Fire Effects: Restoration of Watersheds and Springs

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Fire in the southwest affects ecosystems both at the watershed scale and at the smaller, habitat-level scale of springs, and *tinajas*. As fire regimes continuing to change, addressing the effects of fire on watersheds and water sources is becoming increasingly important for managers and restoration practitioners. This workshop provided information on trends in fire effects on watersheds, streams, and springs; offered tools to respond to these impacts before and after fires; and fostered a discussion on next steps. The focus was on how land managers and restoration practitioners can foster resilience, restore ecological function, and ease transition for ecosystems and species in the face of changing fire regimes with a focus on the following questions:

- What are examples of fire-induced changes in watershed and water sources?
- What restoration and management tools are currently working? What is missing?
- How can restoration approaches at the watershed scale and micro-habitat scale be combined?
- What are some next steps for post-fire restoration in the southwest?

Workshop Results

The workshop had 67 participants including land and resource managers, researchers, restoration practitioners, conservation practitioners and tribal members. The format consisted of a series of 11 presentations (see presentation list p. 4) followed by facilitated networking and small group discussions. Discussions were organized by topic and participants addressed the following questions:

- **Tools:** What restoration tools are currently working for wildfire effects?
- **Challenges**: What hasn't worked? What are some of the challenges? How are you taking climate change into account?
- **Recommendations:** What are 2-3 recommendations you have for managers and practitioners? (specific strategies/tools, research, training, new partnerships, etc.)

Specific results from participant discussions are organized below in the following topic areas: springs, vegetation, vegetation and Burned Area Emergency Response (BAER), and research.

Springs

Available tools include: fencing to exclude ungulates (depending on management objectives); vegetation – species/techniques; online spring inventory database (Springs Stewardship Institute, springsdata.org); and remote sensing tools (including drones) to see and monitor wet areas.

New tools that are needed: curriculum for schools including adding springs to Project WET and reaching underserved communities (environmental justice); inventories of springs; and identifying wells in vicinity of springs that may be affecting them.

Participants highlighted an ongoing need for improved hydrological knowledge of springs which can be accomplished through:

- Isotopic studies
- Instruments to monitor/understand water dynamics

Figure 1. Workshop participants discuss springs and fire. Photo courtesy of Tahnee Robertson.

Challenges include:

- Identifying what we are managing for at springs (e.g., surface water vs wet meadow)
- Lack of inventories
- Loss of traditional knowledge of restoration techniques
- Identifying and understanding timeframe/reference condition at a spring (e.g., pre-fire)
- Climate change pushing vegetation/species up slope
- Inefficiency of restoration due to lack of basic hydrology of springs (how water is getting there)?
- The lack of legislative need to focus on springs
- Water rights – which may work against protection of springs
- Lack of human resources (or is it funding?)
- Lack of focus on and understanding of springs by public
- Roads influencing springs
- Understanding how to restore springs, and actually measuring success
- Climate change that is making dynamic systems even more dynamic
- Restoration needs to be appropriately scaled
    - Take into consideration landscape and geomorphology
- Lack of archaeological surveys – and lack of understanding of deep history
    - Can archeological surveys be a way to find unmapped springs?

    - Could help determine sustainability of springs
    - Less known about springs at higher elevations
- Livestock grazing, including water development
- Invasive species

Recommendations

- Monitor the following: threats, hydrology, fire effects, vegetation and effects of restoration
- Monitoring should guide actions to be taken at springs (protection/restoration)
- Set conservation priorities for springs
- Work to get more people involved – citizen science, education
- Bring in cultural resource component, which may bring in regulatory tools
    - Traditional cultural properties
    - Archaeological surveys
- Make sure restoration is based on data and knowledge; focus on function of systems
- Evaluate ecosystem services and functions
    - Challenge: What if spring found not to be "valuable?"

Vegetation

Available tools include: prescribed burns, allowing natural fires to burn, fuel load treatments, post-fire seeding, and education including FireScape.

Challenges include: lack of money for fuel treatment compared to fire suppression; steep slopes hindering vegetation rehabilitation; public perception; monsoon storms leading to high levels of erosion; lack of tree cover, lack of native seed sources including the potential to introduce non-natives by seeding after fires; limited amount of BAER funds; agency regulations that may not support vegetation rehabilitation; and politics.

Recommendations

- Take proactive rather than retroactive action
- Develop a long-term view on post-fire monitoring and treatment (greater than 3 years)
- Make native seed more widely available
- Education and investment in fuel treatment

Vegetation and BAER

Available tools include: stream surveys; botany blitz conducted by NGO-Agency partners; BAER handbook and communication; retardants and avoidants; and GIS.
There is also potential to use tools from other projects in post-fire response (e.g., wildlife cameras)

Challenges include: BAER teams are tasked with a lot of different tasks; lack of funding; there is a need for different types of modeling; lack of long-term data collection to look at trends; lack of knowledge and location specific expertise; and regional seed restrictions.

Figure 2. Participants discuss strategies for recommendations for next steps to improve BAER and vegetation management. Photo courtesy of Tahnee Robertson.

Recommendations

- Prioritize springs and other sensitive aquatic habitat in BAER approach
- Bring values (such as retardant avoidance) to forefront of process
- Develop better seed collection and storage
- Support a better market for weed-free seed
- Conduct post-fire monitoring
- Consider springs a value at risk
- Conduct pre-fire treatments at springs
- Cross-training of practitioners/managers on other subjects in order to support monitoring
- Better collect pictures and basic data

RESEARCH

Available tools include: spatial modeling programs; bacterial communities; outreach (including reaching youth).

Challenges include: developing statistically significant data; unexpected events – losing control of site; practitioners that are not willing to try different approaches; ability to achieve long-term results; developing research that is applicable at the landscape-scale; funding and timeframes that do not support long-term research; successfully extrapolating from existing research; understanding if tools are applicable to other locations/regions and making tools replicable; and the changing social/societal context (need for developing young persons' minds – away from TV, phone, Netflix, politicization, translating to public).

Recommendations

- Greater collaboration with translators
- More outreach, better communication to general public
- Improved data sharing
- Taking youth into the wilderness
- Show overwhelming evidence to close-minded researchers

OVERALL RECOMMENDATIONS

- Work to develop and make available necessary plant materials for rehabilitation work
    - Educate decision-makers about need for plant materials
- Frame monitoring in a long-term context (i.e., funding) and at the landscape-level spatial scale
- Value aquatic habitats beyond their value to endangered species
- Educate about fire prevention and the difference between nature- and human- caused fires
    - Educate about the value of natural resources in general – not necessarily ecosystem services studies, but similar concept (e.g., DLCC)
- Address issues through communication, and collaboration on shared interests/challenges/tools (e.g., Cross-Watershed Network)
- Engage citizens, volunteers, and youth with hands-on opportunities (e.g., Youth Outdoor Pathways)

Figure 3. There were 67 participants at the workshop.

Presentation List

- *Fire effects on watersheds*, Ann Youberg, Arizona Geologic Survey
- *Forecasting post-wildfire flood risk under current conditions and future scenarios: Examples from Saguaro National Park East*, Jon Pelletier, University of Arizona
- *BAER – three years of monitoring on control vs. treated sites*, Mike Natharius, Gila National Forest

- *Sediment reduction and watershed restoration in response to 2010 Schultz Fire, Flagstaff*, Allen Haden, Natural Channel Design
- Watershed restoration pre- and post-fire in the Chiricahua Mountains, Carianne Campbell, Sky Island Alliance
- *Fire effects on tinajas and frog habitat at Saguaro National Park,* Don Swann, Saguaro National Park
- *Initial response to fire on springs*, Samantha Hammer, Sky Island Alliance
- *Response of vegetation after wildfire on the Warm Springs Natural Area in Moapa, Nevada,* Von K. Winkel and David J. Syzdek, Southern Nevada Water Authority
- *Increasing resilience and creating habitat refugia at springs in the Chiricahua Mountains,* Carianne Campbell, Sky Island Alliance
- *Post-fire spring restoration following Rodeo-Chediski Fire,* Daniel Pusher, White Mountain Apache Tribe
- *Developing guidance for climate-informed springs ecosystem restoration,* Louise Misztal, Sky Island Alliance