

**Indians, Fire, and the Land**  
in the Pacific Northwest

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## *Introduction*

### *Basic Issues*

**I**n May and June of 1792, George Vancouver's British-sponsored exploring expedition entered the uncharted waters of Puget Sound. Expecting a forested wilderness inhabited by unsophisticated natives, they were surprised at what they found. At Penn Cove, on Whidbey Island:

The surrounding country, for several miles in most points of view, presented a delightful prospect consisting chiefly of spacious meadows elegantly adorned with clumps of trees, among which the oak bore a very considerable proportion, in size from four to six feet in circumference. In these beautiful pastures . . . the deer were seen playing about in great numbers. Nature had here provided the well-stocked park, and wanted only the assistance of art to constitute that desirable assemblage of surface, which is so much sought in other countries, and only to be acquired by an immoderate experience in manual labour.<sup>1</sup>

Among the "pine forests" of Admiralty Inlet, Joseph Whidbey noted "clear spots or lawns . . . clothed with a rich carpet of Verdure." The "verdure" of these "lawns" included "grass of an excellent quality," tall ferns "in the sandy soils" and several other plants: "Gooseberrys, Currands, Raspberrys, & Strawberrys were to be found in many places. Onions were to be got almost everywhere." Whidbey was nostalgic: the lawns had "a beauty of prospect equal to the most admired Parks of England."<sup>2</sup>

Nearly two centuries later, in 1979, well after the "lawns" observed by Vancouver's party had been converted to agriculture, the "pine forests" partially cut and managed for timber production, many indigenous species supplanted by Eurasian varieties, and the villages and seasonal camps of the Native Americans replaced by the cities and farms of Euro-American newcomers, anthropologist Jay Miller

went into the Methow Valley [north-central Washington] with a van load of [Methow Indian] elders, some of whom had not been there for fifty years. When we had gone through about half the valley, a woman started to cry. I thought it was because she was homesick, but, after a time, she sobbed, 'When my people lived here, we took good care of all this land. We burned it over every fall to make it like a park. Now it is a jungle.' Every Methow I talked to after that confirmed the regular program of burning.<sup>3</sup>

Separated by 187 years of systemic, region-wide ecological change in the Pacific Northwest, these two sets of observations address several themes central to this volume.

The Pacific Northwest at first contact with Euro-Americans was not exclusively a forested wilderness. West of the Cascades, as documented in the Vancouver journals, there were large and small prairies scattered throughout a region that was climatically more suited to forest growth. And east of the mountains, as the Methow passage suggests, the forests of the past were quite different, with a minimum of underbrush and clutter. Other differences in local environments were present both east and west.

Vancouver believed that "Nature" alone was responsible for the "luxuriant lawns" and "well-stocked parks"; there is nothing in any of the expedition's journals suggesting that the Native inhabitants of the "inland sea" had any hand in their existence. Until relatively recently, most anthropologists believed this as well. The traditional stereotype of non-agricultural foraging peoples was that they simply took from the land and did not have the tools or knowledge to modify it to suit their needs. We now know better. Indigenous Northwesterners did indeed have a tool—fire—and they knew how to use it in ways that not only answered immediate purposes but also modified their environment. We now know that the "lawns" that Vancouver observed on Whidbey Island, the prairies that early trappers and explorers described in the Willamette Valley, and the open spaces that led the Hudson's Bay Company to select the site of Victoria for their headquarters in 1845 had been actively manipulated and managed, if not actually "created," by their Native inhabitants. Anthropogenic (human-caused) fire was by far the most important tool of environmental manipulation throughout the Native Pacific Northwest.

This does not mean, of course, that fire was ubiquitous in the pre-contact Northwest, that all peoples used it, nor that all environments were shaped by it. The "interior valleys" province<sup>4</sup> and the ponderosa pine forests of the east were most heavily affected; in contrast, fire use in the coastal wet forests appears to have been relatively limited. The amount of environmental modification practiced by Northwest Native Americans did not begin to approach the magnitude of change instituted by their Euro-American successors, or for that matter, the great majority of agricultural peoples. But the change they did create was much greater than has been assumed.

In almost all cases, the immediate reason for environmental fire use in the Northwest related to the food quest. Northwest Native Americans used fire in fire drives of deer and elk and in gathering species such as grasshoppers and tarweed. But more than this, they used it to create environments suitable for some of their most-favored food plants, such as camas and other root crops and many species of wild berries. Firing in the camas beds, huckleberry fields, oak groves, and tule flats, as well as other environments, took place *after* harvest, as a kind of post-use cleanup process, with ecological consequences in following seasons. Although reliable evidence is sparse, snippets of information such as that from the elderly Methow woman suggest that local

Native Americans may have shared with their Euro-American successors an aesthetic that favored open, manicured spaces, and deplored weedy clutter.

We have underestimated not only the Native Americans' ability to modify their environment, but their knowledge of it as well. Anthropologists have been very late in appreciating this information, and in most of the Pacific Northwest, much too late to collect it. The elders who retained the ecological knowledge have, for the most part, passed on. The fieldwork of several of the contributors to this volume<sup>5</sup> not only has captured a great deal of this remaining "traditional ecological knowledge," but (by implication) has given us a hint of the vast well of information that already has been lost.

Although we can't know exactly what was in the heads of these original environmental managers, we can look at the fruits of their labor—the environments first reported by early explorers—and gain some idea of what their knowledge included. There are only so many ways to produce open prairies in environments suitable for coniferous forests or bunchgrass plains where sagebrush and juniper are more likely to grow. Native Americans understood the concept of plant succession. They knew that the creative use of fire reverted the successional sequence to its early stages, and they favored fleshy annual plants with easily accessible nutrients instead of longer-growing, later-stage species that locked up nutrients in hard-to-utilize packages. Native Americans probably knew as much if not more about specific plant sequences in local communities as contemporary forest and rangeland specialists.

Although Northwest Indians were not agricultural, it is clear that they also understood that fertilizer—whether ash in tobacco plots or seaweed in clover beds—improved the growth of subsequent crops. Studies of camas plot exploitation from several separate areas suggest an understanding of the benefits of transplanting, weeding, and aerating the soil. And in recent times, Indian women in different areas have trimmed and cut back different berry species to enhance growth. Although we must recognize and control for the possibility that some of these practices have been influenced by post-contact exposure to White techniques, chances are most of them are aboriginal.<sup>6</sup>

Other ecological effects of burning and other traditional management practices that are apparent today may not have been so obvious or primary in the world of the Native Americans. The beneficial effects of understory and spot burning in several forest types as a preventive to wildfires, disease outbreaks, and extensive forest burns, now so apparent to Northwest forest managers, have become timely because of the ill-advised, unnatural (and culturally specific) practice of fire suppression. Likewise, Native Americans may not have understood contemporary ecologists' concept of "edge environments." But the effects of creating more ecological "borders" through selective burning were the same: to increase the number and variety of species in any given area. Native Americans also were not concerned with species

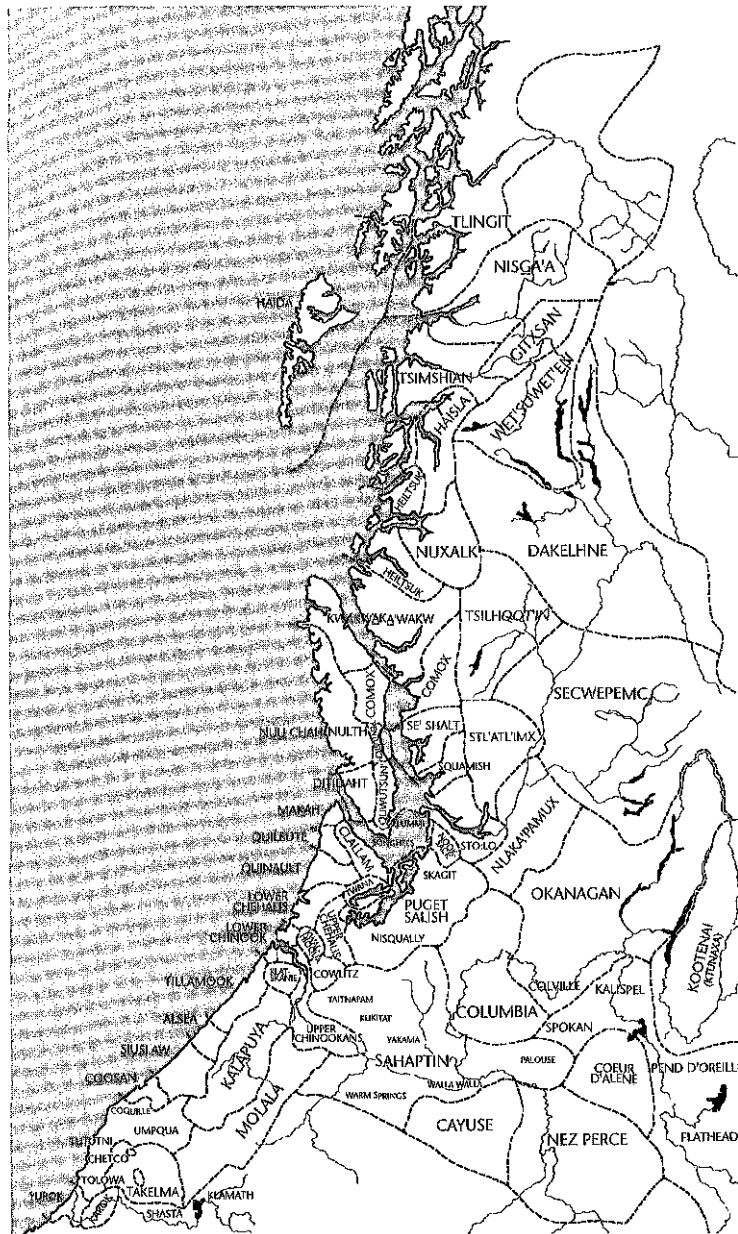
depletion and loss and overall biodiversity: these are problems and issues of our own practices and times.

### *Patterns of Indian Burning in the Pacific Northwest*

The papers in this volume summarize virtually everything that is known about Pacific Northwest Indian use of fire in the environment. Since the greater part of what the Indians knew has been lost, we are left with only a few early descriptions of fire-influenced environments and the few details elders were able to recall about former cultural systems of fire. But what remains shows a notable consistency—in species interactions, landscape consequences, and cultural patterning of fire use. Wherever mountain huckleberries were gathered, fire appears to have been applied in similar ways; wherever ponderosa pine forests occurred, the effects of anthropogenic fire appear to have been the same; wherever the fire drive was used to hunt deer, it was conducted in a similar fashion. Topographical, climatic, and ecological characteristics limited how fire could be safely and efficiently used in different ecosystems. Cross-cultural similarities in fire use may represent optimal ways of using fire to produce particular desired results, invented once or several times and spread to other cultures. Viewed together, these limitations and similarities constitute what the acknowledged expert on anthropological fire, Henry Lewis, would call “patterns” of Indian burning.

The Pacific Northwest, however, is not a unified environment, nor were its indigenous cultures all alike. There were numerous regional environments, and local cultures varied in the mix of elements that made up their total cultural systems. In the early 1980s, when I was collecting data for my paper on Willamette Valley Indian fire use, I noted that cultural patterns of fire in the Pacific Northwest tended to fall into identifiable regional clusters. In 1993, forest ecologist James Agee described the varying fire ecologies of major ecosystems in the Pacific Northwest.<sup>7</sup> As might be expected, many regional cultural patterns of fire use correspond closely to the ecosystems discussed by Agee. What follows is an attempt to expand and refine this discussion of regional patterns of fire use, incorporating the new, broader database on Indian fire represented by the papers in this volume, plus the greatly improved (since 1985) understanding of Pacific Northwest fire ecology.

The discussion will be organized by “ecoregions,” defined as “regions of relative homogeneity in ecological systems or in relationships between organisms and their environments.” There currently is no region-wide consensus on the exact delineation of ecoregions (Maps 2 and 3).<sup>8</sup> Those used here are broadly defined and vary from strictly biological systems by including humans among other organisms and indigenous cultures as forms



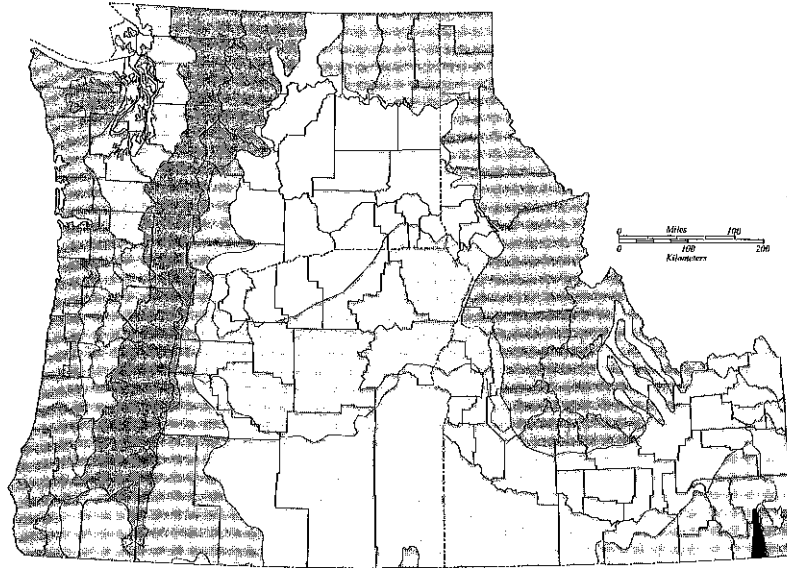
Map 1. Peoples of the Northwest Coast and Plateau culture areas. Map by David Mybrum, based on map by Wayne Suttles, *Native Languages of the North Pacific Coast of North America*. Copyright Cameron Suttles, 1978. British Columbia First Nations names from "First Nations of British Columbia" map, UBC Museum of Anthropology, 1996.















of adaptation to differing environments. Anthropologists divide the Pacific Northwest into two large “culture areas”: “Northwest Coast” west of the Coastal-Cascade crest, and “Plateau” east of it, in the upper drainages of the Fraser and Columbia rivers (Map 1). Within these two major groupings, researchers have defined different subareas, mostly on the basis of clusterings of important culture traits.<sup>9</sup> The following discussion, of course, takes into account variations in only one cultural subsystem—the use of fire. Within the framework of eight “ecoregions,” there is a summary of major vegetation types, an inventory of recorded indigenous fire uses, and a definition (where the evidence will allow) of the regional cultural “pattern” of fire use.

### *Coast Ecoregion*

The Coast ecoregion is discussed (for British Columbia) in Nancy Turner’s “Time to Burn: Traditional Use of Fire to Enhance Resource Production.” Called the “Coast Range ecoregion” in the U.S., in B.C. it corresponds to the “Coastal Western Hemlock vegetation zone,” including most ecoregions of the “Coast and Mountains ecoprovince.” Extending along the entire coast from 42° to 58°, there is considerable latitudinal variation in species composition. Major tree species are Sitka spruce (*Picea sitchensis*), Western hemlock (*Tsuga heterophylla*), red cedar (*Thuja plicata*), and Douglas-fir (*Pseudotsuga menziesii*) in the south. Understories include swordfern (*Polystichum munitum*) and salal (*Gaultheria shallon*), and mosses and Alaska blueberry (*Vaccinium alaskaense*) in the north. Indigenous cultures include all the peoples with Pacific coastal frontage: Tlingit, the coastal Tsimshian peoples, Haida, Heiltsuk, Nuxalk, Kwakwaka’wakw, Nuuchahnulth, Makah, Quileute, Quinault, Chinook, Tillamook, Siuslawan, Coosan, and Tututni. The high precipitation (200–300 cm/yr) and importance of marine resources probably explain the relative lack of historic or anthropological documentation of anthropogenic burning in this region. Yet it did occur. Early explorers attributed autumn smoke at both Cape Flattery and the mouth of the Rogue to Indian-caused fires.<sup>10</sup> Three coastal peoples (Coos, Tillamook [probable], and Quileute) burned back brush to facilitate deer hunting.<sup>11</sup> Burning of limited areas to encourage berry growth seems to have been the most common use, however: Turner reports it for all coastal B.C. peoples from Haida to Nuuchahnulth; and anthropologist Elizabeth Jacobs verified it among the Tillamook:

every few years the berry pickers would burn over the salal or shot huckleberry (*Vaccinium ovatum*) patch. That meant no berries there next season, but a greatly improved crop the second year. This was done to improve blackberry patches as well, these vines bore more lavishly the immediately following season.<sup>12</sup>



|  |   |
|--|---|
|  Coast Range                             |  Blue Mountains                 |
|  Puget Lowland                          |  Snake River Basin/High Desert |
|  Willamette Valley                      |  Northern Basin & Range        |
|  Cascades                               |  Northern Rockies              |
|  Sierra Nevada                          |  Middle Rockies                |
|  Eastern Cascades Slopes<br>& Foothills |  Wyoming Basin                 |
|  Columbia Basin                         |  Wasatch & Uinta Mountains     |

Map 2. Ecoregions of Oregon, Washington, and Idaho. The Omernik and Gallant classification (1986), from *Atlas of the Pacific Northwest*, edited by Philip L. Jackson and A. Jon Kimerling, published by Oregon State University Press, 1993.

Agee states that fire is, indeed, rare in this zone, and that when it does occur, shrubs including salal, red huckleberry (*Vaccinium parvifolium*), salmonberry (*Rubus spectabilis*), and vine maple (*Acer circinatum*) are early colonizers.<sup>13</sup> The limited ethnographic citations mention burning for the first two species more than once.

Along the Olympic Peninsula coast, burning may have maintained prairies at Quillayute and Forks, where important food sources such as bracken were concentrated.<sup>14</sup> The Tillamook area presents an interesting case. It has been



Map 3. Ecoprovinces of British Columbia. Map by Ric Vrana after original by Dennis Dimarchi, courtesy of Province of British Columbia, Ministry of Environment, Lands and Parks.

suggested that Tillamooks also may have burned to open up areas for camas (*Camassia quamash*), which on archaeological evidence appears to have been formerly much more widespread.<sup>15</sup> On the coast itself, anthropogenic fire use may have been locally intense, as the following notation indicates:

October 1856. At this time there was not a bush or tree to be seen on these hills (Bay City) as the Indians kept them burned off every spring, but when the whites came they stopt the fires.<sup>16</sup>

But at the same time, there is no ethnographic or historic evidence of patterned Indian use of fire in the forested interior of Tillamook County, an area dominated by seral stands of Douglas-fir. Throughout the Coastal ecoregion, Indian subsistence was oriented to the sea, and the few reasons for fire use recorded by anthropologists do not indicate interior exploitation.<sup>17</sup>

### *Puget Sound Ecoregion*

The Puget Sound ecoregion combines three overlapping ecosystems in Agee: Western hemlock, Douglas-fir, and Oregon oak; and corresponds to the "Georgia Depression" ecoprovince of British Columbia. Ecologists characterize this as an area of mixed communities: "Prairie, oak woodland, and pine forest are encountered."<sup>18</sup> Microclimatic differences and glacial soils are important influences. Cultures are all Coast Salish, including Quwutsun', Sto:lo, Lummi, Lushootseed (Puget Salish), Upper Chehalis, and Cowlitz speakers. Anthropogenic burning was concentrated in the prairies of the middle section of this region, which dotted the landscape from the Cowlitz River in the south to the Tsolum River on Vancouver Island. The prairies, their maintenance by fire, and their important plant species are discussed in Richard White's "Indian Land Use and Environmental Change: Island County, Washington, a Test Case," Estella Leopold and Robert Boyd's "An Ecological History of Old Prairie Areas in Southwestern Washington," and Nancy Turner's "Time to Burn."<sup>19</sup>

Although the origin of the prairies dates to a warm, dry period between 9500 and 4500 B.P., their maintenance was due to patterned seasonal burning by the Salishan peoples. Firing of the prairies every year before the first autumn rains is documented in Hudson's Bay Company journals at Forts Nisqually and Victoria, by early settlers on Whidbey Island, and in ethnographic accounts from all areas. On the Nisqually Plains there was definite patterning to the late summer/early fall fires. Journal references from several years consistently fall during the dry time from August 13 to September 12, with intermittent blazes in the preceding and following months, apparently dependent on annual climatic variations.<sup>20</sup>

Economically important plants were concentrated on prairies; fire was used in the management of important species such as camas, blackberries (*Rubus ursinus*), and bunchgrass (*Festuca idahoensis*); and virtually all the other prairie species used by Indians are fire followers (e.g. bracken, *Pteridium aquilinum*) or benefit from frequent low-level fire (e.g., acorn production). One of the area's earliest ethnographers provides a clear picture of the productivity of the western Washington prairies and how their major crops were gathered:

the kamas . . . are found in great quantities . . . in the prairies . . . and they were formerly a great article of trade with the interior. Besides these, the roots of the sunflower [*Balsamorhiza deltoidea*] and fern are largely used, and a small white root of rather insipid taste [probably chocolate lily, *Fritillaria lanceolata*]. From the fern, they make a species of flour which is baked into bread. The kamas season is in the latter part of May and June, and then as well as in the fall when the sunflower is dug, the prairies are dotted over with squaws, each armed with a sharp stick and a basket, busily engaged in digging

them. At these times, camps are generally found near the skirts of timber which border the open lands for the convenience of gathering and preserving. The kamas are baked in the ground.<sup>21</sup>

Burning the prairies in early autumn before the rains allowed a second growth of the native bunchgrass, providing year-round pasture for deer and (in later years) horses.

Everywhere, in this part of the country [Nisqually in 1841], the prairies open wide, covered with a low grass of a most nutritious kind, which remains good throughout the year. In September there are slight rains, at which time the grass commences a luxuriant growth, and in October and November, there is an abundance of green grass, which remains until the ensuing summer, about June, it is ripe, and drying without being wet, is like our hay in New England; in this state, it remains until the Autumn rains begin to revive it.<sup>22</sup>

The western Washington prairies were a major feature of the “managed landscape” of the pre-White Pacific Northwest.

### *Willamette Valley Ecoregion*

The Willamette Valley ecoregion is discussed in Robert Boyd’s “Strategies of Indian Burning in the Willamette Valley.” It includes valley wet prairies and oak savannas, riverine deciduous (ash, [*Fraxinus latifolia*] and alder [*Alnus rubra*]) corridors, and encircling foothill conifer (Douglas-fir and Western hemlock) forests. Dominant tree species are Oregon oak (*Quercus garryana*), Douglas-fir, and bigleaf maple (*Acer macrophyllum*). The indigenous valley grasses were displaced early and are not well known; they probably included native bunchgrasses *Deschampsia cespitosa* in the wet prairies and *Festuca rubra* in the savannas. Forbs (flowering plants) accompanied the prairie grasses; various shrub species grew in the borders and forest understories. Cultures include Kalapuya and Klikitat (intrusive) in the valley and Molala in Cascade conifer forests.

As in western Washington, prairies were central to Indian settlement and subsistence. But the Willamette Valley, prairies were more continuous and of much greater extent than in western Washington. According to analyses of 1850s land survey maps,<sup>23</sup> prairies covered the greater part of the valley and its lower elevation foothills. Lightning fires are rare in western Washington and northwestern Oregon, but plentiful historical records substantiate extensive indigenous burning in late August–early September, and apparently spottily and earlier in special microenvironments. Burning was a constituent part of many food-getting activities, including the deer drive and tarweed (*Madia* spp.) and grasshopper gathering; otherwise it was apparently used

after harvest with secondary benefits for acorn, root, and berry (various species, notably camas and blackberry) production. Fire also was important in the production of basketry materials (e.g. hazel, *Corylus cornuta*) and in tobacco cultivation. The particulars of the cultural management of all these species are largely unknown and must be surmised given the termination of aboriginal burning in the 1850s. But the ubiquity of fire in the subsistence quest and environment has led one researcher to term the indigenous valley life-style a “pyroculture.”<sup>24</sup> The Willamette Valley was the most intensively fire-managed environment in the aboriginal Northwest.

### *Upper Rogue Ecoregion*

The Upper Rogue ecoregion is described in Jeff LaLande and Reg Pullen’s “Burning for a ‘Fine and Beautiful Open Country’: Native Uses of Fire in Southwestern Oregon.” The Upper Rogue (“Sierra Nevada” on Map 2) is characterized by mixed Douglas-fir and hardwood forests with considerable altitudinal variation: oak and ponderosa pine predominate in the savannas; Douglas-fir with several other species mid-range; and white fir (*Abies concolor*) is important in higher elevations. Shrub composition is highly mixed and variable with hazel, poison oak (*Rhus diversiloba*), blackberry, and wild rose (*Rosa gymnocarpa*) common. Fire-resistant species and open understories were typical in most associations. The Upper Rogue is transitional, both environmentally and culturally, between the Willamette Valley and California.<sup>25</sup> It is drier with more lightning fires; there is a greater variety of ecosystems and a more diverse assemblage of economically important fire-affected species. Cultures included Takelman-speaking Takelma and Cow Creek Umpqua, and several Athapascan-speaking peoples on Rogue tributaries and the middle Umpqua river.

Firing was not limited to the valley savannas but occurred in higher-elevation mixed woodlands and (apparently) along trails and ridges as well. Early historical accounts describe “chains of prairies” along trails and grass-covered ridgetops, reminiscent of fire-maintained “yards” and “corridors” known from the southern Washington Cascades, northwest California, and several other regions.<sup>26</sup> All the “reasons” for burning in the Willamette Valley were duplicated here, with some variation: less concentration on roots and more on seeds, burning for both hazelnuts and basketry material, and in the utilization of mid-elevation species such as the sugar pine (*Pinus lambertiana*). And there is more surviving ethnographic data on the social direction of firing activities.

### *Cascade Ecoregion*

The Cascade ecoregion (Pacific and Cascade Ranges ecoregion of the “Coast and Mountains” ecoprovince in B.C.) is discussed in two papers: David French’s “Aboriginal Control of Huckleberry Yield in the Northwest”; and Helen Norton, Robert Boyd, and Eugene Hunn’s “The Klikitat Trail of South-Central Washington: A Reconstruction of Seasonally Used Resource Sites.” The ecoregion includes lower-elevation conifer forests and high-elevation subalpine communities. The forests are dominated by Douglas-fir with Western hemlock and Western red cedar in old-growth areas. Understories include salal, rhododendron, Oregon grape (*Berberis nervosa*), vine maple, and oceanspray (*Holodiscus discolor*). Subalpine trees include silver and subalpine fir (*Abies amabilis* and *A. lasiocarpa*) and Engelmann spruce (*Picea engelmannii*). Plant communities are locally dominated by Cascade blueberry (*Vaccinium deliciosum*), black alpine sedge (*Carex nigricans*) and *Saxifraga tolmiei*. Cultures: includes the higher elevations of all the Pacific Coast B.C. peoples and most Coast Salish, Northwest Sahaptin Taitnapam and Klikitat, Upper Chinookans, and Molala in the States.

Burning of black mountain huckleberry patches (*Vaccinium membranaceum*) was the prominent activity in the subalpine zone, with the particulars and effects well known, since the practice survived until recent times, well within the memories of living informants. Autumn burns took place after the berry harvest; the ecological effects on huckleberries and other vegetation were well understood and manipulated by the Indians. Productivity was enhanced by managed fire; fire prevented invasion by shrubs and trees. Burned over areas were limited in extent and, particularly in the southern half of the Northwest, apparently dotted along trails that traversed both subalpine and lower forested zones. Other useful species (e.g. various *Vaccinium*, beargrass [*Xerophyllum tenax*], and kinnikinnick [*Arctostaphylos uva-ursi*]) were available altitudinally in these “yards.” In post-contact times, the openings along trails picked up an added function as pasture for horses. Most peoples who exploited this region visited it seasonally when desired species were ripe; a few southern Pacific Northwest peoples, in particular the Molala of the western Oregon Cascade foothills and the Taitnapam and Klikitat of the southern Washington Cascades, spent much of their annual round in the prairies and openings of the subalpine zone and neighboring forests. Like other Northwest peoples who occupied more extensive grasslands, these latter three also could be called “prairie peoples.”<sup>27</sup>

### *Columbia Basin Ecoregion*

The Columbia Basin is discussed in William Robbins's "Landscape and Environment: Ecological Change in the Intermontane Northwest." Most researchers divide the basin into three zones, but considering the cultural adaptation, it is better viewed as a single region, with significant environmental differences varying by altitude. Geographically, the ecoregion centers on the steppeland of eastern Oregon and Washington and coincides with the southern, western, and central portions of the Columbia Basin. Ecologists characterize the central, driest portion as sagebrush (*Artemisia*) steppe. Sagebrush, however, is very vulnerable to fire, while the three dominant annual bunchgrasses (*Festuca idahoensis*, *Agropyron spicatum* and *Poa sandbergii*), found throughout the ecoregion, are not. The steppe also included a medley of assorted forbs: besides the dominant yarrow (*Achillea millefolium*), there were economically important species such as the *Lomatiums* and certain lilies valued for their roots. In higher elevations were ponderosa pine forests, usually a narrow strip between the treeless steppes and montane coniferous forests but fairly large in the Yakima and Grande Ronde Valleys. Camas and balsamroot (*Balsamorhiza sagittata*) were common components of the ponderosa pine zone.

Indigenous cultures included some Upper Chinookans, Sahaptin,<sup>28</sup> Nez Perce, and Columbia Salish. These peoples were seasonably mobile and their subsistence quest took them to different locations as wild foods became available. As far as plant foods were concerned, the sequence was roughly altitudinal: dry land roots (e.g. *Lomatium cous*, *Lewisia rediviva*) in April and May, camas in June through September, and black mountain huckleberry in August–September.<sup>29</sup> Most extant evidence on fire use from this region is historical and suggests that burning also followed an altitudinal gradient: low-lying areas (near villages?) "lately burnt," with new grass or clover (*Trifolium*) in May and early June; open prairie land (from Walla Walla, the Palouse region, Wascopam, and Umatilla) during August; higher areas (in the Grande Ronde or the Blue Mountains) in late August.<sup>30</sup> The best source on reasons for fire use in this area comes from anthropological "culture element" inventories: five peoples burned to gather "sunflower seeds"; four "burned brush to drive game out."<sup>31</sup> The most frequently mentioned "reason" for burning in the historical literature is for a new growth of grass, followed by the deer drive, animal forage, and seed gathering. One source mentions grasshoppers; it is likely that the early White observers, who saw the fires but didn't ask "why," missed many more reasons. The dating of the historical citations suggests post-harvest "clean-up." Alan Marshall's Nez Perce informants "asserted that the firing of prairies . . . was intentional and common because it improved the quality and quantity" of the three most important Nez Perce plant foods: *Lomatium cous*, *L. canbyi*, and camas. Marshall notes that the intentional burning of these root patches, along with harvest-associated

disturbance of the soil and replanting of unsatisfactory roots, resembled “swidden techniques” used elsewhere by horticultural peoples.<sup>32</sup>

### *Northern Rockies Ecoregion*

The Northern Rockies ecoregion (“Southern Interior Mountains” ecoprovince in B.C.) is discussed in Stephen Barrett’s and Stephen Arno’s “Indian Fires in the Northern Rockies: Ethnohistory and Ecology” and John Ross’s “Protohistorical and Historical Spokane Prescribed Burning and Stewardship of Resource Areas.” Geographically, the region includes northwest Washington, southeast B.C., the Idaho panhandle, and Montana west of the continental divide. Ponderosa pine was found in the valleys; Douglas-fir and lodgepole pine (*Pinus contorta*) at mid elevations; grand and supalpine firs (*Abies grandis* and *A. lasiocarpa*) higher up. Important understory species include the three Plateau grasses, camas, and sunflower in the ponderosa zone; Oregon boxwood (*Pachistima myrsinites*), pinegrass (*Calamagrostis rubescens*), and several economically valuable plants: black mountain huckleberry, grouseberry (*V. scoparium*), beargrass, and wild rose in the mountains. Cultures: the larger part of the ranges of the Salish (Flathead, Pend d’Oreille, Kalispel), Spokane, Coeur d’Alene, and Colville Interior Salish and Kootenai.

In western Montana, burning clearly was concentrated in the valleys where settlements occurred, with less frequent firing intervals at higher elevations. Fire was frequent enough that it kept forest understories in the ponderosa zone clear and prevented succession to closed Douglas-fir stands. These findings seem to be borne out by the several uses documented ethnographically for the Spokane: “clean-up” around villages and springs and in tule stands; to create deer browse and horse pasture; for camas, cous, sunflower seeds, and pinenuts in the “pinney woods.” Deer drives probably extended into the lower elevation forests. In higher elevations, campsites and trails as well as mountain huckleberry patches were burned. Individuals with special “powers” and knowledge directed the deer drive<sup>33</sup> and huckleberry patch burning.

### *Middle Fraser Ecoregion*

The middle Fraser (“Southern Interior” ecoprovince) is discussed in Nancy Turner’s “‘Time to Burn’: Traditional Use of Fire to Enhance Resource Production by Aboriginal Peoples in British Columbia.” From Hope upstream, the Fraser River drainage is a highly dissected plateau with canyons and mountain ridges. Vegetational zones shift rapidly with elevation: there are bunchgrass associations on the middle Fraser, the Thompson, and along the Okanagan (which, although in the Columbia drainage, probably should be considered an outlier of this ecoregion). A thin ponderosa pine belt surrounds

all these areas, with interior Douglas-fir forests on the plateau and Engelmann spruce/subalpine fir associations in the mountains. Cultures include Stl'at'imx (Lillooet), Nlaka'pamux (Thompson), Secwepemc (Shuswap), and Okanagan.

The subsistence round here was, as might be expected, highly altitudinal, though people apparently did not follow a strictly uphill sequence, instead moving back and forth between zones as need dictated. Roots and berries were important foods, though with a different selection than in the Columbia Basin: camas and cous were absent, and serviceberry (*Amelanchier alnifolia*) was the most important berry species. Indians burned every few years to manipulate crops of montane roots (avalanche lily, tiger lily, spring beauty; *Erythronium grandiflorum*, *Lilium columbianum*, and *Claytonia lanceolata*) and, less frequently, the black mountain huckleberry. In the lower elevations, burning is not as well documented, though it certainly occurred. "Blueberries" (various *Vaccinium* species), onions (*Allium*), raspberries (*Rubus idaeus*), and blackcaps (*Rubus leucodermis*), all managed by fire, are found here, and Turner notes that serviceberry is a fire follower, producing best in twenty to forty-year-old burns. Hazel bushes were burned in the lowest elevations.<sup>34</sup> More information on lower-elevation burning may be preserved in early historical records, such as the Hudson's Bay Company's Fort Kamloops Journal.

### *Gitxsan Interior Cedar-Hemlock Zone*

This zone (corresponding to the Nass Basin and Nass Ranges ecoregions of the Coast and Mountains ecoprovince) is described by Leslie Johnson in "Aboriginal Burning for Vegetation Management in Northwest British Columbia." The northern-most region covered in this book, it is (as Johnson notes) "transitional between the northwest coast and boreal interior" and is named after the co-dominant red cedar and hemlock. Unlike virtually all other forested regions in the Northwest, this area lacks Douglas-fir. Mosses are important, as are subalpine fir, bunchberry (*Cornus canadensis*), and the black mountain huckleberry. The Gitxsan people are located wholly within this zone; neighboring Wet'suwet'en territory is a part of the sub-boreal Central Interior ecoprovince, dominated by Engelmann spruce, with mosses and bunchberry.

Burning to manipulate berry crops (black mountain huckleberry, low bush blueberry [*V. caespitosum*], and soapberry [*Shepherdia canadensis*]) was most important here, and unlike in the south, most berry patches were not far from villages. Berry burning occurred in autumn; patches were burned every four years. Gitxsan also burned floodplains in spring (originally probably to manage riceroot, *Fritillaria camschatcensis*), and around villages. Johnson suggests that the seral plant communities of the area may have been influenced by Indian burning.

### *Background Research on Anthropogenic Fire*

In-depth studies of fire use by indigenous peoples such as those of the Pacific Northwest are recent, resulting from the convergence of several lines of research: in geography, anthropology, environmental studies, and history. Early on paleoanthropologists recognized that fire use was an important technological advance in human cultural evolution. By providing artificial warmth, fire allowed early humans to expand into cold environments, and through cooking, to break down tough plant and animal tissues, thus increasing food supplies. The “domestication” of fire traditionally has been set at around 500,000 years ago, concurrent with the first evidence of occupation of the colder latitudes of Eurasia by *Homo erectus*. There is archaeological evidence that the fire drive in hunting grazing animals was used at this time too. But traditionally, anthropologists considered this solely a technological advance.<sup>35</sup>

#### *Geography*

Studies of the role of anthropogenic fire in the environment were instead initiated by geographers, most notably Carl Sauer at the University of California (Berkeley), in the 1930s and 1940s. Sauer and his students noted that many “savannas, steppes, and prairies,” particularly in the Americas, were shaped by what he called aboriginal “fire economies,” in which fire was a major and recurring tool of the food quest. Sauer considered the savannas of Middle America, the tall grass prairies of the Midwest, and the open deciduous forests of the early contact East Coast all to have been shaped by anthropogenic fire. His theories have been confirmed by later geological studies.<sup>36</sup> In the Northwest, a watershed geographical study was Carl Johannessen *et al.*’s 1971 “The Vegetation of the Willamette Valley,” which documented the role of anthropogenic fire in the maintenance of valley prairies. In recent years, several geographers have returned to the theme of anthropogenic effects on the landscape in pre-Columbian America, with particular attention to the role of fire.<sup>37</sup>

#### *Anthropology: Stewart and Lewis*

Anthropological studies of fire use also began at the University of California, but were approached from a different perspective. Beginning in the late 1930s, the anthropology department began an ambitious “culture element survey” of virtually all the Indian cultures of the West Coast. Informants were questioned about the presence or absence of various traits: technological, social organization, subsistence, etc., and comparative lists were constructed from their answers. One ethnographer, Omer Stewart, who was responsible for

most Great Basin peoples, noted what previous ethnographers had missed: aboriginal fire use was ubiquitous throughout the interior west, often with significant environmental effects. In 1953, he completed an 800-page comparative study (as yet unpublished), and several articles on Indian fire use followed. As an anthropologist, Stewart was concerned with the role of fire in culture: he wanted to know *why* Indians burned—what were their reasons? But ecological effects were important too: like Sauer, Stewart believed that the Great Plains were maintained largely by anthropogenic fire.<sup>38</sup>

The seminal paper in the anthropological literature on fire, Henry Lewis's 1973 *Patterns of Indian Burning in California*, combined the ecological awareness of Sauer with the anthropological sensibility of Stewart (as well as practical knowledge derived from experience as a fire-fighter in northern California's national forests). Lewis brought together ethnographic, ethnohistoric, and ecological evidence that made it clear that Indian fire use strongly influenced the pre-White environments of northern California, from grassland through chaparral to redwood forests, setting back natural successions, clearing underbrush, and producing open areas in the forest. Since 1973, Lewis has written on many aspects of aboriginal fire use, including the role of anthropogenic fire in plant and animal resource management and domestication, the technology of burning and cross-culturally valid types of burned areas, and "traditional ecological knowledge." Beyond northern California, he has conducted fieldwork on fire use among northern Alberta Indians and Australian aborigines. His fieldwork with living informants who until recently practiced aboriginal burning has allowed him to flesh out the bare bones of practices that were otherwise known only through historical accounts of surviving pyrogenic environments, and to fill in a gap that earlier anthropologists had overlooked.<sup>39</sup>

### *Anthropology: Resource Management*

The anthropological perspective on fire use also includes a consideration of its role in the native food quest, or subsistence pattern. Sauer's list of "reasons" for burning included examples where fire was not only a tool that produced immediate results in hunting and gathering, but also a way of modifying the environment to attract wild animals or to produce greater future yields of plants. The latter kind of fire use is very important in West Coast ethnography, where *none* of the Native peoples (with the exception of a few in southern California) practiced "true" agriculture, where the ground is broken and plants are grown from seeds or cuttings, and where there is demonstrable genetic change in species tended by humans. West Coast peoples *understood* the concept of planting (many grew tobacco from seed), but none used it with food plants. In the 1930s it was pointed out that one southern Basin group,

the Owens Valley Paiute, *irrigated* crops (wild hyacinth and yellow nutgrass), although they did not plant them. Later studies among Nevada Paiutes uncovered other forms of what was initially termed “environmental manipulation,” including broadcasting seeds and burning to improve future growth. The earliest “ethnobotanical” studies in the Great Basin, California, and the Northwest inventoried the vast range of wild plants available to and used by Native peoples. More recent studies are much more sophisticated, and despite the rapidly diminishing pool of native knowledge, or “ethnoscience,” try to uncover the myriad ways these wild resources were managed in lieu of true agriculture.<sup>40</sup>

In California, for instance, ecologist Kat Anderson has found, through interviews with Native American elders, that plant species used in basketry (such as deer grass and redbud) were either burned over or pruned to cause regrowth of straight, long stems or branches; sedge plots were weeded, spaced, and left fallow to produce rhizomes suitable for baskets; and plots of lilaceous bulbs were dug selectively, aerating the soil and severing and leaving smaller bulbs to grow back. The California researchers now use the word “environmental management” to refer to this bundle of sophisticated techniques, and recognize that Indians not only were causing significant alterations in their environment, as Lewis has shown, but also were probably directing change in the gene pool of selected species, as Anderson has suggested. In 1993, several significant California papers were published in *Before the Wilderness: Environmental Management by Native Californians*, an inspiration for this volume.<sup>41</sup>

For the Pacific Northwest, the problem of indigenous plant management was addressed at a symposium, “Was the Northwest Coast Agricultural?,” at the 1997 meeting of the American Association for the Advancement of Science. The proceedings of that symposium, edited by Douglas Deur and Nancy Turner, are to be published as a volume tentatively titled “*Keeping it Living*”: *Traditional plant tending and cultivation on the Northwest Coast*. Papers address several topics relevant to the contributions in this volume: the foraging-cultivation continuum and the definition of “agriculture”; management of two important wild root crops: camas among the Coast Salish and wapato (*Sagittaria latifolia*) among Chinookans; and plant management among two North Coast peoples, Tlingit and Tsimshian. Nancy Turner and Sandra Peacock, in “Anthropogenic Plant Communities of the Northwest Coast,” discuss (for British Columbia) several of the management techniques Kat Anderson has studied in California, including tilling, weeding and clearing, pruning, replanting and transplanting, and “gardening” of owned plots of important species, using a combination of techniques. They also survey eight “anthropogenic plant communities” in British Columbia, where the precontact vegetation cover was altered by human activities.

### *New Directions in Archaeology*

A few of the papers in *Keeping it Living* address specifically archaeological subjects. Douglas Deur discusses the archaeological evidence for Kwakwaka'wakw management of springbank clover (*Trifolium wormskejoldii*) in rock-lined plots along the coast, where they were "fertilized" by seaweed deposited at high tide; and for camas in Tillamook County (Oregon), where archaeological remains suggest a much wider distribution in pre-contact times, perhaps facilitated by burning to create suitable environments.<sup>42</sup> And Dana Lepofsky and colleagues from Simon Fraser University, in an innovative paper, describe their project to determine the antiquity of anthropogenic burning among the Sto:lo people of the lower Fraser River. Lepofsky *et al.* combine several research methodologies used by the contributors to *Indians, Fire, and the Land . . .*, including ethnographic interviews with elders, fire ecology (place and time of burns), carbon lenses in soil profiles, and palynological studies of changing vegetation.<sup>43</sup>

"Documenting Precontact Plant Management on the Northwest Coast: An Example of Prescribed Burning in the Central and Upper Fraser Valley, British Columbia" is significant not only for its methodology, but for what it hopes to find. Lepofsky *et al.* hypothesize that burning represented a form of "resource intensification" similar to that known archaeologically for salmon and camas, when improved knowledge and technology created increases in food supply, contributing indirectly to population growth and overall cultural complexity. They anticipate that the record will show evidence for increased burning and "burning specialists" (e.g., Ross, this volume) coincident with the appearance of more complex hierarchical social systems 2,500 year ago. Not mentioned, but possibly as important, may be the pronounced climatic cooling and retreat of productive dryland environments that occurred in the Northwest about the same time (Leopold and Boyd, this volume). As many important species became less common, knowledge of ways to maximize their growth may have been at a premium (LaLande and Pullen, this volume). In the southern Plateau, this "cooling down" period has been associated with several changes in adaptation, demography, and cultural complexity.<sup>44</sup> Holistic studies such as Lepofsky *et al.* hold great promise for future research.<sup>45</sup>

### *Fire Ecology*

Fire ecology itself is a new field. Development of the field was stymied for many years by what has been called the "Smokey the Bear syndrome": a pervasive belief, peculiar to Western cultures, that fire was a destructive force, particularly in forests, that had to be contained or eliminated. During the 1960s, the (non-governmental) annual Tall Timbers fire ecology conference was the only place where one might encounter researchers who were interested

in the positive effects of fire on the environment. With the growth of the field of ecology itself in the 1970s, it became apparent that fire was an integral part of an interrelated system of plants, animals, and the land. Its ecological benefits of cleansing, fertilizing, altering succession patterns, and creating mosaics high in species diversity emerged as a counterbalance to the more readily perceived problems of economic loss of timber and wildfire destructiveness. We now know that many forest and rangeland species, particularly in western North America, are adapted to regular low-level, recurrent fires, and that the raging wildfires characteristic of the post-settlement West are abnormal—a product, ironically, of the very policies that were instituted to prevent them. Forest and range managers just now are beginning to play catch-up with what the original inhabitants of the American West knew all along. Prescribed fire, mimicking pre-contact conditions, is a large part of the U.S. government's Northwest Forest Plan, in both coastal and interior lands. In the past fifteen years there have been several high-visibility conferences on fire ecology, and Stephen Pyne's books (*Fire in America*, 1981, and *World Fire: the culture of fire on earth*, 1995) have introduced the field to a broad audience. In the Pacific Northwest, two important volumes on fire ecology have appeared recently: John Walstad *et al.*'s 1990 *Natural and Prescribed Fire in Pacific Northwest Forests* and James Agee's 1993 *Fire Ecology of Pacific Northwest Forests*. In all of these more recent volumes there is a growing appreciation of the role of Native Americans in pre-settlement fire ecology; Agee in particular devotes several pages to it.<sup>46</sup>

### *Environmental History*

American historians also came to the topic of Indian fire use late, concurrent with the rise of the new subfield, environmental history, in the 1970s. Most environmental histories limit themselves to the relationship between the European colonists of North America and the land, but a few have adopted a more holistic approach, and have backtracked to consider the relationships of Native Americans and the land as well. Two of the most influential books in the sub-field, Richard White's *Land Use, Environment, and Social Change: the shaping of Island County, Washington* and William Cronon's *Changes in the Land: Indians, Colonists and the Ecology of New England* do just that, and lay considerable importance on the Indian use of fire in shaping the environment (White has said, "No single Indian practice contributed to more dramatic changes in North American environments."). These environmental historians have adopted (consciously or intuitively) the anthropological concept of "ecological transition," an abrupt shift in systemic relations, which like the more familiar concepts of demographic transition, epidemiological transition (or even scientific revolution) signifies a revolutionary change in the way

things are ordered. Regional environmental histories with this long historical perspective continue to be written: from the Northwest, three important works are Peter Boag's *Environment and Experience: settlement culture in nineteenth century Oregon*, Robert Bunting's *The Pacific Raincoast: environment and culture in an American Eden, 1778–1900*, and William Robbins's *Landscapes of Promise: the Oregon story, 1800–1940*.<sup>47</sup>

### *Introduction to the Papers*

As a result of the post-contact “ecological transition” in the Pacific Northwest, most of the environments first encountered by the Whites are gone or radically changed, and the knowledge that lay behind their active management has disappeared with them. We, the current inhabitants of the Northwest, need to know what these earlier environments were like—what their possibilities are—so we can best manage them for today. Most of the original ethnohistorical data on pre-White Northwest fire environments, scattered in early historical records, is not readily available. Much of that data is reprinted here. Since the early 1970s, regional anthropologists, their blinders to the effect of hunter/gatherer/fisherfolk on their environments removed, have documented the indigenous use of fire, both by recording early historical observations and by interviewing the few surviving native peoples who understood the patterns and remember some of the techniques. Again, we need to do our best to record and recreate this knowledge so it can serve us today. The papers reproduced here include the larger part of what is known about Indian environmental fire use in the Northwest.

The papers represent several different disciplines and approach the problem of aboriginal fire from several perspectives, each with its own methodology. Of the twelve, six are by anthropologists, three are by historians, two by botanists, and one by professional foresters. Several of the contributors are ethnobotanists; three are environmental historians; one of the anthropologists is an ethnohistorian; one of the botanists a palynologist. The papers come from all parts of the Native Northwest: northern B.C., British Columbia in general, the Montana Rockies, northeast Washington, the Columbia Plateau, Whidbey Island, southwestern Washington, the Willamette Valley, and southwestern Oregon. In addition, there is a comparative paper which considers indigenous burning in northern Alberta, northern California, Australia, and western Washington.

Nine of the papers originally were published elsewhere; the majority of these have been revised and updated. Three of the papers have not been published previously: two were prepared especially for this volume. The papers are presented in chronological order of first appearance. Ordering them in

this fashion shows how and when ideas first appeared, were picked up by different disciplines and applied to different areas, and how the pool of knowledge grew and the case for indigenous fire management in the Northwest became stronger.

All the papers reproduced here date from the second half of the twentieth century. But the oldest analytical work on regional fire use predates them by a century. This is James G. Cooper's "Report on the Botany of the Route," in volume 12 of the *Report of the Pacific Railroad surveys of 1853–55*.<sup>48</sup> Like many of the earliest explorers of the Northwest, Cooper noted the effects of Indian fires, but then went a step beyond to incorporate this observation in his theory of the origin of the "dry prairies" of western Washington. They were, he held, maintained by regular Indian burning.<sup>49</sup> Cooper also collected some 150 species of plants native to these managed prairies, and noted that their floral composition tied them to prairies in California and the Midwest. But as Richard White observes (in this volume), Cooper's insights were ignored for a century.

The first paper on anthropogenic fire printed here, David French's 1957 "Aboriginal Control of Huckleberry Yield in the Northwest" had different roots. French was aware of Omer Stewart's papers on the role of Indian fire in cultural evolution and shaping the environment, but his immediate concern was with what today would be called the "foraging-agricultural continuum," and the origins of agriculture itself. French's Indian informants, though not technically "agricultural," understood the principle of planting, and "managed" (although he did not use this word) a wild crop, the black mountain huckleberry, through burning. French's paper, though influential among local anthropologists, has never been published. The second paper, Richard White's "Indian Land Use and Environmental Change: Island County Washington, a Test Case" built on different precedents. White, a historian, had read Carl Sauer's works on environmental modification through fire, as well as Cooper's "Botany of the Route." Combined with contemporary anthropological data on Northwest Indian plant use plus his own historic research on the environment of Whidbey Island, White revived Cooper's argument that the prairies were shaped by Indian fire, and found a reason in the propagation of three useful plants. The paper, printed in *Arizona and the West* in 1975, was influential in the emerging field of environmental history. A third important regional paper, not reprinted here, was Helen H. Norton's 1979 "The Association between Anthropogenic Prairies and Important Food Plants in Western Washington." Norton, while acknowledging the precedents of Cooper and White, built on them. An ethnobotanist well versed in the growing regional descriptive school of Erna Gunther and Nancy Turner, she uncovered historical data on Indian fire use in the Nisqually Plains and analyzed Cooper's prairie plant list, making the discovery that an unusually large proportion of the

prairie plants were utilized by the Indians for food, technology, and medicine. By 1979 the link between Indian fires, environmental modification, and useful plants had become clearer.

In the early 1980s, on the eastern margin of the Pacific Northwest, foresters Stephen Barrett and Stephen Arno produced several papers on the effects of Indian fires on Rocky Mountain forests. The precedent here was the growing literature on fire ecology, and the desire to—using methodologies from forestry—test the hypothesis drawn from the local body of historical and ethnographic sources that Indian fire as well as natural fire had important effects on the environment. Helen Norton, Robert Boyd, and Eugene Hunn's 1983 "Klikitat Trail of South-Central Washington" returned to the records of the Pacific Railroad Surveys, in this case the journal of George McClellan, to study prairies situated along an otherwise forested, cross-montane trail. The journals contained evidence for anthropogenic fire, following Cooper, and Norton's analysis of a species list again showed a significant proportion of useful species. Robert Boyd's 1986 "Strategies of Indian Burning in the Willamette Valley" drew on two precedents: Henry Lewis's "Patterns of Indian Burning in California" and Carl Johannessen *et al.*'s "Vegetation of the Willamette Valley." Adding to Johannessen's list of sources on Indian fire, Boyd, following Lewis, analyzed the data in both a cultural and ecological context, and reconstructed the role of fire in the local subsistence round. Estella Leopold's 1988 "Ecological History of Old Prairie Areas in Southwestern Washington" drew on yet another line of evidence, that of palynology, to investigate the role of anthropogenic fire in the maintenance of regional prairies. Regional pollen sequences dating back several thousand years revealed a warm, dry period when the prairies were formed, followed by a cooler period until the present when human fires prevented their invasion by coniferous forests. Historical and ethnographic data subsequently supplied by Robert Boyd demonstrated the connection of fire to Indian subsistence. Henry Lewis and Theresa Ferguson's "Yards, Corridors, and Mosaics: How to Burn a Boreal Forest" builds on the fieldwork of Lewis and his student Ferguson on fire in several different foraging cultures, primarily northern Alberta and Australia, but also California and the Northwest. Like a companion paper by Lewis,<sup>50</sup> it searches for cross-cultural similarities in how foraging people burn their environments.

"Time to Burn: Traditional Use of Fire to Enhance Resource Production by Aboriginal Peoples in British Columbia," by ethnobotanist Nancy Turner, draws on all previous regional papers for its inspiration, but, with field data and an emphasis that are particularly Turner's: extensive ethnographic interviews on the role of fire in the management of specific useful plant species native to British Columbia. William Robbins' 1993 "Landscape and Environment: Ecological Change in the Intermontane Northwest" returns to

the broader concern of environmental historians with the effect of anthropogenic fire on the landscape itself: precedents are White, Cronon, and Sauer. Robbins' data for the Columbia Plateau come mostly from his own historical research, but are influenced by rangeland manager Dean Shinn's "Historical Perspectives on Range Burning in the Inland Pacific Northwest"<sup>51</sup> and Eugene Hunn and Robert Boyd's anthropological studies. Indian fire is one of several human-caused environmental influences in the Northwest since the last glaciation. Ethnobotanist Leslie Johnson's 1994 "Aboriginal Burning for Vegetation Management in Northwest British Columbia" is based upon several years of field work among the Gitksan and Wet'suwet'en peoples and is firmly in the school of Turner and Lewis: emphasizing the role of fire in the management of particular useful plant species as well as in shaping local environments. Jeff LaLande and Reg Pullen's "Burning for a 'Fine and Beautiful Open Country': Native uses of fire in Southwestern Oregon" builds on the work of Lewis and Boyd in adjacent Northern California and the Willamette Valley, with data collected by Pullen from the unpublished fieldnotes of ethnographers such as John Harrington, plus a concern with historical change and management issues arising from LaLande's historical studies and work with the U.S. Forest Service. John Ross's "Protohistorical and Historical Spokane Prescribed Burning and Stewardship of Resource Areas" is based upon several decades of fieldwork with the Spokane people. Ross shares with Hunn and Turner a concern with "traditional ecological knowledge" concerning fire management of useful species, and offers a perspective on fire use among eastern Salishan peoples that complements the more experimental methods and scientific data of Barrett and Arno.

### Notes

1. George Vancouver, *A Voyage of Discovery to the North Pacific Ocean and Round the World, 1791-1795*, vol. II. W. Kaye Lamb ed. (London, 1984), 568.
2. Whidbey's observations are recorded in Archibald Menzies, "Menzies' Journal of Vancouver's Voyage, April to October, 1792" (*Archives of British Columbia Memoir V*, 1923), 48. The list of berries comes from Edward Bell, "A New Vancouver Journal" (*Washington Historical Quarterly* 5 and 6 var. pp., 1914 and 1915), 222. The "onions" were most likely camas lilies (*Camassia quamash*), in flower at the time of Vancouver's visit, though species of *Allium* also are native to the Northwest.
3. Jay Miller, letter to Robert Boyd, May 28, 1996.
4. Upper Rogue, upper Umpqua, Willamette, and Cowlitz valleys; Puget Sound and Strait of Georgia islands.
5. E.g., Hunn, Turner, Johnson, and Ross.
6. This paragraph draws on several papers presented in the 1997 American Association for the Advancement of Science symposium, "Was the Northwest Coast 'Agricultural'?", particularly the title paper, by Douglas Deur;

“Anthropogenic Plant Communities on the Northwest Coast: An ethnobotanical perspective,” by Nancy Turner; and “Coast Salish Resource Management: Incipient Agriculture?,” by Wayne Suttles.

7. James K. Agee, *Fire Ecology of Pacific Northwest Forests* (Washington, D.C., 1993).

8. The definition is from James Omernik, “Ecoregions of the Conterminous United States” (*Annals of the Association of American Geographers* 77(1): 118–25, 1987), 123. The standard work on ecoregions in Washington, Oregon, and Idaho is by Omernik and Alisa Gallant, *Ecoregions of the Pacific Northwest* (Corvallis, 1986). For British Columbia, the best delineation of ecoregions is by Dennis Dimarchi *et al.*, in the “Environment” chapter of R. Wayne Campbell *et al.*’s *The Birds of British Columbia*, vol. 1: 55–144 (Vancouver, 1997). For Oregon, an equivalent detailed delineation is the Defenders of Wildlife’s *Oregon’s Living Landscape: Strategies and opportunities to conserve biodiversity* (Portland, 1998). On the related topic of vegetation cover, standard works are Jerry Franklin and C. T. Dyrness, *Natural Vegetation of Oregon and Washington* (Corvallis, 1988) and Del Meidinger and Jim Pojar’s *Ecosystems of British Columbia* (Victoria, 1991).

9. There are several pertinent sources, but the best summaries appear in Wayne Suttles’s “Introduction” to *Northwest Coast*, vol. 7 of the *Handbook of North American Indians* (pp. 1–15, Washington, D.C., 1990) and the equivalent chapter by Deward Walker in *Plateau*, vol. 12 of the *HNAI* (pp. 1–7, Washington, 1998).

10. John Hoskins, “Narrative...,” pp. 161–289 in *Voyages of the “Columbia” to the Northwest Coast, 1787–1790 and 1790–1793*, F. W. Howay, ed. (*Massachusetts Historical Society Collections* 79, 1941), 243; and LaLande and Pullen (this volume).

11. LaLande and Pullen (this volume), Warren Vaughan, “Early History of Tillamook” (ms. in Multnomah County Library, Portland); Reagan in Lewis and Ferguson (this volume).

12. Elizabeth Jacobs, “Nehalem Tillamook Ethnographic Notes,” William Seaburg, ed. (ms. in Seaburg’s possession).

13. Agee, 192.

14. Helen H. Norton, “The Association between Anthropogenic Prairies and Important Food Plants in Western Washington” (*Northwest Anthropological Research Notes* 13(2): 175–200, 1979), Appendix 1.

15. Douglas Deur, “Was the Northwest Coast Agricultural?,” paper presented at symposium of the same name, 1997 Meeting of the American Association for the Advancement of Science, Seattle.

16. Vaughan, “Early History of Tillamook.”

17. In “wet Douglas-fir” forests such as the Coast Range, fire-return intervals are long and stand-replacement fires usual. In the Coast Range of Oregon, fire histories show marked differences (in fire frequency and type) between the relatively wet ocean-facing west versus the drier eastern Willamette Valley margin. It has been hypothesized that late summer/early fall Indian-set prairie fires, abetted by seasonal east winds, were a significant factor in these differences. (Peter Impara, “Spatial and Temporal Patterns of Fire in the Forests of the Central Oregon Coast Range,” PhD dissertation, Oregon State University, 1997.)

18. Franklin and Dyrness, *Natural Vegetation of Oregon and Washington*, 88.

19. Two other important sources are Helen H. Norton, “The Association between Anthropogenic Prairies and Important Food Plants in Western Washington” (*Northwest Anthropological Research Notes* 13(2): 175–200, 1979) and Patrick Dunn

- and Kern Ewing, eds. *Ecology and Conservation of the South Puget Sound Prairie Landscape* (Seattle: The Nature Conservancy of Washington, 1997).
20. See George Dickey, ed., *The Journal of Occurrences at Fort Nisqually, Commencing May 30, 1833; Ending September 29, 1859* (Fort Nisqually Association, 1993). See also Norton, "Association . . .," 180–81.
21. George Gibbs, "Tribes of Western Washington and Northwestern Oregon" (*Contributions to North American Ethnology* 1(2): 157–361, 1877), 193.
22. Joseph Clark, *Lights and Shadows of Sailor Life* (Boston, 1847), 222. Though Clark does not mention fire, it was an integral component of the sequence, as the Fort Nisqually Journal citations demonstrate.
23. Carl Johannessen *et al.*, "The Vegetation of the Willamette Valley" (*Annals of the Association of American Geographers* 61(2): 286–302, 1971). A later version is in *Oregon's Living Landscape*, 194. As of this writing, the Oregon Natural Heritage Program is preparing a detailed, large-scale map of pre-settlement Willamette Valley plant cover. The map in Boyd (this volume) is an early draft.
24. Leland Gilson, Luckiamute Basin Survey (ms., 1989).
25. On the latter, see Henry Lewis's classic "Patterns of Indian Burning in California: Ecology and ethnohistory," pp. 27–54 in Blackburn and Anderson, *Before the Wilderness . . .* (1993).
26. See John Evans, "Journal, July 11, 1854–August 4, 1856" of a geological survey of the Rogue (typescript of ms. in Library of Congress, Oregon Historical Society, Portland). This pattern is described for northwestern California and other regions in Henry Lewis's "Patterns of Indian Burning in California" and Lewis and Ferguson's "Yards, Corridors, and Mosaics" (this volume). Evans's descriptions especially recall those in George Gibbs's contemporary journal from the neighboring Klamath Valley, "Journal of the Expedition of Colonel Redick M'Kee, United States Indian Agent, through North-Western California. Performed in the Summer and Fall of 1851." pp. 99–177 in vol. 3 of Henry Schoolcraft, ed., *Historical and Statistical Information Respecting the History, Condition and Prospects of the Indian Tribes of the United States* (Philadelphia, 1853). Neither Evans nor Gibbs, however, specifically mention fire.
27. Pre-contact fire intervals in "dry Douglas-fir" forests were typically more closely spaced than those in "wet Douglas-fir" forests, individual fire extents were smaller, and the fires themselves were less severe. Forests in the western Cascades of Oregon at contact were apparently patchworks composed of mosaics of different-aged stands. There have been several studies of Cascade Range Douglas-fir fire histories; the best known is Peter Teensma's "Fire History and Fire Regimes of the Central Western Cascades of Oregon" (PhD dissertation, University of Oregon, 1987). See also Wallin *et al.* 1996 (fn. 7, conclusion).
28. Sahaptin-speaking peoples include most of the Warm Springs peoples, Yakama, Walla Walla, Palouse (all in the Columbia Basin ecoregion); and Taitnapam and Klikitat (in the Cascade ecoregion) (see Map 1).
29. See Eugene Hunn, *Nch'i-Wána, "The Big River": Mid-Columbia River Indians and Their Land* (Seattle, 1990), 119–34; and Alan Marshall, *Nez Perce Social Groups: An ecological interpretation* (Ph.D. dissertation, Washington State University, 1977).
30. The evidence consists of a body of fifteen citations, drawn from Robbins and this author's notes (1806–1858): four citations date from May 1 through June 15;

- seven from August 2 through September 3, and four (all, unfortunately, from 1834) from the third week of August through September 1.
31. Verne Ray, "Culture Element Distributions XXII: Plateau" (*Anthropological Records* 8: 99–258, 1942), 117, 132.
32. Marshall, "Wild Horticulture: The Nez Perce subsistence base" (paper presented at the 1991 meeting of the American Anthropological Association, Chicago).
33. Cline, Walter *et al.*, "The Sinkaietk or Southern Okanogan of Washington" (*General Series in Anthropology* no. 6, 1938), 19.
34. See also Nancy Turner *et al.*, Thompson Ethnobotany: Knowledge and Usage of Plants by the Thompson Indian People of British Columbia (*Royal British Columbia Museum Memoir* No. 3, 1990) and N. Turner, "Plant Resources of the *Sel'at'imx* (Fraser River Lillooet) People: A Window into the Past," pp. 405–69 in Brian Hayden, ed., *A Complex Culture of the British Columbia Plateau: Traditional Sel'at'imx Resource Use* (Vancouver, 1992).
35. See Loren Eiseley, "Man the fire-maker" (*Scientific American* 191: 52–57), 1954; Kenneth Oakley, "On man's use of fire, with comments on tool-making and hunting," pp. 176–93 in Sherwood Washburn, ed., *The Social Life of Early Man* (New York, 1961); and Walter Hough, "Fire as an agent in human culture" (*U.S. National Museum Bulletin* 139, 1926).
36. Sauer's relevant works include "A Geographic Sketch of Early Man in America" (*Geographical Review* 34(4): 529–73, 1944); "Grassland Climax, Fire, and Man" (*Journal of Range Management* 3(10): 16–21, 1950); "Fire and Early Man" (*Paideuma* 7: 399–407, 1962); and "Man's Dominance by Use of Fire," (*Geoscience and Man* 10: 1–13, 1975).
37. Perhaps the most notable of Sauer's followers is William Denevan of the University of Wisconsin. See in particular his "The Pristine Myth: The Landscape of the Americas in 1492," in the special 1992 issue of the *Annals of the Association of American Geographers*, commemorating the Columbian quincentenary. William Dickinson's 1994 presidential address to the Geological Society of America, "The times are always changing: The Holocene saga" (*GSA Bulletin* 107(1): 1–7, 1995), is yet another example of how this theme has entered the scientific mainstream.
38. Stewart's important papers, noted in several of the contributions to this volume, include "Burning and Natural Vegetation in the United States" (*Geographical Review* 41(2): 317–20, 1951); "Why the Great Plains are treeless" (*Colorado Quarterly* 2: 40–50, 1953); "The Forgotten Side of Ethnogeography," pp. 221–48 in Robert Spencer, ed., *Method and Perspective in Anthropology* (Minneapolis, 1954); "Forest Fires with a Purpose," "Why Were the Prairies Treeless?" and "Forest and Grass Burning in the Mountain West," all in *Southwestern Lore*, 1954–1955; and "Fire as the First Great Force Employed by Man," pp. 115–33 in William Thomas, ed., *Man's Role in Changing the Face of the Earth* (Chicago, 1956). Stewart's recent biography, *Cannibalism is an acquired taste: and other notes from conversations with anthropologist Omer C. Stewart* (Carol Howell, ed.; Niwot, CO, 1998), contains a section on his work on anthropogenic fire written by Henry Lewis. As of this writing (1998), Stewart's "800 page" manuscript is being edited by Lewis and Kat Anderson, and will be published by the University of Oklahoma Press. For two other contributions on fire and the Great Plains (by an anthropologist and limnologist) see Waldo Wedel, "The

Central North American Grassland: Man-made or Natural?," pp. 39–69 in *Studies in Human Ecology* (Washington, 1957), and Philip Wells, "Historical Factors Controlling Vegetation Patterns and Floristic Distributions in the Central Plains Region of North America," pp. 211–21 in Wakefield Dordt and J. Knox Jones, eds., *Pleistocene and Recent Environments of the Central Great Plains* (Manhattan, KN, 1970).

39. Lewis's relevant papers include *Patterns of Indian Burning in California: Ecology and Ethnohistory* (orig. 1973; reprinted in 1993 as pp. 55–116 in Thomas Blackburn and Kat Anderson, "Before the Wilderness: Environmental Management by Native Californians" [*Ballena Press Anthropological Paper #40*]); "The Role of Fire in the Domestication of Plants and Animals in Southwest Asia: A Hypothesis" (*Man* 7(2): 195–222, 1977); "Maskuta: The ecology of Indian fires in Northern Alberta" (*Western Canadian Journal of Anthropology* 7(1): 15–52, 1977); "Fires of spring" (film, 1978) and "Indian fires of spring" (*Natural History* 89: 76–83, 1980); *A Time for Burning: Traditional Indian Uses of Fire in the Western Canadian Boreal Forest* (Edmonton, 1982); "Fire Technology and Resource Management in Aboriginal North America and Australia," pp. 45–67 in Eugene Hunn and Nancy Williams, eds., *Resource Managers: North American and Australian Hunter-Gatherers (AAAS Selected Symposium #67, 1982)*; "Yards, Corridors, and Mosaics: How to Burn a Boreal Forest" (with Theresa Ferguson; 1988 and this volume); "Non-Agricultural Management of Plants and Animals," pp. 54–74 in Robert Hudson, K. R. Drew, and Leonid Baskin, eds., *Wildlife Production Systems: Economic utilization of wild ungulates* (Cambridge, 1989); "Ecological Knowledge of Fire: Aborigines vs. Park Rangers in Northern Australia" (*American Anthropologist* 91(4): 940–61, 1989), "Technological Complexity, Ecological Diversity, and Fire Regimes in Northern Australia: Hunter-Gatherer, Cowboy, Ranger," pp. 261–88 in A. T. Rambo and K. Gillogly, eds., "Profiles in Cultural Evolution" (*University of Michigan Anthropological Paper No. 85, 1991*); and "Management Fires vs. Corrective Fires in Northern Australia: An Analogue for Environmental Change" (*Chemosphere* 29(5): 949–63, 1994).

40. Julian Steward's "Ethnography of the Owens Valley Paiute" (*University of California Publications in American Archaeology and Ethnography* 33(3), 1933) initiated the discussion on West Coast resource management without agriculture; James Downs, in "The Significance of Environmental Manipulation in Great Basin Cultural Development," pp. 39–56 in Warren d'Azevedo *et al.*, *The Current Status of Anthropological Research in the Great Basin: 1964* (Reno, 1966) introduced the term "environmental manipulation." For an influential review of the California proto-agriculture issue, see Lowell Bean and Harry Lawton's "Some Explanations for the Rise of Cultural Complexity in Native California with Comments on Proto-Agriculture and Agriculture" (orig. 1973; reprinted in 1993 as pp. 27–54 in "Before the Wilderness . . ."). Representative and well-known examples of the early classificatory phase of West Coast ethnobotany include George Mead's "The Ethnobotany of the California Indians: A compendium of the plants, their users, and their uses" (*University of Northern Colorado Occasional Publications in Anthropology, Ethnology Series no. 30, 1972*) and Erna Gunther's "Ethnobotany of Western Washington" (*University of Washington Publications in Anthropology* 10, 1945; rev. ed. 1973, University of Washington Press).

41. The most thorough treatment of (Marion) Kat(harine) Anderson's research is her 1993 dissertation, "The Experimental Approach to Assessment of the Potential

Ecological Effects of Horticultural Practices by Indigenous Peoples of California Wildlands" (Ph.D. dissertation, Wildland Resource Science, University of California); pertinent published articles include "California Indian Horticulture: Management and Use of Redbud by Southern Sierra Miwok" (*Journal of Ethnobiology* 11(1): 145–51, 1991), and "The Ethnobotany of Deergass, *Muhlenbergia rigens* (P)oaceae: Its uses and fire management by California Indian tribes" (*Economic Botany* 50(4): 409–22, 1996) and "From Tillage to Table: The indigenous cultivation of geophytes for food in California" (*Journal of Ethnobiology* 17(2): 149–69, 1997) on utilized species; "Tending the Wilderness" (*Restoration and Management Notes* 14(2): 154–66, 1996), "California's Endangered Peoples and Endangered Ecosystems" (*American Indian Culture and Research Journal* 21(3): 7–31, 1997), and (with Michael Barbour and Valerie Whitworth) "A World of Balance and Plenty: Lands, Plants, Animals and Humans in a Pre-European California," pp. 12–47 in Ramon Gutierrez and Richard Orsi, eds., *Contested Eden: California before the Gold Rush* (Berkeley, 1997) on broader management and ecosystem issues. "Before the Wilderness: Environmental Management by Native Californians," edited by Thomas Blackburn and Kat Anderson, was published as *Ballena Press Anthropological Paper* no. 40 (Menlo Park, CA, 1993).

42. See also Deur's "Salmon, Sedentism, and Proto-Cultivation: Towards an Environmental Prehistory of the Northwest Coast," to appear in Paul Hirt and Dale Goble, eds., *Northwest Lands and Peoples: An Environmental Anthology*. (Seattle, in press).

43. Among the small body of regional palynological studies few (e.g. Leopold and Boyd, this volume) consider the human factor in pre-settlement vegetation change. Other researchers, however, recognize the need. See Richard Hebda and Cathy Whitlock, "Environmental History" (pp. 227–54 in Peter Schoonmaker, Bettina von Hagen, and Edward Wolf, *The Rainforests of Home: Portrait of a North American Bioregion*. Washington, 1997), 247–48.

44. See James Chatters, "Population Growth, Climatic Cooling, and the Development of Collector Strategies on the Southern Plateau, Western North America" (*Journal of World Prehistory* 9(3): 341–400, 1995).

45. For a second recent archaeological study that uses charcoal remains and palynology to determine past patterns of anthropogenic burning, see Paul Delcourt *et al.*, "Prehistoric Human Use of Fire, the Eastern Agricultural Complex" and "Appalachian Oak-Chestnut forests: Paleoecology of Cliff Palace Pond, Kentucky" (*American Antiquity* 63(2): 263–78, 1998). Delcourt *et al.* hypothesize that a local vegetation shift from fire-intolerant cedars to fire-tolerant oak and chestnut (plus associated useful understory species) was due largely to purposive anthropogenic burning.

46. An early article, cited in the first paper of this volume, is Charles Cooper's 1961 "The Ecology of Fire" (*Scientific American*, April 1961: 150–60). A selection of papers from the early years of the Tall Timbers proceedings gives an idea of the breadth and significance of their contributions, e.g.: "Fire, a Tool Not a Blanket Rule in Douglas-fir Ecology" (Leo Isaac, vol. 1: 1–17, 1962), "Fire Ecology—Grasslands and Man" (Edwin V. Komarek, vol. 4: 169–220, 1965), "Fire and the Ecology of Man" (Komarek, 6: 142–170, 1967), "Fire and Animal Behavior" (Komarek, 8: 160–206, 1969), "Prescribed Burning for Elk in Northern Idaho" (Thomas Legee, 8: 235–53, 1968), "The Forest Primeval in the Northeast—A Great Myth?" (Daniel Thompson and Ralph Smith, 10: 255–65, 1970). Three

- notable recent volumes arising from symposia, all edited by Johann Goldammer, are *Fire in the Tropical Biota: Ecosystem processes and global challenges*, *Fire in Ecosystem Dynamics: Mediterranean and Northern perspectives* (both 1990; The Hague and New York) and *Fire in the environment: The ecological, atmospheric, and climatic importance of vegetation fires* (New York, 1993). Stephen Pyne's books originally were published by Princeton and Holt; both were reprinted in 1997 by the University of Washington Press. Walstad *et al.*'s volume is from Oregon State University Press; Agee's from Island Press, Washington, D.C. A classic, yet older, regional study is Rexford Daubenmire's "Ecology of Fire in Grasslands," pp. 209–66 in J. B. Cragg, ed., *Advances in Ecological Research* vol. 5 (New York, 1968).
47. See Richard White's "American Environmental History: The Development of a New Historical Field" (*Pacific Historical Review* 54(3): 297–337, 1985). "Indians in the Land: A conversation between William Cronon and Richard White" (*American Heritage*, Aug–Sept 1986, 19–25) is a stimulating introduction to some of the ideas of the environmental historians about Indian land use. The quotation from White comes from his co-authored (with Cronon) "Ecological Change and Indian-White Relations," pp. 417–29 in Wilcomb Washburn, ed., *History of Indian-White Relations*, vol. 4 of the *Handbook of North American Indians* (Washington, 1988), 421. On the concept of ecological transition, see John Bennett, *The Ecological Transition: Cultural anthropology and human adaptation* (New York, 1976). Boag's *Environment and Experience* was published in 1992 by the University of California Press; Bunting's *The Pacific Raincoast* in 1997 by the University of Kansas, and Robbins's *Landscapes of Promise* in 1997 by the University of Washington Press.
48. Pp. 13–70 in volume 12 of *Report of Explorations and Surveys to Ascertain the Most Practicable and Economical Route for a Railroad from the Mississippi River to the Pacific Ocean . . .* 36th Cong., 1st Sess., House Executive Document 56 (Serial Set no. 1055).
49. The crucial passage from "Botany of the Route" is reproduced in Lewis and Ferguson (this volume).
50. "Fire Technology and Resource Management in Aboriginal North America and Australia," pp. 45–67 in Eugene Hunn and Nancy Williams, eds., *Resource Managers: North American and Australian Hunter-Gatherers* (*AAAS Selected Symposium #67*, 1982).
51. *Journal of Range Management* 33(6): 415–23, 1980.