Indigenous Fire Stewardship: Federal/Tribal Partnerships for Wildland Fire Research and Management

Frank Kanawha Lake

Over millennia, many indigenous and Tribal peoples in North America's fire-prone ecosystems developed sophisticated relationships with wildland fire that continue today. This article introduces philosophical, conceptual, and operational approaches to working with American Indians through research and management partnerships in the fields of wildland fire, forestry, and fuels, with applications to climate change and forest landscape restoration strategies (Mansourian and others 2019). Of central importance are respectful collaborative relationships among the various parties (Tribes, agencies, organizations, academics, and citizens) that seek to integrate both indigenous and Western knowledge systems into environmental stewardship practices.

Frank K. Lake is a research ecologist for the Forest Service, Fire and Fuels Program, Pacific Southwest Research Station, Arcata, CA.

There is a great degree of genetic, linguistic, and cultural diversity among the indigenous peoples of North America, who comprise numerous American Indian and Alaskan Native Tribes. Tribal cultures are as diverse as the fire-prone ecosystems across North America (Stewart 2002). The Tribes, clans, and other sociocultural institutions of indigenous communities are as varied as the habitats they live in. Just as there are different local habitats, so there are numerous cultural uses of the landscapes and species that comprise tribally valued resources, all of which are affected both spatially and temporally by fire in some manner.

For many Tribes who have lived and evolved with fire-prone ecosystems, aspects of their traditions, livelihoods, economies, and cultures evolved with and rely on fire-dependent species and fire-affected ecological processes. At this nexus of people and their environment is the genealogy of indigenous fire stewardship and how cultural burning practices formed. Analogous to fire-dependent species, many indigenous peoples and Tribal communities are fire-dependent cultures, having adapted to and been influenced or affected by the fire regimes of their landscapes (Lake 2018). Indigenous fire stewardship, derived from many types of knowledge systems, can be described as "the use of fire by various Indigenous, Aboriginal, and Tribal peoples to modify fire regimes, adapting and responding to climate and local environmental conditions to promote desired landscape, habitats, species and to increase the abundance of favored resources to sustain knowledge systems, ceremonial and subsistence practices, economies and livelihoods" (Lake and Christianson 2019). Central to indigenous fire stewardship is the cultural ability to mediate and reduce extreme natural fire events by adapting to changing climatic and environmental conditions. Fire-dependent cultures can be thought of as mutualistic with their fire-prone ecosystems (Lake 2018).

Indigenous knowledge can help identify trigger points, thresholds, and indicators for ecosystems, habitats, and resources of interest.

TYPES OF INDIGENOUS KNOWLEDGE

Indigenous knowledge, which reflects Tribal communities' metaphysical and biophysical understanding of their environment, encompasses traditional ecological knowledge, traditional fire knowledge, and traditional forest-related knowledge.

- ***Traditional ecological knowledge*** has been defined as a "cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with the environment … [it] is both cumulative and dynamic, building on experience and adapting to changes" (Berkes 1999).
- ***Traditional fire knowledge,*** as defined by Huffman (2013), is "fire-related knowledge, beliefs, and practices that have been developed and applied on specific landscapes for specific purposes by long time inhabitants." Traditional fire knowledge encompasses over 69 distinct elements, as documented in a global synthesis of indigenous people and their relationships with fire. Included are elements of geology, topography, soils, vegetation, fuels, weather, fire behavior, and fire effects, along with fire operations, fire governance, and various social factors (Huffman 2013).
- ***Traditional forest-related knowledge*** is defined essentially as traditional ecological knowledge (Trosper and Parrotta 2012)

At the foundation of many indigenous creation teachings is the belief that humans are related to all aspects of their environment—that they have interrelationships with nature. This corresponds to the belief that fire is spirit, an element that is often revered and feared but is also essential to fire-prone ecosystems and fire-dependent species; fire is critical to the health of fire-dependent cultures. Many indigenous cultures consider their knowledge and use of fire a spiritual obligation, part of indigenous/Tribal land and resource stewardship practices (Eriksen and Hankins 2014; McKemey and others 2020). In many indigenous teachings, fire is "medicine" for people and land. With respect to prescribed fire or indigenous fire stewardship, not enough fire can make the land and people sick (unhealthy),

At the foundation of many indigenous creation teachings is the belief that humans are related to all aspects of their environment.

and too much fire can be bad as well (akin to a catastrophic overdose). Central to indigenous fire stewardship is the sociocultural ability to influence, mediate, and reduce extreme natural fire events by adapting to changing climatic and environmental conditions (Lake and Christianson 2019).

For many Tribes, the cessation of indigenous fire stewardship and colonial government policies of fire suppression (which collectively resulted in fire exclusion) have degraded the land and many species used as valued resources. With increases in fuel loading, growing vegetation density and the resulting catastrophic fires are like an overdose of medicine. Additionally, among indigenous philosophies, if fire is medicine, then water is like the blood of land and people. Fire is connected to water at all scales, and water is sacred and one of the highest resource values (Hannibal 2014).

Indigenous knowledge guides fire stewardship in fire-prone ecosystems for fire-dependent species. Cultural burning is human services for ecosystems,* a tool for fulfilling spiritual obligations in Tribal belief systems and practices (Eriksen and Hankins 2014). The evolution of cultural fire regimes emerged from indigenous cultural adaptations to form fire-dependent cultures. The spatial and temporal extent of indigenous fire use varies by ecosystem and habitats and is linked to fire-affected resources of value. Philosophically, if fire is medicine, then indigenous fire stewardship and cultural burning are human services that meet obligations for metaphysical (spiritual) commitments. These human services achieve biophysical stewardship and environmental resource objectives and deliver a range of sociocultural values (Eriksen and Hankins 2015; Worl and Norgaard 2019).

Anyone considering collaboration with indigenous peoples and Tribal communities should know that indigenous fire stewardship is diverse, with a distribution of gender, age, and cultural responsibilities among individuals in a community. Members of indigenous communities hold various types of knowledge and practice various types of cultural burning, and it is important to ask what their particular responsibilities for and roles in fire use are. Differences in indigenous fire stewardship and cultural burning reflect roles based on spiritual/ceremonial, subsistence, utilitarian/domestic, and economic/security responsibilities and governance. Working with diverse indigenous communities (Nations-Tribes/villages), groups (clans/families), and leaders (governance/religious) means including a full range of indigenous knowledge systems (Eriksen and Hankins 2014, 2015).

Anyone seeking to understand the reasons for and objectives of indigenous fire stewardship and cultural burning should be aware that indigenous people might not disclose specifics due to their belief systems; to a desire for confidentiality; or to fear of inappropriate exploitation, adoption, or cooptation of practices by nonindigenous peoples. Indigenous knowledge, particularly related to indigenous fire stewardship, is a responsibility. Those seeking such knowledge should be clear as to their reasons for wanting it (the use it serves or the objective it achieves) and understand what commitments they make in exchange for acquiring the knowledge.

*Bill Tripp. Karuk Tribe. Personal communication.

INDIGENOUS FIRE STEWARDSHIP AND CULTURAL FIRE REGIMES

Cultural fire regimes differ from natural fire regimes, and indigenous cultures have developed sophisticated burning practices (Huffman 2013; Lake and Christianson 2019). Pyrodiversity is augmented by cultural burning, which can become human services for fire-prone ecosystems. Indigenous fire stewardship created cultural fire regimes by influencing and diversifying the frequency, seasonality, extent, locality, intensity, and resultant severity of fires (Lake and others 2017; Lake and Christianson 2019; McKemey and others 2020). For example:

- **Frequency:** Indigenous peoples apply fire for specific resource values and objectives (fig. 1). Such applications of fire are often more frequent than natural ignitions with respect to particular resources and habitats.
- **Seasonality:** The timing of burning is often different from natural ignitions (that is, lightning) and more diverse within seasons, linked to plant and fungus phenology or breeding and migration times for animals (such as ungulates, birds, and fish).
- **Specificity:** Ignition strategies within different ecosystems and habitats are targeted toward various species used as resources.

The continuum from a natural fire regime (based on ignitions such as lightning) to a cultural fire regime (based on human fire use) depends on the extent and magnitude of indigenous fire stewardship (Lake and Christianson 2019). Often, the objectives of cultural burning are directly linked to responsibility for using different burning practices in response to topography, fuel loading, phenology, weather, and resource quality as well as cultural, spiritual, ceremonial, subsistence, utilitarian, and economic objectives (Eriksen and Hankins 2014, 2015; McKemey and others 2020). Documented reasons for American Indian fire use include but are not limited to hunting, crop management, pest management, range management, fireproofing, clearing areas for travel, clearing riparian areas, basket materials, and fuelwood (see Stewart 2002).

ROLE OF SCIENTIFIC RESEARCH AND INDIGENOUS KNOWLEDGE IN SUPPORTING WILDLAND FIRE MANAGEMENT

Indigenous science support for exploring management options builds on the foundation of indigenous knowledge and Tribal traditional ecological knowledge. Researchers can seek to understand indigenous science support needs, the research questions of interest, and the management challenges that Tribes and indigenous communities face. In developing research partnerships with indigenous communities, researchers should link multiple lines of evidence using various interdisciplinary methods to broaden the exploration of indigenous fire stewardship and cultural burning. Responding to policy directives and management needs, researchers can explore the treatment-based outcomes of traditional ecological knowledge and cultural practices as part of their experimental approach.

Including the elements of indigenous knowledge (traditional ecological knowledge, traditional fire knowledge, and traditional forest-related knowledge) can lead to a better understanding of the implications of frequency and/or seasonality for developing treatment prescriptions and discerning the effects of potential management strategies. Indigenous knowledge can help identify trigger points, thresholds, and indicators appropriate to the ecosystems, habitats, and resources of interest. Indigenous knowledge can reveal the metrics applicable at a particular scale or useful for exploring synergistic mechanisms or effects. In working cooperatively with Tribes and Tribal organizations, indigenous knowledge can guide land managers in the monitoring and adaptive management of habitats, species, and resource conditions and their desired quality or abundance based on their sociocultural uses. This can contribute to a better understanding of the implications of fire effects on the values associated with habitats, species, and resource conditions (Welch 2012).

Fire-dependent cultures can be thought of as mutualistic with their fire-prone ecosystems.

Figure 1—*A mixed-conifer/hardwood forest in the western Klamath Mountains, partially burned to improve subsistence resources of Tribal value affected by fire (mushrooms, huckleberries, and oak (acorn) food resources associated with a known cultural use site). Photo: Frank K. Lake, USDA Forest Service.*

In developing a research framework for incorporating indigenous knowledge, researchers would be well advised to consider the following questions:

- At what scale should forestry, fire, and climate effects be studied?
- At what scale should wildland fire and fuels reduction treatments be evaluated as management practices in relation to tribally valued resources and habitats?

- How should the scale or metrics that are most applicable be identified?
- What are the resources and habitats valued within a cultural ecosystem services framework?

Resources are broadly tangible and intangible elements of the environment: landscapes (areas), sites, objects, and states of mind. Natural and cultural resources are used to perpetuate Tribal customs, practices, and knowledge systems. Habitats are landscapes or places that support Tribal ceremonial and subsistence practices, which are often defined in biophysical or sociocultural terms as site characteristics for places that support—or potentially could support—single or multiple resources of Tribal value (fig. 1).

In upscaling and integrating research approaches to support strategies for collaborative restoration planning and implementation, researchers can draw on such interdisciplinary methods as paleoclimate and fire history (that is, lake sediment pollen/charcoal cores and tree age/fire scars) as well as ethnographic and oral-histories data (including historical maps and photos), taking into account past and present Tribal resource uses across a variety of habitats. For example, studies in the field of ethnobotany can focus on how indigenous fire stewardship and cultural burning (as well as wildland fire) promote species used for basketry and as foods (see Hummel and Lake 2014; Long and others 2016; Marks-Block and others 2019).

A research project—or, more likely, a program—can link individual plant traits as one organizational unit (such as an ethnobotany-food or basketry plant) that can be nested within plots (as a defined sampling area containing the plant's habitat or population). For example, forestry/vegetation plots, as a discrete sampling area, can be used to characterize habitat and resource quality, focusing on trees, fuels, and understory plant diversity. Cross-scale units of study, such as a 30-square-meter plot area, could then be studied using remote sensing (such as satellite imagery or aerial LiDAR) to reflect local interest (onsite resources or values associated with a particular habitat type) and scaled up to landscape conditions. The results could be combined with evaluations by managers and Tribal practitioners of existing conditions to determine how public and Tribal values would influence the development of prescriptions for various treatments (Lake 2013) and for assessment of those treatments and wildland fire effects.

Indigenous fire stewardship is inclusive of gender, age, and cultural responsibilities among individuals in a community.

Some commonly aligned public and Tribal values are reducing hazardous fuels and fire risk (for example, in the wildland–urban interface to protect life, property, and resources for increasing suppression action effectiveness) while also promoting the heterogeneity and resilience of the vegetation. Reduced fuel continuity increases human and wildlife access and mobility; retains larger and older fire-resistant trees; and promotes fire-adapted/drought-tolerant species associated with biodiversity that are used by Tribes as food, medicine, and materials (fig.2). It can also give wildland fire managers more options for suppression actions or to achieve resource objectives when and where desired. For example, managers might use such strategies as:

Figure 2—*Fire personnel on the Six Rivers National Forest in California conducting a prescribed cultural burn on a strategic ridge along a road to improve opportunities for future wildland fire response and Tribal gathering access. The understory contains a high density of beargrass (a tribally valued basketry resource requiring fire to promote desired leaf growth). Photo: Frank K. Lake, USDA Forest Service.*

- Promoting drought-tolerant fire-adapted species by removing undesired (fire-intolerant or diseased) trees through thinning from above, reducing crown area, reducing tree density, and creating openings or extending patch size for early-seral understory species;
- Manual thinning from below to reduce understory fuel continuity, including mastication on plantations and chainsaw cutting to reduce the density of small trees and shrubs as ladder fuels and to increase the height to live crown;
- Contributing to overall increased species heterogeneity while retaining certain trees (based on species preference as well as on size/diameter, height, crown positions/form, and vigor) and certain shrubs (used as food, basketry, and wildlife cover); and
- Placing piles and conducting seasonal burns to reintroduce fire after long periods of fire exclusion or to build upon recent fire effects.

Infused into the research study design would be sociocultural, ecological, and economic considerations of how multiple public and Tribal values can be simultaneously achieved.

CROSS-CULTURAL AND INTERDISCIPLINARY UNDERSTANDING AND COMMUNICATION

Researchers, managers, and practitioners who seek to work with indigenous communities on wildland fire management, fuels management, and forestry projects can take various partnership approaches. A crosswalk of variables of interest, metrics, and strategies or treatments that could be studied, monitored, and evaluated can help in exploring treatment-based outcomes for achieving desired resource conditions. Table 1 is a starting point for considering some of the main forestry and wildland fire variables and factors that could be aligned with management treatments in exploring research study design or management strategies. The goal is to understand how related factors or interest "variables" can be addressed through management.

ALIGNING COMMUNITIES' VALUES WITH RESEARCH AND MANAGEMENT STRATEGIES

Many forest landscape restoration strategies are designed to promote heterogeneity and resilience (see Hessburg and others 2015). At broader scales across planning units, land managers might consider strategically placed landscape area treatments (Finney 2001), which target about 20 to 30 percent of the planning area for a single treatment or combination of treatments. Working with Tribes and other entities to align values (such as through a "values overlay") can help managers identify the areas of highest priority for treatment with limited resources, such as roads, ridges, and the wildland–urban interface. By incorporating indigenous knowledge, the partners can learn about historical contexts that pertain to modern resource management objectives (figs. 2, 3; Harling and Tripp 2014).

Climate change vulnerability assessments and adaptation planning can help identify the threats, stressors, and other challenges to the local environment and to Tribal or community stewardship practices (Karuk Tribe 2019). Forest landscape restoration

Table 1—*Alignment of forestry and wildland fire variables with cultural and Tribal values and restoration treatments.*

Forestry/wildland fire management factor or interest	Forestry/fire variable/metric	Cultural/Tribal value linked to forestry/fire interest	Cultural variable or value	Restoration treatment that aligns management and tribal values
Forest and understory plant diversity	Species per acre; diversity index	Higher density of foods, material, medicinal plants	Increased seasonal use for multiple purposes	Thinning certain types of trees and shrubs; wildland fire
Tree diameter/size ranges	Diameter at breast height; basal area	Larger full crown; structurally diverse trees; fewer trees per acre	Older/mature forest with favored tree species	Thinning certain types of trees; wildland fire
Crown fire initiation; ladder fuels; canopy tree volume and density	Canopy base height; ground-to-crown height; torching index	Increased access, foraging, and viewing	Walking and searching quality; site quality for valued species	Limbing up large trees; removing small suppressed trees; removing selected trees; thinning from above
Brown's fuels transects; surface fuel loading	Tons per area by fuel size classes; fuelbed depth; duff/litter depth	Increased access, foraging, and viewing; percentage of duff for fungi and herbs	Walking, searching, and foraging quality	Removing surface fuels by manual or mechanical means or by wildland fire
Canopy cover/closure; sunlight	Density of tree crowns (bulk density); amount of sunlight on plot	Open or partial sunlight for fruiting and understory plants (shrubs, forbs, ferns, grasses)	Quality and quantity of fruit; light for understory plants	Manual or mechanical thinning of certain types of trees; single-tree treatments

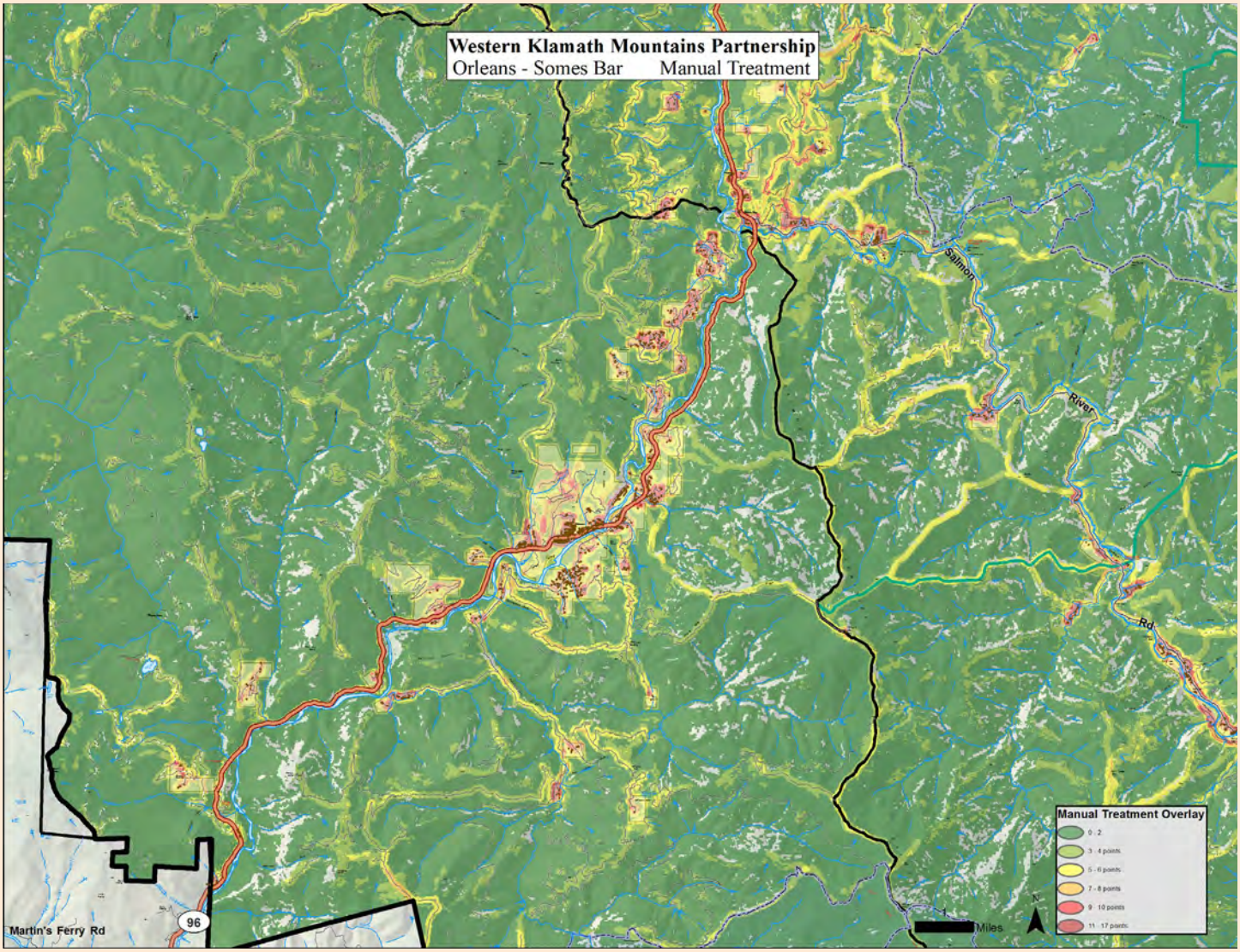

Figure 3—*Map of the area near Orleans/Somes Bar, CA, depicting the overlay assessment of values that represent zones of agreement for prioritizing treatments, from red (highest priority) to green (lowest priority). Source: Karuk Department of Natural Resources, Western Klamath Restoration Partnership.*

planning strategies could incorporate ecosystem services provided by fire-prone landscapes, taking natural and cultural resources of importance to the public and Tribal communities into account. Restoration partnerships can align research and management components by tiering to national and State policies, authorities, and regulatory initiatives (such as the National Cohesive Wildland Fire Management Strategy).

The Cohesive Strategy has three main components:

1. Resilient landscapes;
2. Fire-adapted communities (or, in a Tribal context, fire-dependent cultures); and
3. Wildland fire management responses.

Efforts to integrate research and management into the three components can link to Tribal and rural community values (fig. 2). This can be achieved by aligning multiple resource objectives with community values for the reintroduction of fire, taking an approach that supports Tribal ecocultural restoration or revitalization. Adaptive research and management can integrate shared values by collaboratively developing or selecting the metrics (what is measured as well as why and at what scale it is measured) and by incorporating agreed-upon indicators of success for strategies with treatments at different scales. Such treatments might be to improve the condition of resources of interest (such as the quality of habitat for threatened or endangered species), to increase the abundance of trees or shrubs used by

Establishing meaningful working relationships with indigenous communities and Tribes results from consultation, coordination, and communication for more successful collaboration.

In many indigenous teachings, fire is "medicine" for people and land.

Tribes for food and basketry, or to improve the composition and structure/fuel loading at the habitat or plot scale.

TRIBAL TRADITIONAL KNOWLEDGE AND FOCAL SPECIES AS INDICATORS

In connection with linking forest landscape restoration strategies with indigenous knowledge about fuels and wildland fire treatments, some Tribes use focal species to represent different habitat requirements across the landscape. Each species has components of its life history that make it vulnerable to or benefit from the effects of wildland fire (see Karuk 2019).

In northwestern California, for example, the Western Klamath Restoration Partnership adopted the Somes Bar Integrated Fire Management Project indicators. The Karuk Tribe selected Pacific giant salamander (for water); willow (for riverine/riparian habitats); Roosevelt elk (a seasonal elevational migrant); Pacific fisher (for old-growth forest with early-seral habitat); and northern spotted owl (for conservation/threatened and endangered species). Indigenous knowledge of these species' habitat requirements, combined with broader shared values representative of the overall restoration partnership, are integrated into the development of prescriptions for mechanical, manual, and fire-based treatments (Harling and Tripp 2014; Lake and others 2018). These focal species are also represented in research and monitoring approaches linking treatment units to habitats and the broader landscape regarding the reintroduction of fire (Karuk 2019).

WORKING WITH TRIBAL GOVERNMENTS AND INDIGENOUS COMMUNITY ORGANIZATIONS: WILDLAND FIRES

Establishing meaningful working relationships with indigenous communities and Tribes results from consultation, coordination, and communication for more successful collaboration. In several regions, the Forest Service has Government-to-Government agreements or memorandums of understanding (MOUs) between national forests and Tribes (see the sidebar for sample text from an MOU signed in 2019). These agreements are national to regional in scope (a national agreement template, for example, is the Master Cooperative Wildland Fire Management and Stafford Act Response Agreement).

Locally, fire and fuels management agreements or MOUs tiered to different authorities utilize designated Tribal representative and the Tribal heritage resources advisors or consultants who work with incident management teams (IMTs) on wildfires. These Tribal leaders and consultants work directly with incident leadership and fireline field resources, which can foster cooperative job training and wildland fire education for Tribal and non-Tribal fire personnel. This gives IMTs and field-going fire leadership (branch/division), type I and type II crews, and specialists such as archeologists, members of wildland fire use modules, fire behavior analysts, and GIS/planning consultants opportunities to work with local traditional knowledge. Such agreements, along with an understanding of Tribal values and interests, can help wildland fire managers protect or mitigate impacts to maintain archeological, cultural, and heritage resources (see Lake 2011).

Wildland fire affects more than archeological sites. The living cultural resource and habitat conditions are potentially affected by fire suppression strategies and actions and by the fire itself, both indirectly and directly (Welch 2012). When adequate consultation, coordination, and communication take place between Tribes and IMTs/fire personnel, wildland fire management activities can foster and support living cultural resources linked with traditional practices and desired fire effects from patches (as resource gathering areas) across the landscape (as multiple resource

MEMORANDUM OF UNDERSTANDING

Between The

KARUK TRIBE

And The

USDA, FOREST SERVICE

KLAMATH & SIX RIVERS NATIONAL FORESTS

And The

USDI, BUREAU OF INDIAN AFFAIRS

SACRAMENTO FIELD OFFICE

This MEMORANDUM OF UNDERSTANDING (MOU) is hereby made and entered into by and between the Karuk Tribe, hereinafter referred to as "Tribe," the United States Department of Agriculture (USDA), Forest Service, Klamath and Six Rivers National Forests, hereinafter referred to as the "U.S. Forest Service," and the United States Department of Interior (DOI), Bureau of Indian Affairs, Sacramento Field Office, hereinafter referred to as the "BIA."

Background: In 1994, a consultation protocol MOU was signed by the Karuk Tribe and Klamath National Forest as a framework for conducting Government to Government Consultation. This was a useful tool; however, it was quickly identified that existing protocols did not allow for timely Karuk consultation and coordination during wildland fire incidents.

The Karuk Tribe and Klamath National Forest then signed the inaugural Fire MOU 1996 to "establish and maintain a mutually beneficial strategy for incorporating Karuk

gathering areas affected by fire at different seasons and frequencies) (Lake 2011; Lake and others 2017).

Across the United States, more consultation and coordination are needed with Tribes on fuels reduction treatments and wildland fire management. In northwestern California, fire management agreements/MOUs between the Karuk Tribe and the Six Rivers National Forest have improved working relationships through the use of Tribal elders (level II, nonfireline qualified) and heritage consultants (level I, fireline qualified) to share traditional knowledge and Tribal values regarding wildland fire management (Lake 2011). Coordinating resources for carrying out fire suppression strategies and for managing fires to achieve resource objectives has improved understanding of the effects of fire suppression and exclusion and of fuels management treatments on the condition of landscapes and species as well as on the quality of their cultural use. The agreements support the sharing of knowledge about values at risk, which can be used in the Wildland Fire Decision Support System and for local implementation of the Cohesive Strategy while increasing the pace and scale of desired burning and protecting cultural/heritage resources and Tribal values. Such Government-to-Government agreements/MOUs support knowledge exchange for linking traditional ecological knowledge to fire effects in relation to cultural resources and Tribal values (Lake 2007, 2013; Welch 2012).

DECOLONIZING WILDLAND FIRE MANAGEMENT AND RESEARCH

Decolonization of wildland fire management and research is an indigenous-led process together with partners (governments, organizations, academics, and private individuals). Most of the work has been conducted based on academic descriptions of decolonization processes in research related to nonfire disciplines. The key is to recognize and acknowledge the effects of colonization on indigenous lands and territories as well as the impacts on indigenous cultures and knowledge systems and on fire-prone ecosystems. The process builds understanding of the colonial factors that have contributed to erasing indigenous fire sovereignty and cultural fire regimes and of the factors that still affect indigenous communities (Eriksen and Hankins 2015; Norgaard 2019).

The main colonial factors have been—and still are—Federal and State fire policies to eliminate or limit indigenous burning and stewardship practices, ranging from actions by the first Spanish governor of Alta California to later State and Federal laws, such as the 1911 Weeks Act (Norgaard 2019). The factors include the effects of genocide and the forced removal and relocation of Tribes, followed by governmental, religious, and educational efforts to acculturate Tribal peoples, along with the passage of fire laws and legal sanctions that prosecute indigenous peoples for what Federal and State authorities consider to be illegal burning (such as cultural burning classified as arson and incendiarism). Examples include legal actions at the Federal and State levels against indigenous "arsonists" or fines and imprisonment of Tribal people for incendiarism when they were or are carrying out practices conforming to what they consider to be their precolonial retained rights to burn and a sociocultural responsibility (Norgaard 2019).

Decolonization of wildland fire management and research can take a multiscaled approach of collaborative governance that entails:

- Supporting indigenous sovereignty (self-governance) and decision-making authority (coleadership/oversight) through collaborative partnerships;
- Increasing and improving administrative and jurisdictional opportunities for indigenous fire stewardship through coleadership, shared decision making, and indigenous management of ancestral Tribal territories;

Of central importance are respectful collaborative relationships.

Cultural concerns into the existing incident management system used by the Forest Service for the management of wildfire." There have been four iterations of the MOU since 1996, one in May 2001, which included as new signatories, the Six Rivers and Shasta Trinity National Forests; one in April 2008, which included the Six Rivers but not the Shasta Trinity; and one in 2013, which tracks the 2008 version and expired in July of 2018.

These iterations mentioned above, coupled with the Karuk Tribe's active involvement with the Forests during management of wildland fire incidents, have helped raise awareness regarding the value of incorporating Karuk Traditional Ecological Knowledge into fire management strategies to better protect important tribal values; and have helped create the fifth iteration of this living document.

Title: Terms of Expedited Tribal Consultation During Wildland Fire Incidents

I. PURPOSE:

The purpose of this MOU is to document the cooperation between the parties concerning wildland fire incidents, providing clear direction to the Tribe, Forest Service and BIA regarding ordering and reimbursable expenditures protocols, as well as Roles & Responsibilities for personnel assigned to an incident. It further provides a communication structure, allowing for expedited consultation with the Tribe during ongoing incidents. It enables Tribal concerns to be considered while providing for safe, effective, and efficient wildland fire management activities on lands managed by the Forest Service. This instrument outlines a cooperative approach to addressing concerns in the area of mutual interest depicted in Attachment "A" "Karuk Aborignial Territory" in accordance with the following provisions

- Supporting funding for increased fiscal/budgetary appropriations and allocations to support indigenous fire stewardship;
- Planning at meaningful scales for cross-jurisdictional prioritization of and strategies for types of fuels and wildland fire management and research (Lake and others 2017; Karuk 2019); and
- Taking operational actions on the ground to carry out programs and projects with indigenous engagement, including consultation, coordination, and cooperation for improved collaboration.

These steps will lead to a healing process of reconciliation, repatriation, and restoration for indigenous communities. They can promote the recovery of indigenous burning practices, fire-adapted ecosystems and species, and cultural fire regimes to support Tribal fire-dependent cultures. This approach can be aligned with the broader public interest, wildland fire management opportunities, and governmental policies.

POTENTIAL FOR PARTNERSHIPS

Philosophical, conceptual, and operational approaches toward working with American Indians to form research and management partnerships in the fields of wildland fire, forestry, and fuels hold promise for applications to climate change and forest landscape restoration strategies. In many indigenous teachings, fire is "medicine" for people and land. Anyone who considers collaborating with indigenous peoples and Tribal communities should note that indigenous fire stewardship is both diverse and inclusive of gender, age, and cultural responsibilities among individuals. Different members of indigenous communities hold different types of knowledge and practice various types of cultural burning.

Some Tribes are using agreements/MOUs, joining collaborative groups, and developing research within management projects linked to forest landscape restoration strategies. Decolonization and restoration of indigenous fire stewardship can take a multiscaled approach of collaborative governance that involves supporting indigenous sovereignty (self-governance) and decision-making authority (coleadership/oversight) through partnerships. Working with Tribes as fire-dependent cultures in fire-prone ecosystems can assist society in learning to live with wildland fire, accomplish resource objectives, and promote socioecological resilience among communities and across landscapes.

LITERATURE CITED

Berkes, F. 2008. Sacred ecology. 2nd ed. New York: Routledge. 313 p.

Eriksen, C.; Hankins, D.L. 2014. The retention, revival, and subjugation of Indigenous fire knowledge through agency fire fighting in Eastern Australia and California. Society and Natural Resources. 27(12): 1288–1303.

Eriksen, C.; Hankins, D.L. 2015. Colonization and fire. Coles, A.; Gray, L.; Momsen, J., eds. The Routledge Handbook of Gender and Development, New York: Routledge: 129–137. Chap. 14.

Finney, M.A. 2001. Design of regular landscape fuel treatment patterns for modifying fire growth and behavior. Forest Science. 47(2): 219–228.

Hannibal, M.E. 2014. Lighting cultural fires: let it burn. Boom: A Journal of California. 4(3): 51–59. DOI: 10.1525/boom.2014.4.3.51.

Harling, W.; Tripp, B. 2014. Western Klamath Restoration Partnership: a plan for restoring fire adapted landscapes. Mid Klamath Watershed Council. 57 p. *https://www.karuk.us/images/docs/dnr/2014%20Western%20Klamath%20Restoration%20Partnership_Restoration%20Plan_DRAFT_FINA%20%20%20.pdf.* (31 March 2020).

Hessburg, P.F.; Churchill, D.J.; Larson, A.J. [and others]. 2015. Restoring fire-prone Inland Pacific landscapes: seven core principles. Landscape Ecology. 30(10): 1805–1835.

Huffman, M.R. 2013. The many elements of traditional fire knowledge: synthesis, classification, and aids to cross-cultural problem solving in fire-dependent systems around the world. Ecology and Society. 18(4): 3.

Hummel, S.; Lake, F.K. 2014. Forest site classification for cultural plant harvest by Tribal weavers can inform management. Journal of Forestry. 113(1): 30–39.

Karuk Tribe 2019. Karuk Climate Adaptation Plan. Karuk Department of Natural Resources. 232 p. *https://www.karuk.us/index.php/departments/natural-resources/525-climate-adaptation.* (31 March 2020).

Lake, F.K. 2011. Working with American Indian Tribes on wildland fires: protecting cultural heritage sites in northwestern California. Fire Management Today. 71(3): 14–21.

Lake, F.K. 2013. Trails, fires and tribulations: Tribal resource management and research issues in Northern California. Occasion: Interdisciplinary Studies in the Humanities. 5. 22 p. *https://www.fs.fed.us/psw/publications/lake/psw_2013_lake005.pdf.* (16 January 2020).

Lake, F.K. 2018. Fire as medicine: fire-dependent cultures and re-empowering American Indian Tribes. Fire Adapted Communities Fire Learning Network. 13 September 2018. *https://fireadaptednetwork.org/fire-as-medicine-fire-dependent-cultures/.* (9 December 2019).

Lake, F.K.; Christianson, A.C. 2019. Indigenous fire stewardship. In: Manzello, S.L., ed. Encyclopedia of Wildfires and Wildland-Urban Interface (WUI) Fires. Basel, Switzerland: Springer Nature Switzerland AG. *https:doi.org/10.1007/978-3-319-51727-8_225-1.* (15 January 2020).

Lake, F.K.; Wright, V.; Morgan, P. [and others]. 2017. Returning fire to the land: celebrating traditional knowledge and fire. Journal of Forestry. 115(5): 343–353.

Lake, F.K.; Parrotta, J.; Giardina, C.P. [and others]. 2018. Integration of traditional and Western knowledge in forest landscape restoration. In: Mansourian, S.; Parrotta, J., eds. Forest landscape restoration: integrated approaches to support effective implementation. New York: Routledge: 198–226. Chap. 12.

Long, J.W.; Anderson, M.K.; Quinn-Davidson, L. [and others]. 2016. Restoring California black oak ecosystems to promote Tribal values and wildlife. Gen. Tech. Rep. PSW–GTR–252. Albany, CA: USDA Forest Service, Pacific Southwest Research Station. 110 p.

Mansourian, S.; Parrotta, J.; Balaji, P. [and others]. 2019. Putting the pieces together: integration for forest landscape restoration implementation. Land Degradation and Development. 49(2): 192–203. DOI: org/10.1002/ldr.3448.

Marks-Block, T.; Lake, F.K; Curran, L.M. 2019. Effects of understory fire management treatments on California hazelnut, an ecocultural resource of the Karuk and Yurok Indians in the Pacific Northwest. Forest Ecology and Management. 450: 117517.

McKemey, M.; Ens, E.; Rangers, Y.M. [and others]. 2020. Indigenous knowledge and seasonal calendar inform adaptive savanna burning in northern Australia. Sustainability. 12(3): 995. *https://doi.org/10.3390/su12030995.* (30 April 2020).

Norgaard, K.M. 2019. Salmon and acorns feed our people: colonialism, nature, and social action. New Brunswick, NJ: Rutgers University Press. 312 p.

Stewart, O.C. 2002. Forgotten fires: Native Americans and the transient wilderness. Norman, OK: University of Oklahoma Press. 352 p.

Trosper, R.L.; Parrotta, J.A. 2012. Introduction: the growing importance of traditional forest-related knowledge. In: Parrotta, J.A.; Trosper, R.L., eds. Traditional forest-related knowledge: sustaining communities, ecosystems and biocultural diversity. World Forest Series. Dordrecht, The Netherlands: Springer: 1–36. Chap. 1. Vol. 12.

Welch, J.R. 2012. Effects of fire on intangible cultural resources: moving toward a landscape approach. In: Ryan, K.C.; Jones, A.T.; Koerner, C.L.; Lee, K.M., tech. eds. Wildland fire in ecosystems: effects of fire on cultural resources and archaeology. Gen. Tech. Rep. RMRS–GTR–42–vol. 3. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station: 157–170. Chap. 8.

Worl, S.; Norgaard, K.M. 2019. What Western States can learn from Native American wildfire management strategies. GreeenBiz. 1 November 2019. *https://www.greenbiz.com/article/what-western-states-can-learn-native-american-wildfire-management-strategies.* (31 January 2020).

SUGGESTED RESEARCH EXAMPLES

Hummel, S.; Lake, F.K. 2014. Forest site classification for cultural plant harvest by Tribal weavers can inform management. Journal of Forestry. 113(1): 30–39.

Hummel, S.; Lake, F.; Watts, A. 2015. Using forest knowledge: how silviculture can benefit from ecological knowledge systems about beargrass harvesting sites. Gen. Tech. Rep. PNW–GTR–912. Portland, OR: USDA Forest Service, Pacific Northwest Research Station. 9 p.

Long, J.W.; Anderson, M.K.; Quinn-Davidson, L. [and others]. 2016. Restoring California black oak ecosystems to promote Tribal values and wildlife. Gen. Tech. Rep. PSW–GTR–252. Albany, CA: USDA Forest Service, Pacific Southwest Research Station. 110 p.

Marks-Block, T.; Lake, F.K; Curran, L.M. 2019. Effects of understory fire management treatments on California hazelnut, an ecocultural resource of the Karuk and Yurok Indians in the Pacific Northwest. Forest Ecology and Management. 450: 117517.