TESTIMONY BEFORE THE U.S. HOUSE OF REPRESENTATIVES SUBCOMMITTEE ON FORESTS AND FOREST HEALTH OVERSIGHT HEARING ON THE DECLINE OF ASPEN IN THE WESTERN UNITED STATES.

May 14, 1998

Charles E. Kay
Institute of Political Economy
Utah State University
Logan, UT 84322-0725

I would first like to thank the Chairman and the Committee for inviting me to testify here today. I have a B.S. in Wildlife Biology and a M.S. in Environmental Studies both from the University of Montana, and a Ph.D. in Wildlife Ecology from Utah State University. I am presently an Adjunct Assistant Professor in the Department of Political Science and a Senior Environmental Scholar at that University's Institute of Political Economy. I have conducted extensive research on aspen in Utah, Wyoming, Idaho, and Montana, including Yellowstone National Park. In addition, at the request of Parks Canada, I have conducted research on aspen in Banff, Yoho, and Kootenay National Parks. Moreover, I have traveled widely throughout the West and am familiar with aspen management problems in Arizona, New Mexico, Colorado, and South Dakota. In fact, during the last ten years, I have personally collected data on more aspen stands, in more areas than any other ecologist in western North America. My research on aspen and long-term ecosystem states and processes in the West has been widely published in books and scientific journals, and I have submitted copies of those papers to the committee's staff.

Aspen Ecology

To properly manage western aspen stands, it is first necessary to have a basic understanding of aspen ecology. Contrary to popular perception, aspen is not a seral species because, under present climatic conditions, it does not reproduce from seed in the Intermountain West, and has probably not done so for the last 10,000 years. Aspen does produce millions of viable seeds each year, but the species has exceedingly demanding seedbed requirements. In fact, during the period of recorded history, there is no evidence that even a single aspen clone has been successfully established from seed on natural substrates anywhere in the West. Aspen seedlings are more common in the northern Canadian Rockies and in eastern North America, and there may be windows of opportunity that allow seedling establishment at infrequent intervals of 200 to 400 years or longer in the West, but successful sexual reproduction of aspen is still exceedingly rare. Even in northern Canada and the eastern United States, forest management practices discount the possibility that aspen will successfully established from seed.

Instead, aspen reproduces by vegetative means where new shoots or suckers arise from existing root stocks - - this is termed root-sprouting or root suckering. Thus, all the stems within a clone are genetically alike having arisen from a common root system, and the clone is the individual organism, not each aspen tree. This means that aspen clones found in the West today have likely survived for thousands of years via vegetative regeneration. Some clones in the southern Rockies are thought to be as much as a million years old. So, in a sense, western aspen represents old-growth ancient forests, not seral plant communities. Aspen, in fact, may be among the longest-lived organisms on Earth.

Western aspen clones are also generally quite large. In Yellowstone, for example, randomly selected aspen stands averaged more than an acre in size, and larger clones are common. One clone in southern Utah, named Pando, contains an estimated 47,000 stems, covers 106 acres, and weighs approximately 6,000 tons, making it the largest known living organism on Earth. More importantly, if aspen is replaced by invading conifers or lost due to overbrowsing, there are no proven means of reestablishing those clones - - this is one reason why the decline of aspen is one of the most important, if not the most important, forest health issue in the West.

Although individual trees within a clone are relatively short-lived, usually less than 150 years, long-lived aspen clones are often dependent on periodic disturbance, such as fire, to stimulate vegetative regeneration via root suckering and to reduce competition from conifers. Aspen will "appear" after a fire, though, only if it is already present - - that is, if the clones are already established. It will not seed onto the site. Thus, the presence of aspen indicates a long history of past disturbance, primarily frequent fire. Fire-return intervals of 20 to 130 years are necessary to maintain aspen, and as fire cycles lengthen, aspen is eliminated.

At current rates of burning, it would require about 12,000 years to burn the entire aspen type in the West. So something is clearly different today than it was in the past, and if present trends are allowed to continue, much of the aspen in the West will be lost during our lifetimes. It should be noted, however, that approximately one-third of western aspen may be potentially climax - - these stands lack invading conifers, and even in the absence of fire or other disturbance, they will successfully regenerate via root suckering, producing mixed-age stands, if browsing is not excessive (see below).

The decline of aspen in the West

Based on early photographs and other historical records, the area occupied by aspen in the West has already decline by 60 to 90 percent, or more, since European settlement. Even in National Parks, aspen is in serious decline, and in some parks it is nearing ecological extinction. In Yellowstone, for example, the area occupied by aspen has declined by approximately 95%, and at least a third of the park's aspen clones have been eliminated since that area was set aside as this nation's, and the World's, first national park in 1872. Similarly, aspen is in serious decline in Colorado's Rocky Mountain National Park, New Mexico's Bandelier National Monument, as well as in Canada's Banff, Jasper, Yoho, and Kootenay National Parks. In fact, based on inside-outside park comparisons, aspen is generally in worse condition inside parks and other protected areas than it is on adjacent multiple-use lands. Moreover, many western aspen stands contain old-age or single-age trees and have not successfully regenerated for 80 years or longer.

This is important because aspen communities support an array of other species and have the highest biodiversity of any upland forest type in western North America. Bird communities, for instance, vary with the size, age, and location of aspen clones, as well as with grazing intensity and history. If aspen is lost, many birds and small mammals will decline, some precipitously. Thus, aspen is an excellent indicator of ecological integrity and forest health. Canada, for instance, has designated aspen as a key indicator of ecological integrity in her Rocky Mountain national parks.

Why is aspen declining?

Before European settlement, aspen burned at frequent intervals throughout the West, and it is generally assumed that those fires were started by lightning. Research and experience, though, have proven that aspen is extremely difficult to burn. "Asbestos type" and "firebreak" are terms often used to describe aspen. Crown fires in conifers drop to the ground when they encounter aspen and, before autumn leaf-fall, spread only short distances into aspen stands. Researchers have noted that "wild fires that had burned thousands of acres of shrubland or conifer types during extreme burning conditions usually penetrated less than 100 feet into pure aspen stands." Lightning-fire ignition rates for aspen are also the lowest of any western forest type, and overall ignition rates are less than half that for all other cover types, including grasslands.

Aspen will readily burn only when the trees are leafless and understory plants are dry - - conditions that occur only in early spring or during late fall. Before May 15 and after September 15, when aspen is normally dry enough to burn, however, there are few lightning strikes and virtually no lightning fires in the Rockies - - see Figures 1 and 2. So if aspen burned at frequent intervals in the past, as fire-frequency data and historical photographs indicate it did, then the only logical conclusion is that those fires had to have been set by Native Americans, who used fire to manage plant communities for human benefit. So, aspen is declining due to active fire suppression by various government agencies and the lack of aboriginal burning. That is to say, aspen has not been and is not now being disturbed at frequent enough intervals - - in short, the stands need more disturbance. Historically, the trees in most aspen stands were less than 80 years of age while today, most aspen stands rarely contain trees less than 80 years old. Contrary to popular perception, there were relatively few old-age aspen trees in the past, unlike current conditions.

This, though, is only part of the problem, for even where aspen has been burned or logged, it has often failed to successfully regenerate - - defined as producing new stems greater than six feet tall. In Yellowstone, for example, the 1988 wildfires burned approximately one-third of the aspen in the park, yet none of those stands has successfully regenerated because all the new aspen suckers were repeatedly eaten to within inches of the ground by elk and other wild ungulates. The same is true in Canada's Banff National Park where Parks Canada has been forced to curtail its prescribed burning program because elk were severely browsing all the new aspen suckers. In fact, research has shown that fire or logging only hastens the decline of aspen where herbivory is not controlled.

The same is true in Utah where I recently measured all the aspen containing exclosures on the Fishlake and Dixie National Forests. Several of the exclosures were of a three-part design with a total exclusion portion fenced to exclude all ungulates, a livestock exclusion portion fenced to exclude livestock but to allow access by wild ungulates, and a combined-use portion where all ungulates, wild and domestic, are free to graze. By monitoring aspen stem dynamics on these three treatments, the effects of deer and elk herbivory can be measured separately from that of livestock, in this case cattle.

Aspen within all total exclusion plots successfully regenerated and developed multi-aged stems without fire or other disturbance, while aspen subjected to browsing by only wildlife, either failed to successfully regenerate or regenerated at significantly lower stem densities than aspen on total exclusion plots. Moreover, on combined wildlife-livestock use plots, most aspen failed to successfully regenerate, or did so at even lower stem densities. This means that even if all livestock were removed from our public ranges, deer and elk alone would still prevent most aspen regeneration. More importantly, aspen stands dominated by old-age or single-age trees, as is now common throughout the West, are not a biological attribute of aspen, as generally assumed, but an artifact of excessive browsing. In Arizona, for instance, the Forest Service has had to fence treated aspen stands to keep elk from consuming all the new suckers, and when the fencing was removed after several years, elk still killed most of the new aspen trees by breaking stems and browsing.

Since it is often assumed that large numbers of elk and other ungulates inhabited the West before game populations were decimated by European settlers, this raises the question of how aspen was able to survive for the last 10,000± years. First, historical photographs show that aspen throughout western North America was virtually unbrowsed during the 1800s, unlike conditions today; i.e. the condition of the vegetation in early photographs indicates that all ungulates were rare. Second, historical journals indicate that elk and other ungulates were actually quite rare in the Intermountain West, contrary to popular perception. Between 1835 and 1876, for instance, explorers spent 765 days in the Yellowstone ecosystem on foot or horseback, yet they reported seeing elk only once every 18 days - - today there are nearly 100,000 elk in that ecosystem. Similarly, between 1792 and 1872, 26 expeditions spent 369 days traveling through the Canadian Rockies yet reported seeing elk only 12 times, or once every 31 party-days. During early historical times, elk were also rarely seen in Utah, Arizona, New Mexico, or Colorado. Moreover, archaeological data indicate that elk and other ungulates were rare in pre-Columbian times, as well. Of the ungulate bones unearthed at more than 400 archaeological sites throughout the Rockies, elk accounted for only 3 percent of the total. Even where elk are numerous today, their bones are rarely recovered from archaeological sites - - this is especially true in Yellowstone and other national parks.

Simply put, the available data suggest that there are more elk on Intermountain ranges today than at anytime in the last 10,000 years. Similarly, there are more mule deer on western ranges today than at anytime during the last 10,000 years, except for the 1950-1960's, and 1980's. As I have explained in various scientific publications (i.e., see Human Nature 5:359-398, Western Journal of Applied Forestry 10:121-126, and Alces 33:141-164), hunting by Native Americans once kept ungulate populations in check. In fact, by keeping ungulate populations low, Native Americans actually promoted biodiversity; i.e., Native Americans were the ultimate keystone predator.

Management Considerations

Aspen then is an excellent indicator of ecological integrity and forest health because its condition and trend provides information on long-term ecosystem states and processes. And as Aldo Leopold noted some 40 years ago, "if we are serious about restoring ecosystem health and ecological integrity, then we must know what the land was like to begin with."

The very presence of aspen, for instance, indicates that aboriginal burning was once widespread. Determining how fires started is critical because fires set by hunter-gatherers differ from lightning fires in terms of seasonality, frequency, intensity, and ignition patterns. Most aboriginal fires were set in the spring, between snowmelt and vegetation greenup, or late in the fall when burning conditions were not severe. Unlike lightning fires, which tend to be infrequent, high-intensity infernos, native burning produced a higher frequency of lower-intensity fires. Aboriginal burning and lightning fires thus create different vegetation mosaics and, in many instances, entirely different plant communities. Moreover, aboriginal burning reduced the number of high-intensity, lightning-generated fires. Once aboriginal fires opened up the vegetation then subsequent lightning fries behaved like those set by Native Americans.

Aspen also indicates that Intermountain ecosystems developed with relatively low levels of ungulate herbivory. This, in turn, suggests that today's land managers will have to control grazing if western aspen communities are to survive. Populations of elk and deer on most western ranges today clearly exceed their range of historical variability - - i.e. populations are much higher than they have ever been before. Aspen in the past was perpetuated and probably enhanced by aboriginal land management, so the only way to maintain or restore western aspen communities is through active management.

This also applies to other western forests and rangelands, since there is no evidence that Native Americans specifically managed aspen communities. Instead, aspen was managed as part of a larger landscape. As a result, the Americas as first seen by Europeans had been shaped by native peoples for at least 12,000 years. There was no wilderness. Unless the importance of aboriginal burning and hunting is recognized and modern management practices changed accordingly, our ecosystems will continue to lose the biological diversity and ecological integrity they once had. Although managing nature may appear to be an oxymoron, federal and state agencies must actively manage aspen to ensure its survival at anything approaching historical levels, or properly functioning aspen communities will become a thing of the past.

Maintaining and restoring aspen are important because, as mentioned above, those communities have exceedingly high biodiversity, second only to riparian areas on western ranges, and because aspen covers millions of acres across the West. Beaver, a critical keystone species, for instance, often depend on healthy aspen communities. In addition to forest products, aspen communities produce forage for both wildlife and domestic livestock and can withstand moderate levels of grazing. Moreover, during autumn, aspen provides an outstanding visual resource with economic benefits to local communities. As conifers replace aspen, more water is transpired into the atmosphere and therefore not available for streamflow or understory production. In Utah alone, it has been estimated that as much as 500,000 acre feet of water is lost each year because conifers have replaced aspen. Understory forage production has also declined precipitously as aspen stands have been converted to conifers - - this, in turn, has contributed to the overgrazing of many western ranges. The decline of aspen, then, has ramifications far beyond the loss of a single species. Thus, the condition and trend of aspen communities should be a major consideration as we attempt to revive our ailing western forest ecosystems.

It must be remembered, though, that doing nothing <u>is</u> management, and a decision that has wide-ranging consequences. Following the status quo in the West means, among other things,

- excessive browsing and continued suppression of fires will continue to adversely affect aspen;

- aspen will continue to decline and will eventually be eliminated from large areas;

• biodiversity will be reduced as aspen is replaced by conifers and other vegetation types;

• coniferous forest fuels will accumulate, setting the stage for high-intensity crown fires that could not only threaten human life but also most likely create burn patterns not previously seen in the West; and

• creating wilderness areas and parks and then allowing nature to take its course, often called hands-off or "natural-regulation" management, will only consign aspen to extinction, especially if ungulate populations are not controlled.

Finally, the magnitude of the problem is immense. In Utah alone, it has been estimated that we will have to treat 50,000 acres a year for 20 years just to maintain the presence of aspen on the landscape at its current abundance, plus an additional 1,000,000 acres must be treated if we are to return aspen to its former range of historically variability. Moreover, because many aspen stands cannot be burned due to human safety considerations, logging will need to increase dramatically, if western aspen is to survive. To counteract the effects of excessive elk and deer browsing, many of those clearcuts will also have to be quite large and the roads left open to further discourage wildlife use - - the exact opposite of current management practices. In southern Utah, where deer herds have historically been very high and where elk numbers are now increasing, it has been suggested that logging areas should be a minimum of 1,000 acres, and even larger clearcuts may be needed, if aspen is to escape browsing and successfully regenerate. There is even less hope for aspen in our national parks, unless there is a marked change in the management of those areas.

In closing, I would suggest that Congress send a strong message to the Forest Service to not only properly manage western aspen stands, but to adequately fund its aspen research program. In the past, the Forest Service had a specific aspen research unit, but that project was abandoned in 1985. While more recently, the Forest Service has failed to adequately fund aspen research despite the fact that the agency's own forest ecologists now recognize the need to develop innovative ways to restore aspen communities. I am not necessarily suggesting that Congress has to appropriate additional funds, just change the priority on how present funds are being spent. I also suggest that the Forest Service and other federal agencies be directed to monitor the condition and trend of aspen communities as a prime measure of forest health.

Thank you for your time and consideration.

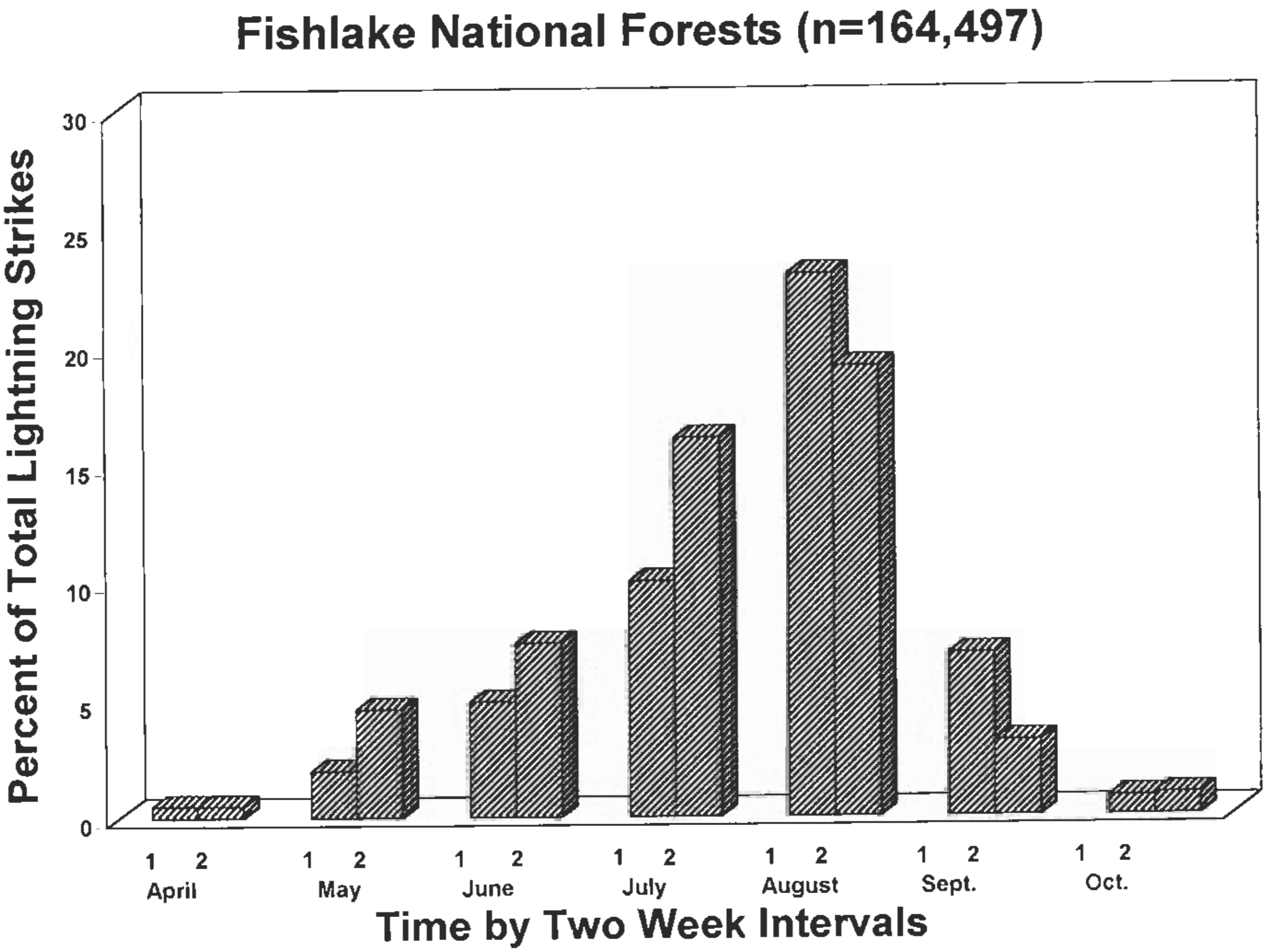

Figure 1. Frequency distribution of lightning strikes on the Fishlake National Forest in south-central Utah. When aspen is normally dry enough to burn in early spring or late in the fall, there are few lightning strikes. This is true throughout western North America. Graphed are 164,497 lightning strikes that occurred from 1985 through 1994. Lightning data are from the Bureau of Land Management's Automatic Lightning Strike Detection System, Boise, ID courtesy of the Fishlake National Forest, Richfield, UT.

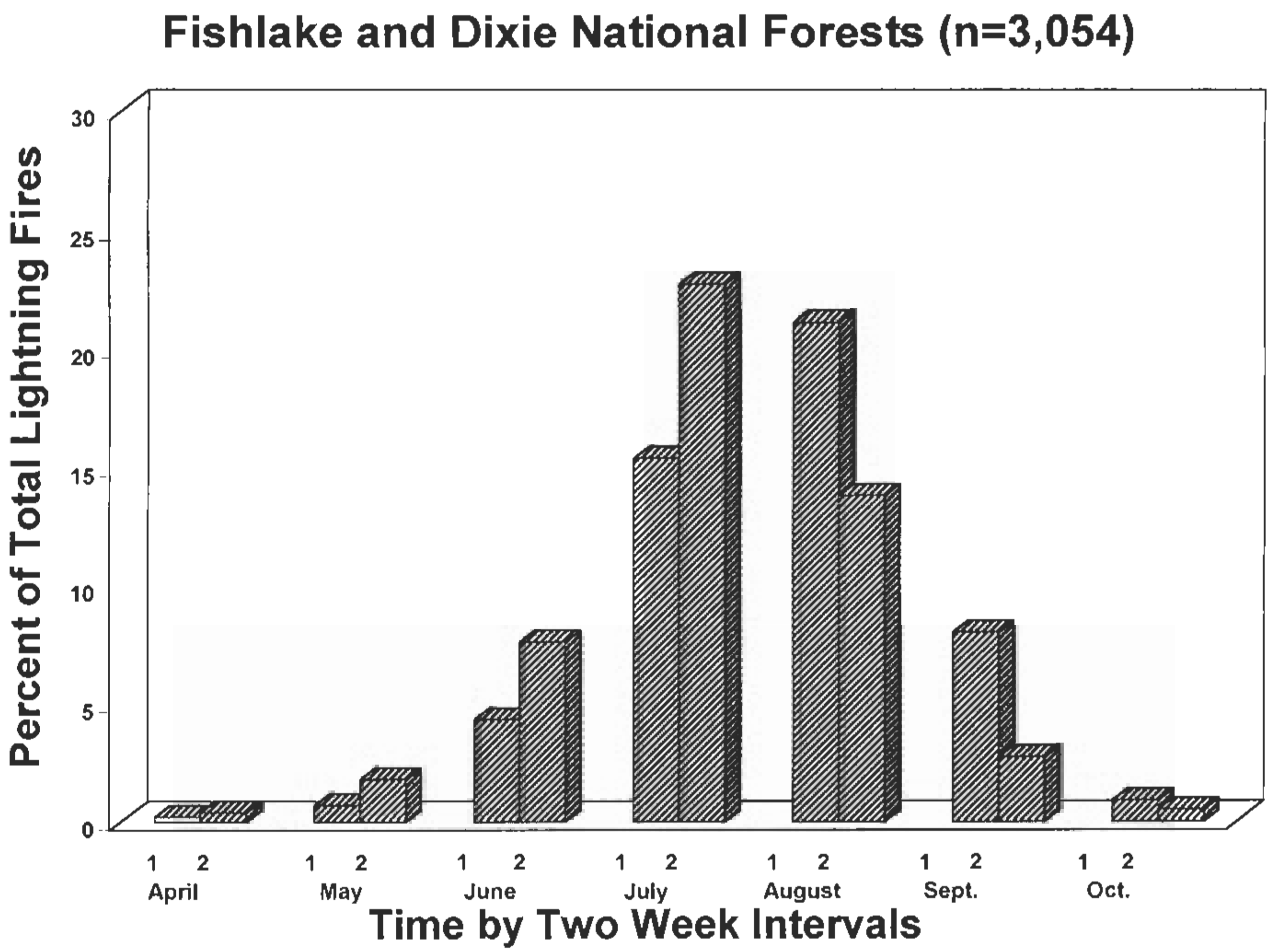

Figure 2. Frequency distribution of lightning-caused fires on the Dixie and Fishlake National Forests in south-central Utah. When aspen is normally dry enough to burn in early spring, prior to May 15th, and late in the fall, after October 15th, not only are there few lightning strikes (see Figure 1), but there are almost no lightning-started fires. Although there are virtually no lightning fires capable of burning aspen, historical photographs indicate that aspen in southern Utah burned frequently during the early 1800's (Kay unpublished repeat photographs - - work in progress for the U.S. Forest Service and Utah Division of Wildlife Resources). This suggests that those fires had to have been set by Native Americans, as this part of Utah was not settled until 1860-1875. Again, this pattern is common throughout western North America. Graphed are 3,054 lightning-caused fires. Forest fire data from the Dixie National Forest, Cedar City, UT and the Fishlake National Forest, Richfield, UT.

Attachment A - - Decline of Quaking Aspen in the Interior West - - Examples from Utah. Rangelands 20(1):17-24. 1998.

Attachment B - - Is Aspen Doomed? Journal of Forestry 95(8):4-10. 1997.