Gen. Tech. Rep. PSW-101 Berkeley, CA. Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture; 1987.

What Will the Wildlands Be Like in the Year 2000... Future Perfect or Future Imperfect?[1]

Carol L. Rice[2]

Abstract: Profound changes have taken place in the western wildlands during the 20th century that will have great impact on land management policy and operations. Wildlands are being developed. Reduction of fire has altered plant species relationships in terms of dominance and density. The number of ignitions will continue to increase. The trends unchanged will result in greater resource damages. Little can be done to stem the tide of encroachment into the wildlands and its attendant increase in human caused fires. Land managers can restore the balance of plant spcies [sic] as well as fuel accumulation only with sweeping management activites [sic]. Land managers will need to develop a wide power base among the public so the needed programs will be funded.

As this is a future-oriented paper, a review of the futuring process may be in order. The process of futuring requires one to first identify trends and then discover implications of those trends to develop a vision of what we would like to see in the future. By futuring one can develop an effective plan to change the probable coming events, and select preferred scenarios from the possible. The reader is also encouraged to keep in mind the words of George Eliot: "Prophecy is the most gratuitous form of error."

[1]Presented at the Symposium on Wildland Fire 2000, April 27-30, 1987. South Lake Tahoe, California.

[2]Proprietor. Wildland Resource Management, Walnut Creek, California.

TRENDS AFFECTING THE WILDLANDS

There are three major changes shaping our nation wildlands. The first is urbanization, with an increase in wildland use as well as an increase in the number of people near wildlands. The second change is an accumulation of fuel loads, of both dead and live biomass, The third change is a shift in plant species composition towards climax.

Urbanization

Loss of homes in the chaparral of southern California first brought attention to the problem of urban encroachment into wildlands, but the problem has developed far beyond that. California's grasslands now have a natural succession from annual grass to intermingled ranchettes to subdivisions of thousands of homes. Similar succession is taking place in the woodlands of California's interior valley as well.

Development is being concentrated on grasslands and woodlands because these vegetation types are largely in private ownership and are next to historic population centers (which are usually situated near rivers). Additionally, grasslands and woodlands occur normally on flat locations, where it is easy (i.e. inexpensive) to build. Lastly, the profit motive is a driving force; certainly present economics dictate that more money can be made on homes than cows. Sadly, I see urbanization as the climax or ultimate steady state for these vegetation types in California, and by the year 2000 they therefore will no longer be considered wildlands.

The rest of this paper will therefore focus on the state of the forests in the year 2000, where the next wave of urbanization--nationwide--will take place. Bolsinger (1980) reported in 1977 alone that 220,000 acres of private timberland were being developed for non-forest use in California. This rate of development is probably being duplicated in every other forested state.

Removal of Wildlands From Production

The establishment of more homes around forests results in land being taken out of production for traditional commodities such as timber or grazing. The productivity of croplands and wildlands has been reduced nationwide more by development (via land use change) than by soil erosion.

Besides the loss of forest productivity due to direct land use conversion, there is a broader, more widespread loss of production around communities due to political forces. For example, the new inhabitants of the land previously classified as wildlands tend not to allow grazing or timber harvesting around their community. The prevailing sentiment is to have vegetation in their community surroundings remain the same, to let the little trees grow--of whatever kind, shape or vigor.

Increase of Values at Risk

Obviously urbanization greatly increases the values at risk. While the value of commercial timber is not negligible, the situation of a custom home on a half-acre clearing does significantly increase the values that need to be protected. As suburban encroachment into the forest continues, values at risk dramatically rise.

Limitation of Management Options

At the same time the new neighbors prohibit many uses of the forest, they also limit options for management, especially fuel management. The same two factors play here as in the issue of lost commodity production. The more direct cause of this limitation is the pattern of development, or the placement of homes. The situation of Stone Canyon, Los Angeles County, exemplifies the difficulties faced. Here homes are located on the ridge with their drinking water supply located below. The fuel in between is that which largely contributed to the "blow-up" in the 1961 Bel Air Fire. An innovative and ambitious program was required to treat the area. Elsewhere homes are routinely placed at the top of steep ridges and at ends of chimneys which greatly complicates the use of prescribed fire and heavy machinery. The distribution of these developments increases management cost, and limits how land management agencies can treat the wildlands.

Political pressure is the second, more indirect cause of limitations of options. For example, the same communities that simply would not allow prescribed burning during the 1960's may now advocate the use of fire, but disallow the use of herbicides. The new inhabitants will be more citified so the inconveniences posed by management activities will be increasingly unacceptable--whether it is ash in swimming pools or traffic from logging trucks. The allowances change with time and present a constant challenge.

Increase in Number of Ignitions

While the number of acres burned has been stable in California since 1964, the number of fires has almost tripled to approximately 11,500 (Bolsinger 1980). One constant is the weather, which will still consist of dry hot summers in the West. regardless of the vegetation and fuels. As usage intensifies, fire occurrence can be expected to increase further since the number of people have risen, and most fires are human caused. Eighty percent of all fires in California are started by roads so as we improve access, we spread the distribution of fires.

Most fire history studies find fire frequency declines with the onset of suppression. However, on the El Dorado National Forest off Highway 50 in California, a study discovered an increase in the number of fires after 1930 which were caused largely by campers and recreational use (Rice 1983). The impact of Highway 50 is very extensive now, as was the pony express and settling trails before. Road routes change, and settling trails consisted of a network of routes rather than narrow bands of travel. Both factors indicate fire impacted a much broader area than a roadside ribbon of land. The number of ignitions will increase where roads are established--often into areas of timber harvesting. Entire drainages are affected with new roads, because roadside fires in the valley floor commonly run to the top of the ridges.

Thus the trend of increasing urban encroachment into wildlands removes acres from production, restricts options for fuel management, increases values at risk, and increases the number of ignitions.

Fuel Accumulation

The second major trend in the wildlands is that the fuels are accumulating. This has been documented numerous times. For this discussion, accumulated fuels include standing live fuels in the biomass. So when a forest is thickly stocked or choked with underbrush, this too is a build up of fuels. Many dense forests appear productive, yet the space is taken with trees that are dead and dying because of suppression.

Heady and Zinke (1978) noted in Yosemite "forest stands have thickened with the continuous establishment of trees over the last 100 years." The current large amount of prescribed burning in this park has started to reverse this trend, but staff there admit even this aggressive program is just nibbling away at the backlog.

Gruell (1980) documented the fuel accumulation in the Bridger-Teton National Forest which was most apparent on productive sites where fire return intervals are short. He pointed out the importance of higher tree density where, in whitebark pines, fire behavior was a function of tree density. Where stocking was poor fire spread was not continuous, so it created an uneven-aged stand. In closed stands, fire behavior was much more intense, leaving an even-aged stand.

Shift in Species Composition Towards Climax

The third trend affecting wildlands is the shift in plant species composition to a more advanced successional stage.

Forests of the Sierras in the 1800's included large areas of "open and park-like" pine stands with little undergrowth. In contrast, the forest surrounding the Stanford Sierra Conference Center, where the Symposium was held, consisted of a white fir/incense cedar understory with a pine overstory. This is typical of the stand structure and species composition in the "new" California.

The "new" forest of California and throughout the West can be represented by the results of a stand age analysis done on the El Dorado National Forest (Rice 1983). Even though the old overstory consisted of ponderosa pine, no significant amount of pine existed as regeneration in the understory. The most apparent shift in vegetation was a shift in the proportion of canopy cover for each species. There were no new species on the site, and no species dropped out entirely, but the proportion of each species had shifted dramatically. Relative to other forests of the West, the area was a productive site. Additionally, the area was somewhat moist for a typical pine site. Because of these two conditions, succession proceeded more rapidly than on dry, or nonproductive sites. Species change may be happening more rapidly and before other areas in the West.

Nonetheless, a change in the composition of the forest has been observed widespread. Heady and Zinke (1978) predicted that if no catastrophe or management impact occurs, the previous black oak/ponderosa pine forests of Yosemite will be increasingly dominated by incense-cedar, white fir, Douglas-fir, and scrub oak. Gruell (1980) noted a subalpine fir understory in lodgepole pine and Douglas-fir forests. Spruce fir forests are also in a stage of late succession. He pointed out that the douglas fir forests are 100-125 years old, created by tremendous fires when the stands were in advanced succession. He linked the successional advances which were widely observed to a reduced fire frequency.

The stand age structure of a typical forest stand has shifted toward younger trees. This is obviously a product of the conversion of forests from old-growth to regulated stands. But additionally, the forest has become more densely stocked, largely of more shade tolerant trees, and with species less tolerant of fire. These trees can be expected to gain dominance by the year 2000.

Throughout history the seral species have been preferred timber. In Maine, white pine was logged to provide masts to outfit the King's navy. The hardwoods that replaced the pine are not now harvested with the same vigor. In the west ponderosa and sugar pine were logged in the 1800's while the more shade-tolerant species were left. So the shift to a greater proportion of climax species will tend to reduce the value of the timber output. Bolsinger (1980) stated that the mix of species harvested has changed because of both species availability as well as the market. Ponderosa pine and sugar pine comprised 70 percent of the wood used in California in 1869, 50 percent in 1946, and 23 percent in 1980. An increase in the cut of firs can be expected because of the large inventory of firs (now 28 percent of softwood volume in California).

Human impact has hastened this shift in species composition. During the 1800's harvesting reduced or eliminated the seed source of seral pines, which produced the first shift in species. This is an odd situation where logging caused a shift in species composition towards climax. Harvesting--like fire--in a gross way, can set the successional stage back a notch. But now, all forms of disturbance (other than grading and paving) are prohibited around communities, so the shift is more insidious, certain, and lasting.

As an indicator of change in the proportion of each tree species, the 1945 vegetation map by Wieslander explained the mixed-conifer classification as a pine - Douglas-fir - fir mix, while in the 1980 CALVEG map (Matyas and Parker 1980). the emphasis shifted with the mixed conifer classification described as a fir-pine mix.

This confronts the forester with a dilemma: One of the tenets of modern silviculture has been that the plant material most inherently adapted to a site is that found growing on the site. But it may not be so now. The present forests of the West require the forester to be part sleuth and part historian to determine what should be growing on any site. Yet even this may not be enough to change or divert the trend but only to chronicle it more precisely.

CONCERNS OF FIRE MANAGERS

The implications of the three trends are several. The foremost concern pertains to the increased number of ignitions in an increasingly vulnerable environment. Homes and lives are likely to be lost at an advanced rate from what we are used to seeing today. More and more forests may be lost as well. Fuel treatment takes place around areas of harvest, but initial logging roads open the forest to access and increased numbers of ignitions follow better access. The stands leading to and surrounding the harvest site may be hazardous, susceptible, and accessible. A long recognized impact of harvesting is the conversion of the local fire climate to one of greater windspeeds, and higher amounts of solar radiation which warms and dries fuels. These modifications in wind, air structure, and fuel moisture may result in greater changes in behavior than the temporary addition of more fuel in the form of slash (Countryman 1955).

Fire in young trees usually results in a total loss because they are not salvageable. As the large, old growth trees are removed and more of the forest is occupied by small trees. the relative effect of fire on yields will be more severe, and less of the fire-killed volume will be salvageable (Bolsinger 1980).

The serious implications with the shift in species relate to the ecological adaptations of the species to compete successfully. Pine and other seral species have manifested adaptations (litter fall, thick bark) that allow them to compete successfully in a fire regime of frequent occurrence. Firs and other climax species do not have these adaptations and so are less fire resistant.

Because of the increased stocking of the forest and multi-layer canopy, the distribution of fuels is more continuous, vertically and horizontally, than in the past.

Since fire occurrence can be expected to rise in the future, existing trees can be expected to be exposed to at least one fire during their life cycle. Fir and similar species of advanced successional stage can he expected to have a large mortality because of their lesser fire resistance and the conditions they produce to promote crown fires. The probability that stands of fir (or climax species) growing in places where pines (or seral species) have historically grown will reach maturity and eventually be available for timber is significantly less than it would be for pines were they maintained on the site.

The cards are stacked against the new vegetation reaching maturity, because of the increased number of ignitions and vulnerability. More fires will occur, each one with an increased probability that it will damage more trees and inflict greater damage to each.

Where fire is kept out, disturbance by insects or fungi is inevitable. As an example, Williams and others (1980) showed that outbreaks of Douglas-fir tussock moth largely occurred on pine sites now occupied by Douglas-fir. Douglas-fir growing on fir sites were not attacked.

The implications of increased amounts of dead material caused by acid rain has yet to be widely recognized. Acid rain will profoundly alter the fuel characteristics by increasing the dead-to-live ratio of forests to make them more flammable. As thousands of acres become affected, larger, and higher intensity fires are likely to result.

In Canada, some have advanced the idea of calculating the fire loss into long run timber yield assessments (Reed and Errico 1985, Martell 1980, Van Wagner 1983). What's interesting is that for fire sensitive species, even modest rates of fire can result in large reductions in long run yields, and shorter rotations.

Thus total resource damage will be greater with the new fire regime from the changed fuel complex. Not only are fires destroying homes and forests, but insects and acid rain will also damage forests in the future.

VISION: CLIMAX OR ANTI-CLIMAX?

In the best of possible worlds, the following five preferred scenarios would be the future:

1. Since fires cannot be entirely excluded in areas of high access and risk, the wildlands surrounding the border would be of low-fuel volume, fire-resistant species. This would be done by harvesting and intense fuel management in some places. Fuels would be treated on a frequency proportional to the fire return interval.

2. Forest practices would increase the proportion of seral species and reduce the amount of fuels in the wildlands. Pines would be planted after harvesting where they have historically grown. Both the composition of species and stocking of stands would be restored via firewood cutting, thinning, and other silvicultual [sic] treatments.

3. Fire loss--including that of timber producing stands and improved developments--would be minimized.

4. The public would be aware of forest dynamics and supportive of management activities. The public would trust recommendations of land managers.

5. Budgets would be adequate to accomplish mandated responsibilities and tailored to fit a project. Overall budgets won't increase, but money will be allocated for priority projects. Funding for management treatments would receive priority consistent with the increased values at risk Pre-emergency treatments will be as well supported as emergency measures.

How will we accomplish these visions, or turn the probable future--one of doom and gloom--into the rosy preferred future described above?

Much of the rosy future scenario depends on management treatments, most of which require funding. One exception may be the selection of species to plant, where most foresters are already choosing the most appropriate type. Another exception would be the regulation of firewood cutting to reduce stocking levels and fuel loads. All other treatments such as hazard reduction or thinning necessitates funding which, in turn, requires political support.

Homeowners are most likely to be the power base for action. They will empower officials to manage the land well. It is therefore incumbent on land managers to express the message that the profession is caring for the land and serving the public. If resource managers convince the public that they are skilled and have good judgement, this major powerbase will allow them to conduct the management activities needed.

Minimizing costs is not the main concern. Homeowners in California are making that a clear message. In the urban interface of the Berkeley/Oakland hills, officials are getting the message that homeowners would prefer to have lands managed with hand labor and goats, even after seeing that these treatments are sometimes 10 times more expensive than alternatives. The power of homeowners is also illustrated in the small City of Hercules where staff are trying to set up a tax assessment district, which would generate over $50,000 per year solely to reduce the fire hazard in the city's 300 acres of wildlands. This effort is because a small, vocal group of homeowners demanded that fires that burned their homes had to stop. In a surprising quote from Ecclesiastes. "A feast is made for laughter, wine makes merry, but money answers all things."

Although most people can be convinced of the necessity for management, there will be a hard-core group of those who wish to do nothing and spend nothing even in the face of impending disaster. With more clusters of small developments, this group will have in increasing impact.

Within the spectrum of management treatments, a shift toward presuppression activities should take place. This is especially important around communities. Pyne (In press) contrasted the United States' and Australia's fire protection strategies. Our protection strategy in the United States is based on the belief that any fire can be suppressed if hit hard enough when small enough. In Australia, on the other hand, protection strategy is based on the idea that the intensity of any fire (and thus damage) can be reduced if fuels are reduced. Hopefully we can reach a balance in the next millenium. The shift from the 10-A.M. policy (control of all fires before 10-A.M. of the following day) to the "three C's" (contain, confine, control) is a signal of this advance.

Four points serve as a summary. Our forests are changing in a way that sets the stage for more stand replacing fires through a shift in species and fuel characteristics. The forests are themselves more vulnerable to any fire and thus more difficult to manage. Increased fuel management will be a key activity to reduce resource damages. The homeowners in the local community will limit our options, or empower us to do our job well. Which direction will be taken depends on whether land managers take concerted action to educate and inform the public of the profession's integrity and skill.

REFERENCES

Bolsinger, Charles. 1980. California forests trends, problems and opportunities. Res. Bulletin PNW-89. Portland, OR: Pacific Northwest Forest and Range Experiment Station, Forest Service. U.S. Department of Agriculture; 138 p.

Countryman, Clive. 1955. Old-growth conversion also converts fire climate. In: Proceedings of the Society of American Foresters Meeting: 158-160.

Gruell, George E. 1980. Fire's influence on wildlife habitat on the Bridger-Teton National Forest. Wyoming. Volume 2--Changes and causes, management implications. Res. Paper INT-235. Ogden. UT: Intermountain Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture; 207 p.

Heady, Harold F.; Zinke, Paul J. 1978. Vegetational changes in Yosemite Valley. National Park Service Occasional Paper No 5. National Park Service, U.S. Department of the Interior; 25 p.

Jensen, Herbert A. 1947. A system for classifying vegetation in California. California Fish and Game 33(4): 199-266.

Martell. D.L. 1980. The optimal rotation of a flammable forest stand. Canadian Journal of Forest Research 10:30-34.

Matyas, Wendy; Parker. Ike. 1980. CALVEG: Mosaic of existing vegetation of California. San Francisco, CA: Regional Ecology Group, Forest Service. U.S. Department of Agriculture; 27 p.

Pyne, Stephen J. The fire next time: old fire problems and new problem fires. In: Proceedings, Ninth Conference on Fire and Forest Meteorology; 1987 April 21-24; San Diego, CA. American Meteorological Society; [In press].

Reed, W.J.; Errico. D. 1985. Assessing the long-run yield of a forest stand subject to the risk of fire. Canadian Journal of Forest Research 15:680-687.

Rice, Carol L. 1983. A fire history of the Ice House Compartment. Unpublished report to the El Dorado National Forest supplied by author.

Van Wagner, C.E. 1983. Simulating the effect of forest fire on long-term annual timber supply. Canadian Journal of Forest Research 13:451-457.

Wieslander. A. E.; H.A. Jensen. 1945. Vegetation types of California. Berkeley. CA. California Forest and Range Experiment Station. Forest Service, U.S. Department of Agriculture; map.

Williams, Jerry T.; Martin, Robert E.; Pickford, Stewart G. 1980. Silvicultural and fire management implications from a timber type evaluation of Tussock moth outbreak areas. In: Proceedings Sixth Conference on Fire and Forest Meteorology; 1980 April 22-24; Seattle, WA. Society of American Foresters; 191-196.