

EFFECTS OF MAN ON THE FOREST ENVIRONMENT

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At first glance, the topic assigned me today seems innocent enough and, in light of our present technological information, fairly straightforward and simple. I have been asked to comment on the effects of man on the forest environment, particularly in the redwood region, an area with which I am very familiar. And I shall, of course, try to fill my assignment. I will be describing to you some of the more obvious, immediate and measurable effects that man is having on the watersheds, soils, wildlife--and aesthetic values-- of the redwood forest community. At the same time, being an environmentalist, I am very mindful that this topic is neither innocent, straightforward, nor simple; I have actually been handed a loaded subject. The effect of man on the forest environment is a matter of profound importance to the human race. It has its roots--if I may be permitted a dubious pun--in man's earliest history. It has implications which we are only now beginning to comprehend, and they are frightening implications. Man's impact on earth's forests must take its place alongside of man's impact on the oceans and on the air he breathes: it is a guts issue. It raises the question of man's ultimate survival.

And so while I will discuss the immediate, short term impact of man on the redwood forests, I will try to relate it to the long term effects as well as to the broader issue--of man's survival. Only in this way can we get a true perspective and understanding of what we are doing in the redwoods, as we go about the final cutting of one of the earth's last great virgin forests.

In the brief time allotted me, I can obviously do no more than touch briefly on man's historic impact on earth's forests. But I think it is important to recall that there were forests on earth long, long, before there was ever man. For instance, there were redwoods very much like our own California Coastal Redwood living 130,000,000 years ago in Manchuria--and they were by no means earth's first forests. If we are to accept the Darwinian theory of man's evolution, we must acknowledge the fact that forests were in fact prerequisite to our being. As John Stewart Collins puts it in his provocative book, The Triumph of the Tree, "It was the tree that gave the hand to life. It was the tree that promoted the upright posture. It was the tree that made sight dominant over smell. Must we not say that it was the tree that gave man to life? Anyway, it was under the auspices of those ancient boughs that he appeared. And having appeared, he was destined to interfere with the Order of Nature. The very forests were doomed."

For man, of course, started using--and destroying-- trees almost as soon as he became man; he burned wood. As soon as he invented the tools for it he began to chop down trees. Forests were obviously extremely useful--even essential--to him as he travelled down the long pathway to civilization. Wood provided the natural resource for so many of man's structures, his houses, his ships, his masts and oars, his wheels, his fences, his wagon, and so on. Ultimately, of course, trees would provide him with many amenities of his higher civilization--with his newsprint, his toilet tissue, match sticks, furniture, paneling, and so on. And always, trees provided him with the wood for his funeral pyres and his coffins. In far less obvious ways, the forests were essential to man from the beginning; trees helped to form the earth's soil and to stake it down. They helped to cycle water, to prevent floods; and very importantly, forests formed the habitat for many of the animals on which man depended for his food.

Recognizing little of this, man has historically used his forests both blindly and wantonly. The most enlightened men of their eras chopped down the forests of the watersheds around the Mediterranean--the trees that grew along the Tigris and Euphrates Rivers, the cedars of Lebanon, the trees of Rome and Greece, the mighty forests of Dalmatia, and the girdle of forests from the Congo to Khartoum. Billions of trees fell, even as the trees of Britain and northern Europe would fall, too. And as the forests fell, so, too, did the early civilizations. In many places, the earth was turned to a desert.

If early civilizations were carved from the wood of the earth's forests, much of our more recent history--particularly our North American continent--has been born of wood and, too often, of smoke. When the white men first landed on the eastern shores of North America, they found some of the grandest forests of all time--long-leafed pine, hickory, oak, maple, elm, cedar, sassafras, whole legions of magnificent hard woods and conifers. It is said that after landing in Massachusetts the Pilgrims fell first upon their knees--and then upon the forests. Almost literally, the pioneers then chopped their way westward, flattening the trees before them, pillaging the woods, mining the trees with no thought to the future. Westward moved the pioneers, "clearing the land," as they put it euphemistically. They left almost nothing of the forests they found; the State of Ohio, for example, was covered with a fabulous hardwood forest of which not one scrap remains.

Historically, then, man's impact on the forest environment has been--with rare exceptions--one of ruthless destruction. Most of the forests which survived did so accidentally; almost none that civilized man found remained unchanged.

More recently, of course, we have begun to think and care much more about the effect of man on our forests. We have had to do so for the simple reason that our old growth forests have almost run out. And so for the past 100 years, we have begun in this country to talk about forestry. In the United States, we have taken the European concept of "multiple use" and "sustained yield," interpreted them as we wished, and made these concepts part of our laws. We have set up the United States Forest Service to enforce the laws of multiple use and sustained yield and to protect our publicly owned forest lands; in most States, we have forest practice acts which purport to protect the forests in private ownership. We have schools of forestry in many of our universities. We have a timber industry that talks a great deal about the "wise use" of forest land. And we also have many splendid theories about the best way to cut our forests so that they will go on regenerating themselves ad infinitum. Unfortunately, we have pathetically little in the way of long-term experience to back up too many of our theories. Seed in the perspective of geological time--or the time we know redwood forests have grown on California's north coast--professional forestry--even in Europe--is very young indeed, scarcely 400 years old. This is not nearly old enough to have provided any conclusive evidence as to the long-term effects that man is having on even the most intelligently "managed" logging operations.

Which brings us, logically, to the redwoods, to the great forests of Sequoia sempervirens, the tallest living trees on earth and among the oldest, symbols of California and the glories of the west. Redwoods are considered by many to be the most prodigal forests of all. When the white men first found them--only two centuries ago--these extraordinary trees stood in splendor on nearly two million acres of coastal land along the north Pacific, stretching from a little south of Monterey where the Spaniards first came upon them, to slightly north of what would one day be the Oregon boundary. On ridge after ridge, in canyon after canyon, and on every river flat, the great trees towered. Standing with Douglas firs on the slopes and in the higher places, they stood in pure stand along the streams, forests of prodigious beauty.

A very ancient species, with fossils dating back to Upper Jurassic times, as I mentioned the genus Sequoia had once flourished widespread throughout the northern hemisphere. Now, through the quirks of geology and climate, these redwoods were compressed into a relatively small region along the Pacific coast where they were making their last stand. Still, there were two million acres of redwood forests in the narrow band that rimmed the foggy northern California shores, and it seemed to the white men who found it an infinite forest. Some of the trees approached 400 feet in height, some were taller, if the records are correct. Some had diameters 20 feet and more, so their stumps were big enough to dance upon. And civilized man, looking at these trees, was full of awe. But awed or no, he did as expected, and proceeded to cut them down forthwith.

The early logging of redwoods was no easy thing. It took a crew of men working together several days with their axes and whipsaws to bring a giant down. Because there were so many trees, the loggers took only the best and left the rest standing in most places, so that logging then was inadvertently selective, at least in some places. In other places, the logging was final. In the Oakland hills, for instance, there were exceptional trees of enormous girth and height; sailors used them to chart their courses through the Golden Gate. They were cut down in the 1850's and they did not grow again.

Of particular interest is the forest that clothed the canyons and crest of Bolinas Ridge on the western slopes of Mt. Tamalpais in Marin County. There were heavy stands of redwoods in the canyons on the shore side with trees as much as 50 feet in circumference. On the more open ridges and the gentle slopes, there were forests of pine, Douglas fir, oak and alder; willows grew in the wet places along the free-flowing streams that drained Bolinas Ridge. The fish and wildlife of this forest world were prodigious; elk in bands of as many as 1,000 roamed the area. There were so many trout in the streams, the first settlers built fishponds to "farm" them. California mountain lions and grizzly bears were among the common residents around...as were the Miwok Indians who gathered shellfish in Bolinas Lagoon and had for thousands of years.

The effect of man on this forest environment was dramatic. In seven brief years of logging--from 1849 to 1956--loggers hacked the hillsides and canyons into a web of skid roads and took out several million board feet of redwood lumber which they lightered down the lagoon, loaded onto schooners and sailed into San Francisco to help build the burgeoning young city. The silting of Bolinas Lagoon was immediate and prodigious; it came on so rapidly that maps drawn in 1957 show two "old embarcaderos" which had been covered with silt and abandoned in less than a decade of logging.

Once they had cut out the biggest redwoods, the Bolinas pioneers then scalped the hillsides of the oak, alder pine and fir; for twenty more years they cut these trees for cordwood and shipped it into the city--sometimes at the rate of 400 cords a week. By the end of the last century, the Bolinas forest environment had been totally and irrevocably altered by man. Along with the removal of the trees, the erosion of soil and the filling of the lagoon at the toe of the mountain, much of the fish and wildlife resource of the forest had been destroyed. The elk, the lion and the bear were long since gone; and so, too, were the Indians. Today, only one family of Miwok Indians is known to be alive. The trout dwindled, along with the silver salmon which had also spawned in the same streams. A new and different environment was emerging and would continue to emerge. When you visit the area now, you will find a lovely and serene place, but it gives little hint of the forest environment it once supported, so profound has been the effect of man.

The same holds true for a large part of the redwood region. Of the original nearly 2 million acres of redwood forest about one million eight hundred thousand acres have now been cut, and in some places, cut again. In many areas, the land has not recovered as serenely as it has around Bolinas Lagoon. In places, all trace of the original forest has been eradicated by man. The City of Eureka, for instance, stands on the site of an early fine forest; the city zoo now occupies what is left of it--a piece of land about 40 acres in size. It has at least one redwood thirteen feet in diameter to remind the spectator of the kind of trees that once grew around here--but now this tree, like much of the area around it, is draped in English ivy, another effect of man. Great areas of early forest have, of course, been converted to pastureland, or turned into farmland, or paved over with freeways. How great has been the loss in wildlife and fish from these places we will not ever know for sure, for early records were scanty. We can only note

with some nostalgia the reports that salmon spawned so thick in Bull Creek in Humboldt County that in spring it was impossible to drive a wagon across the stream.

And what has become of the rest of the great redwood forests...of the less than 200,000 acres of virgin trees still left uncut as of this point in time? As you know, there has been a continuing effort to save redwoods since the turn of the century. Because the United States government originally allowed all the redwood forests to slip into private hands by the turn of the century--often with no payment at all to the government--every bit of redwood forest that has been protected to date has had to be bought back, or given into, public ownership. To date, about 60,000 acres of uncut forest have been set aside in State Parks and the new Redwood National Park, and at great cost. Many of these parks are very small, one State Park in particular being notable since it is almost taller than it is wide. And what of the rest of the virgin forest, the final 130,000 acres remaining in private hands? With few exceptions the trees are being cut down as fast as possible.

Today's logging is a far cry from the logging of the 1850's. Now, two men with chain saws can fell a thousand-year old redwood in an hour. Logging methods have changed drastically, too; the redwoods now are usually clear-cut; the total forest cover is removed along with the trees; and the soil is scraped bare by bulldozers. This is supposed to insure sustained yield of the redwood forests for all time. This is a highly questionable assumption as I shall explain shortly, and of course we have no proof at all that it will work. And, however it may be justified, it is brutal and destructive to the ancient forests that have occupied this land for so long. And more and more it is becoming clear that this kind of logging is causing a low, but certain devastation of the entire redwood region.

Let us consider certain facts and specifics. The geological formation of the coast range which supports these last forests of *Sequoia sempervirens* is known as the Franciscan formation. It is a mass of loosely consolidated shists, shales and metamorphosed rocks with volcanic intrusions here and there. The soils are soft and extremely vulnerable and subject to erosion. The terrain is also cleft into deep canyons with steep slopes which are further subject to erosion. The laying down of productive topsoil on such a formation is a very slow process; it takes thousands of years of weathering of soil and deposition of humus to form the top soil which can support a forest of this sort. Once established, of course, a living forest contributes to the build up of the rich soil; a delicate balance becomes established between soil and the life it supports. There is a constant exchange of essential nutrients and a cycling of minerals. The soil supports the forest and the forest holds together the soil. Once the forest is removed, however, once the bulldozers do their work, once logging roads and skid roads scarify the soil, a deadly process of erosion sets in. Some is visible and measurable; there may be heavy siltation in the streams and rivers, or, as at Bull Creek, site of one of the greatest pure redwood groves, a whole glacier of unloosed gravels torn from cutover hills may be moving inexorably downstream. Huge slumps and slides may also occur in the terrain of the redwood region following logging. According to Brown and Ritter of the U. S. Geological Survey, the Eel River, principal drainage stream of the redwood region, has the highest average annual suspended sediment yield per square mile of any river in the United States of its size or larger. This yield in tons per square mile is more than 15 times that of the Mississippi River and more than 4 times that of the Colorado. According to other studies conducted by Robert Curry of the University of Montana, so great is the loss of top soil in the redwood region that it (top soil) is being eroded 100 times faster than it is being built up. Robinson in a preliminary study estimates that there has already been a 60% decline in the productivity of the area.

A further reason for this is the insidious and invisible loss of nutrients that appears to result from clearcutting. Clearcutting, as Curry puts it, severs the nutrient cycle that exists between the soil and the trees. Recent studies conducted in the Hubbard Brook forests of New Hampshire indicate an enormous loss of essential nutrients in runoff from clear-cut areas. Not only is there a resultant impoverishment--and eventual sterility of the soil--there is also eutrophication of the streams of clear-cut watersheds, with blooms of algae and de-oxygenation of the waters, which has serious impact on the fish resources of such regions.

The impact of man on the forest environment, indeed, reaches inevitably--like a shock wave--to every form of life the forest supports. As a specific example, when a forest is logged, the stream habitat of the fish is inevitably altered and often destroyed. When the ground cover is disturbed or removed, rain water sheets off, there may be flash floods, and water flow is always increased temporarily. Temperatures are changed and increased, also, when the forest canopy is removed. Heavier sedimentation follows logging; erosion of silt and sand may smother the gravel beds used by anadromous fish for spawning. Along with inorganic debris, organic debris--and nutrients from the soil--may lead to heavy oxygen-depletion in stream water. And finally, there may be physical obstructions, such as logs and slash dumped into streams and rivers, which prevent the fish from completing their usual runs.

All of these adverse effects on fishing have been felt in the redwood region. Because of the lack of adequate early records, it is hard to measure the full magnitude of the loss in the fish resource to date. We do know, however, that the fabled salmon run at Bull Creek, that prodigious quantity of fish, has been totally destroyed following particularly devastating logging upstream. We also know, from California State Fish and Game fish counts initiated on the Eel River in the 1930's that there has been a dramatic drop in numbers of salmon and steelhead in the Eel and its tributaries as clear-cut logging has increased in this region. For instance, in the first ten years that counts were taken on the south fork of the Eel, the run of steelhead averaged 18,264 fish per year, with over 25,000 counted in 1945. During the ten years between 1960 and 1970, the average run of steelhead per year was 6,372. And during the past five years, the count has dropped to an average of just 3,045.

The redwood forest environment, then, has suffered havoc at the hands of man for almost a century and a quarter now. The evidence is all around and inescapable, and in view of what we have learned scientifically about soil loss in this region, for instance, and with the other effects we may expect from continued clear-cutting, it does seem remarkable that we are continuing the final destruction of this remarkable forest. Yet, unless drastic action is taken and taken soon, all of the forests outside of the State Parks and the National Park will be cut down--right up to the border of these parks. This will leave only small islands of virgin groves floating in a sea of cutover land which may regenerate new forests--of a sort--to be cut if they do grow, until the soil becomes too thin or too sterile to support further growth. The remaining groves--which have been likened to wet jelly beans on the side of a bathtub--will be subject to flooding and increasing blowdown as their watersheds are denuded. The entire redwood region can look forward to a limited life expectancy as the precious nutrients are leached from its soil with every clear-cut logging operation. The loss of the physical environment is incalculable.

The loss of the aesthetic value of this region is another major and irreplaceable one, and I have left it until last only because it is so intangible and so personal a matter. Yet to many people, the beauty of the redwoods provides their greatest value of all. There is an almost mystical experience that comes to such people when they stand or walk in a virgin redwood grove. In the dim green-gold light that filters into the understory, the massive columns of the sky-scraping trees have agelessness and solidity that is remarkably reassuring. There is the sense of time flowing uninterruptedly, and reaffirmation of the continuity of life. To many people, the destruction of this experience is a true desecration; the sight of a clear-cut redwood forest is sickening; the sound of chain saws is frightening and foreboding. Ironically, one of the places where such sights and sounds are now unavoidable is the new Redwood National Park. The park was located principally in Redwood Creek where the last great unbroken stands of virgin redwoods stood--only three short years ago. The Congress, which can justify the spending of a million dollars or more for a mile of freeway, could not in its wisdom justify the spending of the necessary millions it would have cost to purchase all the forest community which should have been inside the park. (As it was, the cost authorized for this park--\$92,000,000--was a record expenditure for any park.) During the past three years, the logging companies which own the immediately neighboring land have been cutting down the trees as quickly as possible; the once near-pristine watershed is becoming increasingly scarred and denuded. The waters of Redwood Creek run heavy with silt. The life expectancy of this once-beautiful place is being shortened daily as the logging goes on.

I recommend strongly a trip to the new Redwood National Park on Redwood Creek--not only for a visit to the beautiful redwoods but for a firsthand demonstration of the effect of man on the forest environment. What is happening immediately around this park--for which, incidentally, I fought so long and hard--not only makes a mockery of our national park purposes, but it is a travesty of the concept of preservation of the land.

One would think that we might have learned a lesson from the denuding of hills above the Tigris and Euphrates Rivers, or from the bare hills of Dalmatia or the deserts of Africa, China and Palestine. One would think we might have learned a lesson from the forests of our own continent, from the muddy waters of the Mississippi and the Eel, from the loss of the fish and the birds and the animals which make up the diversity of life. One would think that we might have questioned, long since, our total impact on the forest environment--along with our impact on the ocean and the air, on the land and the earth that supports us. Let us hope, as we consider the forests of the redwood region, that we will pause and look again, that we will at last learn from what we see--before it is entirely too late.

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