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PETER LANDRES PRESENTATION -- ECO L CONSIDERATIONS IN USING PRESCRIBED FIRE

Today, I'd like to talk about three ecological considerations in using prescribed fire: defining ecological goals; identifying ecological concerns; and last, examining some overarching questions that need to be asked about proposed uses of prescribed fire.

We heard the metaphor earlier in this Conference about the need for using prescribed fire and mechanical treatments to reduce fuels accumulated from fire exclusion so that we don't get our ecological "teeth" kicked in. This is a valuable perspective. This is also a limited perspective because fuel treatments and prescribed fire are intense manipulations that may pose long-term ecological risks.

Throughout this talk I'll drive towards a single bottom-line: we need to understand and weigh the potential benefits and impacts to both ecological and socio-economic values before we use prescribed fire. I'd like to go back to the story of King Solomon, raised in an earlier question-and-answer session, to illustrate this notion that with every action there are things that we gain and things that we lose. King Solomon wants to build his big temple and there are these large cedar groves, so the King says, "I need these big trees to build this temple." Yet his people say, "Hey, these cedar groves are beautiful and they are filled with wildlife. We don't want you to cut these trees down!" So the social scientists who advise King Solomon say "Well, if we improve our participatory processes and talk with the people about their concerns, we may still be able to cut these trees." So the social scientists and psychologists figure out ways to improve the political discourse between the King's administration and the people who were concerned about cutting the trees. Eventually, the people feel that they were involved in the decision-making process and the trees are cut to build King Solomon's temple. Today there are very few Cedars of Lebanon. The moral of this story is that we can improve deliberative discussions and allow people to feel good about the process, but what happens in the end? Perhaps we can improve the social acceptability of fuel treatments, but what are the ecological costs? What are the potential ecological implications we need to think and talk about before we take action?

Before talking about ecological considerations in using prescribed fire, I want to talk briefly about the ecology of fire. From an ecological perspective, fire simply is. What I mean by this is that fire is a fundamental transformer of ecological systems and is neither "good" nor "bad." There

are certainly negative consequences from fire when it threatens and destroys property or life, but whenever and wherever fire occurs, it will always play a large role in shaping biological systems.

Fire is very patchy in its intensity and in the types of impacts it has. Fire doesn't sweep across the landscape in a uniform manner. In some places the soil is scorched. In other places it is not. In some places the canopy is burned. In other places, not. Fire has many, many different effects on plants, wildlife, and the ecosystem, and many of these effects we are just now starting to appreciate. By killing trees, fire creates snags that wildlife use. In the short term, fire may kill isolated fish populations, but in the long term downed trees felled by fire provide organic input to streams and habitat for fish. Fire converts organic matter into inorganic nutrients that plants then can take up in their roots. Fire has many effects on an ecosystem. And as a professional ecologist, I'd suggest that we still don't know all of the short- and long-term effects of fire that life now depends on in fire-dependent ecosystems.

What is the problem when fire is excluded and fuels accumulate in fire-dependent ecosystems? Decades of fire exclusion have caused a variety of ecological impacts. We know that fire is a fundamental transformer of ecosystems that alters the composition, structural patterns, and distribution of vegetation. When we exclude fire, we allow certain plant species to grow in the forests that otherwise would have been taken out by fire. We know some, but not all of the ways that wildlife depends on vegetation, and when we alter the pattern of vegetation by excluding fire, we alter the distribution and abundance of wildlife. By excluding fire, we have set these landscapes on a different ecological pathway. In some ecosystem types, such as moist forests with infrequent but severe fires, we are within the realm of our historical understanding of fire regimes and fuel accumulations. In others, especially drier forests with frequent, low severity fires, we're generally outside the realm of that understanding, putting these ecosystems at risk.

We can reduce these accumulated fuels that pose both social and ecological risks using two primary methods: mechanical thinning and prescribed (or management-ignited) fire. For the purposes of this talk, I will not discuss a third way of reducing accumulated fuels – to let naturally occurring wildland fires burn.

Ecological Goals for Using Prescribed Fire

Prescribed fire is typically used to accomplish two different general goals. The first is to accomplish socio-economic goals, mainly to reduce hazardous fuels that pose an immediate risk to life and property. Everyone in this room already knows about problems in the wildland urban interface and the fuels that people have allowed to grow next to their homes. I won't talk further about hazard fuel reduction and this socio-economic goal. Instead, I'm going to concentrate on the second general goal for using prescribed fire, which is to accomplish ecological goals.

Prescribed fire can be used for two specific ecological objectives. While both objectives are related to one another, they are also different in their intended purpose, implementation, and outcomes. The first ecological objective is to restore natural fire regimes and the effects of natural fires on the ecosystem. For this objective, prescribed fire may be used to reduce fuels that have accumulated from fire exclusion. These may be dead fuels on the ground or live fuels like trees that serve as ladders to carry fire from the ground into the crowns of larger and typically older trees. For this restoration objective, prescribed fire is used to reduce accumulated fuels to the point where naturally-ignited fires will be allowed to burn, presumably with their

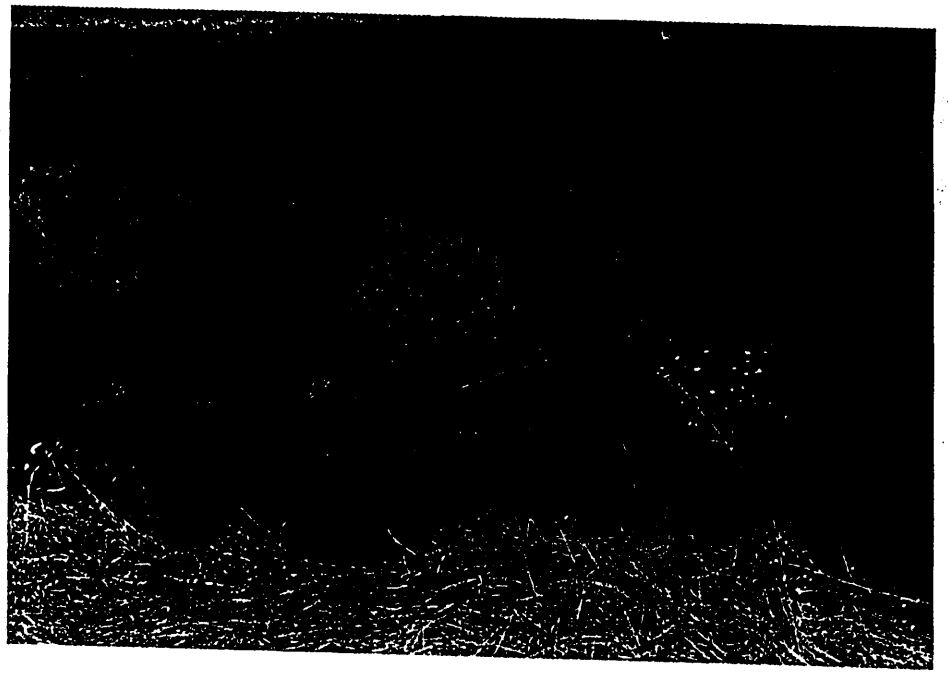
natural effect on the ecosystem. Typically, in western forests prescribed fire is used to accomplish restoration of high frequency, low severity fire regimes.

The second ecological objective for using prescribed fire is to maintain a natural fire frequency. In some situations, naturally-ignited fires are suppressed because of the risks these fires pose to life and property. In these situations, natural fire frequencies will only be maintained by prescribed fire. For example, in the Selway-Bitterroot Wilderness there are two distinct fire practices. In the central part of the Wilderness in Idaho, natural ignitions are allowed to burn if conditions are within prescription. On the eastern margin of the Wilderness adjacent to the communities in the Bitterroot Valley, however, most wilderness fires are suppressed because of the perceived risk that these fires will burn out of the Wilderness and threaten life and property in the community. We may never allow naturally ignited fires to burn in the east margin of the Selway-Bitterroot Wilderness because the risks to adjacent communities are simply too high.

In these high-risk areas, the primary use of prescribed fire would be to maintain low fuel accumulations that provide "defensible space" around valued property and allow fire suppression actions if needed. The secondary priority for using prescribed fire in these situations is to meet the ecological objective of maintaining the natural fire regime and the fire-dependent ecosystems that are valued by society.

Ecological Concerns in Using Prescribed Fire

There are two broad types of concerns associated with the use of prescribed fire for accomplishing either of these ecological objectives of restoration and maintenance: technical concerns and institutional concerns. I'll first talk about the technical concerns, and then the institutional.



There are three technical concerns for the use of prescribed fire. The first concern is that we often lack the quantity and quality of information we need on reference conditions to adequately judge the need for prescribed fire. In some cases, we have adequate information to decide whether prescribed fire is needed or not. But in many cases we have insufficient information and we make implicit or explicit assumptions about past fire regimes and their effects. Earlier we heard discussion about how difficult it is to define the word "natural." I want to reinforce this as a basic question when we talk about restoring or maintaining fire-adapted ecosystems. The definition of "natural," or of "reference conditions," defines the context and often the

management target, and if there is confusion about this target, we have little idea what we will accomplish with prescribed fire. For example, ponderosa Pine forests are generally understood to have frequent, low severity fires that prevent ground and ladder fuels from accumulating. But some recent research suggests that historically even in these ecosystems there were places with large fuel accumulations and severe fires. Which of these very different situations defines the "reference conditions" that will set the objectives for using prescribed fire?

Do we have sufficient information on the history of fire? The study of fire scars and cross-dating these scars to other trees can determine the exact years in which fires occurred. We can develop good information about the frequency of fires for a given area. The problem is that this type of understanding takes a lot of effort: cutting trees, sanding cores or "cookies," dating them, and developing a fire chronology. For some areas, we have wonderful data about the frequency and size of fires, but the information is limited to the area that was sampled. For most areas we don't have high quality information about the frequency, size, distribution, or severity of historical fires, and how these variables change over time and from one place to another. Extrapolating information on reference conditions derived from fire scars from a few sites may not be sufficient for the broad-scale application of prescribed fire.

What about weather? Prolonged drought, especially following wet years, tends to produce active fire seasons. Do we have historical information on prolonged drought? We can use tree rings to reconstruct some of this climate information, but do we know what the weather was locally? Local frontal storms produce the lightning and winds that often drive large fires. For most areas we do not have this type of weather information for past fires, limiting our knowledge of past fire behavior on which we develop current prescriptions for fire use.

What were the fuels like when historical fires burned? We can use modeling to infer how much fuel was available, which is a good beginning. We can also use historical vegetation maps to make inferences about fuels. The ecological objective is to use prescribed fire today to restore historic fuel conditions. But given our paucity of information on how past fires burned in historic fuels, we build layer upon layer of inference to use prescribed fire to restore historic fuel conditions, with little certainty about how effective we are.

What about native people? We have some information about where native people were burning, especially in places such as the Sierra Nevada in California. In other areas we don't have much knowledge about past burning practices of native peoples. For example, how often were native peoples burning in higher elevation areas? Again, the information is meager.

To summarize this first technical concern, we simply don't have the quantity or quality of information we would like to have about reference conditions for using prescribed fire, nor are we likely to ever have this information for all areas. As a result, we often end up extrapolating information from other areas, from models, and from opinions, and we don't really know the ecological effects of all these extrapolations and inferences.

My second technical concern is that we generally lack information on the direct and indirect effects of prescribed fire as a surrogate to maintain a natural fire regime and its effects. The idea of restoring and maintaining fire-dependent ecosystems is based on the presumption that prescribed fire is an effective surrogate for natural fire. How much do we know about this? I have two concerns here. The first is that natural fires, especially in the Northern Rocky fire-dependent ecosystems, tend to occur when the probability of control is low. In other words, the most active fires typically occur

in mid to late summer when frontal weather systems occur, we've had extended periods of drought, and fire-fighting resources are low. When will prescribed fire be used? Because of the substantial risks, prescribed fire will not be used in mid to late summer. Instead, it will most often be used when fuel moisture is higher and the probability of frontal systems is low. In other words, a prescribed fire will most likely be used when the probability of control is high. Does this change in timing and likely fire intensity make a difference ecologically? It appears that it does. Research in Australia on the effects of prescribed fire as a surrogate for natural fire strongly points to the conclusion that prescribed and natural fires have very different ecological effects if the intensity and timing of the fires are different.

We also lack of information on the indirect effects of prescribed fire. Does prescribed fire affect the establishment and growth of noxious and exotic weeds? What are the effects of prescribed fire on small mammals? We may be able to say that a prescribed fire met its objectives for reducing fuels, but what's the effect of this action on all the other things that comprise a forest ecosystem?

My third and last technical concern is the "one-size-fits-all" solution of using prescribed fire across a landscape. To illustrate this concern, let's again consider the Selway-Bitterroot Wilderness, covering 1.3 million acres. A map of fire regimes in this Wilderness shows the tremendous diversity of fire regimes in this wilderness. This diversity of fire regimes in the Selway-Bitterroot Wilderness is driven by diverse topography, which strongly influences vegetation, fuels, and fire behavior. The broad scale application of one or even a few different fuels and fire prescriptions across such a variable landscape can have potentially severe ecological consequences. Yet when there is strong public and political pressure for using prescribed fire to reduce fire risks to life and property, there is an equally strong potential for applying the limited information we have as broadly as possible. Applying one or even a few prescriptions across topographically and ecological diverse landscapes is the source for much of the concern about the use of prescribed fire.

I next want to address several institutional concerns with using prescribed fire, again from an ecological perspective. Chief among these concerns is a lack of clearly defined goals in using prescribed fire. Possible goals for the use of prescribed fire include: restore natural processes; restore a desired ecological condition, such as old-growth forests; restore a landscape mosaic of successional stages; maintain a relict fire-dependent plant community; or, produce forage for wildlife. These are just examples, but they illustrate the breadth of potential goals. What is crucial is that each goal may require a different approach, a different application of prescribed fire. Without clearly and explicitly defining the goals for using prescribed fire, the public cannot know or understand what the outcome of using prescribed fire is supposed to be.

Another institutional concern is the inequality of social values compared to ecological values, and the risks and benefits of using prescribed fire. Most people are risk averse regarding fire, and the ecological benefits of letting a fire burn rarely receive the same weight as the social benefits of suppressing fire. The danger that flames and smoke pose to life and property will always take priority over environmental philosophy and the long-term, sometimes subtle ecosystem functions that depend on fire. Exacerbating this inequality is the lack of formal agency processes for fairly and equitably evaluating the tradeoffs between social and ecological risks and benefits from using prescribed fire. Does the public, especially the conservation community, trust the agency to fairly evaluate and balance ecological and social risks, over both the short- and long-term? In my opinion, this trust is lacking, likely making efforts to use prescribed fire a difficult contest of wills that pits different community groups against one another with the agency in the middle.

A related institutional concern is our lack of understanding about how to apply prescribed fire in different management settings. For example, in areas adjacent to homes in the wildland-urban interface, there is little question about the need for using mechanical fuel treatments and prescribed fire. Wilderness, however, is politically and administratively a very different landscape, and wilderness managers wrestle with whether we should even consider the use of prescribed fire in wilderness. One of the fundamental values of wilderness is as a place that is "untrammeled" or unmanipulated and uncontrolled by people. We can use prescribed fire in wilderness, but the more important question is whether we should manipulate wilderness in this way, even for the goal of reducing fuels that have accumulated from decades of fire suppression. And do we go into wilderness and reduce fuels mechanically before we prescribed fire? These philosophical questions go to the heart of what wilderness is and remain unresolved.

The last institutional concern I want to discuss is a lack of humility. For decades agencies vigorously said "We need to stop fire!" Now the agencies are saying, with equal vigor, "We need to light fires!" But do we really know when and where prescribed fire must be used, or is most effective? Do we really understand the consequences of what we're doing? One of the best examples to illustrate this problem is the Swedish chemist who invented DDT. He received the Nobel Prize for his invention because it killed mosquitoes and saved thousands of lives from malaria. Only much later did we realize the profound negative ecological consequences of DDT. I'm concerned that we may be swinging the fire pendulum all the way from one side to the other, from complete exclusion to complete use of prescribed fire. I'm not arguing against the use of prescribed fire because I firmly believe that it can play a vital and important ecological and social role. What I am arguing for is that we use caution and humility, that we be clear about what we know and what we don't know, and strive to develop a process that fairly evaluates and weighs the social and ecological risks and benefits of prescribed fire.

Overarching Questions about Using Prescribed Fire

In closing, I'd like to offer four overarching questions that I think need to be asked, and answered, whenever and wherever prescribed fire is proposed. First, are the goals and objectives clearly stated, and if so, what are the potential short- and long-term ecological consequences? If the ecological consequences are likely to be severe, then much more caution and public discussion is warranted in using prescribed fire. Second, is there sufficient understanding about reference conditions and restoration actions? And is our understanding at the appropriate spatial and temporal scales? For example, a lot of fire research has been at the "stand level" and our knowledge is fairly robust about fire at this spatial scale, but we have much less understanding about landscape scale fire behavior and fire effects. Third, what are the benefits and risks of using prescribed fire versus not using prescribed fire? We have many choices and we need to be explicit about these choices and their likely outcomes. In some cases we may have a good understanding about the likely socio-economic benefits but poor understanding of the ecological risks. Such cases may be common, and I'd suggest that we need to be open and straight forward with the public about what we know and what we don't know. Fourth, what can we learn from the use of prescribed fire? Right now we have the opportunity to use prescribed fire as an experiment to improve our understanding about fire and its management. If we don't learn from our use of prescribed fire, we will have lost this wonderful opportunity to improve our understanding about how to maximize the benefits and minimize the risks of using prescribed fire.

DISCUSSION SESSION

- You've talked about mechanical treatments and prescribed fire and the concerns they raise about restoration and maintenance. I've heard of recent proposals about chemical treatments. I'm curious about their ecological effects. Where do chemical treatments come in with relationship to what you just told us? *Peter Landres responds*: The use of herbicides to reduce fine fuels is an issue I don't know much about, but the concerns I raised are the same with any type of fuel treatment. It doesn't matter if you're talking about the use of chemicals or any other treatment. Each type of treatment will have different ecological effects. With chemicals we might be very concerned about their impact on the soil fauna and flora. Will those chemicals have a long-lasting impact on native plants in the area? What are the indirect effects on small mammals? If you wipe out a whole bunch of plants in the area, then you wipe out the seed source for small mammals, as well as the little places small mammals and birds like to hide – underneath grass bunches, for example. What are the rippling affects on intermediate sized carnivores? *Follow-up question*: Aren't there problems that are specific to chemicals - people's perceptions of chemicals? *Peter Landres responds*: Absolutely. Chemicals have well known negative impacts on people and there's a large literature on toxicology, so people are knowledgeable and concerned about chemicals. As we start going down this chemical path to fuel treatment, it will be real interesting to see what happens with regard to social perceptions.

- You spoke of our tendency not to recognize indirect responses to interventions that seem to have been a good idea. Now we know, years later, that fire suppression created very different responses than we anticipated. How can we know what to do now? *Peter Landres responds*: I think the parallels between fire suppression and prescribed fire are really ironic. The question was already raised about whether prescribed fire will mess wilderness up even more than fire suppression already has. There are scientific components as well as ethical components to that question. There are many people who can accept that we messed up in the past, but from this point on, let's keep our hands off and accept the negative consequences of fire suppression. But there is another ethical view that says, "We messed up in the past, and it's our moral responsibility to do everything in our power to overcome the problems that we've caused." In my view, these discussions need to be based on the relative risks and benefits of acting versus not acting in each specific situation.

- Two highly related questions. Number one, why did you put the activities of native people under the category of "natural?" And number two, how do reference conditions, those that refer to a state of nature, relate to recent ecological theories that emphasize the flux of nature? *Peter Landres responds*: I put native peoples under the category of "natural" for the purpose of defining management goals and targets. We need to be explicit about what we are defining as "natural," and we are really defining social values. Do we choose to include native peoples' activities under "natural" or do we choose not to include these activities? I don't think it really matters whether the management community chooses to include or exclude the effects of native people in defining natural reference conditions. The crucial part is that managers be very clear and explicit about the values that drive what is included and excluded in the definition of "natural." To respond to your second point about the dynamic flux of nature, let me assure you that in my definition, reference conditions are absolutely not static conditions. Ecological systems are dynamic and constantly changing, adjusting, accommodating to what is going on every day. Every time I hear the phrase, "balance of nature," I cringe because this phrase conveys to society an imprecise, wrong notion that ecological systems strive towards and achieve some sort of "balance" or steady state. This is

a relevant discussion for the use of prescribed fire because some people claim or imply that ecological systems are now "out of balance" because of fire suppression, and that prescribed fire can bring them back into balance. That is an imprecise and incorrect ecological notion.