

CFRF Final Report

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Research problem, hypotheses, and goals

My research has been conducted in partnership with the White Mountain Apache Tribe, through the auspices of its Watershed Program. This Program, and the Tribe in general, are concerned with promoting the health of streams across the Tribe's 1.6 million acre Reservation. My research problem was to design a framework for evaluating riparian wetland health that used quantifiable indicators and was compatible with cultural values. The framework would then serve as a basis for designing restoration treatments as well as evaluating other aspects of stream productivity.

My research sought to identify valid ecological indicators and place them within a framework that was compatible with traditional cultural views. As such, they bridged the natural and social sciences.

What is an appropriate way to evaluate health and restoration capability of riparian wetlands on the White Mountain Apache Reservation?

I broke my main question (above) into three parts:

Question 1: What short-term indicators are sensitive to changes in riparian wetland health?

Hypothesis 1a: Short-term indicators measuring wetland vegetation, soil quality, and hydrogeomorphologic conditions can distinguish healthy from unhealthy conditions within a site.

Hypothesis 1b: Short-term indicators measuring wetland vegetation, soil quality, and hydrogeomorphologic conditions are sensitive to changes in riparian wetland health through time.

Examples of these short-term indicators may be cover of native wetland graminoids, cover of bare soil, soil organic matter content, channel width-depth ratio, and channel entrenchment ratio.

Question 2: How do long-term indicators influence the restoration capability of riparian wetlands?

Hypothesis 2: Long-term indicators govern the ranges of short-term indicators of riparian health.

Examples of influential long-term indicators are geology, soil characteristics, climate, and watershed area.

Question 3: What is an appropriate framework for evaluating the health of riparian wetlands on the White Mountain Apache Reservation?

Hypothesis 3: A framework that classifies sites according to long-term indicators and then evaluates conditions based on short-term indicators is appropriate for evaluating health and designing restoration treatments. This framework is compatible with traditional Apache indicators and conceptions of stream health.



Field / data collection experience and participatory research

Collection of field ecological data went smoothly, although it did require an extensive commitment to working on the Reservation throughout the field season. Data was collected with the direct participation of tribal member staff of the Watershed Program (**left**), so that they were better able to follow the research project. Indeed, some staff members collected the data while I checked and analyzed their results. Consequently, these individuals are able to discuss issues about methodology and help interpret results. I have

also worked with the staff in the data analysis phase of the research. Staff members are using results from these analyses in their own reports.

I did not complete as many interviews with traditional experts as I had initially intended, but in many respects I exchanged quantity for quality. For example, I conducted two follow-up sessions with particularly informative individuals. I relied on four individuals as my primary consultants, but I supplemented their perspectives with information collected from several others through various methods. I tried to mix group discussions, slide presentations, with more conventional one-on-one site visits (**above**). I also had a staff member from the Watershed Program participate in some of the interview sessions, so that she could better understand the nature of this research.



Preliminary findings and analysis

Several highlights of the research thus far are:

Geologic Analysis

My evaluation of “long-term indicators” pertaining to the geology of the Reservation has proved extremely productive. I have classified sites into four groups corresponding to fundamental soil properties. I have related the four types to the Apache concept of the four directions, because it provides a powerful way of simplifying complex relationships and because it translates these ideas into a culturally familiar context. The usefulness of my approach has been borne out in discussions with tribal members, who previously have had little exposure to the extensive geologic research that has been carried out on their lands.

Cultural Framework

Interviews with cultural advisors have found a strong basis both for selected indicators and for restoration techniques. The interviews yielded several surprises, including accounts of traditional restoration activities and appreciation of the ecological significance of particular geologic formations. I learned that there were solid cultural foundations for our assessment and restoration methodologies. However, the results of interviews also reminded me of the need to extend my time frame when evaluating stream health.

Evaluation of Short-term Indicators

Evaluation of vegetation data supported my hypotheses that vegetative parameters such as late successional cover, native cover, grass-like cover, and soil cover would serve as good indicators of riparian health. Channel morphology also provided essential information in evaluating condition. Soils data also reinforced the results of the other analyses. I have attempted to summarize the results of these indicators in characterizing stream health. Such simplifications facilitate evaluation, but they do leave out considerable detail that is important in understanding why streams change the ways they do. Consequently, I am currently working on conveying my results in ways that capture the richness of the data without making it too complex to comprehend.

Examination of Restoration Treatments

Evaluation of sites that were treated with combinations of grazing management and physical interventions helped to demonstrate the validity of an integrated approach to restoration. The study has supported development of restoration guidelines that the Tribe can apply to other degraded sites.

The tiered approach to evaluation informs the process of designing treatments by first demanding consideration of the inherent potential of the site, as determined by its geology and local climate. The next step is to consider the physical condition of the stream; if the morphology has been severely disrupted, then physical interventions are most likely needed before other treatments can succeed. However, if the site is in good morphological condition, then a focus on vegetation and grazing management is warranted. The cultural perspective also demands that we consider timing and interactions with humans when prescribing treatments; patience is often an essential element of the restoration strategy.

Benefits of research to the community

My research has served the community in several ways:

1. Strengthening tribal management of water resources
2. Training tribal member staff in assessment and analysis methods
3. Building the tribal database of riparian conditions
4. Validating assessment techniques in use by Tribe
5. Guiding design and evaluation of land restoration projects
6. Developing public education materials
7. Linking culturally valued resources to ecological indicators
8. Building a framework for additional ecological research efforts

I will highlight the last two items in the list. The geologic analysis has established a useful means for studying distributions of rare biota. These species, many of which reside in riparian areas, may be significant culturally or biologically. A better understanding of the vegetation patterns on the Reservation will help in conserving these valuable species. This approach may prove very beneficial in protecting important tribal values. We can also use other measures of ecological health, such as production of aquatic life, in place of wetland vegetation. The framework developed through this analysis will be adaptable to a variety of research applications.



Strategies for sharing results with the community

The greatest challenge in my research process still lies ahead, as I strive to convey my results to various audiences, but particularly those within the tribal community. One part of my strategy lies in developing visual media, such as videos, to describe the dynamics of

riparian ecosystems on the Reservation. We have found that slide shows of photo points are an effective means of communicating information efficiently. However, I believe that the potential of video is even greater. We are currently completing our first professional video of our restoration efforts. But I am looking forward to translating various parts of my research to video.

Other tangible outputs of my research include the following:

- Assessments of ongoing restoration projects,
- Reference materials for training assessment techniques, and
- Ecological education activities, including presentations at the Watershed Program's Eco-Camp (**above**) and an outdoor exhibit in development at the Tribal Cultural Center (**right**).

Planned Publications

I am planning on trying to publish four papers from my dissertation dealing with these subjects:

1. Relationships of ecological indicators to dominant geologic formations
2. Response of short-term ecological indicators to restoration treatments
3. Cultural basis for evaluating and planning restoration treatments
4. Morphological effects of riffle treatments (in review)



Lessons learned (and ways to improve the program)

Since I worked for my community for several years before engaging in the research project, my experiences may not translate well to others. For instance, I was able to rely on personal connections far more than someone coming in fresh would have been. However, this aspect of my experience itself is instructive. I feel that the Community Forestry program should try to enlist more individuals who are already engaged in community forestry as practitioners. I realize that it is naïve to think that a good practitioner would necessarily be interested and successful in becoming a researcher, but I also believe that, when it comes to community forestry, good researchers are well invested in their subjects. Rather than simply being an advocate, one must know the pitfalls and hazards of their subject. Such knowledge comes from direct experience.

While I do not reject the CFRF's current model of researchers coming into communities, I believe it is also worth exploring an alternative model: *cultivating researchers within communities*. Community forestry is fundamentally different from many types of research, due to its inherently activist intent. Communities must have direct access to the results of research, as well as being able to initiate it themselves. However, many communities will not be interested in exposing all their inner workings to outsiders. The model of research-from-within may better address many types of issues, particularly those involving development of internal capacity. For high conflict issues, or issues in which the community is facing external forces, the model of researcher-from-without may still have advantages. CFRF is a sound program; however, I believe that it must develop more relationships beyond the traditional pool of academics. More non-traditional students from disadvantaged communities should be recruited for participation in the program.