite wilderness involves one or more of these section 4 (c) exceptions or a violation of law (activities allowed with a research permit but illegal for the general public).

National Park Service (NPS) policy requires that, in addition to the screening provided by our research permit process, we must apply the minimum requirement concept to research projects in designated wilderness, whether or not a 4 (c) exception is proposed. In Yosemite, most of our proposals involve impacts to wilderness character in one of two categories: 1) installations, which primarily impact visitor experience and is a 4 (c) prohibition, and, 2) collecting, which is primarily a biophysical impact and is a violation of law: 36CFR 2.1, which prohibits "possessing, destroying, injuring, defacing, removing, digging, or disturbing from its natural state" virtually all natural and cultural resources in a national park.

The management of installations presents numerous challenges. While there is some policy guidance on administrative structures, most of it concerns installations built to manage recreation impacts such as bridges, trails, and signs. Policy specific to scientific installations is vague. Some fundamental questions are: How many installations are already in the wilderness? Should small markers like tree tags be considered installations? What is an acceptable number of scientific installations in a given area? What factors impact visitor experience when they discover such an installation? How does management ensure that installations are removed when they are no longer needed?

While the existing permit application process considers the impact of collecting and disturbance, it hasn't necessarily considered the cumulative impacts. Collecting and disturbance tend to target certain species and populations disproportionately: those that are rare, endangered, charismatic, and easy to access.

Mark Fincher, Wilderness Specialist, Yosemite National Park, CA, U.S.A.

In: Watson, Alan; Sproull, Janet; Dean, Liese, comps. 2007. Science and stewardship to protect and sustain wilderness values: eighth World Wilderness Congress symposium: September 30–October 6, 2005; Anchorage, AK. Proceedings RMRS-P-49. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

A perusal of scientific literature and the Yosemite Library files provides an example of what we are trying to avoid. The Mt. Lyell Salamander (*Hydromantes platycephalus*) is a species of special concern in California, existing in small, isolated populations at high elevations in the Sierra Nevada mountain range. One of the most accessible populations is on the summit of Half Dome. The suitable salamander habitat on the summit is less than 1 hectare (2 acres) in size. In the first 20 years after discovery in 1916, between 100 and 200 individuals were collected from this population (including 84 over 1 month), and many more since that time (Adams 1942). While this population has survived, it seems likely that such intensive collecting damaged the genetic health of the population.

Wilderness Research Impact Class Assessment (WRICA)

To manage the large number of proposals, we developed the Wilderness Research Impact Class Assessment (WRICA) (fig. 1) and Cumulative Research Impacts Tracking System (CRITS). These tools attempt to quantify the impacts of research to the diverse components of wilderness character in a simple, streamlined manner. They necessarily require subjective, informed judgment, and can only provide an approximation of the overall effects of a given project. Information needed from researchers includes:

- Approximate person-field days and maximum party size.
- Type and amount of any resources collected or disturbed, by location.
- Any proposed use of motorized equipment or mechanized transport.
- Location, number, description, and removal date of all proposed installations, including plot markers.

Proposals identified through the WRICA score sheet as low impact are covered by a programmatic minimum requirement analysis. Approximately 75 to 85 percent of proposals assessed so far have been considered low impact. All others require a separate analysis, written collaboratively by the NPS Wilderness Specialist and the appropriate NPS scientist, who also serves as a liaison with the researcher.

The purpose of this assessment is three-fold:

1. To reduce the procedural burden in the research permitting process by identifying those studies that have minimal impacts and can be covered by a programmatic minimum requirement analysis.
2. To provide a quantitative assessment of impacts from research projects. Such an assessment gives us a better tool to weigh impacts against benefits, track cumulative impacts, and design mitigation measures.
3. To give research applicants a better understanding of the impacts of their research on wilderness values, and improve research design to mitigate or avoid such impacts.

The assessment divides proposals into three categories:

Class 1: Research involving simple observations or measurements made by small numbers of people.

Class 2: Studies that involve greater numbers of people, some limited impact to visitor experience, collecting small amounts of common resources, or some minor Wilderness Act section 4 (c) exceptions.

Class 3: Any proposal that includes significant section 4 (c) exceptions, including significant structures or installations, motorized equipment, or helicopter transport, or proposals that request an exemption from park regulations, including significant collecting, exceeding group size, etc. Research that does not include 4 (c) violations or an exemption from regulations but still poses a significant risk to wilderness values is included in this category.

Class 1 proposals are covered by a programmatic Minimum Requirement Analysis (MRA) and do not require specific approval from the Wilderness Management office; but the total number of such proposals is tracked by the Wilderness Manager. Class 2 proposals require communication with the Wilderness Manager but in most cases are covered by the programmatic MRA. Class 3 proposals require a separate MRA, including approval by the Wilderness Manager, Chief Ranger, and Superintendent.

Cumulative Research Impacts Tracking System (CRITS)

Some of the most significant impacts to wilderness character are composed of many seemingly insignificant single actions. In order to make responsible minimum requirement decisions, the cumulative impacts of these actions need to be tracked. These impacts come from different categories of administrative activities in wilderness, making them more difficult to track.

The following cumulative impacts of scientific research will be tracked:

Motorized Equipment and Motorized Transport Use

This will be tracked across all administrative use categories as part of the park's wilderness character assessment. 2005 will be the first time we have attempted to collect this data; no standards have been set.

Collecting and Disturbance

While these impacts are usually short-term and minor, care must be taken that rare resources and species are not collected or disturbed repeatedly over time in a way that would cause long-term negative effects. For this reason all collecting and disturbance activities will be recorded in a geo-referenced database. This database will be checked by species and location for each new research proposal that involves collecting or disturbance.

Structures and Installations

Structures and installations can present a significant impact to wilderness experiences. Such installations will be assessed for obtrusiveness and remoteness to develop an installation score for each research proposal. A standard (expressed as an installation density) will be developed for

Instructions for WRICA Score Sheet

This form is meant to be simple and quick to complete. Good judgment is required, as impact classes for some variables are only broadly defined. A clarification on terms: “rare” includes, but is not limited to listed species, and should include species or other resources that are locally rare but otherwise common. All cultural resources would be considered “rare” abiotic resources.

Installations are divided into two categories: Items like inconspicuous tree tags, buried plot markers, and well-hidden miniaturized data loggers are considered “barely discernable” installations. All other structures and installations are considered separately based on their permanence and obtrusiveness.

Unobtrusive installations: Larger plot markers, installations that are small and well hidden; underground or under water. It would be highly unlikely for visitors to notice these unless they were very close; perhaps within 5 meters.

Obtrusive installations: Larger, harder to hide instruments and collectors, etc. These would be noticed by most visitors within 20 meters and virtually all visitors within 5 meters.

Very obtrusive installations: Larger stations/instruments, exclosures, “real-time” stations with solar panels and antennas. Visible from long distance.

Rate each impact according to the scores given. The impact class can not be lower than the highest score given. So if any impact rates a 3, for example, the impact class must be at least a 3 regardless of the total score. Then add the scores, and use the total to calculate the impact class as follows.

Class 1: 0-5

Class 2: 6-12

Class 3: 12+

The installation score is not included in the overall score but is calculated and used separately to track the cumulative impact wilderness wide.

WRICA Score Sheet

Experiential Impacts

Transport: Hiking (0) Stock (1) Wheelbarrow/cart (2) Helicopter or other Mechanized (8)

Peak season helicopter use (10) _____

Group size: Legal (0) Over legal (3) _____

Total person days in wilderness: Less than 50 (0) 51-150 (1) 151 or more (2) _____

Visitor surveys: Questioning visitors in wilderness? No (0) Yes (2) _____

Any motorized equipment? No (0) Yes (3) Peak season use (5) _____

Surveillance: Will visitors be observed? By: researcher (1) Counter (3) Camera (7) _____

Installations:

Barely discernable:

Number: 0 (0) 0-10 (1) 10-50 (2) 50+ (3) _____

Permanence: 2 weeks or less (0) 2 wks- 1 yr (1) 1 yr- permanent (2) _____

Larger installations:

Number: none (0) 1 (3) 2-5 (4) 6+ (5) _____

Obtrusiveness: unobtrusive (1) obtrusive (5) very obtrusive (15) _____

Permanence: 2 weeks or less (1) 2 wks- 1 yr (2) 1-5 yrs (3) permanent (10) _____

Installation score: See attached instructions.

Total: _____

Any other visible or audible effects of research? Short term (less than 1 year), Unobtrusive (1) Short term, obtrusive (2)

Long term (1 year +), unobtrusive (3) Long term, obtrusive (4) _____

Figure 1—Instructions for WRICA score sheet (continued on next page).

Biophysical impacts

Collecting:

Will any abiotic resources be destroyed or removed from the park?

None (0) Common (1) uncommon or rare (3) _____

Will any biotic resources be killed or removed from the park?

None (0) Common (2) Uncommon (3) Rare (5) _____

Amount killed or removed _____ Sm (1) Med (2) Lg (3) _____

Disturbance:

Will any abiotic resources be disturbed? None (0) Short term, common (1)

Short term, Uncommon/rare (2) long term, common (3) long term,

Uncommon/rare (4) _____

Will any biotic resources be disturbed? None (0) Short term, common (1)

Short term, uncommon (2) Long term, common (3) Long term,

Uncommon/rare (4) _____

Amount/number disturbed _____ Sm (1) Med (3) Lg (4) _____

Will there be any risk of unintentional destruction or disturbance?

Slight (1) Moderate (2) High (3) (x 2 for uncommon, x 3 for rare) _____

Impacts to Wildness

Will there be any deliberate change to natural processes or current conditions?

Area affected: Less than .4 ha (1 acre) (2) .4 ha-4.0 ha (1-10 acres) (5) Greater than 4.0 ha (10 acres) (8) Radiating effects (25) _____

Risk of unintentional changes: Slight (2) Moderate (4) High (6) (x 3 for radiating) _____

Total: _____

Impact Class: _____

Installation Score: _____

Please include map showing area of research, and specifically indicating the locations of all installations and collecting/disturbance.

Calculating the Installation Score:

Each installation is assessed and scored as one of four WRICA categories, Barely discernable (0.1), unobtrusive (1), obtrusive, (5), or very obtrusive (15). These scores are then multiplied by the following factors:

Distance from road (in air miles)

0-1.6 km (1 mile) (1.0), 1.6 km-8.0 km (1-5 miles) (1.5), over 8.0 km (5 miles), (2.0)

Distance from trail

0-0.4 km (1/4 mile) (1.0), over 0.4 km (1/4 mile) (3.0)

Adjacent to an existing obtrusive or very obtrusive structure such as patrol cabins, bridges, high sierra camps, or existing research installations? (Do not count trails or trail signs)

Yes (0.3), no (1.0)

Scores for all proposed structures are added together by zone, and for the entire wilderness. These numbers are used to track cumulative impacts.

The installation score used to track cumulative impacts is separate and different from the number, permanence, and obtrusiveness scores that are used to calculate impact class and impact score.

Figure 1—Continued

each wilderness zone, and wilderness-wide, to limit the impact of such installations at any one time. Removal requirements are included as part of each MRA and tracking will reflect reported removals. As a standard is approached, the permit committee will be notified so that those proposals that are park priorities are given preference.

Overall Impact. The WRICA worksheet provides a means of tracking overall impact of research in the Yosemite Wilderness. Standards (expressed as an impact density) will be developed to limit the overall impact by zone and wilderness-wide.

Still to be Done

WRICA has worked well to screen proposals; combined with the programmatic minimum requirement analysis it has kept paperwork to a manageable level while focusing review on those projects with greater impacts. The cumulative impacts database has not yet been constructed, however. The current research permit database goes back 4 years; paper files cover another 30 years. The required information is not necessarily included in either data set, however, so the database will be incomplete.

Then comes the much harder task of setting standards. Standards for collecting may prove easiest; specialists should be able to make a pretty good estimate of what level of collecting would adversely affect a given population. Standards for disturbance may prove harder, as it involves both a physical risk to the individuals and an impact to symbolic values of wilderness. Is it acceptable to have every individual of a given population fitted with a radio collar? Installations may be the hardest standard of all. How many observations of scientific installations does it take to destroy one's sense of wildness? Does it depend on remoteness, size, or technical sophistication of the structure? A good topic for research!

Challenges and Possible Solutions

Lack of Communication During Study Design

Perhaps the most significant obstacle to reaching "minimum impact" science in wilderness is a lack of consideration of wilderness values during study design. Typically a study is designed, funding secured, and the permit application submitted with little or no consideration of such values. When aspects of the study design are questioned in an attempt to preserve such values, the wilderness manager often meets with resistance and intractability from the researcher. Education about wilderness values and the minimum requirement concept before studies are designed would reduce frustration on both sides. Communication between researchers and managers throughout the process would lead to greater understanding on the manager's part about the goals, requirements, and potential benefits of a study while keeping impacts to a minimum.

One aspect of this awareness is an understanding of NPS policy, which states, "Potential disruption of wilderness character will be considered before, and given significantly

more weight than, economic efficiency." Conducting research in wilderness with minimal impact sometimes involves more time, money, or effort than in non-wilderness. Unless these factors are included in study design and budget, conflict with the agency is likely.

The presence of a research institute in the park will allow us to communicate with some researchers earlier in the process, and partially mitigate this problem. The majority of researchers will continue to come from outside the park, however, and in these cases, no mechanism exists for managers to communicate with researchers prior to the permit application process.

Failure to Remove Installations After Study Completion

The Wilderness Act is clear that permanent installations should be kept to an absolute minimum, and policy directs that devices be removed when they are no longer "essential," yet many researchers insist that their plot markers and/or instrumentation be permanent, because of some indefinable future value. Perhaps worse, evidence suggests that few among those who are permitted to install temporary structures bother to remove inexpensive ones. The park simply doesn't have the staff to follow-up, and incentive is lacking for researchers to spend time traveling to remote locations to remove inexpensive markers and devices. The result is that in the Yosemite Wilderness, there are thousands of tree tags, plot markers and other scientific litter, some of which is substantial (large stream gauging stations, remote enclosures, 20 foot [6 m] steel marker poles). While a fraction of these may still have some scientific value, most do not due to changes in technology, lack of provenance, deterioration of the installation, or plain lack of interest by the scientific community.

Difficulty in Assessing Benefits

Benefits of research are often more abstract and therefore more difficult to quantify. Managers are put in the position of trying to assess benefits with little knowledge or training in the relevant field, and often resort to asking the researcher, who, of course, places a very high value on those benefits. NPS policy uses benefits as a standard, but that standard is ill defined. For instance, NPS Management Policies allow research and monitoring devices to be installed and operated in wilderness "when the desired information is essential for the administration and preservation of wilderness...." What does "essential" mean in this case? That the research answers a specific management question? That it contributes to a general understanding of the ecosystem? Or that it only contributes to a better general understanding of larger natural processes?

Despite these obstacles, there are situations in which the benefits should be carefully weighed against the impacts before proposals are approved: 1). When the impacts are significant enough to merit a separate Minimum Requirement Analysis; and, 2) When cumulative impacts approach standards, thereby limiting the amount of research that can be conducted in an area. For these situations, the benefits

matrix developed by Landres (2000) should prove to be a useful starting point.

Conclusions

During a recent discussion on this topic, an NPS scientist recited a litany of looming environmental crises and reached the conclusion that “nature is dying.” The implication being that in the face of such a crisis, benefits derived from research so greatly outweighs the impacts that any research in wilderness should be allowed. Yet it is the wildness of these areas, as defined in the Wilderness Act, that give them much of their value, both as core protected areas to perpetuate natural processes and preserve biodiversity and as areas that are valuable for scientific inquiry. Keeping these areas wild also maintains public support for designated wilderness.

Wilderness needs science, and science needs wilderness. But care is needed to safeguard the values that are embodied in the Wilderness Act. Better communication and understanding between the wilderness management and research communities can go a long way in preserving such values.

References

- Adams, Lowell. 1942. Natural History and Classification of the Mount Lyell Salamander, *Hydromantes platycephalus*. University of California (Berkeley) Publications in Zoology. 28 p.
- Landres, P. B. 2000. A framework for evaluating proposals for scientific activities in wilderness. In: McCool, Stephen F.; Cole, David N.; Borrie, William T.; O'Loughlin, Jennifer, comps. 2000. Wilderness science in a time of change conference—Volume 3: Wilderness as a place for scientific inquiry; 1999 May 23–27; Missoula, MT. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 239–245.