

Community discussion: Changing fire regimes in the Sonoran Desert

The Sonoran Desert, known for its diverse and fragile ecosystems, is experiencing profound changes due to an increase in frequency, severity, intensity, and size of wildfires. Historically, fire was a rare occurrence in this arid landscape, but the introduction of invasive grasses, combined with a warming climate and human-caused ignitions, has altered fire behavior, threatening the desert's unique plant and animal communities. As fire spreads across the landscape, it endangers not only ecological resources but also the social and economic values tied to this region.

At the 4th Southwest Fire Ecology Conference, scientists, land managers, and students gathered to discuss the challenges posed by these changes to the fire regime. Through a collaborative discussion, participants explored three critical questions: What values are at risk? What management strategies could help protect the desert? And what information is needed to guide future fire management decisions?

This fact sheet summarizes the key insights and proposed solutions that emerged from these discussions, highlighting the urgent need for informed and adaptive fire management in the Sonoran Desert.

QUESTIONS & MAIN PARTICIPANT INSIGHTS



1. What values (ecological, social and economic) that you associate with the Sonoran Desert are threatened by the increasing spread and occurrence of wildfire?

The Sonoran Desert represents a functionally diverse ecosystem with high ecological integrity and cultural importance. Its preservation is essential for maintaining regional biodiversity, protecting ecosystem services, and supporting the cultural heritage of indigenous and local communities.



2. What management actions and strategies could be taken to protect, conserve or optimize these values given today's altered fire regimes? Is restoration possible? What can be done to help the desert resist change (i.e., ecological degradation) or be more resilient? Or realign or adapt conditions to make fire occurrences more manageable?

Participants questioned the feasibility of large-scale restoration and emphasized the importance of preventing further grassland conversion and wildfire impacts. Key priorities included protecting refugia, using prescribed fire where grassland conversion has already occurred, and integrating social and political action with ecological strategies.



3. What information do desert managers and fire ecologists need to manage Sonoran Desert values and resources now and going into the future?

*Ecological change in the Sonoran Desert is outpacing research. Managers need timely, applied information on invasive species control and adaptive strategies. Participant input echoed priorities outlined in *Fire in the Desert* (2024), highlighting the need for accelerated research and action.*

Question 1: What values are threatened?

Invasive grasses are driving the changes in the fire regime in the Sonoran Desert, transforming it from a diverse ecosystem into a fire-prone grassland. This shift threatens ecological (green), social (yellow), and economic values (orange), as outlined by color coded-group in the table below.

Values	Impacts	Concerns
Biodiversity	Loss of biodiversity occurs as scrublands transition to grasslands and invasive species outcompete native species.	Loss of specialist species and those with narrow ranges, an increase in threatened species, and a loss of critical habitat for endangered species.
Water	Fire negatively impacts water resources by affecting water quality and quantity.	Reduction of already limited water supplies. Water loss has already occurred in the desert due to over-extraction and warming and drying trends.
Soil	The soil crust can be damaged, and properties (chemical and physical) altered by high severity fire. Burned areas experience increased erosion, which disrupts nutrient cycling, damages habitat and infrastructure, and reduces ecological resilience as large erosion channels form.	Arresting or stopping erosion after large-scale disturbance is costly and difficult.
Viewshed	Invasive species and fire can individually or collectively alter a viewshed, an area with aesthetically pleasing views.	As grass overtakes Sonoran Scrublands and fire transforms the land, economic and recreational impacts can be large and lasting.
Cultural Resources	Wildfire can impact archeological and historical sites, including plants and animals used by the Tohono O'odham, Yaqui, Ak-Chin, and other Indigenous peoples.	Precious cultural resources and traditions could be damaged or lost.
Quality of Life	Air quality issues & heightened risk to life and property in the Wildland Urban Interface (WUI).	Smoke poses health risks, particularly to the elderly and those with breathing issues. Communities in the WUI face higher fire damage risks, with homes and businesses lost annually.
Recreation	Hiking, biking, OHV, camping, hunting, and etc. are popular recreation activities in the Sonoran Desert.	Fire and post-fire flooding can damage trails, and high fire risk may lead to forest closures. Recreationists also accidentally start fires each year.
Wildland Firefighters	Firefighters can be exposed to excessive heat while suppressing fires in the desert.	Extended fire seasons mean that firefighters spend more time suppressing fires, and are exposed to more smoke and heat over longer periods of time.
Economic Ramifications	Negative impacts on ecotourism and local economies including agriculture, loss of structures and homes, and increases in insurance rates all can be an effect of both grassification and wildfire.	Tourists may choose not to visit due to effects on recreation, local economies can be hurt, structures lost, and insurance rates increased or even unavailable.

Loss of the Saguaro

Saguaro—an iconic symbol of the Sonoran Desert—is at risk due to the grassification and subsequent increase in fire frequency and intensity in the desert. Saguaro is not fire-adapted. It did not establish in a region with frequent fire, and it cannot survive the novel conditions in the Sonoran Desert. Mature and young saguaros are often immediately killed by fire or are severely injured, and experience delayed mortality. Saguaro is a slow growing plant, and studies have shown no detectable saguaros with post-fire monitoring occurring 6-26+ years after a fire ([Learn more*](#)). As fire becomes more intense and frequent, scientists have suggested that saguaros may be permanently excluded from an area.



Photo 1: Pre-fire: April 2015. Photo by Jim Malusa



Photo 2: Post-fire: November 2023. Shows explosive growth of non-native annuals, Sahara mustard and red brome. Photo by Jim Malusa.

Question 2: What management strategies can be used?

Key management strategies aim to prevent the Sonoran Desert from becoming a fire-prone grassland. The group discussed options ranging from accepting grassland conversion, to using fire to manage the ecosystem, and conserving more pristine areas.

Conservation efforts focus on protecting saguaro and desert habitats, defining refugia, and reducing fuel in strategic zones (e.g., near highways and recreational areas). Techniques include prescribed burns, targeted grazing with virtual fencing, and selective herbicide applications to control invasive grasses. Socio-political strategies emphasize advocacy, grassroots mobilization, and policies that fund fire prevention, reduce ignitions, and promote collective action, such as Firewise community initiatives and public education on invasive plant removal. Post-fire restoration and invasive species removal were viewed as challenging and costly. Participants favored revegetation using Sonoran Desert ecological processes, including nurse trees and dryland restoration techniques like seedballs and soil pits. Restoration efforts should be guided by adaptive management and scientific research and should be conducted strategically by acknowledging spatial limits on where restoration may not be productive.

Ultimately, long-term resilience requires recognizing that some areas have been permanently altered, needing fire management and ecological preservation, while others still require focused efforts to prevent transition to invasive grasslands.

*Helmy, O. (2021). *Carnegiea gigantea*, saguaro. In *Fire Effects Information System* (Online). U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Missoula Fire Sciences Laboratory. Retrieved April 4, 2025, from <https://www.fs.usda.gov/database/feis/plants/cactus/cargig/all.html>

Question 3: What do land managers need to know?

The changes occurring in the Sonoran Desert have occurred much faster than the pace and scale of research. Fire ecologists and managers need information on a wide range of topics from best ways to prevent invasive species spread to adaptive management solutions. *"Fire in the Desert,"* published May 2024, contains a comprehensive list of research needs and areas of focus (page 33) that closely aligns with the answers to research needs collected by participants during this November 2024 conference session.

Fire in the desert?

In areas that have high ignition rates due to proximity to roads or recreational use, managers are using prescribed fire to reduce fuels during times that are more favorable for safe burning conditions (i.e., cooler and less windy). While introducing fire to the desert is outside the historical fire regime, this strategy can improve firefighter safety, and reduce risks to communities in the WUI and other values.

VIDEO // Fire Prevention
Case Study on Accidental
Ignitions



SCIENCE SYNTHESIS //
Fire in the Sonoran Desert



GROWING EDGE // Designing
Fuel Breaks for Desert
Ecosystems



*The **Southwest Fire Science Consortium (SWFSC)** is a regional organization that facilitates knowledge exchange and disseminates wildland fire research and information across agency, administrative, and state boundaries in the Southwest. Funding provided by the Joint Fire Science Program (JFSP). The SWFSC is one of 15 Fire Science Exchange Networks funded by JFSP.*

Additional funding for this project came from the Arizona Wildfire Initiative at Northern Arizona University's School of Forestry.

