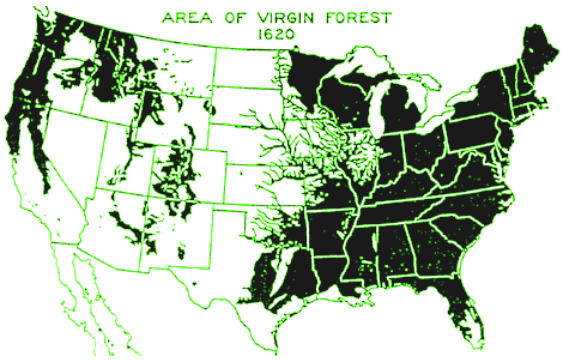
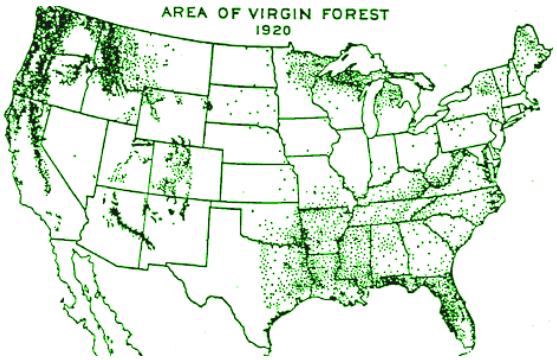
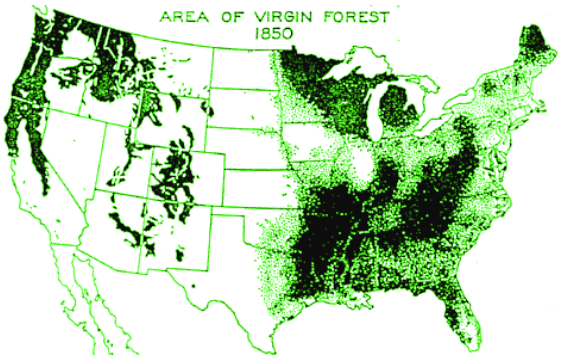
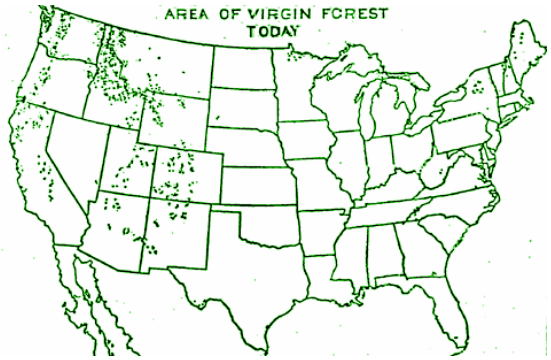
Old-Growth Again

Restoration Forestry and Global Cooling









"Nobody made a greater mistake than he who did nothing because he could only do a little." - Edmund Burke

Old-Growth Again Restoration Forestry (OGA) is a "hands-on" California company restoring logged forestlands to their ancient form while practicing ecologically and economically restorative forestry. OGA is the parent company of Forever Redwood.

The continuing disappearance of old-growth forest habitat accelerates the global decline of wildlife and biological diversity. The large decline in the standing timber volume of the world's forests contributes directly to the release of additional global warming carbon into the atmosphere. Restoration forestry reverses this decline by recreating old-growth habitat and removing carbon from the atmosphere by adding standing timber volume consistently decade after decade.

This manual describes the restoration of 700 acres of Redwood forest in Northern California and it invites the reader to become involved and participate. It documents a small-scale example that can be applied to forests of any size. After a brief introduction to forest-use history and its consequences, OGA's "eco-logic" is described – the transformation of a logged land into a beauty-filled productive forest where trees become old-growth again.

Education by example is slowly spreading restoration forestry knowledge and use. Over time, restoration forestry's growing track record will make irrelevant the "jobs versus environment" argument between preservationists and their industry counterparts. The manual focuses on how to go beyond "sustainable forestry" to add volume back to the forest thru true forest restoration. Only by adding large amounts of volume to the forests of the world can the prior balance of carbon be restored. The manual concludes with additional reading references and the business and legal framework to maintain any forest in a restoration model through subsequent ownerships. To help develop restoration forestry in Northern California, educational and investment opportunities are described and made available.

Front Cover: Historical Maps from 1620 to 1920 published by the U.S. Forest Service in Economic Geography, Volume 1, 1925. The today map published in 1990 by the Greater Ecosystem Alliance, Box 2962, Bellingham, WA 98227. The amount of old-growth forest in the U.S. has declined further since the last map was published in 1990. Although these maps accurately depict the range of the old-growth forests, they misrepresent the amount of old-growth trees. Studies of the Pacific Northwest show that old-growth trees before European settlement covered a fraction of the total forestland at any given time. Estimates vary widely, from 5% to 38% of total acreage. In other words, when viewed on a small map, landscapes of endless variety (and age) are condensed into an unbroken forest of old-growth trees that never existed. Trees of all ages make up an old-growth forest. The maps are accurate only when this is kept in mind.

Credits: Thanks to Frank Marrero for editing help and thousands of hours of service in the woods. Thanks also to Warren Linney, Ian Morris, Maria Eugenia Blanco, A. Terry Patten, Ronald Harbin and other friends that helped the project grow over the years..
Forest Timeline Art on page 2 by Jeff Grove of Petaluma, CA.

Photos by author unless otherwise stated. Page 45 drawing by Sky Simard-Hernandez.
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Old-Growth Again

Restoration Forestry and Global Cooling

By Raul Hernandez

What is an Old-Growth Forest?

The simplest definition is "a forest that has never been logged." But, old-growth/ancient forests are more complex than that. At least six components make-up an old-growth forest:

1. Trees 200 or more years old.
2. Trees of all ages.
3. Large standing dead trees (snags).
4. Large fallen trees in streams and on the forest floor.
5. Many canopy layers (uppermost branchy layer of the forest).
6. Fertile, textured soil.

The old-growth Headwaters Forest was protected from logging in Northern California in 1999. EPIC, a local non-profit, continually challenged the state-approved harvest plans in court to prevent its destruction. Photo used with permission of Greg King, EPIC Box 397 Garberville, CA 95542.

Until one is committed,
there is hesitancy,
the chance to draw back,
always ineffectiveness.
Concerning acts of initiative (and creation),
there is one elementary truth
the ignorance of which
kills countless ideas and splendid plans:
That the moment one definitively commits oneself,
then providence moves too.
All sorts of things occur to help one
that would never otherwise have occurred.
A whole stream of events issues from the decision,
raising in one's favor
all manner of unforeseen incidents
and meetings and material assistance
which no person could have dreamt would come their way.
Whatever you can do, or dream you can, begin it.
Boldness has genius, power, and magic in it.
Begin it now. - Goethe

Degrading Industrial Forestry Practices in Mendocino County's Redwoods (early 1990's): The uncut forestland visible in the top of the photo is the Jackson State Demonstration Forest. Photo by Hans J. Burkhardt

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I: Economy and Ecology

Humanity exists within an intricate web of biological/energetic relationships. Over time, this web has evolved seemingly infinite biological expressions on the earth from landscapes to homosapiens.[1] Where forestland develops, the most evolved landscapes are the old-growth forests. At the dawn of history, these all-age forests covered half of the earth's land surface outside of the arctic regions. Since then, over 40% of this forest has been converted to human use or turned into desert. This historical conversion continues with a growing percentage of the remaining forest being simplified, fragmented and/or degraded. (A 1997 United Nations study reports that between 1980 and 1995, deforestation totaled 2,000,000 km^2 in developing countries while the industrialized world reclaimed a modest 200,000 km^2 of forest area.)

The large biomass of a mature forest moderates the earth's energetic extremes in a variety of ways. For example, mature forests have a tremendous capacity to retain water and influence overall weather patterns. They continually recycle and increase local rainfall. They release large amounts of moisture when the air is dry and re-absorb moisture at night or when raining. They moderate streams by quickly absorbing and slowly releasing water into the watershed. The forest absorbs pollution and also moderates temperature and wind. The larger and more extensive the forest cover, the greater the moderating effect. The larger the biomass of a forest, the greater amount of carbon it holds.

In contrast, the highest and best use of land *economically* begins with skyscrapers and moves down in order of economic concentration to suburbs, industrial agriculture and forestry. By its short-term nature, the market economy undervalues the highly evolved state of "undeveloped" earth-land and its web of biological relationships**.** As long as equal value does not exist for both ecology and economy, the quantity and quality of the Earth's forests and all related life will continue declining. Despite the work of environmental organizations, the planetary trend is toward more population, resource consumption and pollution while old-growth forests continue to decline. If you are sympathetic to changing this dangerous course, read on. Otherwise, please recycle.

The tree planting programs of the large timber companies is a good example of economy and ecology not being considered equally. These programs are generally praised – even though they convert biologically complex forests into young tree-farms. The tree-farms maximize profits in the short-term and maintain tree cover over the land. But, tree-farms often alter the forest structure and trigger an interrelated chain of consequences. For example, many tree-farms plant only fast-growing "genetically-engineered" species. Chemical herbicides are used to eliminate the naturally regenerating competing trees. Because of these practices, industrially managed tree-farms reduce tree species variety and composition. Less tree species and the logging of all trees while young and small (60 years-old) eliminates habitat for some animals and insects and keeps the biomass of the land at a small fraction of its carrying capacity. The relatively small biomass of the young forest limits the moderating effect of the forestland and its capacity to sequester carbon. (The illustration on page 2 and 3 dramatically illustrates the size and structure differences of a 60-year-old tree-farm stand and a mature and old-growth forest.)

Removing tree species that time selected for a specific area invites long-term imbalance into the forest. The interrelated chain of events continues to slowly unfold. Because different tree species use and build-up varying amounts of soil minerals, altering species composition eventually causes imbalances in the mineral content of the soil. Chemical fertilizers are then used to compensate for the soil imbalances. Because the predators of certain insects are eliminated with their host trees, insect populations change. Insect infestations become common and widespread. This leads to insecticide use and more genetic altering to develop "bug-resistant" trees. The regular use of herbicides, insecticides, and fertilizers cause the soil's natural productivity to drop because the populations of microorganisms and fungi that are part of its biological web decline. Genetic engineering and the use of chemicals add instability by changing the forest's self-regulating form.[2] But, by equally weighing economy and ecology, restoration forestry balances the over-emphasized financial perspective that allows biological degradation to occur.

How Did We Get Here?

"Those who cannot remember the past are condemned to repeat it." – George Santayana

The past 6,000 years are well documented: Aside from the usual chronicles of kings, empires and the arts, we can see the debris of ecological decimation in the path of man. In ancient Greece, the senators of Athens talked for centuries about saving their forests. The woods were so rich with life it was dangerous to travel between the city/states because lions often snacked on the Athenian travelers. The senators continued talking while the forests were cut and grazed to extinction (with the lions and wildlife). Talking has not worked yet. Greece today is a dry polluted peninsula:

> *"What is left now of the soils of Greece, is like the skeleton of a body wasted by disease. The rich, soft soil has been carried off." - Plato*

The same decimation has happened to the great forests of Europe, China, The Middle East (the Cedars of Lebanon), and in every sector of every continent. Although other factors contributed (climactic variations, for example), a clear historical land-use pattern exists. The pharaohs of Egypt did not choose a barren wasteland to build their great pyramids:

> *In Topsoil and Civilization, authors Vernon Gill Carter and Tom Dale point to example after example of civilizations rising and falling according to their use and abuse of the topsoil. In western Iran, northern Iraq, Syria, Lebanon, Greece, and many other now-poor countries that once supported flourishing civilizations, the scenario was the same: People deforested their hillsides to plant crops. When the winter rains came, the fertile topsoil on the slopes was washed away, and the land was ruined in a few generations. "When this happened," the authors write, "the people had to move to new land or eke out an existence on impoverished land. These civilizations declined or perished in a few centuries, as they depleted or exhausted the lands on which they were built."*[3]

This same "gradual desertification" continues expanding over the earth. A 1983 study inventoried over 2.4 billion acres of once productive lands that have been turned into deserts over the past 6,000 years.[4] In the United States, only 22.4% of the acreage of the great forests of the 1600's has disappeared. But, the degradation is much more significant than these numbers suggest. For example, four hundred years ago, there was 950 million acres of forests of all ages where today there is 737 million acres of primarily young forests. When the same figures are looked at more closely, the percentage loss of quality, commercial forestland is actually 43.2% (from 850 million acres to 483 million today)[5]. And, despite the many large beautiful parks and government and industry rhetoric, most of the remaining forestland is not managed to serve economic and ecological interests equally. The overall volume of biomass is a fraction of its carrying capacity with the corresponding loss of carbon sequestering capacity.

Locally, the state of California is a pioneer in environmental law with a strong forest practices law and large preserves. For example, approximately 18% of the state's 1.8 million-acre Redwood forest is set-aside. Some of this parkland is being restored, some "catastrophic-fire" prevention work is being done and approximately 85,000 acres are old-growth. A handful of large companies, a state forest and a few dozen ranch/small timber companies manage most of the remaining Redwood forests for timber production. Over 1,100,000 acres (61% of the total) are managed by:

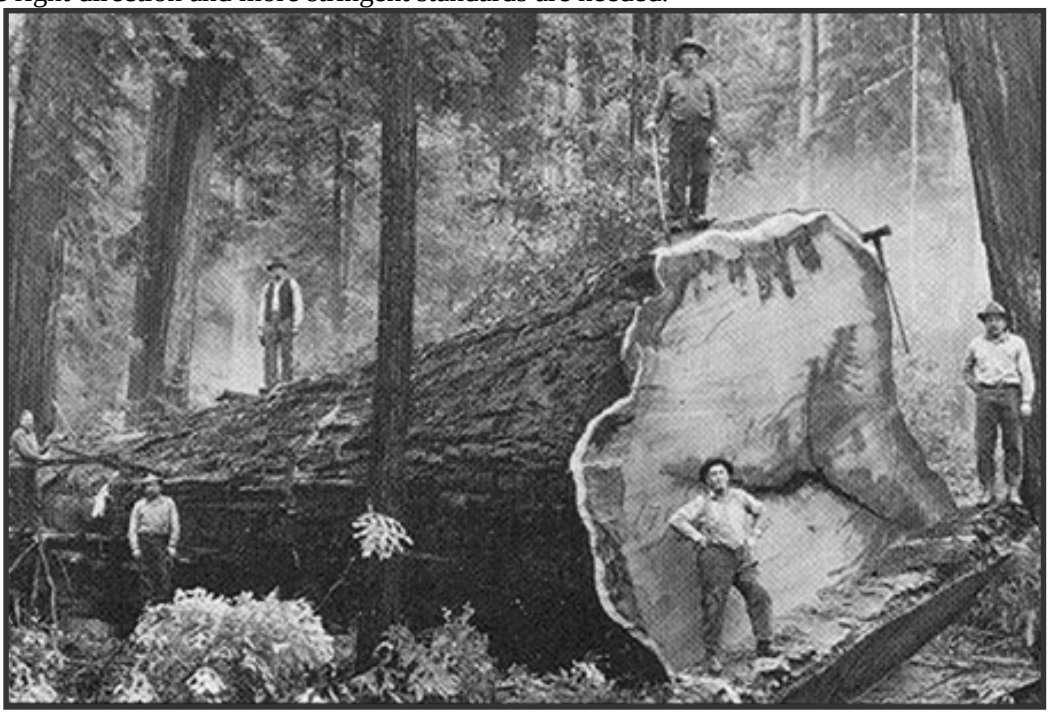
Simpson Timber Co.	400,000+	Mendocino Redwoods	450,000+	Hawthorne Group	185,000+
Pioneer Resources	55,000+	Jackson State Forest	50,200	Gualala Redwoods	30,000+
Mailliard Trust	27,000+	Big Creek Lumber Co.	12,000+		

Until the 1973 forest practice act, poor road building and overcutting degraded the Redwoods and led to long-term erosion, countless landslides and near-extinct fish populations. Although these historic issues have started to be addressed by industry and the state, the long-term ecological outlook remains depressed as short-term economic decisions continue to dominate forest land management.

The overall Redwood landscape is a fragile patchwork. Outside the government protected forests, some forest owners do better work than others. On one end, well-managed stands and restoration projects can be found up and down the Redwood region. On the other end, degraded, very low volume, hardwood-dominated stands are abundant and many forest owners continue to clearcut and high-grade in steep areas causing erosion and regeneration problems. By far the most common forestry practice in the Redwoods is tree farming. Tree farms are maintained as young forests and harvested on 50 to 80 year cycles. Mature or old-growth trees are rarely found on tree farms. "Development" also nibbles at and fragments the Redwood region. Converting forestland into profitable vineyards and/or residential development is a fast growing land-use trend in Northern California.

Recent headline events gave a clear snapshot of the state of the local forests. In 1998, Louisiana Pacific, sold its over-cut 224,000 acres and moved out of state in search of "new opportunities in the marketplace." The new owner, the Mendocino Redwoods Company (MRC), lowered the rate of cut and eventually was certified "sustainably harvested". In 1999, the purchase of the Headwaters Forest demonstrated the great market value of the remaining ancient groves. The Government paid $495 million for the 9,450-acre forest. Headwaters was one of the last large tracts of unprotected old-growth Redwoods.

In 2008, The Pacific Lumber Company (PALCO) was liquidated and sold to MRC. PALCO had severely over logged its lands since a 1985 hostile takeover and couldn't pay its debts. MRC now owns over 450,000 acres of the Redwood forest. Although practicing more conservative forestry than their predecessors, a walk thru MRC lands will convince you that "sustainable forestry" is only a modest step in the right direction and more stringent standards are needed.



This 18-foot diameter Redwood was cut near Fort Bragg, CA in 1933. Smaller-diameter old-growth Redwood still trickle into local mills today. Old-growth wood is of the highest quality and durability. Limited supply has made it very valuable today. (Photo: Save-the-Redwoods League)

Old-Growth Again – Acting Locally

OGA is restoring 700 acres of Redwood forest. Most is within the Gualala river watershed shown above.

Prior to logging, an enormous conifer forest of Redwood, Douglas-fir and Sugar pine teemed with life. In the shade of these ancient giants, hardwoods like Tanoak and Madrone made up a smaller second level canopy. The conifers were up to 10 feet wide and over 250 feet tall. Their lowest branches were usually over 50 feet above the forest floor, creating a shaded, moist "cathedral ceiling" environment with expansive views of the forest interior. Wildlife habitat was abundant and diverse with many large downed logs and dead standing trees (snags). For example, a Black bear could find a den under a large fallen log or a bird of prey could perch within and fly through the tall forest interior.

*The forestland managed by OGA was transformed by "high-grade" logging in the 1950's and 60's***.** It is called high-grading because the "high-grade" trees are removed and the immature, diseased and defective trees are left standing. The tall conifer canopy disappeared when the old trees were cut. The canopy today is about 50% hardwoods (mostly Tanoaks) and 50% young conifers. Because mature Tanoaks rarely grow taller than 80 feet, most of today's canopy is a fraction as tall as it once was. Without a tall and closed canopy to gather summer water from the fog (fog drip), the thin soil becomes drier with less ground vegetation and less water in the streams.

Redwoods and Tanoaks resprouted around their stumps creating rings of small trees where one stood before. With little canopy cover, the pines and firs seeded vigorously in the open sun. The land now has over 1000 mostly small trees per acre instead of about 150 trees of all ages. When the canopy is intact, young trees reach for the small canopy openings and grow few low branches. When the canopy shade was logged away, the young trees grew many low branches. The low branches, combined with overcrowding, replaced the "cathedral ceiling" of the old forest with an impenetrable wall of branches from the canopy to the ground. Instead of walking through an expansive forest, you now have to push branches to walk or see beyond a few feet.

To access the timber, many wide roads and skid trails were bulldozed into the hillside. Where the slope is moderate, most of the roads held. Above many of these roads, the remaining stumps show signs that erosion has removed several inches of soil. On steeper slopes, erosion was severe with many skid trails

collapsing and creating landslides. This unstable land makes up at least 2% of the acreage. Forty years after road building, this land still frustrates regeneration by continuing to crumble and erode into the streams.

Logs were often hauled out via the creeks because it was convenient to do so. The use of heavy equipment changed the content and structure of the streams. The tractors bulldozed and removed many of the large fallen logs, the boulders and the gravel beds that water and time had carved into ideal spawning areas and fish rearing pools. Logging debris in the streams created large logjams that made fish passage difficult or impossible in some areas. (Experts still argue over how much woody debris is desirable for fish habitat in streams.)

Most of the local creek's shade trees were also removed. Evidence suggests that without sufficient shade, the summer's warm water temperatures increase beyond where most fish can survive.[6] When you also add the large increases in fish egg suffocating erosion silt, it is understandable that the wild river populations of California Coho Salmon are less than 3% of what they once were. (We say evidence suggests because although fish obviously die at high stream temperatures, we have little historical stream temperatures to compare with.)

Despite the degraded state of the Gualala river's forests, logging applications are regularly approved for stands that have not recovered sufficient volume since the last cut. For example, an attempt to log 41 acres for a quarter million-board feet of timber was approved by the California Department of Forestry in 1994. The logging was stopped when neighbors refused the logging trucks access to their roads. The land was then sold and became part of OGA's restoration. The land will begin to yield some timber beginning in the year 2015. Twenty years later, OGA will still cut less than half the volume the state approved for harvesting in 1994.

Forest Work Objectives

Restore Old-Growth Species Variety and Canopy Structure: Restoration forestry works with the land's biological relationships. Before removing a tree, its relationship with the canopy, soil, slope of the land, erosion, fire hazard, age and species distribution of neighboring trees are all considered. OGA performs a series of "low-grade" thinnings at intervals of ten years to help the forest slowly recreate a canopy and species structure similar to what existed prior to logging. These "low-grade" thinnings do the opposite of what the logging did by removing mostly deformed and crowded immature trees. Each decade, the thinning removes 10% of the forest's total standing timber volume. Because a young stand adds over 30% new volume of wood per decade, thinning 10% per decade translates into less than 33% of the 10-year growth rate. As the forest matures, the growth rate slowly declines to 10% per decade after the forest is over 200 years old to match the thinning rate. Growth and harvest figures are measured before and after each thinning by a 10% timber cruise.

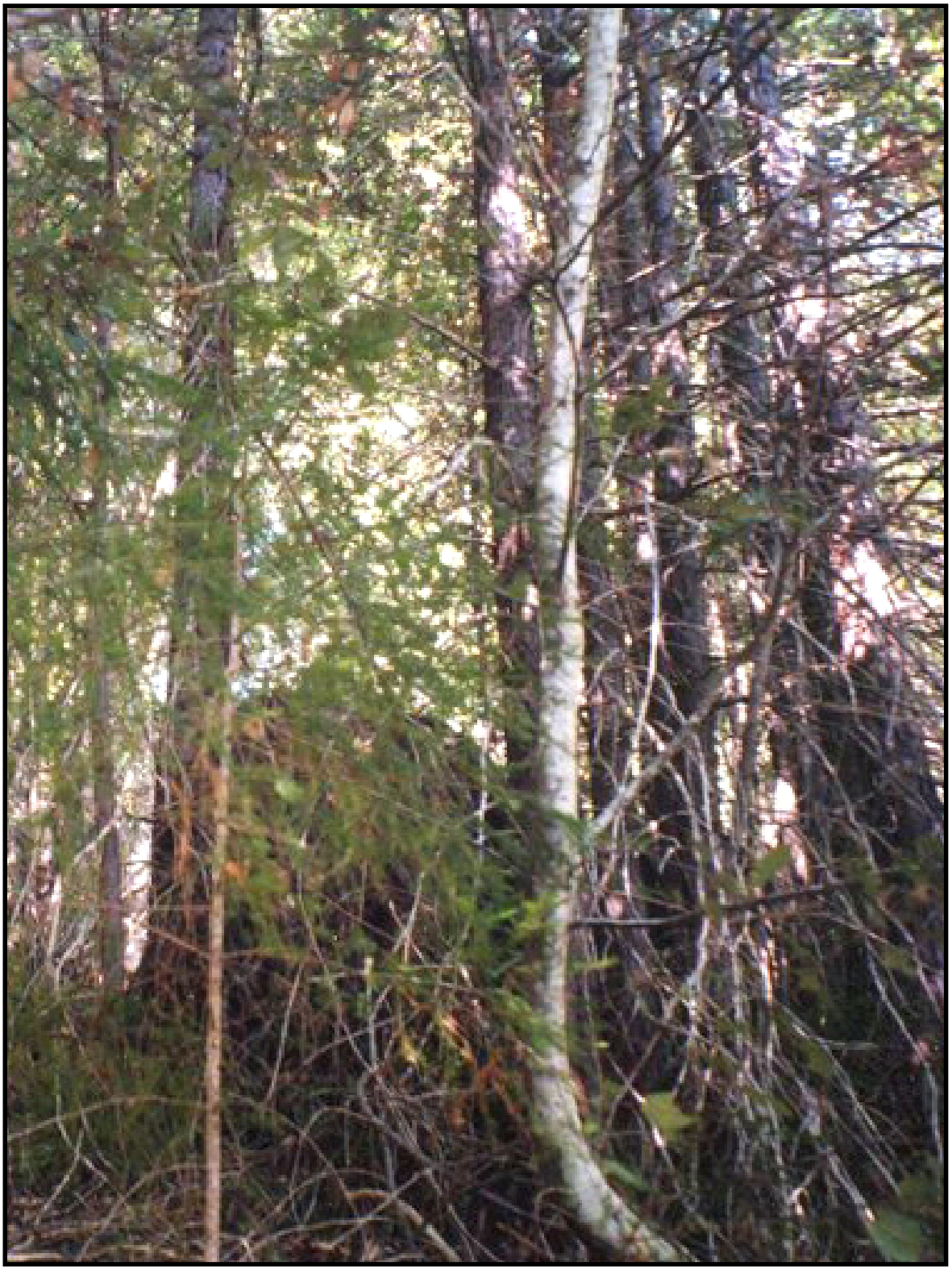
Over the coming decades, the forest will again have a tall coniferous canopy of about 150 trees of all ages with several large snags and deformed (wolf) trees per acre. The species composition volume will slowly return to being approximately 90% conifers from the present day 50%. And, the landslides can slowly be stabilized and overall erosion reduced so that the forest can naturally rebuild its soil. Once the large erosion sources like landslides, gullies, poorly designed roads and skid trails are corrected, some of the stream's spawning gravel beds and rearing pools can be rebuilt. This mimics the stream's natural healing allowing salmon and trout populations to grow in less time.

Demonstrate Financial and Ecological Sustainability: To help recreate a canopy dominated by old-growth and large mature trees, OGA always thins to improve the stand. This allows a high percentage of the best trees to eventually become mature and old-growth. For example, OGA sets aside an average of five of the largest and healthiest trees per acre to live out their lives of up to

500 years or more. Redwoods are favored because of their longevity, but all species are represented. These old-growth trees will grow alongside younger trees that are thinned selectively every ten years. The stand will eventually have a distribution of trees in declining amounts in the under 20, 40, 60, 80, 100, 120, 140, 160, 180, 200 and over 200-year age groups. By maintaining a diverse stand of old-growth, mature and young trees, the forest will approximate its pre-logging structure. A mature forest with trees of all ages offers ideal habitat for many different life forms and offers the richest biological influence for the surrounding area's atmosphere, water and wildlife. As the forest matures, it will become of growing importance as a wildlife corridor for "mature forest dependent" animals. In contrast to sustainable forestry, restoration forestry makes long-term permanent contributions to global cooling by absorbing and holding a large amount of carbon. Sustainable forestry requires only marginal increases in standing timber volume. The rates of cut allowed under certified sustainably management plans lead to only a small sequestering of carbon over many decades while restoration forestry contribution is enormous.

The Restored Forest Becomes an Educational Model: The forest's living example of maturing to old-growth while contributing economically will demonstrate the viability of restoration forestry and encourage others to adopt its principles. Once the streams, the soils, the landslides and the road problems are stabilized, a careful and conservative thinning program performed once a decade becomes the long-term restoration tool. Eventually, as the stand matures to over 200 years, it will approach full stocking and growth and will then match the thinning rate of 10% per decade. At this point, with an average of 150 trees of all ages per acre, each decade's harvest removes one to three mature trees each acre. This is a small portion of the total mature tree volume (up to 30 mature and old-growth trees per acre). The forest with trees of all ages and a canopy dominated by mature and old-growth conifers can be maintained in this state in perpetuity as long as the 10% per decade thinning rate is not increased. These standards are "restorative" in nature because they move the forest towards its ancient form. Restoration forestry standards significantly exceed the requirements to certify a forest as "sustainably-harvested".[7]

Conifers begin making quality wood after age 70. By providing rare mature \wood, OGA can harvest consistent income from a fraction of forest growth. In this way, the ecosystem flourishes and contributes economically. Ecologically, the key is to consistently harvest very lightly and carefully. Economically, the key is to manage land with little or no debt and keep it that way. Forest income is then based on biological factors, not financial demands.



Redwood Stand before the First Thinning: 40 years after industrial logging, the "cathedral ceiling" has become an impenetrable maze of branches from the canopy to the ground. You must push branches to walk or see beyond a few feet.

A Redwood Stand after the First Thinning: The young forest is structurally transformed. Thinning and pruning begins to recreate the expansive understory of the old forest. Over the coming decades, some of the pictured trees will be thinned to add growing room for the best formed and most vigorous trees.

What You Can Do

Restoration forestry exists worldwide; unfortunately, it is small compared to industry and government practices. If you share the old-growth again vision, here are four possible avenues for your interest:

First, if you own forestland, attach a "restoration forestry" conservation easement. This way, you retain ownership and use while restoring and protecting the land in perpetuity. Conservation easements are tailored to the property owner's wishes. They outline how the forest can be used. They legally protect the land's biological diversity by allowing the forest's beauty and majesty to increase decade by decade. Placing a conservation easement on forestland often results in a federal income tax deduction, estate tax relief and/or annual property tax relief. The easement also insures that the recreational value of the property grows as the forest matures into an older ecosystem. And, in time, you and your children will be financially rewarded when the restored forest begins to yield sustainably harvested timber. If the land is in Sonoma or Mendocino Counties, OGA can be contracted to help coordinate the easement process and/or to manage the long-term forest restoration. For more information, call us at 866-332-2403 or email us at info@oldgrowthagain.org. Appendix A explains the conservation easement and includes a complete copy of a conservation easement agreement.

*Second, learn how and do it yourself***.** Our internship program accepts a handful of responsible individuals every year. The goal is to train others to do "hands-on" restoration forestry elsewhere. Tuition is free – room and board is traded for 80 hours of field work/study spread out over a calendar year. (See internship program, page 13).

*Third, become a neighbor***.** Forestland in the area is usually available. Almost all parcels have been logged and are ripe for restoration. Tax breaks are available for investing in forest restoration. Zoning usually allows for two residences per parcel. Parcel size ranges from 2 acres up to 640 acres. Roads are usually gravel and electricity is only available in some areas. For electricity, many residents use a combination of solar power, generators and batteries. Conventional phone service is often available. Cellular phones often work well. Water is plentiful via springs, wells, rain collection or from streams. Property taxes in California are generally fixed at 1% of the property's purchase price. Property taxes increase only when new structures are built via the county's building permit process. Property taxes are often decreased when conservation easements are attached to the deed. OGA maintains a list of available properties.

Fourth, own part of an OGA Project. If direct ownership is complicated or liability issues are a concern, co-ownership is another option. For example, you can own shares in a corporation that holds title to the land. This limits liability and eliminates land management duties. Some OGA managed land is co-owned in corporations or in trusts, while other parcels are owned by two or three individuals in partnerships.

OGA has grown through hard work and relationships with like-minded friends. The most difficult work is the gradual reduction of the hardwood volume and the slash cutting, soil preparation and planting to help the conifers become dominant again. The hardwoods are cut and removed and most is sold for firewood. Firewood is a difficult business to make a profit, but it lowers restoration costs and thereby contributes to the bottom line. OGA's investor partners have invested over $5,000,000 to date. If you would like to be a partner in this vision, please contact us. Tax breaks are available for restoration forestry investments. Besides doing your part to restore forestland, when you add the tax benefits, and land value appreciation, forest restoration is a handsome financial investment long-term.

The forest's bounty – Shane Sutcliffe with a Pacific Giant salamander in the rain.

Restoration takes time and money. OGA's work is partly funded by grants from the California Department of Forestry and the Tides Foundation of San Francisco, CA. OGA is funded by a combination of grants, tax breaks for our property owner-partners and sales of our wood products (firewood, patio furniture sales and custom milling). OGA accepts tax-deductible donations/grants to help defray costs for road and stream restoration work, additional forest improvement and land acquisition.

OGA is action-oriented. We don't write letters to our congressman or do petition drives. We are hard-working, tree-hugging business people. We buy forestland, restore it and practice excellent stewardship <u>ourselves</u>. Talking doesn't get the job done. We prefer to get involved directly and walk the talk. Please consider this a personal invitation… Consider showing up and making it happen. There is an endless amount of work to do. Kick down some $$ to restore and protect your own piece of the planet. Restore forestland and wildlife habitat, make a little money down the road and, if you like, get dirty in the woods in your free time… Investing the time and money to do the restoration right pays off because forest volume and quality multiplies. Some of this growing timber volume is carefully harvested perpetually at an ever-increasing premium while the global cooling overall timber volume increases, and the diversity and beauty of the forestland continually improves.

Restoration forestry is physically demanding. If you or your children would like to work in the woods, the field tasks are tailored to meet individual abilities. Regardless of the weather, a day in the woods is always sweetened by a reinvigorated mind, body and spirit.

Restoration forestry helps reverse global warming. Large trees have many times more growing shoots than young trees because they have more layers of branches and each branch continues to develop growing shoots like an individual tree. Although a 200-foot tree does not have branches near the ground, it generally has over one hundred feet of sun collecting, carbon absorbing and oxygen creating large branches. By limiting the rate of harvest to 1% per year, restoration forestry allows young forestlands to regain almost all the volume of an ancient forest over the course of 120 years. By allowing a working forest to return to volumes close to a climax ancient forest, enormous amounts of carbon are sequestered while at the same time maintaining the forest in production. By contrast,

sustainable forestry, at a rate of harvesting of 2% per year also sequesters carbon in perpetuity, but at a fraction of the amount per acre of a forest managed at a rate of cut of 1% per year (see forest volume accumulation charts on page 53).

Although mature forests grow at slower rates than young forests, they add volume at a greater rate decade to decade. The young forests under industrial or "certified sustainable" programs like the Forest Stewardship Council and others are cut at rates of 2.0 to 2.5% per year limiting the accumulation of volume and carbon sequesteration to a fraction of the carrying capacity of the forest. Under restoration forestry, the accumulated volume of a mature forest is left uncut and standing to keep the global cooling carbon from being released back into the atmosphere.

We hope to restore as much of our Redwood watersheds as quickly as nature, finances and our backs allow. As this project proceeds, it will stand on its accomplishments as an example and inspiration for others to emulate. Visitors are welcomed.

The standards on the pages that follow are simple to understand. They are "on the ground" standards for "doing yourselfers". These standards are the foundation for a "Global Cooling Standard" for forestry practices. For more information, contact Raul Hernandez at (866) 332-2403, email at raul@sonic.net, or write:

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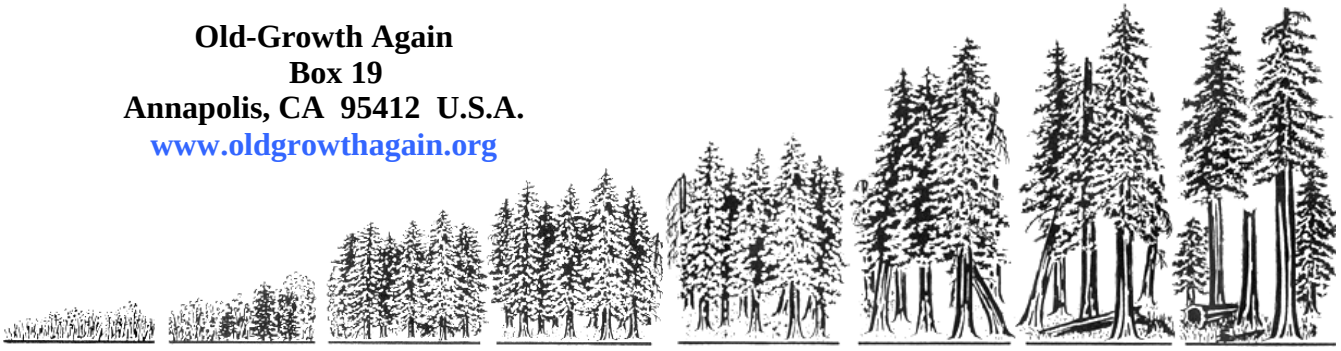

Year 1	15 years	30 years	60 years	100 years	200 years ---------- 500 years -->
Bare soil & herbs	Shrubs & seedlings	Saplings & shrubs	Young Forest	Mature Forest	Old-growth

I know of no more encouraging fact than the unquestionable ability of man to elevate his life by a conscious endeavor… If one advances confidently in the direction of his dreams, and endeavors to live the life he has imagined, he will meet with a success unexpected in common hours. - Henry David Thoreau

Degrading Industrial Forestry in our Backyard: These 1998 clearcuts are in the Fuller Creek watershed next to OGA lands. Other adjacent clearcuts were completed in 1999. The cuts are California Department of Forestry (CDF) approved to remove the dominant hardwoods in an effort to re-establish the conifer canopy. Once cut, the site was burned and partially re-planted. To help the conifers compete with the fast growing hardwoods, several broadleaf herbicides were used. In contrast, OGA restores degraded hardwood-dominated stands without clearcutting, brush burning or the use of chemicals.

For More Information…

Visit us at www.oldgrowthagain.org Phone (707) 495-4955 Fax (619) 374-2462 or write to: OGA Box 19 Annapolis, CA 95412

"There are 3 types of individuals; those who see, those who see when shown, those who do not see."

- Leonardo da Vinci

For Our Children's children…

Footnotes and Additional Reading:

[1] Wilson, Edward O. The Diversity of Life, pg. 15, Harvard University Cambridge, MA 1992

[2] Lansky, Mitch Beyond the Beauty Strip, Saving what's Left of Our Forests, pg. 111-6, Tilbury House, Gardiner, ME 1992 (Exhaustive criticism of Maine's Industrial Forestry.)

[3] Robinson, Gordon The Forest and the Trees, A Guide to Excellent Forestry, pg. 85, Island Press Covelo, CA 1988 – (This is OGA's primary text – an excellent foresters' lifelong research/reference project.)

[4] Dregne, H.E. The Desertification of Arid Lands, Academy Books, New York , N.Y. 1983

[5] Williams, Michael Americans and their Forest, A Historical Geography, pg. 433, Cambridge University Press New York, N.Y. 1992 (Thoroughly documented history of U.S. forestland use.)

[6] Norse, Elliott Ancient Forests of the Pacific Northwest, pg. 104-6, Island Press, Covelo, CA 1990 (Wilderness Society)

[7] The Institute for Sustainable Forestry Pacific Certified Ecological Forest Products, Forester and Landowner Handbook, pg. 6, Redway, CA 1996 (Bulk of text included in Appendix B.)

[8] Eastwood, Bill Forestree News pg. 4, The Institute for Sustainable Forestry, Redway, CA 1994

[9] Margolin, Malcolm The Earth Manual, How to Work on Wild Land Without Taming It, pg. 69-70, Heyday Books, Berkeley, CA 1985 (Experienced hands-on restoration advice.)

[10] Lansky, Mitch Orion Afield "Sustainable Forestry" pg. 28, The Orion Society Great Barrington, MA 1999

[11] Chase, Alston In A Dark Wood, pg. 70, Houghton Mifflin, N.Y. 1995 (Criticism of environmental politics.)

[12] Jepson, Dr. Willis Linn The Trees of California, pg. 108, Cunningham, Curtis and Welch Publishing Company San Francisco, CA 1909 (Early botanical study of California Forest Trees.)

[13] Lindquist, James L. and Palley, Marshall N. Empirical Yield Tables for Young-Growth Redwood, pgs.14–27, California Agricultural Experiment Station Bulletin 796, Univ. of California Press Berkeley, CA 1963

[14] Lanner, Ronald M. Conifers of California, pg. 244, Cachuma Press Los Olivos, CA 1999

In addition to the footnoted publications, the following publications were consulted:

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Arvola, T. F. California Forestry Handbook, State of California Resources Agency, Sacramento, CA 1978

Burkhardt, Hans J. Maximizing Forest Productivity, Resource Depletion and a Strategy to Resolve the Crisis, H. Burkhardt, Emile's Station Ft. Bragg, CA 95437 (A proposal for restoring the local Redwood forests.)

Devall, Bill Clearcut: The Tragedy of Industrial Forestry, Sierra Club Books and The Earth Island Press, San Francisco, CA 1993 (Aerial photo essay of industrial forestry clearcuts worldwide.)

Fazio, James The Woodland Steward, Woodland Press, Moscow, Idaho 1994 (Excellent practical manual for managing woodlands.)

Hawken, Paul and Lovins, Amory and Lovins, L. Hunter Natural Capitalism, Creating the Next Industrial Revolution, Little, Brown and Company, Boston, MA 1999 (Research on technological leaps that can minimize resource use.)

House, Freeman Totem Salmon, Life Lessons From Another Species, Beacon Press, Boston, MA 1999 (The "hands-on" grassroots effort to save the King Salmon of the Mattole River in Northern California.)

Kuchli, Christian Forests of Hope, Stories of Regeneration New Society Publishers, Gabriola Island, British Columbia Canada 1997 (Forest use history and worldwide examples of sustainable forestry.)

Meehan, William R. Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats, American Fisheries Society, Bethesda, MD 1991 (Erosion control and stream restoration textbook.)

Mollison, Bill Permaculture, A Designers' Manual Tagari Publications, Tyalgum, Australia 1988 (Well documented bible of the interrelated forces of the earth and designs for sustainable human interaction.)

Passof, Peter C. Managing your Redwood Forest: An Owner's Manual for the Nineties, U.C. Davis, Davis, CA 1993 Pilarski, Michael Restoration Forestry, Kivaki Press, Durango, CO 1994 (Worldwide restoration encyclopedia)

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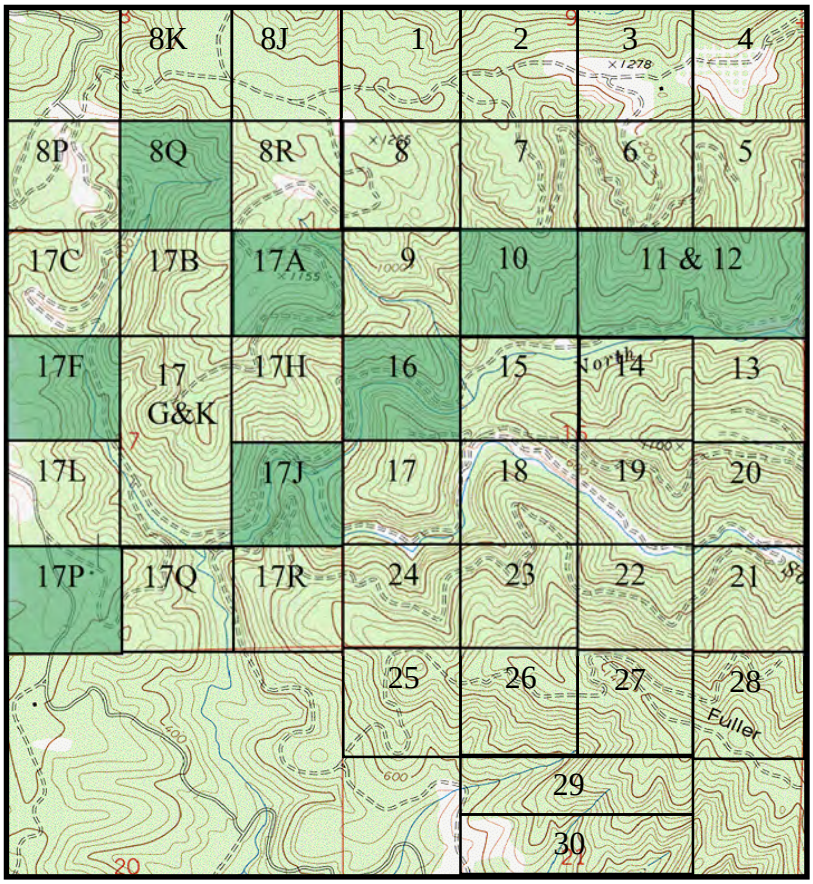
Seldes, George The Great Thoughts, Ballantine Books, N.Y., N.Y. 1985 (Collection of historical thoughts.)

United Nations Development Programme, World Resources 2000-2001Weaver,

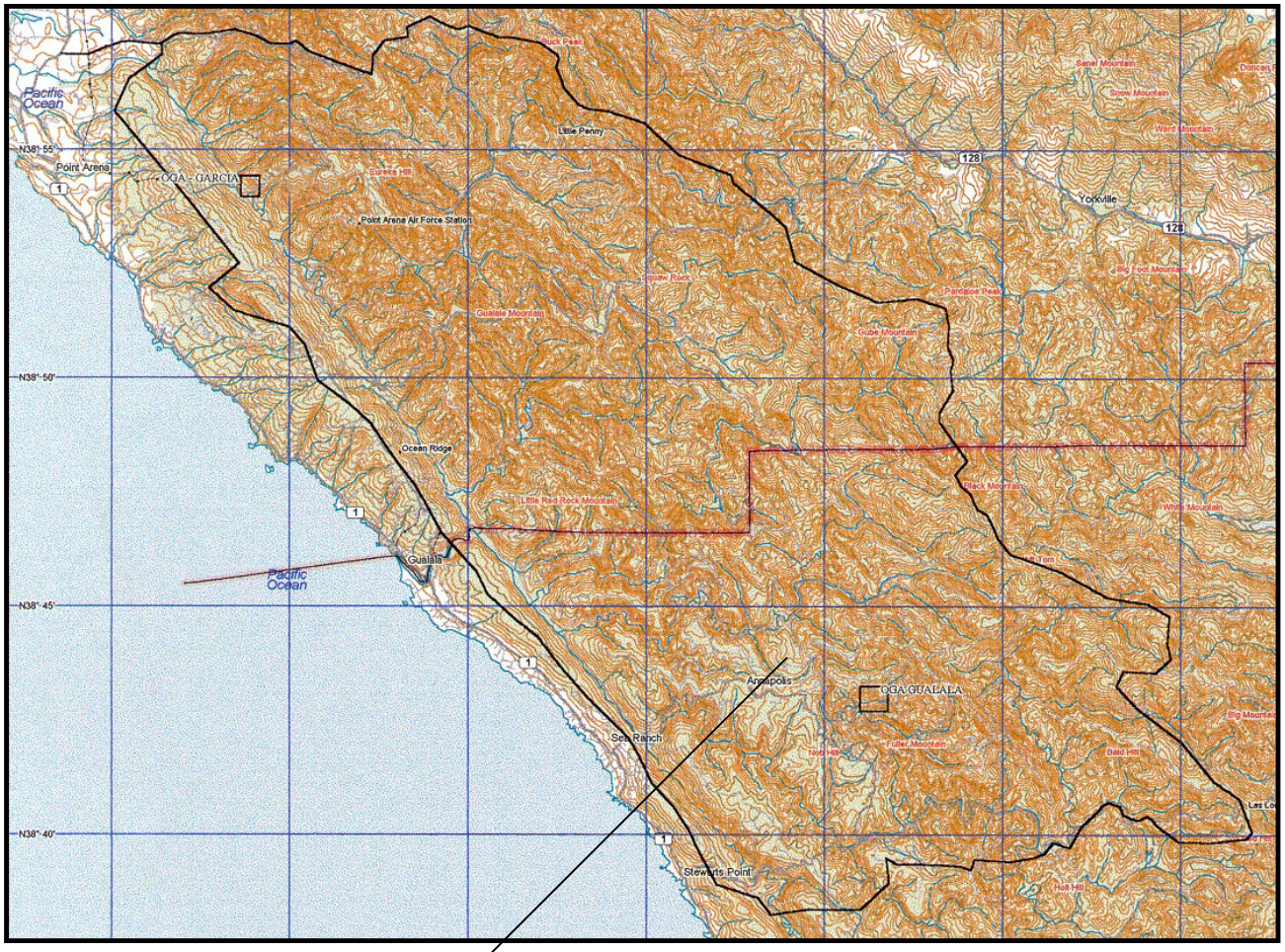
Hagans, Danny K. Handbook for Forest and Ranch Roads, Mendocino Co. Resource Conservation District, Ukiah, CA 1994

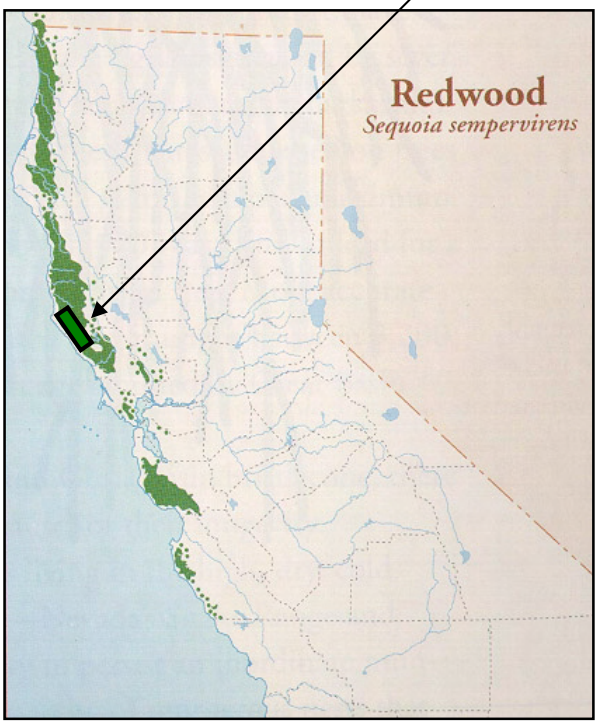
Maps

1. Mendosoma Unit III Subdivision in the Fuller Creek Watershed (Annapolis, California): The USGS topographical map below highlights the subdivision's 46 parcels. OGA manages the dark green areas (8Q,11,12,16,17A & J). The gravel roads are the double dashed black lines. The year-round streams are the blue lines. The brown lines are elevation lines. Each light brown line is a 40-foot altitude change. Each dark brown line is a 200-foot elevation change. Parcels average 41.5 acres. Most are square-shaped lots that measure approximately a quarter of a mile on each side. The one exception is parcel 17 G&K. It was legally combined into one parcel.



Please do not use this map as an invitation to trespass. Resource theft is a constant issue and trespassers are prosecuted. For more information or to walk available land, please contact OGA first.





2. Gualala & Garcia River Redwood forests: The above map shows the Redwood forest areas of the Gualala and Garcia watersheds where OGA lands are located. The small black squares mark the locations of the Fuller Creek lands (labeled OGA – GUALALA) and the lands east of Point Arena, CA (labeled OGA – GARCIA). The red line through the center is the county line. Mendocino County is to the north and Sonoma County to the south. The map area is approximately 25 miles north to south and 10 miles east to west.

3. The Redwoods of California: The green area on the map to the left shows the natural range of the Coastal Redwood forest. It extends from south central California to southern Oregon and totals 1.8 million acres. To give a sense of scale, the arrow highlights the area included in map 2 (black rectangle).

II: Ecology – In-the-Field Restoration Notes

"You don't have to know the names of plants or animals to have a mystical experience in nature." - Phil Arnot, Wilderness Guide

These notes introduce the ideas we keep in mind while working in the woods. Although written for our Redwood/mixed conifer restoration, most of the issues discussed are relevant to other forest types. For a complete treatment of these subjects, see the footnotes and additional reading section.

Lowering Fire Risk

Each year in the United States, millions of acres of forestland are destroyed by wildfires. A large percentage of these losses can be avoided. The main reasons forests are lost is human alteration of the forest structure and the accompanying fire suppression policy:

> *To understand the present day forest, we must look back to pre-white settlement time. The forests were continuously shaped by disturbance regimes, most notably fires, storms, and insect outbreaks. Fire has probably had the largest role in determining and maintaining forest composition and structure here. Native Americans used sophisticated burning techniques in the region for thousands of years. Lightning also started many fires. These frequent fires were mainly gentle ground fires that killed young seedlings and kept ground fuels from building up to dangerous levels. The forests were open and park-like with widely spaced trees. Many early settlers reported the ability to easily ride horseback cross-country through forested areas. Meadow areas were also much more extensive, as can be easily seen by examining forest age structure. Severe fires were rare.*
>
> *It is important to have this image of how the forest looked when considering what to do about the problems facing us today. Not only do we have to deal with the fact that virtually all of the region's old-growth Redwood and Douglas-Fir were cut during the last 50 years, but we also need to consider that the natural stand-shaping fire regime has been replaced by a policy of fire suppression that has traded frequent, low-intensity ground fires for infrequent, devastating stand-replacing fires. Lack of understanding of this second point has led to much confusion. Corporate forestry has ignored the increased fire danger being created by its even-aged clear-cut plantations. On the other hand, many landowners and environmentalists have the idea that it's best to leave cutover-forested areas alone to "heal themselves." While laudable in intent, this strategy does not deal with continuing changes in forest structure and composition caused by the exclusion of the natural fire regime. The large acreage burned each year in catastrophic wildfires is a reflection of this fire suppression policy. But we face a very serious dilemma. Reintroduction of fire in its traditional role is largely not possible because of the extreme fuel buildup and also because it is not socially acceptable. A fire hazard reduction strategy that mimics the effects of mild ground fires by pruning lower branches and thinning [should be implemented]. Eventually, prescribed burns can be carried out.*[8] *- Bill Eastwood, The Institute for Sustainable Forestry*

Logged forests are vulnerable to stand-destroying fires. The conditions are ripe because logging slash is highly flammable and the small fragmented canopy can not retain moisture or stop the wind from blowing through the forest. Crowded young trees grow slowly and their thin bark does not resist fire. Also, small trees and low branches create a fire ladder that helps ground fires reach and destroy the canopy.

If the logged forest is left to recover untouched and the stand survives fire, it eventually will thin itself somewhat but will have lingering structural problems for hundreds of years. It will tend to have overcrowded relatively thin trees and more low-quality trees. Without active restoration, gullies and other erosion problems will persist, slowing the rebuilding of the soil. The canopy will include more hardwoods; a step backward in the evolution of the coniferous forest. The lower hardwood canopy will create a less stable understory microclimate that is drier and hotter during the summer's fire season.

The best protection against stand-destroying forest fires is a predominantly mature or old-growth forest that is regularly thinned and/or prescribe-burned. The lower fire hazard is a natural part of a mature forest. For example, the tall canopy limits the amount of branches that grow near the ground, which makes it difficult for ground fires to climb limbs and burn the canopy. The thick bark of healthy big trees protects them from most intense fires. And, the enclosed understory is moist and limits air movement, which helps keep fires from heating up to dangerous levels.

Moving the stand in stages towards the form it held prior to logging lowers the risk of a stand-destroying fire. The first step is to thin and prune. Thinning eliminates many dead, overcrowded, deformed and flammable trees. It also gives the "released" trees growing room to add more bark thickness and height in less time. For example, we often find crowded 25-year-old Firs that are only five feet tall. With less competition for water and sunlight, dominant 25-year-old firs can exceed 50 feet.

By initially pruning the lower branches of most remaining trees to at least 10 feet (but not more than one-third of the way up the tree), the "fuel" that helps ground fires climb the canopy is lowered. An important final step is to thoroughly cut up the downed tree's slash to below one foot above the soil. This provides a structural web to the soil that fights erosion. It also accelerates its decomposition, which lowers the slash fire risk. After a few rounds of thinning, pruning and slash cutting, the stand is ready for a prescribed burn. Some stands may benefit from a prescribed burn. A carefully supervised burn imitates a ground fire, consumes the fuel otherwise available for a "hot" devastating fire, and releases nutrients for plant growth. Thinning achieves many of the results of a prescribed burn and is often preferable.

Redwoods have genetic protection against fire. After a 10-acre fire, most trees were salvage logged. Among the burnt trees left standing, many Redwoods resprouted branches and tops. No other tree species that died in the fire came back. A fire's intensity determines how many Redwoods can grow new limbs. In the two photos, five Redwoods are growing new branches and two are also growing new tops. The burnt branches will eventually fall off and the fire scars on the trunks will shrink over time as the tree grows. Most Redwoods that cannot grow new limbs sprout new trees from their roots within months to regenerate from the ground up.

Pruning Notes

Pruning the lower branches of most trees opens up the forest. It begins to re-create the expansiveness of the ancient forest for better wildlife habitat and human enjoyment. When pruning, cut as close to the bark as possible. Do not leave stubs. Stubs devalue eventual lumber (knots) and flush pruning allows the bark to grow over and heal the cut in a couple of growing seasons. Machetes may be good for slash cutting, but if used for pruning, they often scar the thin bark of young conifers because it is difficult to make consistently clean branch cuts. Large pruning shears are the preferred tool up to 10 feet above the ground. The power and manual pole saws can trim up to 20 feet above the ground.

When pruning live branches with a pole or handsaw, make an initial cut under the branch so its weight will not tear the bark when falling. The exception to flush pruning is the swollen collar of larger branches (fir, pine and tanoak). This collar protects the tree against disease and should not be pruned. Depending on how much time and energy you have, conifers can safely be pruned to one-third of their height. Large Pine and Fir branches are best pruned in fall and winter when the sap is not running to avoid bleeding trees. Redwood branches can be pruned anytime because they are generally thin and do not seem to bleed. Most conifers are pruned unless near large openings, like wide roads, where lower branches are left as windbreaks. Some Tanoaks are partially pruned to about 8 feet to make human movement in the woods easier. They are not otherwise pruned because they tend to grow thick, fire-resistant branches. Tanoaks selected for future lumber can be pruned of small branches as high as is practical.

Management of Tanoak Resprouts

Vigorous Tanoak re-sprouting will occur when the canopy is opened up after logging. It usually forms tall bushes of dozens of competing stems within a couple years. These bushes use the old tree's existing root system to compete aggressively for water and nutrients with surrounding trees. This is why industrial foresters commonly use herbicides to give conifers a competitive edge.

OGA does not use chemical fertilizers, insecticides, fungicides, or herbicides regardless of application method or dosage. Although the effects these substances have on the soil structure or the watertable are constantly argued over, we choose to side with conservatism. When we thin an area, we leave the canopy mostly intact. By not opening up the canopy, the Tanoak re-sprouting is not as vigorous. When an area is thinned again in ten years, most Tanoak bushes are re-cut and only the most straight, upright and vigorous stem or two are left. We let the brush develop. It is the same economy and ecology point again – the brush slows the growth of surrounding conifers (economic loss), but it provides food and cover for wildlife and keeps chemicals from the soil (ecological gain). As the canopy grows taller and thicker, it will slow future Tanoak growth and encourage more shade tolerant species like Redwood.

Protecting and Building the Soil

Forest topsoil is a symbiotic web of thousands of living organisms. For example, at least 25 different species of fungi/mycorrhizal mushrooms help the roots of the Douglas-fir tree assimilate minerals and exchange nutrients with other trees. In 1816, the well-known German forester Heinrich Cotta wrote in Advice on Silviculture:

> *Formerly we had no forestry science and enough wood… Germany contained immense, perfect, most fertile forests. But the large forests have become small; the fertile have become sterile. Each generation of man has seen a smaller generation of wood. Here and there we admire still the giant oaks and firs, which grew up without any care, while we are perfectly persuaded that we shall never in the same places be able, with any art or care, to reproduce similar trees.*
>
> *The grandsons of those giant trees show the signs of threatening death before they have attained one-quarter of the volume which the old ones contained, and no art nor science can produce on the forest soil which has become less fertile, such forests as are here and there still being cut down… Without utilization, the forest soil improves constantly; if used in an orderly manner it remains in a natural equilibrium, if used faultily it becomes poorer. The good forester takes the highest yield from the forest without deteriorating the soil; the poor one neither obtains this yield nor preserves the fertility of the soil.*

Roads and the Soil

The soil does not have to erode or be damaged because humans work in the woods. For example, logging roads can be redesigned for small equipment and to create more growing room for trees. Most skid roads that OGA has re-opened are one-way and are kept to less than 10-feet wide. Road lengths can also be kept small to limit the loss of soil.

For example, we coordinate skid road re-construction with neighboring parcels to avoid unnecessarily re-opening roads. To minimize erosion in previously logged steep lands, only the most stable roads are re-opened. On steep hillsides, some of the old roads can be re-routed along stable soils and generally kept to a grade of less than 10%. In most areas, the contour of a forest road can be slightly outsloped with rolling dips to facilitate water drainage. Large culverts, bridges and rocked fords can be over-engineered to minimize erosion. Where in-board ditches are necessary, they can be drained at short distances to limit water build up during storms. Stream crossings and road re-openings in creek areas are kept to a minimum. Since the new roads are narrower than the original ones, young trees are kept and/or planted on the edges of the old road bed to protect against sliding and erosion. (For a thorough treatment on forest and range roads, write the Mendocino County Conservation District for their Forest and Ranch Roads Handbook, 405 Orchard Avenue, Ukiah, CA 95482.)

Our inherited roads, like most logging roads of the 1950's, were designed to get the timber out cheaply. The big bulldozers were amazing new tools that could go almost anywhere and do almost anything. The result was lots of bulldozing with little understanding of the consequences. The bulldozed lands are in varying stages of recovery. The steeper hillsides are the most damaged. Road building on steep terrain created many gullies and landslides. The landslides are often difficult and expensive to stabilize. Some landslides have reached bedrock or an angle of repose over the past 40 years and do not have significant amounts of new sediment to deliver to the streams. Other landslides can use immediate attention.

While some slides require heavy machinery and lots of capital to stabilize, some slides can be slowed or stopped by taking a few low cost steps. For example, to slow erosion in the short-term, we reroute and/or dissipate the water flowing into the slide. Some landslides can then be stabilized by securing the base (toe) with boulders, logs from thinnings, or other large slash (thinned branches). To slow surface erosion above the base of the slide, we add hay and small thinning slash to the bare soil areas and around the top edges of the slide. To help root some of the soil in place, we spread organic fertilizers and seed (native variety seeds and/or mixes of rye, clover, and fescue with some wildflowers). Once an organic layer is established, pines, firs or any other shade-intolerant seedlings are planted to speed-up natural regeneration. Seeding and planting has better results early in the rainy season (December to February). When planting, our first choice is to use seedlings from nearby trees. Nursery stock, even if the same species, can have uneven results because the tree's genetics are often adapted to a different latitude, altitude and/or microclimate.

Many of our ridge skid trails were bulldozed down the hillsides in the 1950's. They are recovering very slowly. They have compacted, dry, poor quality soil with small and sparse trees. The only "cure" for compacted soil is to dig it up and turn it.[9] This "cure" is not practical once a stand exists because it kills or injures many trees. To build and restore the soil on these trails, carry slash from nearby thinning and pruning work, spread it over the bare soil areas (mulching) and let time do the rest. The slash will help hold the soil in place. As the slash decomposes, it adds needed nutrients and structure also.

The skid trails that were carved parallel to the contour of the land are in better shape. Over time, they have accumulated leaf litter from the surrounding forest creating a growing medium atop the compacted soil. These trails are now mostly overstocked with 10-to-20 year-old Douglas-firs with some Sugar pine, Redwood and hardwoods. Soil building on these semi-level skid trails is mostly about thinning and mulching the firs.

Thinning and the Soil

Restoration forestry is labor-intensive. Heavy equipment is used cautiously and only where light equipment or labor can't do the job. Many of our skid trails have been permanently closed to machinery to let the soil re-build itself. Chainsaws, power pole saws, pruning shears, hand saws and machetes are the thinning, pruning and slash cutting tools of choice.

When thinning conifers, give preference to vigorous, disease-free, undamaged dominant and co-dominant trees and remove many of the smaller competitors growing under their crowns. Step back and look at the entire tree to make certain that it's the right tree to keep. Check for animal and bird nests before cutting. Look for visible signs of disease or insect damage. The trunk may be rotten, crooked or forked or its top may have snapped off in a recent storm. Sometimes a tall conifer has a thinner crown and is less vigorous than its smaller neighbor you were about to cut.

Take your time and be alert when working in the woods. Mistakes and accidents occur mostly from not taking a relaxed approach. Once a tree is selected, bring it down so that its fall will cause the least amount of damage to surrounding trees. For example, when cutting big trees, sometimes it makes sense to climb and remove the large branches first. A falling trunk causes much less damage to nearby trees than a tall tree with large branches.

After felling, remove the tree's branches (limbing) and cut up the tree trunk into useable lengths (bucking). Because most trees being cut are young, the logs are often moved by hand. If it is a firewood tree, we cut it to lengths that one man can manually roll downhill to the nearest skid road. If a lumber tree, depending on its size and the terrain, it is cut in lengths useable by the mill (from 6 to 16 feet plus 6 inches for trim). Small logs up to 15" in diameter and 12 feet long are pulled out with a light 6-wheel drive rubber-tire ATV with a balancing arch to minimize dragging. For larger logs, either horses or an old D2 small tractor with a long cable are used, depending on the area. Some "sensitive" and/or steep areas are not harvested or thinned, while other steep areas are lightly harvested by "long-line" cable to limit soil compaction and movement. When the terrain is difficult, sometimes the best option is to take a portable mill to the log. The "Lucas" brand mill can be assembled almost anywhere you can walk to.

While cutting up a downed tree, it is a common mistake to also cut small conifers that may have been tangled in it. To avoid hurting the young trees, first cut the downed tree's branches around any tangled young trees and spread the slash. Once the young tree is released and clearly visible, return to cutting up the entire downed tree. Cut the slash so that it lies no more than one foot above the ground. Slash in contact with the soil decomposes faster. We also do not remove or burn the branches or leaves of fallen trees because many of the useable soil nutrients from a fallen tree are in its branches and leaves. By chewing up the branches, we help create rich textured soil compost. Before moving on, we clear debris around the stump and cut it close to the ground to eliminate the "stumpsville" look.

Some trunks over 18" in diameter are left in the woods in long lengths for wildlife habitat and to protect the soil from erosion. The trunks are cut as long as possible and are either left as they drop or in some cases are laid parallel to the contour of the land (perpendicular to the flow of water). They are held in place by old stumps, large rocks, the base of snags or living low-vigor trees. The logs house wildlife and help walking on steep slopes. They also hold soil in place and enrich it as they decompose. The larger the logs, both in terms of diameter and length, the greater the habitat value. When harvesting valuable redwood timber, it is financially difficult to choose to place valuable logs as erosion aids and habitat. Redwood logs that are difficult to remove or that have visible defects can be left for this purpose. Also logs of less valuable species (pine, fir, hardwoods) can also contribute to habitat and the soil.

Many of the Tanoak logs are hauled out and dried for firewood. In some areas, to limit soil movement while removing the firewood, we use 20-foot sections of 15" diameter plastic culverts that are sliced in half and placed on the forest floor. Firewood logs up to 15" in diameter are de-limbed, cut to manageable lengths and slid on the culvert "slides" down to the next skid trail.

If done only for economic reasons, thinning removes snags, hardwoods and small trees to make room for valuable conifers. The goal becomes to create enough space between the crowns of the dominant conifers to maximize their growth rate for a future harvest. Most other trees are cut to limit competition.

In contrast, OGA thins to increase diversity in the stand. We lower tree crowding only enough to maintain healthy growth for at least ten years while restoring the forest's species and age composition. If released too much, fast growing trees produce average quality lumber. We prefer to keep competition in the stand and grow denser, higher quality wood. Because our lands have a moderate to steep slope, this conservative practice keeps the canopy as closed as possible to protect the soil. While thinning we also retain or create snags for wildlife. Since all the pieces are interconnected, restoring the original tree age and species balance helps the soil structure return to a high level of fertility (see page 8).

Thinning on unstable or understocked steep areas (over a 70% grade) can be counterproductive. Even when a full canopy exists, walking on steep slopes requires vigilance to avoid soil movement. Crumbling sections of steep skid trails should also be avoided, but if the trail is the only entrance to an area, building small log bridges can limit sliding.

Tanoak-dominated stands: Before and after first thinning: The "before" photo shows a Tanoak-dominated stand 30 years after logging. The Tanoak's dense understory and canopy suppresses the young conifers struggling in their shade. The "after" photo shows a similar stand after the first thinning and pruning. Removing some Tanoaks gives the young conifers growing room. This helps the forest take a step towards re-establishing its ancient conifer-dominated canopy. If there are not enough healthy conifers growing under the Tanoaks, we clear brush and plant. Every ten years, the process is repeated as necessary.

"Time is a Great Teacher, unfortunately, it kills all its students." – Bumper Sticker

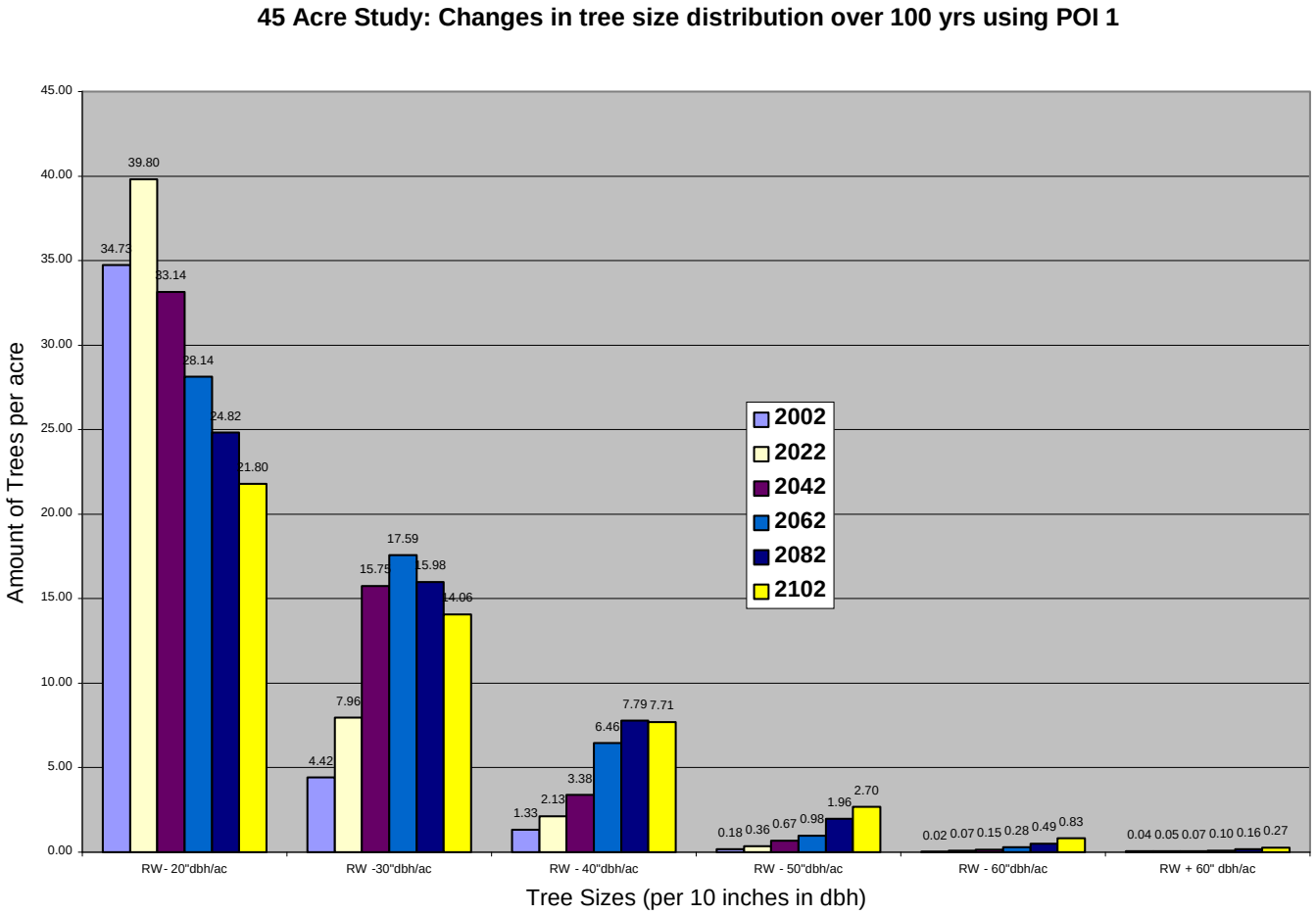
Wildlife Habitat and the Age Distribution of the Trees

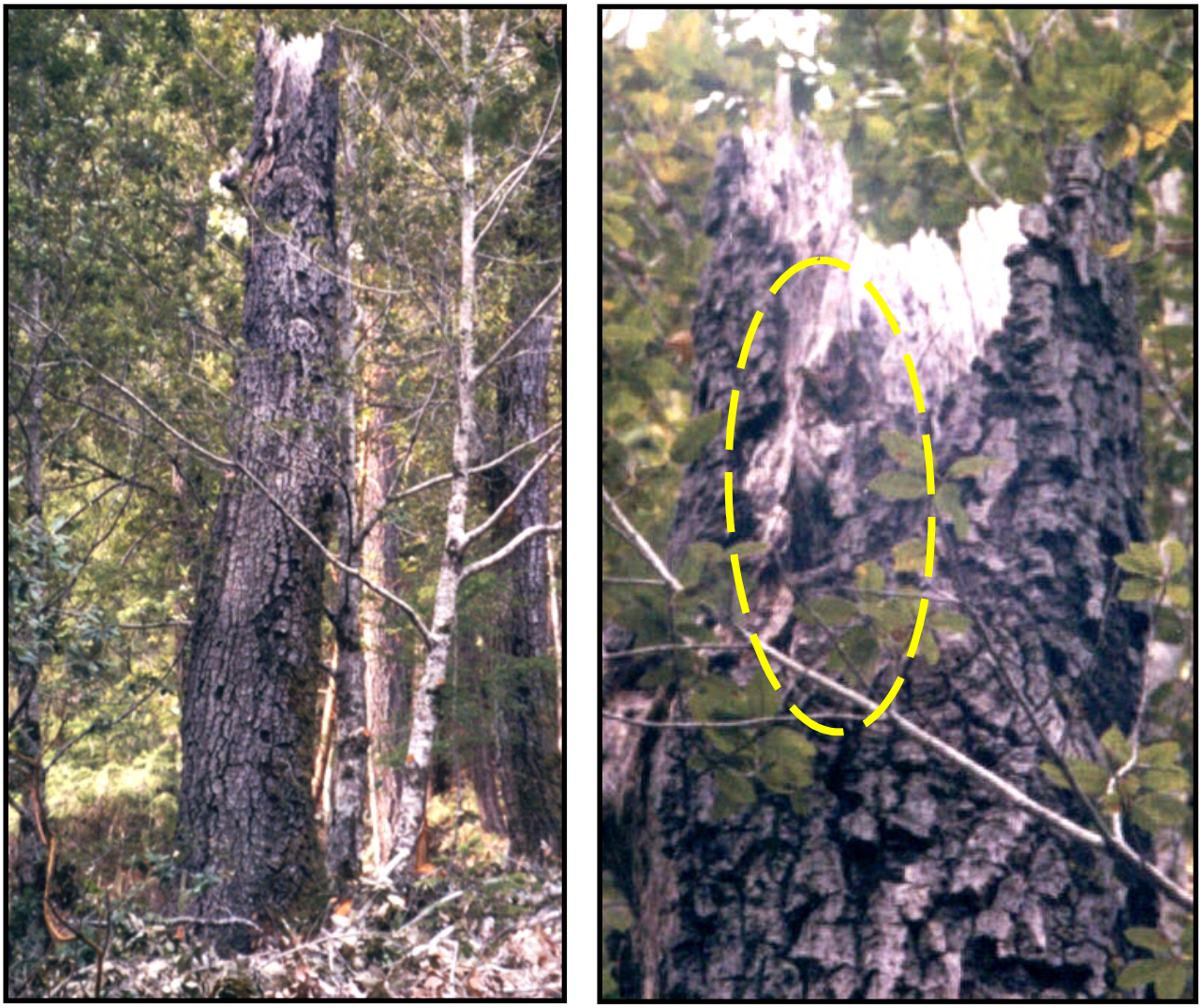
OGA thins and plants to help the forest become an all-age stand with trees in each 20-year age group. In the 1950's and 60's, at least 10% of our forestlands had their topsoil bulldozed away to build roads, skid trails and log loading sites. In the 90% of the land where the soil was not removed, many saplings were left standing because they had no financial value. They are now up to 60-year-old trees. Underneath these young trees, many new seedlings and saplings struggle for sunlight. We remove mostly small, deformed, diseased and crowded trees and favor large, well formed and vigorous trees. We leave more young conifers because they do not take up much space and natural mortality and later thinning will lower their numbers. Some acreage is left unthinned to maintain thickets for small animal cover and we also leave some irregular-shaped trees, dead and dying trees and downed wood to not create a "park-like" stand at the expense of the forest's natural structural diversity.

But to move towards a diverse all-age stand, snags, the old deformed trees and the best saplings and seedlings must also be kept. In some areas, saplings and/or seedlings are the only canopy cover.

OGA sets aside at least 5 trees per acre to grow to old age and die undisturbed. The goal is to have each acre of the forest eventually be dominated by mature and old-growth trees as it once was.

The graph below illustrates the estimated changes over 100 years of the Redwood portion of a 45-acre parcel managed by OGA. (The graph accounts for redwoods only – if the other tree species were included the number of trees per acre would increase by approximately 80%.) For example, the number of redwood trees over 30 inches DBH increases from 1.57/acre in 2002 to 11.51/acre in 2102.





Color camouflage: These two pictures of the same snag were taken seconds apart. In the close-up photo on the right, a screech owl is barely visible as it sleeps away the day in the broken-top of a Tanoak snag.

Standing dead or dying trees make good wildlife habitat. Unless there is an abundance of them, we do not thin them. It is desirable to have several large dead trees (snags) per acre. The snags can stand nearly as long as they took to grow and they are wildlife condos that attract insects, birds and mammals. For example, eagles and ospreys prefer to nest in tall broken tree tops or tall cavities of dead or dying large trees. Screech owls like to live in broken-top snags (see photo above).

To create a "habitat" tree, girdle it by completely cutting into its bark with an ax or a chainsaw in a 6-inch tall ring around the trunk. This breaks the spongy inner bark layer that supplies nutrients from the leaves. The tree will then slowly die. We choose conifers (mostly firs) for "girdling" that are at least 12-inches DBH and that are broken-top, crowded, deformed and/or diseased. Tanoaks are difficult to girdle successfully, but they have a shorter life span and are relatively plentiful as snags.

The forest's natural rate of tree mortality is less than 1% annually. When mature or old-growth trees die and/or fall, many are left as snags or fallen habitat. About a third of the volume of old down logs have sound high-quality wood. Many of these are salvaged and made into furniture to help finance the restoration work.

Restoring Species Composition

The Tanoak is an important link in the biological chain. It grows quickly in direct sunlight and has deep extensive roots to hold on in erosion prone steep slopes. It has a symbiotic relationship to edible mushrooms like Black Trumpet Chanterelles, and it feeds and houses wildlife. Tanoak makes good firewood, and it has a small market for hardwood floor and furniture lumber.

After logging, the Tanoak aggressively established dominance in many areas of the stand. The large conifers were almost all removed while many Tanoaks were undisturbed. Without the tall canopy above them, the remaining Tanoaks grew bigger and denser. Trunks can reach five feet in diameter. Height averages 60 feet with exceptional trees up to 110 feet. Before logging, they made up less than 10% of the old tall canopy. Today, they occupy up to 50% of the new smaller canopy and the conifers often face significant Tanoak competition to reclaim previously logged areas. To help restore the canopy to its ancient form of mostly conifers, many Tanoaks will be removed over the next few decades. Slowly opening the dense Tanoak canopy allows more young conifers to grow between and past them. Local conifers usually grow between 120 and 150 feet tall. In the lower elevations near streams local Redwoods will grow over 250 feet tall. When thinning, keep in mind that even though they were a small part of the tall old-growth canopy, a Tanoak canopy was abundant and well distributed throughout the forest in the shade of the conifers.

Open the canopy conservatively each cutting interval. Forestry manuals usually recommend that degraded sites be clearcut on a small scale of up to five acres and planted to start over. There are other alternatives. For example, contrary to industry and most forestry school teaching, The Pacific Lumber Company maintained a sustainable selection cutting plan in the Redwood region from the 1920's to 1985 with excellent results. OGA selectively cuts at all landscape levels and does not clearcut. If a conifer stand is degraded with poor quality trees and/or is hardwood-dominated, it can slowly be converted to a conifer-dominated site over a few decades via gradual thinning and planting. It has been our experience that on our average quality redwood-dominated lands, it is best to open the canopy very lightly (no more than 20% in most cases) to maximize the survival and growth rate of the planted redwood seedlings.

While thinning, a Tanoak is usually removed in preference to a competing conifer if it is not a straight, upright, high-quality hardwood. When logged, the Tanoaks tended to re-sprout in tight groups of young trees. When thinning a regenerated group of Tanoaks, remember that eventually only one or two trees will remain at most sites, as it was before. Depending on where the crowns are, we leave the healthiest and straightest trees. We retain most Tanoaks over 18 inches in diameter (DBH) because of their habitat value and as shade for the seedlings to be planted.

When thinning, we work to protect the soil from too much unfiltered sunlight in summer and direct wind and rain in winter. If the Tanoak is in an open space or borders a canopy opening, it is usually not removed or pruned. Most thinning is done from below the canopy by cutting small and intermediate size trees. In this way, most of the canopy cover is retained after each thinning is completed. In areas heavily dominated by Tanoak, the canopy is opened up more. Redwoods (sometimes Sugar pine) are then planted in the small openings. As the forest matures, future canopy openings will be smaller.

Redwoods are less abundant than they once were. For example, our stands averaged 50% Redwood tree volume prior to logging versus below 20% today. In Sonoma and Southern Mendocino counties, Redwoods produce seed in their natural setting about once a decade. Propagation mostly occurs via self-sprouting from the existing roots and stumps. In the first decade or two after logging, fir and pine regenerated well in the partial shade of the remaining stand while the shade-loving Redwoods concentrated around stumps. Re-sprouting was minimal along roads and skid trails or on the old log landing sites (at least 10% of the land) because the stumps were bulldozed and the soil was compacted.

Around large old stumps where once a magnificent tree stood, many saplings now compete for dominance. We reduce the number of saplings by leaving the best formed and most vigorous. Saplings that resprouted from the stump are susceptible to breaking at the stump in high winds (windthrow). If the stump resprouts are competing with other saplings growing in the ground, we favor the in-the-ground saplings if all else is equal.

As the canopy cover became denser over the past decade, more Redwood seedlings have survived outside of the original stump areas. To help reestablish the tree's dominance and distribution, we take extra care of these seedlings. Sometimes only inches tall, they compete with other Redwood seedlings or are trying to grow through brush, slash or hardwood competition. The competition is eliminated and the most vigorous and upright of the seedlings is released to grow. Sometimes we find a surviving Redwood seedling that is several feet tall but has poor vigor and/or form. We usually cut it at ground level. Within a couple months it will re-sprout several shoots. With less competition and using the old root system, the new sprouts will usually grow over two feet per year and be a model of good form and vigor!

Old-timers tell us that many firs over 70 years old had "conks" or rot when the local old-growth forests were logged. While thinning, we find that some of the young firs have visible early signs of disease when they are overcrowded. It is a black-colored deforming growth on the bark, or on the inside of the bark that changes the shape of the trunk. Sometimes it is more visible on young trees where the limbs meet the trunk or on the limbs themselves. The older firs that do not have the disease usually grew up with less competition. Because of this, firs with visible deformations are thinned unless left as snags. In general, overcrowded fir stands are thinned a little more than Redwood or Sugar Pine stands to lower the percentage of deformities. These steps will tend to make the fir stands somewhat younger overall than the other conifers.

In contrast, the old-timers say the Sugar Pine was historically favored because of its excellent wood and minimal decay. The local old-growth Redwood had some rot (up to 10%), but less than the fir (up to 30%). All things being equal, when thinning conifers, we favor Redwoods first because they are underrepresented, pine second and fir third. While thinning, if stands are opened too much, winter storms will blow over the remaining unprotected trees. Consider the site and its exposure to prevailing winds, rain, etc. If the remaining conifers are not strong, well established and vigorous, they will need many nearby trees to survive. Tall thin fir (less than 6 inches dbh) that is released in the open will <u>definitely</u> blow over.

The altitude, angle of sun exposure and the height and structure of the canopy create different microclimates from acre to acre. Microclimate variations influence species structure. Redwood is dominant in lower elevation stream areas with fir and pine more abundant at our higher and drier elevations (up to 2200 feet). Overall, the upper canopy before logging was approximately 90% conifers with some hardwood concentrations on the south facing slopes and riparian species in the year-round streams.

At least seven other species are on the land (not counting riparian species). Most abundant is the smooth and bright reddish-brown barked Madrone. This hardwood can be a large extraordinarily beautiful tree (over 300 years old, five feet in diameter and over 100 feet tall), but a recurring blight kills many young Madrones on our lands in Sonoma County. With this in mind, we do not thin most healthy Madrones. In Mendocino County, large Madrones are more abundant and are thinned lightly. The Madrone fruit is a food source to wildlife.

Manzanita is bushy with a tough wood and a beautiful wine-colored smooth bark. It existed sparsely prior to logging and is a fire hazard because it ignites easily. They cling to difficult soil areas and are relatively scarce even after logging. We rarely cut Manzanita unless they are abundant amongst other trees in a specified area.

California Nutmeg is a light-brown barked conifer with prickly leaves similar to Redwood. They grow slowly and have not recovered well from logging. Most are now only 10 to 20 feet tall and not straight. They exude a strong sap odor when pruned and the rare mature Nutmeg is beautiful and prized as lumber (to 70 feet tall and 20" diameter).

The least abundant trees are the Giant Chinkapin, California Bay Laurel, Coast Live Oak and California Big Leaf Maple. The Chinkapin is a beautiful straight-growing hardwood. Its bark and form resembles a Tanoak, but its leaves are shiny and are not serrated like the Tanoak. The Chinkapin often grows to 100 feet in height. The Laurel and Maple are found in the lower elevation stream areas. The Laurel is a pleasant smelling evergreen while the Maple's leaves turn a blazing orange to yellow in the fall. These beautiful hardwoods can also grow to 80 feet. Coast Live Oak is usually found on the drier and most exposed hillsides. Because the Nutmeg, Chinkapin, Laurel, Live Oak and Maple are rare, healthy trees of all sizes are favored when thinning.

Planting Notes

There are several points that increase the survival and growth rates of Redwood seedlings:

On south-facing slopes, our experience is that Redwood seedlings do best with approximately 80% canopy cover to protect them from excessive wind and sun. Too much canopy cover stifles growth. Seedlings seem to need less canopy on most north facing slopes. Another factor in survival is deer browsing and rodent digging. We have lost over 50% of unprotected seedlings this way.

We have experimented successfully with keeping seedlings in two-gallon pots for an extra year before field planting. The one-year old seedlings have very small roots and are susceptible to drying out if spring rains are too sparse. The larger trees can survive the dry springs better and deer damage the larger trees much less (when they do the trees often recover new tops and do not die). The two-year-old container seedlings are 15 to 20 inches tall while the same age seedlings that were planted in the field a year earlier are usually only 8 to 10 inches tall (if they survived). The two-year-old container seedlings are planted fourteen to sixteen inches deep to maximize protection against the long summer dry spells. .

Results for the first 3 years are encouraging with most trees surviving and growing six to twelve inches per year. While in the nursery, we have discovered two-year-olds grew best when in partial sun during the day (morning or evening only) and received generous amounts of water whenever rain water was lacking until planting day. By making the two-year-olds grow vigorously from day one, the fast and healthy growth we have seen so far in the forest seems to justify the higher labor costs.

We plant when the soil is moist in December and January to give the trees maximum soil moisture. We cover the soil around the seedlings with available leaves and small branches to create mulch to hold in moisture. The trees are planted so that they are a couple inches below the contour of the land. This allows the mulch to create a moisture pocket. We do not plant next to existing trees to moderate competition. The two-year-old seedlings are usually planted using a shovel. We dig the holes about 12 inches deeper than necessary to loosen the soil for the plants early growth in the woods. We plant some seedlings within the drip-line of existing trees with success. It seems that as long as the seedlings are not too close to the trunk of other trees, they like the substantial but not total shade. Wherever possible, place plantings directly uphill of downed logs. Downed logs retain moisture and collect nutrients from their own decomposition, from tree duff and from soil that washes downhill. Seedlings that are protected from south and west direct sunlight seem to grow better. When planting in exposed areas, "hiding" seedlings behind logs and other barriers to the southern sun helps them survive the harsh summer sun.

The relation between economy and ecology is etymologically poignant. Eco is Greek for home. Nomos is Greek for law or rule. Economic then, is the rule of the home. Logos is more than the modern "logical". It is Greek for the harmonic gathering, the incarnate word, and it is associated with Apollo's lyre. Ecology then, is the harmony of the home. When harmony and the rule of the home are one, true speech and rich economy coexist. Economy and ecology must be confluent. They must lie upon one another like a couple sharing the same home. When economic rules and ecological harmony are divergent, the law is not "logical". When harmony is sacrificed for a dollar, the home receives no blessings and catastrophe will certainly follow.

Excerpted from "The View From Delphi" by Frank Marrero (Tripod Press)

III: Economy – Walk the Talk

Consider and experience the entire affair yourself. And be humored by the realization that the popular communications media are fundamentally motivated by the necessity to propagandize and entertain through fascinating and alarming messages. This is how they make their money and achieve their power. - Da Free John

These are critical times. The historical decline in the quantity and quality of the earth's forests is still accelerating. Man's economy continues to be in conflict with the ecology of mature and old-growth forests. The media consistently dilutes the severity and implications of this decline and the associated deterioration of wildlife habitat, drinking water quality and biological diversity. See for yourself. The issues are worldwide. Most forested areas outside of parks and preserves is fragmented, over-harvested or in the path of future development. For example, the standing timber volume of our local forests is approximately 20% of what it was before logging began. This is similar world-wide. This 20% figure represents the lost carbon sequestering capacity of these forests. Most of the carrying capacity of the world's forest is not being used! Take a low altitude flight over non-park forestland. The fragmentation and devastation will astound you:

California law limits clearcuts to 40 acres at a time. This 1998 photo was taken in the Gualala watershed near OGA lands. The ten to twelve clearcuts visible create a "checkerboard" effect. Although trees occupy most of the area, they are small and young. Each piece of this checkerboard tree-farm is clearcut every 60 years. (Photo: Sherry Glaser)

Landslide erosion control: mulching bare soil with sterile hay. (Photo: Jason Johnson)

Money and Sustainable Forest Management

To address the deteriorated condition of most industrially managed forestland, the term "sustainably-harvested forest products" and "sustainable forestry" has come into wide use by the timber industry and wood retailers worldwide. It is described as the solution to overcutting, but only one organization that certifies forestland as "sustainably-harvested" has relatively rigorous standards that are a good first step towards forest restoration (Forest Stewardship Council). Most other standards for "sustainably-harvested" are only minor improvements in the field combined with lots of marketing:

All the paper companies in Maine now claim to be following the state's Sustainable Forestry Initiative. I would ask of them, "what are you sustaining, where, for how long, and for whose benefit?" We are talking here about large, absentee landowners who, during the period 1982 to 1995, cut twice as much as net growth, decreased the acreage of spruce-fir, vastly increased the acreage of seedlings and saplings, increased the ratio of low-value species, and lowered hardwood saw log quality. During this period, the combination of mechanization and import of Canadian and Mexican labor reduced woods jobs and kept wages depressed. Export of raw saw logs to Quebec mills reduced value-added jobs and revenues in the state. Many rural communities lost populations. Lately, some of the paper companies have sold off or downsized their pulp or paper mills. We don't even really know who the new owners are.

A truly sustainable forestry system would ensure that, over time, all the habitats capable of supporting viable populations of all the native species are present, despite natural and human-induced changes. It is easy enough to create early-successional habitats – that can be done with a timber harvester in a day. The real challenge is to ensure the presence of late-successional interior forest, which takes more than a century to grow. There needs to be adequate time for recovery from disturbance and adequate sources nearby for recolonization of disturbed areas. Managed forests should, in this regard, complement processes taking place in reserves or wilderness, rather than isolate or fragment them. There also has to be a way to make sure that the land is going to stay permanently forested. One cut, however sensitive, does not mean that the forestry is sustainable, because the landowner could, in a few years, sell to a liquidator or developer. There are ways to make such long-term commitments now with easements, land trusts, or changes in deeds.[10] - Maine author and activist Mitch Lansky

Sustainable Forestry: A First Step Towards Restoration

The Forest Stewardship Council (FSC) administers the strictest "certification standards" for sustainably-harvested forests that are in widespread use today. FSC is represented in the United States by the "Smartwood" organization headquartered in Portland, OR. Smartwood-certification is a positive step for forest management, but sustainability is only a step towards restoration. Restoration forestry standards necessarily must be much higher in certain areas. Two examples:

1. Smartwood certification has been granted in the Redwoods to companies that continue to use chemicals in their forests. In contrast, restoration forestry does not use chemicals in the forest.
2. Smartwood certification requires only modest wood volume restoration over time and the protection of existing old-growth only. Restoring large numbers of mature and old-growth trees is not a requirement of certification. In contrast, restoration forestry actively works to restore and then maintain old-growth trees and high timber volumes (30,000 to 60,000 board feet per acre) for most redwood-dominated parcels.

   Without mature and old-growth restoration, forests are permanently maintained at a fraction of their ecological potential with only small to intermediate sized trees. Among many consequences, the lack of mature and old-growth trees significantly limits habitat value for wildlife and lowers biodiversity and watershed values. The lack of volume limits the forest's natural moderating influence to the local climate and limits its global cooling capacity. Most certified forests in the Redwoods are cut at a rate equivalent to 20 to 30% of the wood volume per decade. This rate of cut allows the oldest trees to mature to between 70 and 100 years. This compares favorably to industrial tree farming standards of 40 to 70 years, but is a fraction of restoration forestry's 200+ years.

The Smartwood certification sustainability standards are exhaustive and rigorous. They were initially created by environmental activists to bring ecological standards into the timber business. Unfortunately, they have been diluted moderately over the years to permit chemical use and higher rates of cutting in order to attract large commercial interests. OGA's board has recently decided to not pursue Smartwood certification because we demonstrate a significantly higher standard. OGA hopes to create a set of vigorous, quantitatively measurable restoration forestry standards. We hope this manual is a first step in developing such standards. The complete Smartwood standards are included in Appendix B for those who may be interested in the most vigorous standards widely in use today. Below are the original guiding principles set in the mid 1990's. Some of these standards are no longer in practice being applied:

The Ten Elements of Sustainability :

1. Forest practices will protect, maintain and/or restore the aesthetics, vitality, structure, and functioning of the natural processes, including fire, of the ecosystem and its components at all landscape and time scales.
2. Forest practices will protect, maintain and/or restore surface and groundwater quality and quantity, including aquatic and riparian habitat.
3. Forest practices will protect, maintain and/or restore natural processes of soil fertility, productivity, and stability.
4. Forest practices will protect, maintain and/or restore a natural balance and diversity of native species of the area, including flora, fauna, fungi and microbes, for purposes of the long-term health of ecosystems.
5. Forest practices will encourage a natural regeneration of native species to protect valuable native gene pools.
6. Forest practices will not include the use of artificial chemical fertilizers or synthetic chemical pesticides (or herbicides).
7. Forest practitioners will address the need for local employment and community well-being and will respect workers rights, including occupational safety, fair compensation, and the right of workers to collectively bargain, and will promote worker-owned and operated organizations.
8. Sites of archaeological, cultural and historical significance will be protected and will receive special consideration.
9. Forest practices executed under a certified Forest Management Plan will be of the appropriate size, scale, time frame, and technology for the parcel, and adopt the appropriate monitoring program, not only in order to avoid negative cumulative impacts, but also to promote beneficial cumulative effects of the forest.
10. Ancient forests will be subject to a moratorium on commercial logging during which time the Institute for Sustainable Forestry will participate in research on the ramifications of management in these areas.

An Economic Blueprint for Restoration

The remainder of this manual is a detailed argument for the economics of restoration. Restoration is rarely practiced because it requires a long-term commitment and substantial physical and financial resources short-term. The economics of Redwood forestry are discussed from several angles:

- What the large companies that control over half of the forest are doing and why.
- What OGA is doing to finance the necessary restoration effort.
- Factors usually not considered that lead to large long-term financial rewards for investing in restoration.

*Restoration forestry achieves dramatic long-term ecological and economical returns***.** For example, a relatively small 80-acre parcel of young forest purchased in 2003 for $400,000 can be transformed in two or three decades into a beautiful forest with over a million dollars in standing timber and a vastly increased land value. This happens because Redwood is valuable and even a young forest can be cut for substantial profit. It happens every day – Redwood land is being clearcut and developed for housing and/or vineyards in Sonoma and Mendocino counties because it is profitable to do so. The large timber companies contribute to this trend because many are slowly and quietly disposing of their over cut parcels.

OGA's mission is to restore forestland and demonstrate its viability economically. This is a difficult task. To begin with, OGA places a conservation easement on most parcels of land it owns or manages before restoration begins. The easement limits development and subdividing of the land. The forest's restoration and its long-term uses are permanently detailed in the easement. Enforcement clauses in the easement insure that the easement's provisions are adhered to. The easement allows the long-term economics and ecology of restoration forestry to develop by eliminating the possibility of a change of heart by a future owner or a sale followed by a cut and run operation (see conservation easement, appendix A.)

A good example of a large scale cut and run operation is the 1985 hostile take-over of the Pacific Lumber Company (PALCO). Since 1869, its 205,000 acre forest was the leading example of truly sustainable "selective" logging. PALCO cut trees far more slowly than they grew. The forest had a large percentage of old-growth and mature trees. Between 1957 and 1985, PALCO's timber volume nearly doubled.[11] The company was consistently profitable by cutting a small amount of high-quality mature and old-growth wood. It offered its employees long-term stability and excellent benefits. Once sold, its rate of cut was more than doubled to pay the junk bonds that financed the sale. The result was a deterioration of the forest, the wood quality and the watersheds. PALCO clearcut and high-graded for 22 years and then filed for bankruptcy and were purchased in 2008.

The largest obstacle to making restoration happen is getting the short-term economics to work. OGA's short-term economic business plan has four parts:

1. Work with investors that need tax relief to purchase forest parcels and secure conservation easements to protect their land. This generates substantial charitable tax breaks for the investors that significantly lower the investor's capital tied up in the property (see detailed example on page 46).
2. Per the standards detailed in this manual, harvest small amounts of Redwood to make the Forever Redwood furniture line to finance restoration work (for more information visit us at www.oldgrowthagain.org).
3. Sell limited amounts of lumber and firewood.
4. The forestland's restoration vastly increases the aesthetic beauty of the land increasing its market value as recreational land.

The landscape of forest management in the Redwoods is fragmented with examples of all types of forest management from preservation to extensive clearcutting. Some small forestry companies do excellent work, while most large companies continue to manage their lands as young tree farms and to sell off parcels. To understand the factors that cause large industrial corporations to degrade their forest holdings, the following excerpt was reprinted with permission from author Ray Raphael from his book "More Tree Talk" from Island Press. The article carefully explains some of the surprising economic assumptions used by timber companies that cause forestland to be over harvested.

Industrial Ownership: Time is Money **(from More Tree Talk pgs 161-9, Ray Raphael)**

The virtues of holistic forestry seem obvious; it is really just thoughtful, sensitive stewardship of the land. It treats nature as an ally, not an adversary. It considers each site according to specific needs. It is, quite simply, forestry that cares about the future. Why, then, is holistic forestry so rarely practiced?

Often, the fate of the forest is determined by managers in distant offices who are not necessarily guided by sound silvicultural criteria. These managers live in a world driven not by sun, wind, earth, and rain but by economic and political realities. Forestry is not practiced in a social vacuum. All the scientific knowledge – and all the best intentions of on-site workers – will come to no avail unless we understand, and can change, the economic and political factors that interfere with good forest management.

There are three basic types of forest ownership in this country: public, private, and industrial. Each type has its own set of blinders, infrastructural forces that encourage short-sighted, exploitative practices while discouraging far-sighted forestry. What are these forces? How do they operate in everyday affairs?

The timber industry owns approximately 15% of the timberland in the United States (over 60% of the Redwoods). This figure varies significantly by region, ranging from 9% in the West to 19% in the South. The reason the industry owns land is obvious: to provide a source of timber and pulp for its processing plants. Although the mills will always be partially dependent upon other sources of raw material, their future is more secure to the extent that they can grow their own trees.

On the surface, it would appear that the industry should invest heavily in its growing stock. In practice, however, the timber companies spend only a small percentage of their revenues on reinvestment in the resource base. Perhaps timber is a "renewable resource," but the forest products companies are not in fact renewing it as vigorously as they could. The annual net growth of softwood trees on forest industry land is only 77% of the amount harvested: on non-industrial private land, by contrast, the net growth of softwood trees is 127% of the annual harvest; on government land, softwood growth is 146% of the harvest. The timber industry, in other words, does not seem to be providing for its long-term interests.

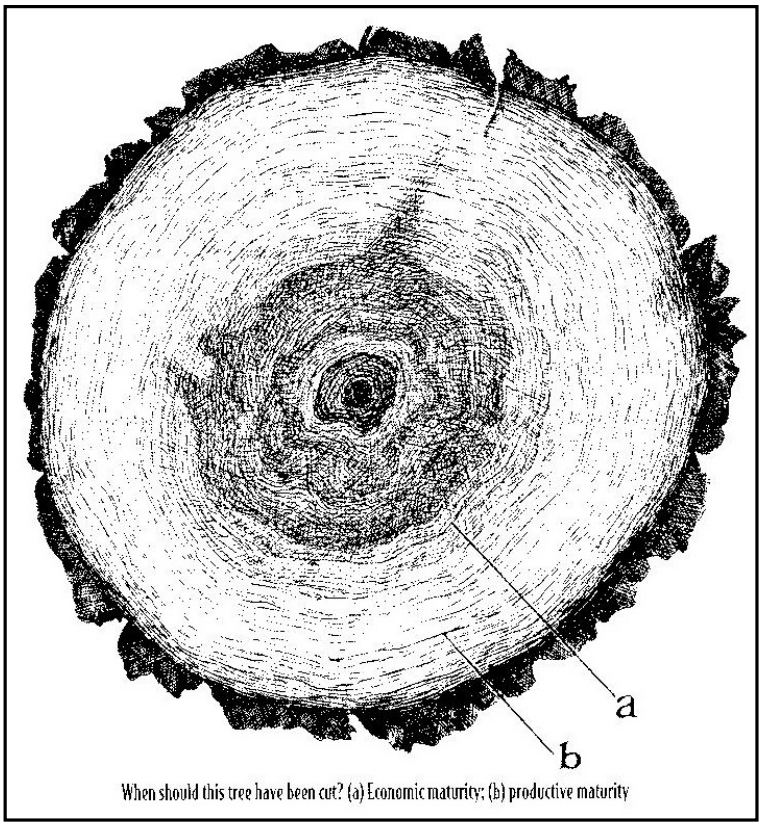
Don't the companies care about their future? Don't the mill owners want to maintain their resource base to provide employment for their children and grandchildren? Of course they do, but from a strictly economic point of view, it is difficult to grow and maintain real forests on their own lands. To understand why timber companies do not find it feasible to make long-term investments, we must examine the peculiar interrelationships among time, timber, and money.

When a corporation chooses to invest money in timber, it effectively chooses not to invest that money elsewhere. Money invested in another field will earn interest or pay dividends on a regular basis; investment in trees, on the other hand, will have to wait several decades to return a profit. When a profit is finally realized by harvesting the timber, the returns must approximate the profits that could have been made from other forms of investment. The revenue from a single crop of trees must be high enough to justify tying up capital for so many years. In other words, part of the cost of growing trees is the interest accrued to the initial investment.

In economic terminology, we speak of the opportunity cost of capital: there is always an opportunity to do something else with your money. The opportunity cost of timber is extremely high because the capital is tied up for such a long period of time. Depending on the interest which could be made in other investments (called the guiding rate of interest, the hurdle rate, or, misleadingly, the discount rate), the opportunity cost can become a prohibitive factor in any long-term forest investment. For every dollar initially invested, a tree that takes 80 years to mature will have to return $23 at 4% interest, $224 at 7% interest, or $2,048 at 10% interest. If the guiding rate of interest is high, investments in the future resource base become financially untenable, since they won't be able to compete with other capital investments. When the cost of interest is taken into account, there is no genuine "long-term" in the practical world of business.

To demonstrate how interest rates render long-term planning financially unsound, one study calculated the soil expectation value (SEV) of a hectare of land that was to produce a crop of trees every hundred years. (The soil expectation value is an economic measure of the capacity of unstocked land to produce timber – adding the revenues, subtracting the costs, and accounting for interest.) Strangely, the guiding rate of interest had a far greater impact on the SEV than the actual productivity of the land. If the productivity remained constant, the land was worth $56,723 at 1% interest but only $7 at 10% interest. A loss of productivity, on the other hand, had only a minimal impact. If the soil deteriorated to the point that the volume of each succeeding crop of trees decreased by 10%, the SEV (figured at a constant 5% interest rate) declined from $741 to $740.43 – a loss of only fifty-seven cents. If the land lost 100% of its productivity after the first generation of trees was harvested – if it literally fell into the ocean – the SEV would diminish by less than 1%.

The implications of these figures are profound: when measured in crude dollars and cents, the future of the forest is not economically relevant. From a strictly business perspective, the long-term fertility of the soil simply doesn't matter. If a company has a chance to invest a mere one dollar per acre on soil improvement that will double the



When should this tree have been cut? (a) Economic maturity; (b) productive maturity

growth of the trees 200 years hence, it is economically foolish to make that investment. Unless each dollar will increase the worth of that future tree crop by tens of thousands of dollars, the company will just be pouring money down the drain.

The length of the crop rotation, like the interest rate, has a significant effect on the economics of timber. With a constant 5% guiding rate of interest, the return on a one-dollar investment will have to be $7 for a 40-year rotation, $30 for a 70-year rotation, or $131 for a 100-year rotation. Naturally, the investment goals for the shorter rotations will be easier to meet. Trees will be harvested earlier in order to avoid the large interest costs that accrue during the longer rotations.

Because of the financial incentive to shorten the cycle, the economic maturity of timber occurs long before the productive maturity. Economic maturity is the point at which a new investment would be more financially lucrative than a continuation of the original investment; productive maturity is the point at which a new crop will produce more timber than the original crop. The time of harvest is determined by the specific goal of the forest managers: Do they want to make more money, or do they want to produce more timber? These are entirely different objectives, and they lead to entirely different management schemes.

In a sense, the decision of when to harvest is not left to the timber companies; it is the marketplace that decides. Consumers want more wood, but they want it at the lowest possible price. In order to keep down the price, the companies naturally try to minimize the cost of interest. When a company harvests at economic rather than productive maturity, it is simply responding to the laws of economics – and to the wishes of consumers who want cheap wood. A company that does not respond to the market is unlikely to stay in business.

Economic maturity is of course dependent upon the guiding rate of interest; when a continued investment in timber fails to match the guiding rate, it is time for the trees to be cut. But how is productive maturity determined? Foresters have a powerful analytical tool for relating productivity with time. They calculate the average annual growth of a tree, computed over its entire life span, and call the the mean annual increment (MAI). The MAI is used to gauge the productive maturity of a tree: when the yearly growth falls below the MAI, it is time to cut the tree down and start over; the tree cannot meet its own standards for production. Conversely, when the annual rate of growth remains higher than MAI, the tree should be allowed to continue growing; it is doing better than average, and presumably better than could be expected of its replacement. In order to maximize production, foresters need only calculate the time at which MAI starts to decline. The culmination of mean annual increment (CMAI) determines the rotation cycle which will produce the most timber.

Timber companies, however, cannot afford to wait for their trees to produce to maximum capacity. In order to turn a profit, they reap the returns from an early harvest and quickly invest in a new crop. The large annual increment in wood fiber is offset by the interest being charged to the original investment. For a typical Douglas-Fir site, the best economic rotation at 5% interest is to harvest every 36 years, whereas CMAI is not reached until 64 years. Economic maturity is achieved much more quickly than productive maturity. By harvesting the trees in their prime, the timber company ignores approximately three decades of peak growth, but it cuts the rotation time practically in half. Instead of continuing to pay interest on its tied-up capital, it realizes a quick profit on the first investment and moves on to the next. Some of this money will go toward replanting, while the rest can be invested elsewhere. In essence, the company gets tow harvests instead of one, as well as the use of the surplus capital for almost thirty years. The end result: revenues for harvesting on a 36-year rotation are approximately twice those of a 64-year rotation.

Ironically, to maximize profits a timber company has to cut corners on production. Worse yet, the wood from early harvests is distinctly inferior to the high-grade lumber fashioned from mature timber. Adolescent trees contain a disproportionate amount of soft and spongy sapwood, as well as numerous knots from the branches that have not broken off; older trees, on the other hand, can be made into clear, strong, tight-grained boards. Generally, trees

from commercial species such as Douglas-Fir must be a foot in diameter before they contain even a modest proportion of quality saw timber. If Douglas-Fir is harvested at 36 years of age, the yield from 12-inch-wide or larger trees is less than 10,000 board feet per acre. At 64 years, the yield from a similar site would be about 50,000 board feet per acre. A company that harvests at economic maturity will get less than 20,000 board feet per acre in 72 years (two rotations); if it were to harvest at productive maturity, it could have obtained two-and-a-half times the quality of saw timber in a shorter period of time.

The implications of this discrepancy are serious. It is well known, of course, that economic incentives of private industry do not always coincide with the public interest. We accept the fact that the private sector must sometimes be required by legislation to take actions that are economic liabilities: they must be made to clean up their own wastes, for instance, or to provide safeguards to the consumer. The problem here is even more basic: the timber itself is sacrificed for the sake of profit. The strongest arguments in favor of private enterprise are based upon efficiency and production: corporations may not always act according to the best interests of the environment, but at least they get the job done, they deliver the goods. The private sector, we assume, produces what we want to consume. Not so in this case. The peculiar relationship between time and timber causes private industry to fail at its ostensive task: maximizing production.

The problem is not with the companies themselves, but with an economic system in which interest rates are pitted against the time it takes to grow trees. Private enterprise, operating according to economic necessity, is simply not suited to the job of producing the most and the best timber products. When the guiding rate of interest exceeds 3%, as it does in the current economic landscape, sound economic practices on the part of timber companies are literally counterproductive. Quality saw timber cannot be produced on corporate lands, except at exorbitant prices that offset the cost of interest – and which the consumers, at least so far, are unwilling to pay.

The same economic reasoning that favors shorter rotations causes the timber companies to shorten the natural cycle of forest succession. By bypassing the pioneer stage, they also bypass many years of interest. And in their choice of methods for eliminating unwanted brush, any savings they can make will be greatly enhanced by the guiding rate of interest, since they can take the money saved and invest it elsewhere. Area-wide treatments such as the spraying of herbicides are preferred to the more personalized (and generally more expensive) site-specific treatments such as manual release. Any extra input during the early years of the cycle must produce a much-magnified output, or it simply isn't worth the money. If the application of herbicides is $10 per acre cheaper than hand-clearing, the savings will amount to several hundred dollars per acre by the timber they tree is finally harvested. If the companies don't think that the end product from hand-clearing will be several hundred dollars more valuable than the end product from spraying herbicides, then they do not feel justified in making that extra $10 investment.

As the guiding rate of interest gets larger, silvicultural decisions become increasingly dependent on economic criteria. At 1% interest, every dollar saved now will result in a $2 savings seventy years down the line; at 10% interest, every dollar will result in a $790 savings. Although these are extremes, the fluctuation in the guiding rate of interest enters significantly into real-life decisions. Forest economists speak of the net present value (NPV) for a given site over a defined planning period – the sum of the revenues minus the sum of the costs, taking the guiding rate of interest into account on both sides of the balance sheet. If the NPV falls below zero, the project becomes an economic liability; if the NPV remains positive, the project is worth undertaking. But the NPV hinges upon the guiding rate of interest. At a 3.5% rate of real interest, manual release and precommercial thinning on the Hoopa Valley Indian Reservation lead to a positive NPV; at 4% interest, these same projects generate negative values and would lose money for the tribe. Similarly, interplanting Douglas-Fir stands with green manure tres such as red alder might make economic sense at low rates of interest, but at high rates this investment in the future forest cannot be justified.

How can the magical guiding rate of interest, or "discount rate," be determined? This is no easy task. Basically, it is no more than the projected rate of real interest that is expected to prevail throughout the economy in the years covered by the planning period. Needless to say, the exact rate of interest forty years hence is anybody's guess. This uncertainty makes economic planning exceptionally difficult. Timber company managers, in order to avoid being devastated by high interest rates in the future, must make their projections reasonably high; they are safer if they assume the worst. But the assumption of a high rate of interest both limits investment and increases the importance of time as a determining factor in management decisions. Less money can be spent on the future, while rotation cycles become even shorter.

Why, one might ask, would anyone want to invest in timber? If the investment is so sensitive to the guiding rate to interest, and if the interest rates of the future are so hard to predict, isn't it just too risky?

If timber had no economic value prior to harvest, the risks would indeed be too great. In fact, however, timber is traded on the open market long before harvest; it has economic value even as it grows. Timberland buyers and sellers are speculating in a future product. The speculation can be worthwhile because the investment appreciates in three distinct ways. (1) With each passing year, a tree grows upward and outward. The annual increase in volume varies by species and site, but it is generally of significant magnitude for several decades. (2) As the tree matures, its end product takes on greater value. At first it can be turned only into pulp, then into low-grade lumber, and

finally into high-grade lumber or veneer. This change is called ingrowth. (3) Available resources become more scarce, price increases tend to outstrip the overall rate of inflation. With timber values increasing in three ways simultaneously, timber owners can realize healthy and competitive profits. From the 1960s though the 1980s, nominal returns on timber investments were approximately 12%; real returns ranged from about 5% to 8%.

These last two factors – ingrowth and price increase – encourage timber owners to wait rather than cut, serving as partial checks against early harvesting. The effects of high interest rates, however, are potentially more significant than the increased price of wood products. It is hard to imagine, for instance, that the real price of lumber will be 131 times higher in a hundred years than it is today, although that in fact would be the effect of a 5% real interest calculated over a century.

The ultimate test of profitability for timber owners, as for any capitalist enterprise, is the internal rate of return (IRR): the compounded annual interest rate earned on the initial investment. If the IRR compares favorably with the guiding rate of interest – what capital could generate if put to some other use – then the project is worthwhile. Today, growing trees can produce a respectable IRR and is therefore a good investment – but only with short rotations. The shorter the cycle, the more predictable the results. Frequent harvests generate capital for repeated investments, whether in timber or in some other field. Just as second-growth trees are more manageable than old-growth, so too are investments that last only 30 or 40 years easier to control than those that take twice as long to turn a profit.

In order to shorten the rotations as much as possible, investors are increasingly moving toward producing pulp instead of saw logs. The pulp can then be pressed together, simulating old-fashioned lumber. Without an understanding of economies, we might suspect that it makes more sense to produce real boards than to glue wood pulp. But pulp can be grown much more quickly, bypassing the incredible impact of time on forest investments. Pulp plantations produce marketable merchandise in a small fraction of the time it takes to grow real timber. From an economic standpoint, the time frame for growing pulp – say 15 to 30 years – can be handled within a capitalist economy; the time frame for regenerating a real forest – say 70 to 300 years – is incompatible with capital investments that must produce competitive rates of return.

Time, in the terms of forest economics, is measured in years or decades but never in centuries. With no economic incentive to plan beyond the next crop or two, investments in soil structure or erosion control cannot be justified financially. Any notion of spending money to repair a damaged ecosystem is ludicrous from a business point of view. Environmentalists claim that the timber companies are acting unethically by ignoring the distant future, but the problem is actually fiscal, not moral. The problem is created by a system in which we all play a part, consumers and producers alike. Given the fact that a corporation is an economic entity, why should it invest in activities that show no financial reward? Perhaps it will make token gestures, but these amount to no more than charitable contributions or affirmations of good will. There is no structural reason for a corporation to practice the kind of forestry that will lead to a healthy, productive stand of trees 200 years from now.

The whole economic edifice is entirely rational – but it is based on a logic that has nothing at all to do with silviculture or ecosystem management. Financial reasoning leads the companies to cut trees more frequently than they should, lessening the total production of quality saw timber. It leads them to ignore the principles of forest succession that should form the basis of sound forest management. It leads them to harvest timber from areas that are too sensitive to withstand the onslaught of heavy equipment, too steep to avoid subsequent erosion, or too exposed to generate a new crop of trees. It leads them to pay little heed to nontimber values such as water quality, fisheries, and wildlife habitat. And it leads them to skimp on investments that would benefit tomorrow's timber, since the nature of interest rates renders long-term, slow-return expenditures fiscally unwise.

Corporations at the close of the twentieth century, however, do not operate exclusively according to economic principles. Increasingly, they function as public entities that are legally responsible in some respects to furthering the good of society. Whether willingly or not, they are subject to regulatory constraints which tell them to act against their immediate economic self-interests. The purpose of regulations is to account for "externalities" – factors which do not show up on the balance sheet.

Ironically, the preservation of the resource base for the distant future constitutes such an externality. Whether or not the future productivity of the site is economically significant, timber companies must preserve the integrity of the soil in order to satisfy legal requirements. If reforestation expenses were treated as discretionary investments, they would be hard to justify financially; but by defining reforestation as a necessary expense charged to the previous harvest, the regulatory agencies are able to make sure that trees get planted – even though tree planting might not be profitable if interest rates are taken into account. In a sense, these regulatory restraints help the companies think about the future, since they have little economic incentive to do so on their own.

Some timber companies go a step further: They take non-economic factors into account voluntarily, not just because they are forced to comply with the laws. In particular, family-controlled "dynastic" companies are more likely to take future productivity into consideration, even though there is no profit to be made by doing so. While the impact of interest favors short-term investments, "dynasties" sometimes view time more leniently. A healthy future for the forest means jobs for the children and grandchildren. Although employment opportunities for unborn

offspring do not appear on the balance sheet, family or community-oriented businesses operate as if this type of human variable has value. Harvesting timber, to some executives, represents more than just a way to get rich; it's a way of life worthy of being preserved.

Forest Productivity

In the 1920's, Dr. Willis Linn Jepson, Professor of Botany at the University of California and President of the California Botanical Society wrote:

> *Magnificent bodies of Redwood, as yet untouched by the axe or only partially exploited, occur on the main Eel River, South Fork Eel River, Van Duzen River, Mad River, Redwood Creek, lower Klamath River and Smith River. The trees in these splendid forests are mostly mature or past maturity, 6 to 16 feet in diameter, 100 to 200 feet in height or taller, and yield 125,000 to 150,000 feet board measure (BF) per acre. Limited areas have produced as high as 200,000 to 500,000 feet board measure per acre and yields of 1.5 million feet to the acre are on record. On hill slopes, as in Mendocino and Sonoma (counties), the cut is about 20,000 to 50,000 feet to the acre*[12]

Local logging removed most of the conifer volume and approximately half of the hardwood volume. For example, OGA's 550 acres average 9,000 BF/acre in conifer wood volume today versus approximately 40,000 BF/acre that existed before logging. Hardwoods now make up approximately 50% of the total volume versus approximately 10% before logging. Over the next few decades, the living volume per species will be returned to its pre-logging makeup of approximately 55% Redwood with 30% Douglas-fir and Sugar pine and 15% hardwoods. Although their volume will slowly be returned to approximately 15% of the total, the hardwoods will continue to dominate the lower understory with smaller trees.

The yield table below approximates the average rate of wood growth of our upland forests. To understand this chart, the following terms are defined: Site Index 120 means the dominant trees will average 120 feet in height at age 100. Mean Annual Increment is the average growth since year 1 and periodic Annual Increment is the average for the 10-year period. Basal area averages the total square feet of tree trunks over 4.5 inches in diameter at breast height per acre. Gross yield measures total growth per acre since year 1. Gross yield overestimates total volume at any age because it does not account for natural mortality.

Volume per Acre of young-growth Redwood/Douglas-Fir/Sugar Pine
(All Tree Species with Redwood at least 50% of Basal Area)
Stands at least 60% stocked, Site Index 120, 10.5 inch DBH and larger[13]

Age (Yrs)	# of Trees	Height	Basal	BF/Ac	Gross Yield	Gross Periodic
of Trees	(over 10.5 in)	(ft)	Area,ft^2/ac	Mean Annual Increment	(BF)	Annual Increment (BF/ac)
20						
30	73	48	91	103	3,100	250
40	99	62	145	220	8,800	570
50	121	73	198	330	16,500	770
60	135	84	250	455	27,400	1,090
70	142	94	295	578	40,400	1,300
80	145	104	333	671	53,700	1,330
90	147	113	371	748	67,400	1,370
100	146	120	402	813	81,300	1,390

The table's growth rate peaks at 1,390 board feet per acre per year. Compared to forestland anywhere in the world, this is an extraordinary growth rate, yet for Redwoods it is average:

> *Redwoods produce wood at a phenomenal rate. In 1923, University of California forestry professor Emanuel Fritz established the "Wonder Plot" on an acre of second-growth redwood near Fort Bragg; by 1995 it had produced 343,000 board feet of timber (4,760 board feet per acre/year). Of all the world's vegetation types, mature redwood forest produces the greatest biomass per unit area – more than 1,400 metric tons per acre according to one study.*[14]

Practicing Profitable Restoration Forestry

The public is repeatedly told that Industrial forestry methods must be used to make money managing forestland. Considering the state of most forestland and the short-term reality of the marketplace, this is true. However, if helped along and given a few decades to rest and grow, most mature forests will significantly out-produce industrially managed lands decade after decade. One reason this happens is that most forestland grows more timber in its second fifty years of life than during its first fifty years. For example, from the yield table, age 50 gross yield = 16,500 BF/ac growth in the first fifty years. Age 100 gross yield = 81,300 BF or 64,800 BF/ac growth in the second fifty years.

OGA's founders first purchased forestland in the Gualala Watershed of Sonoma County in 1994. At that time, like every year, demand for wood products was degrading forests in every corner of the globe. We could not separate our forests from what was happening around us. If OGA restored forests only to protect them, other forests would be logged more extensively to meet the large wood demand. Creating another pretty forest preserve is not OGA's mission. The only way the forest work can grow into a permanent and significant contribution to the earth is to maintain a sustainable accommodation with the needs of the human society around it.

After 5 years of learning on 42 acres, OGA was incorporated in 1999. New partners purchased or co-purchased adjacent lands and OGA manages it by contract. OGA's future harvest income is set-aside to increase the breadth of the restoration work. In this way, land purchases and restoration becomes self-financing and in time the project will make a significant impact by growing along with the trees.

OGA lands are located in the magical Coast Range, 5 miles from the ocean and a 3-hour drive north of San Francisco. Examples of the magic are everywhere. The tallest trees on earth, the Redwoods, live only in the Coast Range. An old-growth Redwood forest has the most biomass of any forest on earth. It has 7 times more biomass per acre than the Amazon rainforests. The local forest is home to the black bear, the mountain lion, bobcat, golden eagle, osprey, hawk, a variety of owls including barn, spotted and screech owls, wild turkey, several species of woodpeckers, snakes and salamanders, foot-long lizards, feral pig, fox, deer, hare, quail, river otter and rainbow trout among many other animals. Recent studies show the watershed is recovering from the logging-related damage. If this continues, we expect the near-extinct wild populations of Coho Salmon to start returning to our creeks within 10 years.

Short-term versus long-term legal protection: Some OGA lands are protected from logging in the short-term. For example, after the old-growth forest was logged in the 1960's, our Fuller Creek lands were sold as a subdivision of 40-acre parcels. The subdivision's Covenants, Conditions, and Restrictions (CC&R's) do not allow commercial activities. The CC&R's are extended every twenty years by a majority vote of the parcel owners. But, forestland is being conventionally logged and/or converted to vineyards all around us (see photo on page 30). The future extensions of the CC&R's will be increasingly difficult because owners are tempted by the high value of vineyard development and timber on their lands. For permanent protection, conservation easements should be attached to the parcel's deed.

Many people believe that the best thing to do for a logged forest is to leave it alone. We understand this sentiment because it took us years to realize that the "leave it alone" philosophy works only to a degree and it does not address many structural problems and stand-destroying fire risks. A logged forest's species composition, canopy structure, road- and logging-caused erosion problems, stream damage, fire danger and other structural problems will take centuries to return to something like it was before being transformed by man. An effort that combines excellent forestry practices with years of hard work helps the forest correct the structural imbalances caused by man in a few decades. We welcome anyone curious about our work to schedule a visit. Words cannot substitute for a walk in the woods. The first-hand impressions gained while walking in the forest

quiets the chattering mind and resolves ideas into experience.

As the preceding article clearly explained, timberland managers, like most business people, place a premium on profits and the time value of money. The time value of money severely discounts the value of future harvests. (In many forests, long-term harvests are also discounted for anticipated fire and/or insect damage over time. In the Redwood region, fire and insect damage is not a major issue.) When profit maximization and the time value of money are combined, the arrow consistently points to young-tree harvesting.

For example, most OGA managed forests are primarily made up of 30-to 40-year-old trees that have regenerated since logging. The timber companies also left young trees that were not valuable at the time along with a few mature and old-growth trees that were either difficult to get to or somewhat less than perfect in form. Most landowners would log our forests now because those young trees are currently 65 to 75 years old and the few mature and old-growth trees are valuable. Clearcutting or high-grading would entice most landowners to take a hefty profit. The regulatory agencies would protect the stream zones from over logging but would allow the hillsides to be cut very heavily. These practices typically leave the forest structure degraded significantly. The hardwood volume becomes even more dominant and although the bare land would be replanted with seedlings, the steep slopes will again have significant erosion and landslides will develop. Starting over, the land would struggle with further degradation to compound the structural problems it was slowly rebalancing before being logged again.

OGA comes to the forest from a different perspective. Degraded or destroyed forestland is available anywhere in the world. Most degraded forests can be restored by working <u>with</u> the land for as long as it takes. OGA invests the time and money to return degraded or destroyed lands to highly productive and biologically diverse forests by permanently practicing restoration forestry. It is worth the wait. The maturing forest delivers the financial bottom line.

The issues are similar everywhere – over-emphasized economics has caused ecological degradation all over the planet. <u>On the other hand, ecological work done outside the realities of economics leads to governmental/charitable dependence or eventual failure</u>. But it does not have to be an either/or proposition. The economy and ecology reality is not difficult to implement on the ground. The difficulty, sad to say, is convincing investors to limit short-term financial returns to pay for long-term ecological and productivity gains that mostly their children and grandchildren will benefit from.

- *Give the land time to heal.* After logging, most stands will regenerate to varying degrees on their own. We plant extensively to help increase conifer stocking and lower erosion in areas that did not recover well. The young forest is thinned of damaged and lower quality trees along with other restoration prescriptions every ten years. Thinning creates wildlife habitat and lowers forest fire hazards. It also helps restore the pre-logging species composition of the forest while increasing overall productivity and the quality of trees.
- *Practice selective harvesting.* Selection harvesting is an excellent management prescription for most forests. By approximating the forest's pre-logging structure and its natural fire regimen, the forest can be managed on a rotation of over 200 years because the probability of large losses from fire or insects is significantly lowered. Under long rotations, the yield table's gross periodic annual increment (GPAI) is well passed its peak. But, GPAI only measures the forest's production of wood over time. It does not measure quality. GPAI is important if you are in the pulp, firewood, low-quality lumber or fiberboard business. OGA produces quality lumber. Long rotations give the forest time to grow large trees. Value per board foot increases dramatically when logs are large and knot-free. Dense-old-growth is the highest quality wood available. In coming decades, mature timber will become even more valuable because it will be increasingly difficult to find at any price anywhere.
- *Restoration work increases forest productivity without chemicals:* To control insect populations and/or hardwood trees that compete with conifers, most industrially managed forests still use herbicides and insecticides regularly. Chemicals damage soil building by killing insects,

microorganisms and fungi essential to the soil building process. Labor-intensive thinning achieves the same results as chemical use by mimicking the forest's tree selection process. By entering the forest every ten years, the natural loss of trees to disease and mortality is reduced by harvesting and selling a portion of them before they deteriorate. This adds periodic income and increases the GPAI. Soil building also helps improve conditions for future timber and non-timber uses of the land. Although the common financial wisdom in the timber industry is that forestry is only profitable if practiced on short rotations, when the following factors are taken into account, restoration forestry is a very good investment. To calculate the standing timber value and sustainable revenues into the future for a parcel of forestland, OGA uses several conservative assumptions:

- *Inflation and timber prices continue to climb.* Although prices and inflation fluctuate significantly year to year, timber prices have consistently increased an average of 2.5% annually after inflation since 1940. OGA forests are mostly Redwood and Douglas-fir. The price appreciation of these species is even more pronounced. For example, although prices have dropped significantly in 2001 and 2002, Fir and Redwood prices increased over 10.5% compounded annually (not inflation adjusted) between 1983 and 2002. The wholesale market value today of quality Redwood boards starts at $1.30 per BF for con-heart beams. In order to remain conservative in our future projections, OGA projects only a 6% annual increase in overall timber prices (not adjusted for inflation). Inflation has averaged approximately 3.5% annually over the past century, OGA's assumptions use 3.5% when calculating the after inflation return.
- *The hardwoods are not given any value as an asset or a source of income.* Many Tanoaks are thinned and sold for firewood at $275 per cord. But, firewood revenues are used to offset restoration expenses and do not yield a profit. Some of the higher quality Tanoaks are retained to be harvested in the future at a premium for the local hardwood flooring and lumber market. Although these post-thinning higher quality Tanoaks may contribute financially at some point, to maintain a conservative calculation, the assumption of zero value is also used.
- Mathematically, a ft^3 of wood equals 12 board-feet (BF) if the entire log could be cut into1 by 1 inch boards and nothing was lost by cutting. A ft^3 from a saw log actually yields between 5 and 7 BF of useable lumber. BF per cubic foot increases as log diameter increases. Hardwood volumes are usually stated in ft^3. Hardwood volumes are converted to BF only to maintain consistency in the yield table calculations using a factor of 6 BF/ft^3. Although volume-wise this is accurate, you cannot actually obtain 6 BF/ft^3 in lumber from hardwoods because of the irregular shape of most hardwood logs.
- *Forest growth is estimated using the yield table's Gross Periodic Annual Increment for the corresponding volume level and discounted to account for the hardwood component, soil depletion from past abuses and the lower stocking of our predominantly hillside properties.* The rate of forest growth will increase as a result of the increase in standing timber volume for many decades. At some point, the growth rate will level off as standing volume increases beyond a certain level. Since 10% of the overall volume is thinned every decade, both the accumulation of volume and its corresponding growth rate will change at a slower rate than the yield table's figures (see page 30).
- *Timber harvesting costs vary between $0.20 and $0.30 BF depending on average tree size, distance of transportation and, topography.* Costs vary inversely with tree size. The larger the trees harvested, the smaller overall costs are in relation to total revenues. For example, an average 42-inch DBH (diameter measured at breast-height) Redwood yields 2,000 BF of lumber. Four average 24-inch Redwoods yield the same 2,000 BF but produce over twice the amount of slash. Total costs are higher for felling, cutting up the slash and handling four 24-inch trees than for one 42-inch tree. Also, the percentage of valuable heartwood per tree increases with diameter. For example, a 24-inch Redwood has less than 45% heartwood, while a 42-inch tree has over 70%.
- *Transportation and Milling Costs:* The topography of the land, understory vegetation and tree spacing also affect harvesting costs. It takes more time to work in an unthinned forest because they are difficult to walk/drive through. A good road system in a well-managed stand lowers harvesting time and yarding costs. Because OGA uses horses in many areas, we keep most logs short (less than 16 1/2 feet), so that the horses can move the logs on narrow skid roads. OGA mills all its own wood. The value added by finished lumber more than offsets the costs. (For example, OGA's milling, transportation and harvesting costs combined averaged $0.58 BF in 2002, while our salvage redwood boards and beams sold for an average of $1.60 BF.)

- *Additional Costs:* In California, a timber harvest plan (THP) or a non-industrial timber management plan (NTMP) must be approved before selling timber. For example, an 80-acre THP usually costs up to $25,000 and must be approved prior to each harvest. A more economical alternative for the long-term landowner is the NTMP. The more thorough NTMP costs up to $35,000 for an 80-acre parcel, but once approved by the state, it is good forever without re-applying each time trees are harvested.

- *Tax breaks make investing in long-term forest restoration economically attractive.* For example, a high-income investor purchased a recently logged 71-acre forest for $160,000 ($100,000 down, $60,000 mortgage) in 1999. A conservation easement was placed on the property, limiting logging and development in perpetuity and setting-aside 15% of the acreage to return to old-growth. Writing the easement required legal help, a certified property appraisal and an NTMP forest management plan with total costs of $40,000. $30,000 was spent cleaning up the logging mess and improving the forest prior to the appraisal. Mortgage and property taxes for the first tax year were $5,000. Total cash invested was $185,000 with $84,000 in tax-deductible expenses (easement costs, improvement expenses, mortgage interest and property taxes).

  The investor gave up many development and subdivision rights to the property (retaining one building site on 1.5 acres). The appraisal determined the easement lowered the property value from $200,000 to $85,000. The difference, $115,000, is a charitable contribution. In the investor's 50% marginal tax bracket (State & Federal), the $84,000 in deductions and the $115,000 in charitable contributions totaled $199,000 or $99,500 in actual tax savings. If the tax breaks cannot be fully utilized in the year earned, the charitable deductions can be carried forward an additional five years. The easement also reduced the property's tax basis from $160,000 (the purchase price) to $68,000. (Tax basis is calculated by reducing the purchase price by the percentage change in the before and after easement appraised values. In this case, $200,000 to $85,000 is a 57.5% reduction which is applied to the $160,000 purchase price.) After the first year, OGA used firewood and furniture revenue to finance the restoration and pay the property taxes. The building rights to the parcel were sold in 2001 to pay off the property while still retaining 3/4ths of the ownership of the parcel. The investor has little additional cash investment in the property until the first sustainable timber harvest in the year 2021.

  Investor's Cash Breakdown: Invested: $185,000 less tax savings of $99,500 for a net cash investment of $85,500. Although the property value is temporarily reduced, the investor understands that the forest management plan will greatly increase the ecological and economical value of the land over time. As OGA completes certain stages of the restoration work, the owner will deed 1/3rd of the future timber rights to OGA. By allowing OGA to share in future harvests, other forestland can be restored. The first harvest and on-site milling in 2021 is estimated to net over $70,000. As forest volume and productivity continues to increase, future harvest values increase dramatically. For example, the second harvest in 2031 is estimated to net over $165,000 (see spreadsheet on page 42).

  Combining the values of building a home or rental within the restored forest and the recreational value of the land, the tax benefits and the long-term lumber income you have a strong economic argument for long-term forest restoration in place on a parcel by parcel basis.

POI 1: Estimated Long-term Effects on Forest Volume, Growth Rate, Species Composition and Value

The table on page 36 estimates changes on an average acre based on OGA's management plan for a 71-acre parcel in Pt. Arena, CA. This parcel was heavily logged at the turn of the century and again in the 1950's and 1999. The growth, standing volume and thinning rates are shown to highlight the restoration that is possible for a typical average quality stand of Redwood, Douglas-fir and Sugar Pine significantly degraded by high-grade logging three times in one century. All $ figures in actual year dollars, volume data is from a 10% cruise completed in October 2000. Other assumptions used are stated in the table.

The table shows how the degraded stand can slowly be transformed by retaining most of each decade's growth and thinning to restore the species composition of the original old-growth forest. For example, in two decades the stand will change from 63.2% hardwoods by volume to 16.1%

while the Redwood volume grows from 14.8% to 33.6%. Standing conifer volume grows consistently from 4,657 board feet per acre in 2000 to 13,707 in 2020 and will reach 34,237 by 2060.

The growth rates used are a combination of present day growth rates calculated by a recent cruise and the Site Index 140 tables (Lindquist & Palley – see page 41). Site index 140 growth rates are adjusted down to account for inventory, stocking and soil depletion. Annual growth in BF per acre increases with standing volume and slows as volume approaches maximum stocking. These numbers are estimates only. Making predictions out over many decades is a hazardous business at best - this long-term table was created to show what is possible by following good principles consistently. It is a model for management purposes and not a predictor of future outcomes.

OGA recovers some restoration costs by selling firewood. Thinned hardwoods are cut into manageable lengths and rolled, slid or hand thrown to nearby skid trails. There they are cut into rounds and stacked for drying. The remaining branches are cut and scattered to decompose back into the soil.

OGA handcrafts fine patio furniture to finance restoration work. We build heavy-duty picnic tables, benches and chairs that are shipped nationwide. Because we cut a very limited amount of salvage and green redwood, it is best to make a value-added product like furniture than to sell boards or logs. See furniture photos at:
www.oldgrowthagain.org

Estimated Changes on an Acre of OGA managed land over a sixty year period

Species	$/BF Before Expenses	Before Thin #1 (2000) Vol-BF	Vol %	Net $ Value	Thin #1 (2001) Vol	Vol %	Net $ Value	Thin POI	After First Thin (2001) Vol	Vol %	Net $ Value
Hardwoods	$ -	8000	63.2%	$ -	4000	50.0%	$ -		4000	46.2%	$ -
Redwood	$ 0.90	1868	14.8%	$ 1,681	0	0.0%	$ -		1868	21.6%	$ 1,681
Fir	$ 0.20	1586	12.5%	$ 317	0	0.0%	$ -		1586	18.3%	$ 317
Pine	$ 0.20	1203	9.5%	$ 241	0	0.0%	$ -		1203	13.9%	$ 241
Total conifers		4657	36.8%	$ 2,239	0	0.0%	$ -		4657	53.8%	$ 2,239
Totals/ac		12657	100%	$ 2,239	4000	31.6%	$ -	0.0%	8657	100%	$ 2,239
Conifer Growth = 400 BF/ac/yr					Thin = 0.0% Of 10-yr conifer growth					0.0%	of total value
Hardwood Growth = 271 BF/ac/yr					Increase in net $ value over 10 years -					n/a	
		Before Thin #2 (2011)			Thin #2 (2011)			Thin POI	After Thin #2 (2011)		
Hardwoods	$ -	5600	39.1%	$ -	2520	45.0%	$ -		3080	26.1%	$ -
Redwood	$ 1.52	3493	24.4%	$ 5,309	0	0.0%	$ -		3493	30.8%	$ 5,309
Fir	$ 0.34	2965	20.7%	$ 1,002	0	0.0%	$ -		3289	25.2%	$ 1,002
Pine	$ 0.34	2249	15.7%	$ 760	0	0.0%	$ -		2249	19.1%	$ 760
Total conifers		8707	60.9%	$ 7,070	0	0.0%	$ -		8,707	73.9%	$ 7,070
Totals/ac		14307	100%	$ 7,070	2520	17.6%	$ -	0.0%	11787	100%	$ 7,070
Conifer Growth = 450 BF/ac/yr					Thin = 0.0% Of 10-yr conifer growth					0.0%	of total value
Hardwood Growth = 16 BF/ac/yr					Increase in net $ value over 10 years -					$ 4,831	per acre
		Before Thin #3 (2021)			Thin #3 (2021)			Thin POI	After Thin #3 (2021)		
Hardwoods	$ -	4312	23.9%	$ -	1940	45.0%	$ -		2372	16.1%	$ -
Redwood	$ 2.72	5498	30.5%	$ 14,969	550	10.0%	$ 1,497		4948	33.6%	$ 13,472
Fir	$ 0.60	4668	25.9%	$ 2,824	467	10.0%	$ 282		4201	28.6%	$ 2,542
Pine	$ 0.60	3541	19.7%	$ 2,142	354	10.0%	$ 214		3187	21.7%	$ 1,928
Total conifers		13707	76.1%	$ 19,935	1371	41.4%	$ 1,993		12336	83.9%	$ 17,941
Totals/ac		18019	100%	$ 19,935	3311	18.4%	$ 1,993	10.0%	14708	100%	$ 17,941
Conifer Growth = 500 BF/ac/yr					Thin = 27.4% of 10-yr conifer growth					10.0%	of total value
Hardwood Growth = 123 BF/ac/yr					Increase in net $ value over 10 years -					$ 10,871	per acre
		Before Thin #4 (2031)			Thin #4 (2031)			Thin POI	After Thin #4 (2031)		
Hardwoods	$ -	3320	15.3%	$ -	996	30.0%	$ -		2324	12.3%	$ -
Redwood	$ 4.88	7355	34.0%	$ 35,863	735	10.0%	$ 3,586		6619	35.2%	$ 32,277
Fir	$ 1.08	6245	28.8%	$ 6,766	624	10.0%	$ 677		5629	29.9%	$ 6,090
Pine	$ 1.08	4737	21.9%	$ 5,132	474	10.0%	$ 513		4263	22.6%	$ 4,619
Total conifers		18336	84.7%	$ 47,762	1834	64.8%	$ 4,776		16503	87.7%	$ 42,986
Totals/ac		24449	100%	$ 24,885	4284	13.1%	$ 4,776	10.0%	18827	100%	$ 42,986
Conifer Growth = 600 BF/ac/yr					Thin = 30.6% of 10-yr conifer growth					10.0%	of total value
Hardwood Growth = 95 BF/ac/yr					Increase in net $ value over 10 years -					$ 25,044	per acre
		Before Thin #5 (2041)			Thin #5 (2041)			Thin POI	After Thin #5 (2041)		
Hardwoods	$ -	3254	12.2%	$ -	813	25.0%	$ -		2440	10.3%	$ -
Redwood	$ 8.73	9427	35.2%	$ 82,328	943	10.0%	$ 8,233		8485	36.0%	$ 74,095
Fir	$ 1.94	8004	29.9%	$ 15,533	800	10.0%	$ 1,553		7204	30.5%	$ 13,980
Pine	$ 1.94	6071	22.7%	$ 11,782	607	10.0%	$ 1,178		5464	23.2%	$ 10,604
Total conifers		23503	87.8%	$ 109,643	2350	74.3%	$ 10,964		21552	89.7%	$ 98,679
Totals/ac		26757	100%	$ 109,643	3245	11.8%	$ 10,964	10.0%	23593	100%	$ 98,679
Conifer Growth = 700 BF/ac/yr					Thin = 33.6% of 10-yr conifer growth					10.0%	of total value
Hardwood Growth = 93 BF/ac/yr					Increase in net $ value over 10 years -					$ 55,693	per acre
		Before Thin #6 (2051)			Thin #6 (2051)			Thin POI	After Thin #6 (2051)		
Hardwoods	$ -	3417	10.5%	$ -	854	25.0%	$ -		2562	8.9%	$ -
Redwood	$ 15.64	11694	35.9%	$ 182,894	1169	10.0%	$ 18,289		10524	36.5%	$ 164,605
Fir	$ 3.48	9928	30.5%	$ 34,507	993	10.0%	$ 3,451		8935	31.0%	$ 31,057
Pine	$ 3.48	7531	23.1%	$ 26,174	753	10.0%	$ 2,617		6,778	23.5%	$ 23,557
Total conifers		29152	89.5%	$ 243,576	2915	76.2%	$ 24,358		26237	91.1%	$ 219,218
Totals/ac		32455	100%	$ 243,576	3823	11.8%	$ 24,358	10.0%	28800	100%	$ 219,218
Conifer Growth = 800 BF/ac/yr					Thin = 36.4% of 10-yr conifer growth					10.0%	of total value
Hardwood Growth = 98 BF/ac/yr					Increase in net $ value over 10 years -					$ 120,539	per acre
		Before Thin #7 (2061)			Thin #7 (2061)			Thin POI	After Thin #7 (2061)		
Hardwoods	$ -	3587	9.5%	$ -	897	25.0%	$ -		2691	8.0%	$ -
Redwood	$ 28.01	13733	36.3%	$ 384,697	1373	10.0%	$ 38,470		12360	36.9%	$ 346,227
Fir	$ 6.22	11660	30.8%	$ 72,583	1166	10.0%	$ 7,258		10494	31.3%	$ 65,324
Pine	$ 6.22	8844	23.4%	$ 55,055	884	10.0%	$ 5,505		7960	23.8%	$ 49,549
Total conifers		34237	90.5%	$ 512,334	3424	79.2%	$ 51,233		30813	92.0%	$ 461,101
Totals/ac		37825	100%	$ 512,334	4321	11.4%	$ 51,233	10.0%	33504	100%	$ 461,101
Conifer Growth = 800 BF/ac/yr					Thin = 42.8% of 10-yr conifer growth					10.0%	of total value
Hardwood Growth = 102 BF/ac/yr					Increase in net $ value over 10 years -					$ 241,882	per acre

To calculate NPV divide Each Thin $ Value by NPV-8% factor & keep total at

NPV-8%	Thin $/acre	Acres	Each Thin $ Value	NPV for each thin	**NPV to date**
			All figures before expenses (harvesting expenses are approximately 50% of revenues)		
1.0	$ -	71	$ -	$ -	$ -
2.0	$ -	71	$ -	$ -	$ -
4.3	$ 1,993	71	$ 141,538	$ 32,795	$ 32,795
9.3	$ 4,776	71	$ 339,109	$ 36,393	$ 69,188
20.1	$ 10,964	71	$ 778,466	$ 38,696	$ 107,885
43.4	$ 24,358	71	$ 1,729,388	$ 39,817	$ 147,702
93.8	$ 51,233	71	$ 3,637,572	$ 38,791	$ 186,493

There exists an extensive body of literature to support OGA's ecology and economy model. For example, the following article first appeared in the International Journal of Ecoforestry in the spring of 1996. It is excerpted and reprinted here with permission from the author, Mr. Hans Burkhardt, Ph.D.

The Economic Aspect of Ecoforestry

A Prescription That Makes Environmental Protection and Maximum Perpetual Revenue Flow Compatible

For anyone who is at all aware of our planetary ecological condition, it is starkly clear that our society must stop its current suicidal mode of action, and we must find more sustainable ways to live and do business. While it is critical that we make sweeping changes in several areas, such as population reduction, over-consumption and fossil fuel use, my purpose is to focus on one critical area – our relationship to the native forest resource.

My intention here is to give information that can be adapted and applied anywhere by people who wish to know how one can restore and sustainably use depleted forest resources. I make my recommendations with deference to economic considerations, because in our money-driven society it is economic viability that will bear strongly on the success or failure of whatever changes we plan to bring about. Consensus opinion assumes that high monetary profits from our forests and good ecological protection are mutually exclusive. However, it is my conclusion, drawn from closely investigating several examples of sound forest management as well as my own experience derived from restoring an inventory-depleted forest, that we can have both: what is good for the survival of the forest is good for the well-being of local communities if only we are patient and wise enough to create such a condition.

How Trees Grow

Tree growth can be divided into three phases:

- The first phase is characterized by very high, rapidly declining percentage growth but negligible volume production. For example, a pencil-thin tree may double in volume in one year, but the volume added amounts to very little. (Growth rates of 100% declining to about 7%.)
- The second phase is characterized by lower, gradually declining percentage growth, high volume growth and ends when average annual volume growth culminates. (Growth rates declining from about 7% to 2%.)
- The third phase is characterized by continued declining percentage growth and a slowly decreasing high volume growth. (Growth rates below 2%.)

All conifers continue to grow substantially in the third phase, some more and longer than others. Redwoods and cedars increase volume considerably for many hundreds of years after reaching culmination of average annual volume growth (CMAI, culmination of mean annual increment.) Also – and this is most important – all tree species show a significant increase in the quality of their wood during the slower, post CMAI phase of growth. This period – when the forest becomes mature – is also the most important for the creation of high inventory and forest sustainability. For the perpetuation of California's redwood forests, this third phase is especially important since it is needed to allow for natural regeneration and thus continued genetic adaptation to changing environmental conditions. Therefore, if native forests are to be used for perpetual timber production, it is imperative, for reasons that include maximum long-term revenue flow for the owner and the local community, not to eliminate this lucrative component of all native forests.

Current North American forestry practice, with few exceptions, does indeed eliminate this third, most important phase of tree growth. And worse, not only are those older trees being systematically

eradicated, but even much younger trees – trees in their most active, pre-CMAI period of growth – are routinely harvested under the current practices of industrial forestry. This level of overcutting has finally made the ongoing destruction of our native forests clearly apparent to everyone who is concerned with our own and other species' survival.

How To Restore Forest Health and Increase Productivity

There is a way to harvest trees for human use that can both increase the future productivity of these depleted forests and at the same time allow them to regenerate and restore themselves. We must do two things. We must harvest, for a considerable length of time, less than is growing, and we must adjust the harvest rate to maintain high inventories of trees in the forests once they are restored. For the few remaining forests not yet damaged by unwise human interference, we need only maintain high inventory, which can be accomplished by harvesting a certain percentage of inventory, as I will explain later.

The Study

A study was conducted designed to simulate various levels of harvest projected into the future to predict the effects on both the sustained health of the forest and its long-term economic productivity. For reliable predictions of future forest growth, one must use the appropriate yield table available, which shows the volume per acre that is likely to be produced for each age class (decade) at a given site. For this study, the yield table produced by Lindquist and Palley (L&P) in 1963 for typical, fully stocked second-growth mixed conifer redwood forest was used as a basis. However, to account for site degradation due to post 1963 liquidation logging, a reduction in yield table was necessary: productivity data from a 1985 Federal Inventory Assessment study led to the conclusion that this could be achieved by lowering site quality from average site index 160 to site index 140 (see yield table on page 30). The actual degree of site occupancy or stocking must also be considered. In this study the average values found by the 1985 Federal Inventory Assessment study were used (55%). In addition, to consider the growth lowering effects of long-term inventory depletion as well as growth favoring effect of long-term inventory increases, yield table values of 50% and 60% respectively were used instead of 55% for both types of scenarios.

One special problem with the yield table used was that there are no second growth stands of redwood older than 120 years in existence. Therefore values had to be constructed by extrapolation of the L&P growth curve and comparison with other conifer growth curves that include the higher age classes. The resulting yield values are presented in page 40 in the Yield-MBF/acre column.

To simulate forest growth, various percentages of standing inventories were harvested. This principle is called percent-of-inventory (POI) harvest control: forests are harvested every decade at a chosen rate of inventory eventually develop an age-class structure that includes all age classes up to rotation age. **Regardless of the initial age-class distribution and growth rate, a forest which is harvested at a specific percent of inventory will eventually grow exactly at that rate.** When the forest has reached this condition it is fully regulated. Harvest percentages can be chosen that characterize good or bad forestry, percentages that will result in plenty of age classes, or just a few.

It is important to note that average percentage growth rates **higher**, not lower than those that result in maximum productivity (about 2%), **lead to sacrifices in both productive capacity and forest sustainability. (**See table on page 40.)

From the yield table being used, one can calculate average percent annual growth up to and including any given age class (decade) by simply dividing the total volume listed for this age class by the sum of all listed age class volumes and multiplying the result by 10. **For most conifer forests the world over, the average growth rate that results in maximum productivity (CMAI) at full regulation is close to 2%.** To arrive at the harvest rate that leads to the highest value of yield at harvest (culmination of revenue flow) 1.0% and 0.9% harvest rates had to be used. These harvest percentages are compared with those presently being practiced by industry in our area: the two largest local timber companies, Louisiana Pacific (L-P) and Georgia-Pacific (G-P) corporations in their long-range sustained yield plans anticipate harvesting at annual rates of 4-6

percent of inventory in the near future. While L-P anticipates dropping their annual harvests to 1-3% of inventory in the very distant future, G-P anticipates a 4.4% harvest rate until the year 2100.

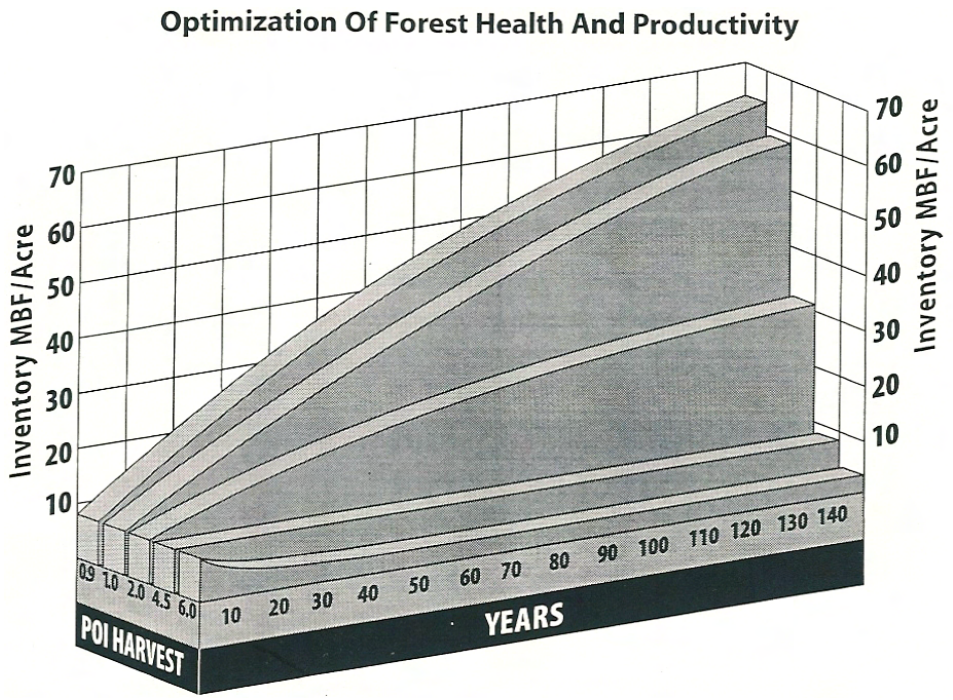
Therefore, for this study, the forest was "harvested" at five annual rates of POI (6.0, 4.5, 2.0, 1.0, 0.9) until growth rates approached harvest rates (full regulation). This can be done by either simple mathematics or by using a suitable computer program. (For instance "Harvest II" is described in the book *Maximizing Forest Productivity**.) Using this procedure, values for inventory, age of oldest trees, productivity and annual harvest were obtained for each scenario. Also assigned is a much-needed value for forest sustainability, which is defined as regulated MBF/acre inventory (= available biomass) divided by the annual percent of inventory harvest (= removal of biomass). The higher the regulated inventory and the lower the annual POI harvest, the higher is the degree of forest sustainability. The accompanying three-dimensional graph and table summarize the most important results of this analysis.

The major conclusions which can be drawn are:

1. Revenue flow culminates at a harvest level of approximately 1% of inventory per year (POI 1).
2. Productivity measured in board feet (international 1/4" rule) culminates at a harvest level of approximately 2% of inventory per year (POI 2).
3. Forest sustainability at the levels investigated is highest at 0.9% of inventory per year (POI 0.9).
4. Unsustainable and low present revenue flow (POI 4.5 and 6) could gradually be increased by a factor of 2 to 3 and become sustainable at the same time if a lower POI is used (POI 2, 1, or 0.9). Community impoverishment would slowly but steadily be replaced by community well being. Forest product quality would gradually change from poor to excellent, and forest related jobs could be increased by 180-250%.
5. The average time needed to **fully** restore our depleted forests' productive capacity and health is about equivalent to the time it took to liquidate inventory and damage forest health: one to two centuries.
6. Industrial forestry, which maximizes short-term profit, leads to annual harvest levels greater than 3 percent of inventory. The consequences of this practice are loss of the following: inventory, productive capacity, potential tax base, permanent jobs, timber quality, community stability, biodiversity and substantial long-term land-owner income.
7. The requirements of Ecoforestry can only be fulfilled at an annual harvest level of 1% of inventory or lower. All other harvest levels reduce too much of the richness, biodiversity and sustainability of the forest.
8. Forest sustainability increases four-fold if the forest is managed for maximum revenue flow (POI 1) rather than maximum yield in board feet (POI 2).
9. Practice of POI 1 harvest control (forest management aimed at maximizing revenue flow) leads to the creation of a secondary forest of near old-growth characteristics, where all age classes are uniformly distributed and the oldest trees are about 200 years old.

In conclusion, one can see that high perpetual revenue flow and good environmental protection are not diametrically opposed. On the contrary, up to the point of maximum revenue flow at approximately the POI 1 harvest level, both seemingly opposing goals of forest management actually improve in synchronous harmony. Harvesting 1% of inventory is the best long-term investment policy for the general public, the local community, the landowner and the forest, when that forest is to be used for timber production while maintaining its ecological integrity.

*Maximizing Forest Productivity is available from H. Burkhardt, Emile's Station Ft. Bragg, CA 95437



Harvest Simulator – Starting Inventory: 8,000 Board Feet (BF) Yield Table: L&P Site Index 140 x 50/60%[1]

POI[2]	Inventory per Acre (at FR)[3]	Age of Oldest Trees Harvested (at FR)	Harvest Level per acre/year (at FR)	Harvest Value per acre/year (at FR) $ per BF[4]	Type of Forestry Practiced[5]	Sustainability of Resource[6]
6.0	4,500	43	270	270	IF	.75
4.5	8,400	57	378	378	IF	1.77
2.0	34,000	108	680	680	MSP	17.00
1.0	67,500	195	675	1012	EF	67.50
0.9	72,200	215	650	975	EF	80.00

[1] Actual yield table figures are reduced to account for the depleted condition of the forest soil and the inventory stocking levels. 50% is used when inventory is further reduced. 60% when inventory is increased (see text).
[2] POI = Annual harvest as a percent of total inventory.
[3] FR = Fully regulated, the condition when growth and harvest are equal and inventory remains constant. For example, full regulation for POI 1.0 is reached at 210 years.
[4] Harvest value reflects the current market price of $1.00 per BF for average quality boards (POI 6.0 to 2.0) and $1.50 for mature and old-growth boards (POI 1 and 0.9)
[5] IF = Industrial forestry: Net present value maximization leads to low inventory, reduced productive capacity, destruction of biodiversity and to community impoverishment.
EF = Ecological responsible forestry; optimizes forest health and revenue flow, respects intrinsic worth of all natural beings; avoids clearcutting and respects the natural aesthetic qualities of the landscape.
[6] The ratio of regulated board feet per acre inventory (available biomass) divided by the annual POI harvest (biomass removal) is used as a measure of forest sustainability.

Old-Growth Again: Maximizing POI 1 For Old-growth Characteristics

The principle points of Mr. Burkhardt's 1994 study have been adopted by Old-Growth Again as the long-term framework of its forest management plan. Old-Growth Again's forest management plan is based on the POI 1 study with a few important adjustments:

The original study estimates that maximum productivity will only reach 680 BF/year. This figure is 48.8% of the published table's maximum of 1,390 BF/year (L&P Site Index 140) and 85% of OGA's estimated peak productivity of 800 BF/year. The discrepancy exists because Mr. Burkhardt's study focused on the benefits of volume recovery and pre-supposed that little or no restoration work would be done to most of the local industrial forests that are now dominated by hardwoods. Many of these lands now grow more hardwoods than conifer lumber. Although this may change somewhat over time, a program of regular thinning and planting would slowly return these degraded lands closer to their previous productivity. Without these additional efforts, overall productivity will remain significantly below historical levels as this study clearly shows. OGA's harvest rates are set at 1.0% POI. Five trees are set aside per acre to age to full maturity (over 500 years). The combination of extensive thinning and planting to restore conifer dominance and the old-growth set-asides helps OGA achieve the results of Mr. Burkhardt's 0.9 POI plan for optimum sustainability.

The complete study, as originally written in the book "Maximizing Forest Productivity," was an attempt to change the way the industrial forestry companies were managing the Mendocino County Redwood forest. To placate the industry, the study was written to allow the oldest trees to be harvested each decade. Because of the conservative rate of cut, the forest would still mature over time until the oldest trees were approximately 200 years old. But, in the intervening decade, the industrial forest industry in northern California has significantly collapsed from its own over cutting and these well-thought out studies were primarily ignored by the large companies. Today, OGA is working to maximize the amount of mature and old-growth trees standing in the forest in the shortest amount of time possible. To do this, we spread the 10% cut over all age classes and no tree over 45 inches in diameter is ever cut. If this change to the 1994 study is overlooked, the forest would still increase in volume at the same rate and eventually achieve old-growth, but at the unnecessary price of losing its best trees each decade.

Trees over 45 inches are left as old-growth and most mature trees are retained decade by decade to maximize mature and old-growth characteristics consistently from day one. In Appendix D, a 2002 field study estimates the tree-size distribution changes in a 45-acre degraded parcel that distributes the 10% volume cut each decade across age and size classes. The 45-acre study parcel includes remnants of mature and old-growth trees left standing after a 95% volume removal in the early 1960's. The study demonstrates the dramatic changes possible by balancing the economic needs of harvesting the larger trees with the ecological needs of the forest to maintain as many mature and old-growth trees as possible at all times.

OGA achieves the 10% cut by limiting the amount of trees cut under 30" dbh to only the poorly formed, diseased or suppressed. The study translates this into an average of a 5% cut per size class under 30 inches. Trees between 30 and 44 inches dbh are cut at a rate averaging 20% per decade. Many of these larger trees are also chosen among the less valuable in their class (leaning, defects, small growing crowns, or overcrowded with excellent replacements nearby). Vigorously-growing, well-formed trees, either atop the canopy or below are usually left to mature to old-growth. All trees over 44 inches are always left as old-growth – whether alive or as snags. The conservative cutting of POI 1 allows a much greater amount of smaller trees to grow up into each size class in the intervening decade than the amount cut. A consistently growing income stream is created while the amount of mature and old-growth trees increase decade by decade.

The 10% thinning rate is not cumulative in two ways. First, if a forest owner elects to not cut for thirty years, it would degrade the forest to add the 10% per decade allowable cuts of the past and cut 30% now. In other words, if you skip a decade, the cut should still be maintained at 10% now and in any future decade to avoid diluting the restoration of old-growth and its ability to produce very high quality wood products. Second, the 10% cut should be distributed in a relatively even manner across the entire acreage. Otherwise, it can be argued that a 10-acre clearcut on a 100-acre parcel is technically a 10% cut. Obviously this or less extreme variations of this scenario are mathematical arguments that undermine real restoration.

IV: Appendix Section: Notes & Contents

A Note about the Appendix Section: The level of detail contained in the appendix sections is exhaustive. It is included to fully document the standards OGA maintains both legally and in the field. In other words, you may not want to read it line for line…

Appendix A: The Conservation Easement Agreement, explains the legal structure and function of the conservation easement. A template of a simple easement agreement is included (9 pages).

Appendix B: The Smartwood Certification Standards for Sustainably Harvested Wood Products is the most ecologically rigorous set of standards in widespread use today. It was created by environmental organizations working with the Rainforest Action Network.

Smartwood-certification is a positive step for forest management. But, attaining certification is a partial step. Restoration forestry sets higher standards in many areas. For example, OGA works to restore old-growth trees by restoring and maintaining timber volumes in excess of 40,000 board feet per acre on average. Smartwood certification requires modest volume restoration over time and the protection of existing old-growth only. Restoring old-growth trees is not a requirement of certification. Most certified forests in the Redwoods cut at a rate equivalent to 20 to 30% of the volume per decade. This rate of cut allows the oldest trees to mature to between 70 and 110 years on average. This compares favorably to industrial tree farming standards of 50 to 80 years, but is a fraction of restoration forestry's 200 years. Although OGA's lands are not certified by Smartwood, we exceed the necessary standards. Our board has elected to not pursue certification to demonstrate a higher standard. The standards to achieve certification are nonetheless rigorous. From OGA's point of view, they are compromised only because the allowable rate of cut is too high. The complete Smartwood standards are attached (11 pages).

Appendix C: Restoration Forestry Newspaper Articles.

The first article introduces the Smartwood label's parent organization, the Forest Stewardship Council (FSC). It is a September 2000 article from the Wall St. Journal.

The second article appeared in November 1997 in the local Santa Rosa Press Democrat. It details the 50-year history of the 50,200-acre Jackson State Demonstration forest. The Redwood forest was exhausted and degraded by logging by the 1940's. It was purchased by the state in 1947 and nurtured back to a highly productive, beautiful forest by 1990. In the past decade, the state has increased its logging on Jackson and caused some controversy locally. Although they would serve the forest best by returning to a lower rate of cut and eliminating the use of herbicides, Jackson forest is still a good example in the Redwoods of the long-term results possible if you practice restoration and sustainable forestry over the long term.

Articles three to five discuss the work of Old-Growth Again. The Winter 2001 Sonoma Land Trust Newsletter article details the restoration forestry easement placed on a 40-acre parcel in Annapolis, CA. The last article is a humorous piece about OGA's furniture making as a source of funding for its restoration efforts. It was published in the Marin Independent Journal newspaper on July 16, 2001.

The fifth article was published in the Independent Coast Observer of Gualala, CA in October 18, 2002. It discusses OGA's work with draft horses to skid firewood and lumber and includes several field photos.

Appendix D: 45-Acre Study on Changes of Tree Size Diameter Distribution over 100 years

With field data from a 100% cruise of redwood trees on 45 acres, an exhaustive spreadsheet calculates the changes in the redwood component of the parcel in terms of volume, harvest rate and tree size distribution. The study uses the growth rate of the stand and subtracts the anticipated natural mortality rate and the restoration forestry harvest rate of10% per decade. An accompanying chart visually displays the results.

Appendix A: The Conservation Easement Agreement

The Conservation Easement is a binding restriction that a landowner places on their property's deed to permanently define and limit the type of development that may take place there. Generally, conservation easements are donated to a nonprofit land conservation organization or land trust. The donation consists of certain property rights that the owner does not want utilized in order to protect identified forest values. The land trust then ensures that the provisions of the easement are carried out in perpetuity. The creation of the easement is a cooperative process between the grantor (landowner) and grantee (land trust). It is tailored to fit the natural characteristics of the land, the personal vision of the landowner for the property's on-going use, and the goals of the land trust to preserve the "public benefit" values identified on the property. When the terms are satisfactory to both parties, they sign the easement and record it with the deed. Land use restrictions and permitted uses are clearly spelled out. The ownership remains with the grantor, and the land can be operated, sold, willed or otherwise transferred as before, subject to the restriction of the conservation easement. Public access is not a requirement, unless the easement is specifically for recreational or educational uses.

Conservation easements are recognized by federal and state statutes as legitimate resource conservation tools. They have been widely utilized by both government agencies and land trusts for scenic and open space preservation around the country. More recently they have become successful tools to preserve both productive timberland and agricultural land from threats of encroaching urbanization and conversion to incompatible uses. Forestland owners can use the conservation easement to put some of their property rights in trust to permanently protect their forest resources. When donating a conservation easement to a land trust, the owners are often rewarded by the IRS for their forest stewardship with considerable income and estate tax deductions. It is not unusual to reduce the appraised value of forest land by 50% through a combination of giving up some parcel and residential rights, as well as permanently limiting the rate of timber harvest to correspond with the forest management plan. It is important to remember that timber harvesting and other compatible productive uses are allowed under a conservation easement as long as there uses are not destructive of the other natural forest values that have been jointly identified for protection. The degree of timber harvesting permitted on forestlands protected by a conservation easement depends on the characteristics of the property. Silvicultural practices considered to have a negative impact on the overall forest ecosystem, such as clearcutting or harvesting on steep or unstable slopes, are typically prohibited. The foremost practitioners of conservation easement design and acquisition are non-governmental, nonprofit land trusts, of which there are close to 1,000 across the country. - Connie Best, President of The Pacific Forest Trust of Boonville, California

On the next page is a copy of a recently completed conservation easement. It clearly spells out all the allowable uses and prohibited uses and the legal remedies available to the land trust to enforce its provisions in perpetuity. It is important to include strict percentage of inventory cutting limitations in the easement to achieve an old-growth again forest. For example, although an easement can limit or prohibit cutting in the stream areas and require setting aside a couple of trees per acre to live out their full biological life, the forest management category of the easement should clearly spell out the rate of cut that will be allowed. If it is vague or allows for a "sustainable rate of cut", this can be interpreted in future decades to allow a rate of cut that equals the rate of growth and the forest will only be sustained at or near its present level of stocking and not restored.

If the percentage of inventory allowed to be harvested is spelled out clearly, it would translate into the following results: A rate of cut of 25% per decade translates into a maximum age of the oldest trees of approximately 80 years. A 20% cut brings the maximum tree age up to approximately 110 years. A 10% cut allows the oldest trees in the forest to mature to over 200 years. A last point to make sure is included clearly in your easement is that the per decade cut does not accrue. What this means is that if you skip five decades, you cannot add the previous decade's allowable cut. For example, if you agree to a 10% cut per decade and do not cut for 50 years, you can still only cut 10% at that time, not 10% times 5 decades or 50%.

WHEN RECORDED RETURN TO:
The Sonoma Land Trust
1122 Sonoma Avenue
Santa Rosa, CA 95405
AP # _____(±40 acres)

DEED OF CONSERVATION EASEMENT
LITTLE CREEK PROPERTY

THIS GRANT DEED OF CONSERVATION EASEMENT is made this 19th day of December, 2000, by _____ ("GRANTORS"), in favor of THE SONOMA LAND TRUST, a California nonprofit corporation ("TRUST").

RECITALS

A. GRANTORS are the sole owners in fee simple of that certain real property (hereinafter "the Property") comprised of ±40 acres located in Sonoma County, California, and more particularly described in Exhibit A, attached hereto and incorporated herein by this reference.

B. The Property possesses natural, scenic, open space, ecological, and forested values (collectively, "Conservation Values") of great importance to GRANTORS, the people of Sonoma County, and the people of the State of California.

C. In particular the Conservation Values include significant natural and productive forestland, wildlife habitat and watershed resources. The protection of these conservation values is specifically consistent with and in fulfillment of the conservation objectives of California's Forest Legacy Program, as set forth in the *Assessment of Need* approved by the U.S. Secretary of Agriculture on January 2, 1996. In addition, the preservation, restoration and long-term stewardship of these forested lands is recognized by the State of California as providing public benefit in the California Forest Practices Act of 1973, the Timberland Productivity Act of 1982, and the California Forest Legacy Program *Assessment of Need* approved in 1995.

D. The Conservation Values of the Property are further documented in an inventory of relevant features of the Property kept on file with the TRUST and incorporated herein by this reference (hereafter, "Baseline Documentation"), which consists of reports, maps, photographs and other documentation, that the parties agree provide, collectively, an accurate representation of the Property at the time of this grant and which is intended to serve as an objective information baseline for monitoring compliance with the terms of this Easement.

E. GRANTORS intend that the Conservation Values of the Property be preserved and maintained by the continuation of land use patterns which do not significantly impair or interfere with those Conservation Values.

F. GRANTORS further intend, as owners of the Property, to convey to the TRUST the right to preserve and protect the Conservation Values of the Property in perpetuity.

G. The TRUST is a publicly supported, tax-exempt nonprofit organization and a qualified organization under Section 501(c)(3) and 170(h) of the Internal Revenue Code, as amended, and the regulations promulgated hereunder, whose primary purpose is the preservation, protection and/or enhancement of land in its natural, scenic, historical, forested and/or open space condition.

H. The TRUST agrees by accepting this grant to honor the intentions of GRANTORS stated herein and to preserve and protect in perpetuity the Conservation Values of the Property for the benefit of this generation and the generations to come.

I. To effectuate the intention of the parties, GRANTORS intend to give to the TRUST a perpetual and irrevocable Conservation Easement (hereinafter "Easement") in gross over the Property, to create certain restrictive covenants and equitable servitudes for the benefit of the TRUST in gross which will bind and run with the Property.

J. Carbon dioxide in the atmosphere is converted by plants to carbon and this carbon is stored in trees and other vegetation and associated roots, surface duff and organic elements in the forest soil. GRANTORS exclusively reserve all forest-related carbon rights appurtenant to the Property, including but not limited to the right to trade, sell, transfer, or lease these rights, and the right to use, store, sequester, accumulate and/or depreciate forest-related carbon within the property. GRANTORS intend, and GRANTEE agrees, that this Easement shall be interpreted to enhance the security and economic viability of any forest-related carbon rights appurtenant to the Property inasmuch as GRANTORS use of such carbon rights is considered by GRANTEE to be consistent with the terms, conditions, and Conservation Purposes of this Easement.

AGREEMENTS

1. ***Grant and Acceptance of Conservation Easement and Extinguishment of Development Rights***. In consideration of the above and the mutual covenants, terms, conditions, and restrictions contained herein, and pursuant to the common and statutory law of the State of California including the provisions of Civil Code sections 815 to 816, inclusive, GRANTORS hereby voluntarily grant and convey to the TRUST and TRUST accepts, for the purposes set forth in Recitals E, F, and H a Conservation Easement in perpetuity over the Property, subject to the provisions and exceptions set forth in this Easement.

2. ***Declaration of Restrictions.*** Subject to the uses that are expressly reserved to GRANTORS or that are expressly permitted hereunder**,** the GRANTORS hereby declare that the Property shall be held, transferred, sold, conveyed, given, leased, occupied, and used subject to all the restrictions, covenants, easements, equitable servitudes, and affirmative obligations set forth in this Conservation Easement in perpetuity over the Property (hereinafter "Easement") and extinguishes all development rights associated with the Property, subject to the provisions and exceptions set forth in this Easement.

3. ***Purpose***. It is the purpose of this Easement to preserve and protect forever the Conservation Values of the Property and to prevent any uses of the Property that will significantly impair or interfere with said Conservation Values. This purpose, as further defined by the provisions of this Easement, is generally referred to collectively herein as "the Conservation Purposes of this Easement." GRANTORS intend that this Easement will confine the uses of the Property to such activities as are consistent with the Conservation Purposes of this Easement.

4. ***Affirmative Rights of the TRUST***. The affirmative rights expressly conveyed to the TRUST are the following: (a) To identify, to preserve, and to protect in perpetuity Conservation Values of the Property; (b) To enter upon the Property and to inspect, observe, and study the Property for the purposes of: (i) identifying the current uses and practices thereon and the baseline condition thereof, (ii) monitoring the uses and practices regarding the Property to determine whether they are consistent with this Easement, and (iii) and to otherwise enforce the terms of this Easement. Except in cases where TRUST reasonably determines that immediate entry is required to prevent, terminate, or mitigate a violation of this Easement, such entry shall be permitted at least once a year at reasonable times, upon seventy-two (72) hour prior notice to GRANTORS, and shall be made in a manner that will not unreasonably interfere with the proper uses and quite enjoyment of the Property. Each entry shall be for only so long a duration as is reasonably necessary to achieve the purposes of this paragraph, but not necessarily limited to a single physical entry during a single twenty four hour period; and (c) To enforce the rights herein granted and to prevent or stop, by any legal means, any activity or use of the Property which, in the reasonable judgment of the TRUST, is inconsistent with this Easement and to require restoration to the condition that existed prior to such activities of such areas or features as may be damaged by such activities.

5. ***GRANTORS' Use of the Property***.

5.1 GRANTORS reserve to themselves, and to personal representatives, heirs, successors, and assigns, all rights accruing from ownership of the Property, including the right to engage in, or permit or invite others to engage in, all uses of the Property that are not expressly prohibited herein or are not inconsistent with the Conservation Purposes of this Easement, provided all applicable governmental approvals and permits are properly obtained. Except as expressly provided herein, GRANTORS retain exclusive access to the Property.

5.2 Without limiting the generality of the forgoing paragraph, this Easement shall confine the uses of the Property to conservation management uses as described herein. Examples of uses and practices which are consistent with the Conservation Purposes of this Easement, and which are hereby expressly permitted, are set forth in Exhibit B, attached hereto and incorporated by this reference. Examples of uses and practices which are inconsistent with the Conservation Purposes of this Easement, and which are hereby expressly forbidden, are set forth in Exhibit C, attached hereto and incorporated herein by this reference.

5.3 The uses and practices set forth in both Exhibits B and C are not necessarily exhaustive recitals of consistent and inconsistent activities, respectively. They are set forth both to establish specific permitted and prohibited activities and to provide guidance in determining the consistency of other activities with the Conservation Purposes of this Easement.

6. ***Approval Criteria***. Prior to undertaking any action that requires the TRUST'S approval as provided in this Easement or Exhibits B and C or which could reasonably have a significant adverse impact upon the Conservation Purposes of this Easement, GRANTORS shall solicit the approval of the TRUST. In such cases, the TRUST'S approval or consent shall be based upon compliance with the provisions of this Easement, the capability of the proposed action to preserve and enhance the Conservation Purposes of this Easement, the manner in which the proposed action is to be carried out, the likely effect of the proposed action upon the Conservation Purposes of this Easement, and on any other basis which the TRUST shall reasonably determine to be in furtherance of the Conservation Purpose of this Easement. Approval or disapproval shall be within the sole discretion of the TRUST and may only be granted upon conditions which tend to further the Conservation Purposes of this Easement. TRUST's disapproval shall not be determinative of GRANTOR's right to conduct the proposed use or activity.

7. ***Approval Process***.

7.1 When approval is required or in the event that GRANTORS desire to solicit the approval or consent of the TRUST pursuant to this Easement, GRANTORS shall submit a written notice of the proposed action not less than thirty (30) calendar days prior to the intended commencement date of the activity in question. Such notice shall describe the nature, scope, design, location, timetable, and any other material aspects of the proposed activity in sufficient detail to permit the TRUST to make an informed judgment as to its consistency with the Conservation Purposes of this Easement. The TRUST shall issue its written approval, disapproval, consent, or refusal of the consent, within thirty (30) calendar days of the receipt of GRANTORS' written request. Should TRUST fail to respond to said notice within thirty (30) days of receipt thereof, TRUST shall be deemed to have consented to the proposed action set forth in GRANTORS' notice. Upon the completion of any such action on the Property, the TRUST shall, at the request of GRANTORS, inspect the Property and, if the action was performed in accordance with the terms of this Easement and the approvals or consents issued by the TRUST hereunder, issue a certificate to that effect, dated as of the time of inspection. The TRUST shall be fully reimbursed by GRANTORS for all costs, including but not limited to reasonable professional fees of surveyors, attorneys, consultants, TRUST staff, and accountants, incurred in servicing GRANTORS request. GRANTORS understand that any oral approval or oral representation made by the TRUST, its officers, employees or agents, does not meet the requirements of this paragraph, does not otherwise bind or commit the TRUST and may not reasonably be relied on by GRANTORS to their detriment. To that end GRANTORS agree that no oral approval or oral representation made by the TRUST, its officers, employees or agents, or understood by GRANTORS to have been made by the TRUST, its officers, employees or agents, shall be used by GRANTORS to assert that the TRUST is, in any way, estopped or has made an election or has waived any provision of this Easement.

7.2 If a dispute arise between the parties concerning the consistency of any proposed use or activity with the Conservation Purposes of this Easement, either party may refer the dispute to binding arbitration by request made in writing upon the other, and GRANTORS agree not to proceed with the use or activity pending resolution of the dispute. Within thirty (30) days of the receipt of such a request, the parties shall select a single arbitrator to hear the matter. If the parties are unable to agree on the selection of a single arbitrator, then each party shall name one arbitrator and the two arbitrators thus selected shall select a third arbitrator; provided, however, if either party fails to select an arbitrator within fourteen (14) days after the appointment of the first arbitrator, or if the two arbitrators fail to select a third arbitrator within fourteen (14) days after the appointment of the second arbitrator, then in each such instance, a proper court, on petition of a party, shall appoint the second or third arbitrator or both, as the case may be, in accordance with Section 1280, *et seq.*, of

the California Code of Civil Procedures, or any successor statute then in effect. The matter shall be settled in accordance with the said statute or other appropriate body of rules then in effect, and a judgment of arbitration award may be entered in any court having jurisdiction thereof. The prevailing party shall be entitled, in addition to such other relief as may be granted, to a reasonable sum as and for all its costs and expenses related to such arbitration, including, without limitation, the fees and expenses of the arbitrator(s) and attorneys' fees, which shall be determined by the arbitrators and any court of competent jurisdiction that may be called upon to enforce or review the award.

8. ***Costs and Liabilities Related to the Property***.

8.1 GRANTORS agree to bear all costs and liabilities of any kind related to the operation, upkeep, and maintenance of the Property and does hereby indemnify and hold the TRUST harmless there from. Without limiting the foregoing, GRANTORS agree to pay before delinquent any and all real property taxes and assessments levied by competent authority on the Property. GRANTORS shall be solely responsible for any costs related to the maintenance of general liability insurance covering acts on the Property.

8.2 The TRUST shall have no responsibility whatever for the operation of the Property, the monitoring of hazardous conditions thereon, or the protection of GRANTORS, the public, or any third parties from risks relating to conditions on the Property. GRANTORS shall hold harmless, indemnify, and defend the TRUST from and against any and all damage, liability, claim, or expense (including attorneys' fees) relating to such matters except as such claim, liability, damage, or expense is the result of the TRUST'S direct negligence, gross negligence, or intentional misconduct. Without limiting the foregoing, the TRUST shall not be liable to GRANTORS or any other person or entity in connection with consents reasonably given or withheld hereunder, or in connection with any entry upon the Property occurring pursuant to this Easement, or on account of any claim, liability, damage, or expense suffered or incurred by or threatened against GRANTORS or any other person or entity, except as such claim, liability, damage, or expense is the result of the TRUST'S direct negligence, gross negligence, or intentional misconduct.

8.3 Notwithstanding any other provision of this Easement to the contrary, the parties do not intend and this Easement shall not be construed such that: (1) it creates in the TRUST the obligations or liabilities of an "owner" or "operator" as those words are defined and used in environmental laws, as defined below, including, without limitation, the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended (42 United States Code, sections 9601 *et seq.* and hereinafter "CERCLA"); or (2) creates in the TRUST the obligations or liabilities of a person described in 42 United States Code section 9607(a)(3); or (3) the TRUST has the right to investigate and remediate any hazardous materials, as defined below, associated with the Property; or (4) the TRUST has any control over GRANTORS' ability to investigate and remediate any hazardous materials associated with the Property. GRANTORS represent, warrant and covenant to the TRUST that GRANTORS' use of the Property shall comply with all environmental laws as that phrase is defined below.

8.4 For the purposes of this Easement:

(a) The term "hazardous materials" includes, without limitation, any flammable explosives, radioactive materials, hazardous materials, hazardous wastes, hazardous or toxic substances, or related materials defined in CERCLA, the Hazardous Materials Transportation Act, as amended (49 United States Code sections 1801 *et seq.*), the Resource Conservation and Recovery Act of 1976, as amended (42 United States Code sections 6901 *et seq.*), sections 25117 and 25316 of the California Health & Safety Code, and in the regulations adopted and publications promulgated pursuant to them, or any other federal, state, or local environmental laws, ordinances, rules, or regulations concerning the environment, industrial hygiene or public health or safety now in effect or enacted after this date.

(b) The term "environmental laws" includes, without limitation, any federal, state, local or administrative agency statute, regulation, rule, ordinance, order or requirement relating to environmental conditions or hazardous materials, otherwise applicable to the Property.

9. ***Access to the Property.*** Nothing contained herein shall be construed as affording the public access to any portion of the Property subject to this Easement. This Easement shall not be construed to preclude GRANTORS' right to grant access to the Property to third parties, provided that such access is not expressly prohibited by this Easement, is allowed in a reasonable manner, and is not inconsistent with the Conservation Purposes of this Easement.

10. ***TRUST'S Remedies for Breach***.

10.1 In the event of a violation or threatened violation by GRANTORS of any term, condition, covenant, or restriction contained in this Easement, the TRUST may, following notice to GRANTORS, which notice shall contain a reasonable and specific cure period, institute a suit in a court of competent jurisdiction to enforce the terms of this Easement, and/or enjoin, *ex parte* as necessary, by temporary or permanent injunction, and/or recover damages for such violation, and/or to require the restoration of the Property to the condition that existed prior to such violation. The notice shall be a general written notification of the condition claimed by the TRUST to be a violation that is mailed or otherwise delivered by TRUST to GRANTORS. If the TRUST reasonably determines that circumstances require immediate action to prevent or mitigate significant damage to the Conservation Values of the Property protected by this Easement, TRUST may pursue its remedies under this paragraph without prior notice or without waiting for the provided cure period to expire.

10.2 Inasmuch as the actual damages which would result from the loss of the values, associated with the Conservation Purposes of this Easement and caused by its breach by GRANTORS, are uncertain and would be impractical or extremely difficult to measure, the parties agree that the damages allowed by Civil Code section 815.7(c) shall be measured as follows:

(a) for an improvement, prohibited by this Easement and which is not removed by GRANTORS, an amount equal to the increase in the value of the Property due to the improvement, as set forth in a written estimate by a qualified person or organization selected by the TRUST, plus interest compounded monthly at the then current rate for post judgment interest for the length of time commencing with the TRUST'S notice until such damages are collected by the TRUST; and/or

(b) for a change in use prohibited by this Easement, whether or not it involves an improvement, an amount equal to any economic gain realized by the GRANTORS because of the change in use, as set forth in a written estimate by a qualified person or organization selected by the TRUST, plus interest compounded monthly at the then current rate for post judgment interest for the length of time commencing with the TRUST'S notice until such damages are collected by the TRUST; and/or

(c) for a change in use prohibited by this Easement, whether or not it involves an improvement or where there is no measurable economic gain realized by GRANTORS, an amount equal to the cost of restoration, as set forth in a written estimate by a qualified

person or organization selected by the TRUST, plus interest compounded monthly at the then current rate for post judgment interest for the length of time commencing with TRUST'S notice until such damages are collected by TRUST.

10.3 If TRUST, in its notice to GRANTORS, demands that GRANTORS remove an improvement, discontinue a use or both and claims the damages allowed by Civil Code section 815.7(c) then GRANTORS may elect to mitigate damages by fully complying with TRUST'S notice within the cure period provided therein. In the event of such full and timely compliance, TRUST shall not be entitled to damages for the breach specified in the notice.

10.4 All reasonable costs incurred by TRUST in enforcing the terms of this Easement against GRANTORS, including , without limitation, costs and expenses of suit and reasonable attorneys' fees shall be borne by GRANTORS; provided however if GRANTORS ultimately prevail in a judicial enforcement action or arbitration proceeding brought by either party, TRUST shall bear its own costs and GRANTORS' reasonable costs and expenses of suit, including, without limitation, reasonable attorneys' fees.

10.5 Forbearance by TRUST to exercise its rights under this Easement in the event of any breach of any term of this Easement by GRANTORS shall not be deemed or construed to be a waiver by TRUST of such term or of any subsequent breach of the same or any other term of this Easement or of any of TRUST'S rights under this Easement. No delay or omission by TRUST in the exercise of any right or remedy upon any breach by GRANTORS shall impair such right or remedy or be construed as a waiver.

10.6 The remedies set forth in this section 10 apply equally in the event of either actual or threatened violations of the terms of this Easement. GRANTORS agree that TRUST'S remedies at law for any violation of the terms of this Easement are inadequate and that TRUST shall be entitled to the injunctive relief described in paragraph 10.1, both prohibitive and mandatory, in addition to such other relief to which TRUST may be entitled, including specific performance of the terms of this Easement, without the necessity of proving either actual damages or the inadequacy of otherwise available legal remedies. TRUST'S remedies described in this section 10 shall be cumulative and are additional to and not intended to displace any other remedy available to either party as provided by this Easement, Civil Code sections 815 et seq. or any other applicable law. TRUST may take such other action as it reasonably deems necessary to insure compliance with the terms, conditions, covenants, and purposes of this Easement.

11. ***Acts Beyond GRANTORS' Control.*** Nothing contained in this Easement shall be construed to entitle TRUST to bring any action against GRANTORS for any injury to or change in the Property resulting from causes beyond GRANTORS' control, including, without limitation, fire, flood, storm, and earth movement, or from any prudent action taken by GRANTORS under emergency conditions to prevent, abate, or mitigate significant injury to the Property resulting from such causes so long as such action, to the extent that GRANTORS have control, is designed and carried out in such a way as to further the Conservation Purposes of this Easement. Nothing contained in this Easement shall be construed to require GRANTORS to take affirmative action to prevent, abate, or mitigate injury to the Property relating to or resulting from such causes.

12. ***Easement to Bind Successors***. The Easement herein granted and the extinguishment of development rights shall be a burden upon and shall continue as a restrictive covenant and equitable servitude running in perpetuity with the Property and shall bind GRANTORS and their heirs, personal representatives, lessees, executors, successors, and assigns forever. The parties intend that this Easement shall benefit and burden, as the case may be, their respective successors, assigns, heirs, executors, administrators, agents, employees, and all other persons claiming by or through them pursuant to the common and statutory law of the State of California, including Civil Code sections 815 - 816 inclusive.

13. ***Condemnation and Extinguishment***.

13.1 This Easement constitutes a real property interest immediately vested in TRUST, which for the purposes of this section only, the parties stipulate to have a fair market value determined by multiplying (1) the fair market value of the Property unencumbered by this Easement by (2) the ratio of the value of the Property as encumbered by this Easement at the time of this grant to the value of the Property as if unencumbered by this Easement at the time of this grant.

13.2 If all or any part of the Property is taken by exercise of the power of eminent domain or acquired by purchase in lieu of condemnation, whether by public, corporate, or other authority, so as to terminate this Easement in whole or in part, GRANTORS and TRUST shall act jointly to recover the full value of the interests in the Property subject to the taking or in lieu purchase and all direct or incidental damages resulting there from. Furthermore, the fair market value of the interests subject to the taking or in lieu purchase for the purpose of just compensation shall be determined as though this Easement did not exist. The TRUST'S share of the amount recovered shall be determined by multiplying the amount recovered by the ratio set forth in paragraph 13.1.

13.3 If circumstances arise in the future that render the Conservation Purposes of this Easement impossible to accomplish, this Easement can only be terminated or extinguished, whether in whole or in part, by judicial proceedings in a court of competent jurisdiction. The amount of the proceeds to which TRUST shall be entitled, after the satisfaction of prior claims, from any sale, exchange, or involuntary conversion of all or any portion of the Property subsequent to such termination or extinguishment, shall be the stipulated fair market value of this Easement, or proportionate part thereof, as determined in accordance with paragraph 13.1

13.4 TRUST shall use any proceeds received under the circumstances described in this section 13 in a manner consistent with its Conservation Purpose, which is exemplified by this grant.

14. ***Assignment.*** This Easement is transferable, but the TRUST may assign its rights and obligations under this Easement only to an organization that is a qualified organization at the time of transfer under Section 170(h) of the Internal Revenue Code (or any successor provision then applicable), and authorized to acquire and hold conservation easements under California Civil Code sections 815 to 816, inclusive, (or any successor provision then applicable) or the laws of the United States. As a condition of such transfer, the TRUST shall require that the Conservation Purpose that this Easement is intended to advance continues to be carried out.

15. ***Subsequent Deeds and Leases.*** GRANTORS agree to incorporate by reference the terms of this Easement in any subsequent deed or other legal instrument, by which they divest themselves of any interest in all or a portion of the Property, including but not limited to a leasehold interest. GRANTORS further agree to give written notice to TRUST ten (10) days prior to the date of any such transfer. The GRANTORS agree to provide a copy of this Easement to any third party acquiring a leasehold interest. These obligations of GRANTORS or GRANTORS' failure to perform such obligations shall not be construed to impair the validity of this Easement or limit its enforcement in any way.

16. ***Estoppel Certificates***. TRUST shall, at any time during the existence of the Easement, upon not less than thirty (30) days prior written notice from GRANTORS, execute and deliver to GRANTORS a statement in writing, certifying that the Easement is unmodified and in full force and effect (or, if modified, stating the nature of such modification) and acknowledging that there is not, to the best of TRUST'S knowledge, any default by GRANTORS hereunder, or, if TRUST alleges a default by GRANTORS, specifying such default. Such certification shall be limited to the condition of the Property as of TRUST'S most recent inspection. If GRANTORS request more current documentation, TRUST shall conduct an inspection, at GRANTORS' expense within thirty (30) days of receipt of GRANTORS' written request therefore.

17. ***Notices.*** Any notice, demand, request, consent, approval, or communication that either party desires or is required to give to the other shall be in writing and either served personally or sent by first class mail, postage prepaid, addressed as follows:

To GRANTORS: **To TRUST:**

or to such other address as either party from time to time shall designate by written notice to the other. Notice shall be deemed to have been given upon actual personal service or, if mailed, five (5) days after the date shown on the postmark of the envelope in which such notice is mailed.

18. ***Recordation.*** TRUST shall record this Easement in a timely fashion in the official records of the County of Sonoma, California, and may re-record it at any time as may be required to preserve its rights in this Easement.

19. ***Successors and Assigns.*** The terms GRANTORS and TRUST wherever used herein, and any pronouns used in place thereof, shall mean and include the above-named GRANTORS and their heirs, personal representatives, lessees, executors, successors, and assigns, including any person claiming under them, and the above-named TRUST and its successors and assigns, respectively.

20. ***Integration***. This instrument is the final and complete expression of the Easement between the parties and supersedes any and all prior or contemporaneous agreements, discussions, negotiations, or understandings, written or oral, all or which are merged into this written instrument.

21. ***Interpretation and Construction***. To the extent that this Easement may be uncertain or ambiguous such that it requires interpretation or construction, then it shall be interpreted and construed in such a way that meets the Conservation Purposes of this Easement. It is the intention of the parties that any interpretation or construction shall promote the Conservation Purposes of this Easement. In all matters of interpretation, whenever necessary to give effect to any clause of this Easement, the neuter or gender specific pronouns include the masculine and feminine, the singular includes the plural, and the plural includes the singular.

22. ***Severability.*** If any provision of this Easement, or the application thereof to any person or circumstance, is found to be invalid, the remainder of the provisions of this Easement, or the application of such provisions to persons or circumstances other than those as to which it is found to be invalid, as the case may be, shall not be affected thereby.

23. ***Joint Obligation.*** The obligations imposed by this Easement upon the GRANTORS shall be joint and several.

24. ***Significance of Recitals.*** The Recitals to this Easement are integral and operative provisions of this Easement.

25. ***Sufficient Counsel.*** The GRANTORS warrant that they have reviewed this Easement and its effects on the Property with appropriate independent legal counsel and financial advisor of their own choosing.

26. ***Controlling Law.*** The interpretation and performance of this Easement shall be governed by the laws of the State of California.

27. ***No Forfeiture.*** Nothing contained herein will result in a forfeiture or reversion of GRANTORS' title.

28. ***Termination of Rights and Obligations.*** A party's rights and obligations under this Easement terminate upon transfer of the party's interest in the Easement or Property, except that liability for acts or omissions occurring prior to transfer shall survive transfer.

29. ***Captions.*** The captions in this instrument have been inserted solely for convenience of reference and are not a part of this instrument and shall have no effect upon construction or interpretation.

TO HAVE AND TO HOLD unto the TRUST, its successors, and assigns, forever.

IN WITNESS WHEREOF, GRANTORS and TRUST have executed this Deed of Conservation Easement this 19th day of December, 2000.

GRANTORS: GRANTEE:

_____ _____

EXHIBIT B
PERMITTED USES AND PRACTICES

The following uses and practices, though not necessarily an exhaustive recital of consistent uses and practices, are permitted under this Easement and they are not to be precluded, prevented, or limited by this Easement. It is further provided that they are undertaken in accordance with the terms and provisions of this Easement and that all applicable governmental approvals and permits are properly obtained. The uses or activities that are expressly reserved to GRANTORS or are expressly permitted hereunder shall be deemed to be consistent with the Conservation Purposes of this Easement.

B.1 To use or lease the Property consistent with the Conservation Purposes of this Easement.

B.2 To maintain, repair, replace, and improve existing fences, roads, skid trails, ditches, pumps, levees, dams, utilities, and other improvements on the Property. In the event of the destruction, deterioration, or obsolescence of any fences, roads, skid trails, ditches, levees, dams, pumps, utilities, or other improvements, whether existing at the date hereof or constructed subsequently pursuant to the provisions of this Easement, GRANTORS may replace same with ones of similar size function, capacity, and location, without prior notice to or approval by TRUST, provided, however, that such replacement is performed or conducted in a manner that is consistent with the Conservation Purposes of this Easement. If there is not already road access to the Building

Envelope (hereafter "Building Envelope") as defined in B.4, GRANTOR may construct a new road to the Building Envelope and maintain, repair, replace, and improve said road.

B.3 To develop water wells and springs, to lay or construct pipes and conduits for the transportation of water; to develop water storage facilities such as freshwater and wastewater tanks and reservoirs, provided however, that such facilities are located so as to minimize visual impacts. Such uses shall be necessary or convenient for permitted uses of the Property or adjacent parcels; and shall be developed in a manner consistent with the Conservation Purposes of this Easement.

B.4 To establish a one (1)-acre Building Envelope, the location of which will be hereafter determined by mutual agreement of the TRUST and GRANTORS. The Building Envelope shall be located outside of the boundaries of the Riparian Zone. The delineation of the Building Envelope boundaries will be physically marked on the ground prior to construction. GRANTORS may construct a single-family residence and attendant structures or an educational study facility and attendant structures within the Building Envelope. If any such structure is destroyed for any reason the structure may be rebuilt. In addition, new structure(s) may be built and addition(s) may be made to structures already existing within the Building Envelope providing said structure(s) or addition(s) conform to all applicable zoning, health and sanitation laws and regulations. There shall be no limitation on the footprint, elevation, style, or materials used to build said new structure(s) or addition(s). The total square footage of all new structure(s) or addition(s) must not exceed ten thousand (10,000) square feet.

B.5 To continue use of existing easements of record granted prior to this Easement. Modification of easements of record as of the date hereof and subsequent granting of new easements require the approval of TRUST, and are subject to the restrictions in Exhibit C. Pursuant to this Paragraph, new easements may only be granted when they are located to minimize impacts on the Conservation Values of the Property.

B.6 To undertake conservation practices, such as streambed restoration, that promote native flora and fauna, soil stabilization, or reduce erosion in accordance with sound, generally accepted practices. Approval of TRUST is required when conservation practices involve significant surface alteration or include using material such as rock or concrete in amounts over ten (10) cubic yards in volume at any one time.

B.7 To remove or control invasive, non-native plant species or feral, non-native animal species that threaten the Conservation Values of the Property, using techniques that minimize harm to native wildlife and plants.

B.8 To utilize the Property for non-intrusive recreational or educational purposes that require no significant surface alteration or other development of the land. Such uses may include, but are not limited to: single-track trail construction and maintenance, hiking, horseback riding, bicycling, fishing, hunting, and nature study.

B.9 To undertake wildfire management plans and to control vegetation to lower the risk of wildfire. Such methods may include, but are not limited to, prescriptive burning (which shall not be undertaken until the Property includes a mature stand of trees),brush removal or limited removal of dead or dying trees. Such plans or actions shall be approved by TRUST and shall be acceptable to the California Department of Forestry and appropriate local Fire Protection Agencies.

B.10 Additional non-residential structures, facilities, roads or other improvements reasonably necessary for the conservation management uses of the Property shall be permitted provided that GRANTORS deliver to TRUST written request for approval of such construction or placement in accordance with the provisions set forth in this Easement. TRUST'S approval shall be based upon its finding that the proposed construction or placement is consistent with the Conservation Purposes of this Easement. Additional fencing deemed by GRANTORS to be reasonably necessary for conservation management and grazing activities may be constructed without the TRUST'S approval; provided however, that the fencing is constructed of open-wire or similar material so as to minimize visual impact and is not inconsistent with the Conservation Purposes of this Easement.

B.11 To prohibit entry upon the Property by unauthorized persons.

B.12 To continue the use of the Property for all purposes not inconsistent with this Easement.

FOREST MANAGEMENT AND HARVEST PLAN(S) (B.13-B.18)

B.13 *Performance Goal.* The Performance Goal (as that term is used herein) for the Property shall refer to the provisions of this Paragraph B.13. The GRANTORS intend to establish a productive, operational timberland, providing for the long-term sustained yield of high-quality forest products while maintaining and protecting other forest values such as wildlife, aquatic, and riparian habitat, watersheds and soils. Thus, consistent with the Conservation Purposes of this Easement, it is the GRANTORS' intent that any forest management activity on the Property be conducted to achieve the enhancement, restoration and maintenance of a mature, complex native north coast coniferous forest ecosystem with distinct old-qualities characterized generally by the following:

a) Approximately eighty percent (80%) coniferous trees and twenty percent (20%) hardwoods. Approximately ninety percent (90%) of the coniferous stand will be Redwood *(sequoia sempervirens)* and ten percent (10%) of the coniferous stand a mix of Sugar pine *(pinus lambertiana)* and Douglas fir *(pseudotsuga menzieii).*

b) Approximately 20,000 board feet of timber per acre present at all times;

c) On average, three (3) or more hardwood and/or coniferous Legacy Trees per acre present at all times. For purposes of this Easement, a "Legacy Tree" is defined as live trees reserved from cutting, including old growth trees, which provide important wildlife habitat, a natural seed source, structural diversity to the forest and a source of snags and downed logs;

d) No clearcut areas in excess of one-half acre anywhere on the Property at any time;

e) A multi-story canopy of variable densities but generally with no less than eighty percent (80%) closure, allowing for gaps occurring due to natural disturbances, mortality and timber harvesting;

f) A varied stand containing a mix of trees of different sizes and ages; and

g) Maintenance of such volume of non-redwood standing dead trees, down logs and large woody debris on the forest floor as is commonly found in late seral redwood forests.

Notwithstanding the above Performance Goal, nothing contained in this Easement shall create an obligation on GRANTORS to conduct forest management activity on the Property; provided, however, if GRANTORS do conduct such forest management activities or seek to conduct a timber harvest, the Performance Goal above and the Forest Management and Harvest Plan standards set forth below shall apply to such activities. The Performance Goal shall not apply within the boundaries of the Building Envelope. The Performance Goal is a long-term goal and is not capable of being achieved on a short-term basis. The individual components of the Performance Goal shall not prevent implementation of Harvest Plans otherwise permissible under the terms of this Easement.

B.14 *Conduct of Forest Management.* To conduct forest management on the Property in a manner consistent with the Performance Goal above and with the following terms:

a) To comply with the Forest Practice Rules of the California Department of Forestry (CDF) and maintain sound forestry practices, trees that are dead, dying, diseased, and/or of poor form and vigor will be targeted for removal;

b) During the first ten years after this Easement is recorded, thinning of conifers less than ten (10) inches in diameter to encourage growth is allowed. A significant portion of the hardwoods less than twenty-four (24) inches in diameter may be harvested in order to lower both the fire hazard and the intense level of competition with the conifers;

c) No harvest of the existing hardwood trees over twenty-four (24) inches in diameter throughout the Property until there is a size and age class mix that conforms to the Performance Goal and/or on the advice of a professional forester;

d) For purposes of this Easement, The Riparian Zone (the "Riparian Zone") along Little Creek will stretch 100 feet from the streambed on each side of the creek. No merchantable conifers may be cut within the Riparian Zone at any time in order to allow for regeneration of an undisturbed old growth forest. After year end 2015, no trees of any type, hardwood or coniferous, may be cut within the Riparian Zone;

e) Maintenance of such volume of non-redwood standing dead trees, down logs and large woody debris on the forest floor as is commonly found in late seral redwood forests; and

f) Harvest and management practices shall occur only in conjunction with a California Forest Improvement Management Plan ("CFIP"), a Non-Industrial Timber Management Plan (NTMP) or a forest management plan of a similar nature, and any amendments thereto, which are approved in advance and in writing by TRUST. Said approval shall not be unreasonably withheld and shall be consistent with the provisions of Paragraph B.17, below.

g) GRANTOR will notify TRUST prior to any harvesting of merchantable timber according to approval process described in Paragraph 6 of this Easement.

B.15 *Payment of Harvesting Fees.* Each and every time GRANTOR harvests timber, GRANTOR shall pay two percent (2%) of the mill receipts for any and all harvested timber to TRUST by the end of the year in which the harvesting occurs. GRANTOR's total obligation per harvest in year 2000 dollars shall be a minimum of Two Thousand Dollars ($2,000.00) and a maximum of Six Thousand Dollars ($6,000.00). GRANTOR's total obligation per harvest shall be adjusted annually by a percentage equal to the percentage change of the previous year's San Francisco Bay Area Consumer Price Index, or successor cost of living index. Should GRANTOR harvest any quantity of timber at any time and not mill said timber but still receive income from a sale of said timber, GRANTOR shall pay two percent (2%) of GRANTOR's gross income from said harvest to TRUST by the end of the year in which the harvesting occurs. None of the aforementioned payments represent a sale to TRUST and shall not be construed as a sale of timber by TRUST or as a measure of TRUST's interest in the Property; the sole purpose of these payments is to defray TRUST's monitoring costs of such harvest(s).

B.16 *Use of Professional Foresters and Other Resource Professionals.* It is the intent of the GRANTORS that all forest management activities be conducted in a manner consistent with the terms, conditions and purposes of this Easement. TRUST shall utilize a registered professional forester or other qualified resource management professional to review the following: any and all forest management plan(s) and any and all update(s) and/or amendment(s) thereto; any and all correspondence and/or other documentation pertaining to said management plan(s) and attendant update(s) and/or amendment(s); and any and all amendment(s) to this Easement to ensure that any of the aforementioned are consistent with the Performance Goal.

B.17 *Specific Restrictions on Commercial Timber Harvest.*

a) No harvest at all of any conifers of any size for ten (10) years from the date of this Easement;

b) The cutting or harvest of hardwoods as part of the Forest Management under Paragraph B.14 shall not be deemed to be a Commercial Timber Harvest.

c) The total permitted harvest volume will be calculated based on the amount of growth occurring during the decades between the 10-year anniversaries of the date of this Easement. If the timber cruise(s) performed by GRANTOR do not correspond to the ten (10) year anniversary dates of this Easement the forester shall be asked to perform an estimate of the existing timber volume on said anniversary date.

d) Each time GRANTOR plans a harvest, GRANTOR shall, at GRANTOR's sole expense, commission a timber cruise by a professional forester and GRANTOR shall provide TRUST a copy of the timber cruise information and any and all related permit(s) and/or other document(s). GRANTOR agrees to complete any timber harvest within a two-year period following the date of the timber cruise, even though GRANTORS' applicable permit might allow GRANTOR to conduct the harvest over a longer period of time. GRANTOR shall send written notice to TRUST upon completion of the timber harvest. Following completion of a timber harvest GRANTOR shall, at GRANTOR's sole expense, commission a timber cruise by a professional forester and GRANTOR shall provide TRUST a copy of the timber cruise information, which timber cruise is intended to determine GRANTORS compliance with its allowable commercial timber harvest under this Easement and to set a new baseline to establish the inventory to determine future growth of timber volume;

e) Based on the results of the above-referenced timber cruise, fifty percent (50%) of the hardwood volume may be harvested every ten years;

f) Based on the results of the above-referenced timber cruise, the GRANTOR may make the following harvest after January 1, 2010: The lesser of:

g) (i) the greater of: (A)seventy-five percent (75%) of the increase in the volume of coniferous trees (over ten (10) inches in diameter) during the previous ten years or (B) the increase in the volume since the date of last Timber Harvest conducted under this Easement; **or** (ii) ten percent (10%) of the total coniferous volume;

h) Based on the results of the above-referenced timber cruise, the GRANTOR may make the following harvest after January 1, 2020: The lesser of:

(i) the greater of: (A) ninety percent (90%) of the increase in the volume of coniferous trees (over ten (10) inches in diameter) during the previous ten years or (B) the increase in the volume since the date of last Timber Harvest conducted under this Easement; **or** (ii) ten percent (10%) of the total coniferous volume;

This section h) is modified by section i) of this Paragraph B.17 below;

i) When the total conifer volume exceeds thirty-thousand (30,000) board feet per acre, GRANTOR may make the following harvest: The lesser of:

(i) the greater of: (A)one hundred percent (100%) of the increase in the volume of coniferous trees (over ten (10) inches in diameter) during the previous ten years or (B) the increase in the volume since the date of last Timber Harvest conducted under this Easement ;**or**

(ii) ten percent (10%) of the total coniferous volume;

j) Trees in the Riparian Zone shall not be counted to determine the volume of allowable harvest after January 1, 2030; and

k) At the conclusion of each harvest entry, a sufficient volume of standing non-redwood dead trees, down logs and large woody debris will be left on the forest floor for the purpose of providing wildlife habitat and assisting in erosion control.

B.18 *Non-Commercial Timber Harvest.* GRANTOR reserves the right to harvest, cut or remove trees of all species for personal, non-commercial use on the Property including but not limited to firewood and lumber and/or for fire or disease prevention or control or for personal safety provided that such harvest, cutting or removal be conducted in a manner consistent with the Conservation Purposes of this Easement

EXHIBIT C
PROHIBITED USES AND PRACTICES

The following uses and practices, though not necessarily an exhaustive recital of inconsistent uses and practices, are inconsistent with the purposes of this Easement and shall be prohibited upon or within the Property, except as expressly reserved to GRANTOR or expressly permitted hereunder in this Easement including the provisions of the attached Exhibit B.

C.1 To impair or threaten the Conservation Values of the Property, except as otherwise expressly provided in this Easement.

C.2 To divide, subdivide, or de facto subdivide the Property.

C.3 To construct any structure, road, or improvement.

C.4 To significantly alter the surface of the land, including, but not limited to, the excavation or removal of soil, sand, gravel, rock, and/or sod, except as materials may be required for the repair of improvements on the Property and then only in small quantities from a site approved in advance by TRUST.

C.5 To construct, place, or erect any billboards on the Property.

C.6 To use motorcycles, all-terrain vehicles, or any other type of motorized vehicles off roadways on the Property, except for GRANTORS or others under GRANTORS' control, when reasonably necessary for permitted management activities or emergency uses.

C.7 To dump or accumulate trash, ashes, garbage, waste, fill, dredge spoils, hazardous or toxic materials and/or inoperative vehicles on the Property.

C.8 To install new utility systems, including but not limited to, sewer, power, fuel, and communication lines and related activities and equipment, except according to easements of record granted prior to this Easement; or except for systems serving permitted uses on the Property or adjacent parcels, provide, however, such systems are developed in a manner consistent with the Conservation Purposes of this Easement.

C.9 To establish any residential or commercial uses except within the Building Envelope.

C.10 The planting or willful introduction of non-native plant or animal species, except within the Building Envelope, and/or the introduction of any invasive non-native plant species anywhere on the Property.

C.11 To establish or engage in any agricultural uses on the property, except within the Building Envelope. For the purpose of this Easement, "agricultural uses" shall include without limitation: grazing of any type; agriculture requiring regular or seasonal tillage; agriculture requiring the addition of fertilizer, biocides or other soil adjuncts; agriculture requiring application of water for irrigation; agriculture requiring trellises or other support structures; animal feed lots; wine making; wine storage; barrel manufacture, storage and repair; bottling of wine and other beverages; wine tasting and sales room and associated access facilities; or processing, storage and sale of crops or products.

Appendix B: "SmartWood" Certification Standards for Sustainably-harvested Forest products

These certification standards re-address and expand many of the forest management methods discussed earlier in this publication. Other methods are also introduced. These standards are taken from "**Pacific Certified Ecological Forest Products (PCEFP), Landowner and Forester Handbook**" written by Fred Euphrat, Ph.D., Registered Professional Forester and published in 1994 by The Institute for Sustainable Forestry (ISF).

PCEFP is a non-profit effort to improve forest practices and broaden choices to consumers. PCEFP's basic principles conform to ISF's "Ten Elements of Sustainability." In California, ISF (Box 1580, Redway, CA 95560) trains and certifies foresters to work within the "SmartWood" certification program guidelines. These principles reflect the experience and knowledge of forestry professionals, as well as a high level of respect for our communities and our planet. By adhering to these principles, all products harvested from the forest are certified sustainable and receive the "SmartWood" label. Sustainably certified forest products command a premium in the market place. Nearly all forest products can be certified with these good management standards. PCEFP defines forest products to include water, wild foods, floral products, and re-creation, as well as wood.

The 10 elements of sustainability guidelines are listed on page 25. The detailed working rules for the field translate the sustainability guidelines into a realistic approach to forest management: A management that considers the interaction of air, water, soil, and vegetation with forest growth and harvesting. The field rules aren't simple because forest ecosystem management is a real challenge. PCEFP promotes low-risk forestry, both to increase harvest value for the landowner and to reduce ecological risk for the landscape. It is based on the idea that communities prosper on healthy landscapes, and those forests provide jobs and income. It respects ecosystem processes as integral components of the landscape, and acknowledges the effects of people's changes to land, water, and vegetation.

A low-risk ecosystem is one that supports diversity, effectively recycles nutrients in place, and is dependent only on easily available outside inputs, and is well connected to other ecosystems. This allows the system to be robust in managing itself, resilient when affected by change, and ever changing over time. We can and must mimic healthy, low-risk ecosystems in forest management and in forest communities. PCEFP management will always strive to maintain ecosystems and communities that support diversity, recycle, and recognize their role within the whole. Though these goals sound extremely general, they are considered in every PCEFP recommendation. To create a functioning ecosystem on a large scale, we start with individual practices on a parcel basis.

The following information introduces each section of the PCEFP goals with basic principles, followed by specific explanations, keyed to points on the field Evaluation Checklist. We've noted which practices we consider most important, valuing those practices as "best," meaning it's a practice we encourage, or "OK," meaning it's a practice we accept. Not meeting the intent of certain goals is unacceptable, or a "fatal flaw." These ratings are a guide to our negative-to-positive scoring. The Field Evaluation Checklist explains the scoring and can be found at the end of this document under Element L: The Evaluation Checklist.

A. Forest and Watershed Management

The crux of PCEPF management is a sustained yield plan. In strictest terms, this means a silvicultural model of the site, which takes present inventory values and "grows" them into the future. PCEFP believes that a timber inventory of a parcel is only the first step in management planning; a complete plan incorporates information about adjacent parcels, the watershed, wildlife resources, and fire planning. Sustained yield of wood is only one product of a sustainable forest, which provides a host of valuable resources.

Tree growth should be calculated at the site's capacity for growth of high-value timber products. Our definition of high-value timber products centers on clear (knot-free) heartwood for construction, woodworking, and plywood. We do not believe that chips represent high-value timber products, so we encourage harvesting of older trees within a forest that produces many resources. While growing large trees, however, the site must be managed for a multitude of resources. Harvesting lower-value products such as firewood, fungi, cones, floral, and ornamental products during the tree-growing phase is not inconsistent with PCEFP's goals, and may provide the landowner and community with important income during the long growing period.

The key to all management is good inventory data, updated regularly, available for both yield projection and ground-checking. With this data, the landowner knows present and potential values for all identified resources, and can manage the forest with lower ecosystem risk. We do not want PCEFP forests subject to "cut and run" logging when wood prices climb, and we believe that a solid management document, followed assiduously, will ensure landowners of revenues and values into the future.

Basic Rules for Forest and Watershed Management: Management planning begins with the landowner's goals. Timber production requires a sustained yield plan. All parcels need a fire management plan, a biodiversity plan, an impact assessment system, and information on alternative resource values. Use experience, simulation and monitoring to predict and assess future resource conditions. Describe management approaches that can be used to put the ownership back on track if particular goals are not being achieved.

1. **Management Plan**: Resource data and descriptions in the management plan are accurate and complete. The plan describes expected management actions and resulting future forest conditions projecting 50 and 100 years out. Minimum requirements for inventory are the same as for a CDF non-industrial timber management plan (NTMP):

- ❑ Data and projections should include understory vegetation, downed wood and non-commercial species (best).
- ❑ Potential forest change scenarios should be listed, including fire, blowdown, insects and disease, and regulatory shifts (OK).
- ❑ Responses to potential accidents are considered, developing alternative revenue paths for the landowner (best).

2. **Fire Management**: The ownership has implemented a fuels management and fire suppression plan. When possible and appropriate, the landowner establishes a system of fire access roads and fuel breaks. PCEFP sees the high fire danger on many small forestlands as the legacy of bad past management. Fire management represents conscious work towards a lower-risk forest. These practices include timber stand improvement, maintenance of canopy, reduction of brush, and slash treatments. Fuel breaks may include shaded fuel breaks, burned areas, and other reduced fuel zones on the property and adjacent parcels. (Fuel breaks which are bare must follow the same site and drainage rules established for Roads and Trails in section E, Roads and Trails) Broad bare areas are the least desirable types of fuel break.

- ❑ The fire management plan notes areas within the forest that have relatively higher fire danger (OK).
- ❑ The fire management plan is contained within the forest management plan (OK).

3. **Watershed Management**: Planned management activities consider and accommodate landscape-level resource conditions on neighboring properties. Harvesting results in less than 15% of the watershed in forest clearings or forest stands less than 10 years old. This element is designed to encourage landowners to be aware of the individual role of their land in the cumulative perspective of the landscape. Watershed minimum size is 25 acres, and assessment will scale up to State of California planning watersheds, about 10,000 acres. Presumably, good management of any given section will reflect positively on the entire watershed; PCEFP will give consideration to units where other

landowners have made these standards unattainable. Single tree selection and thinning are not considered clearings. Watershed management rules should not discourage the landowner from carefully opening the stand for growing space and quality regeneration.

- ❑ Gaps in watershed or landscape features for the larger watershed or planning unit are shown in the management plan (best).
- ❑ Management of the property is used to meet the goals for the landscape, through judicious application of protection zones (best).
- ❑ Landscape-level goals are met using biodiversity and stream protection zones (OK).

4. **Monitoring**: A program is in place to update resource data (e.g., timber, wildlife and plant inventory data), to monitor resource conditions over time, and to adapt management strategies to reduce environmental impact based on the data collected. This approach is called "adaptive management' and is designed to collect key data for improving management. It is better to monitor diverse resources with low-cost techniques than to monitor only a few resources with expensive, failure-prone equipment. Resource data should be reproducible and designed to fit into developing regional geographic databases.

- ❑ Water, fishery, and stream channel data are collected for information on erosion and cumulative impacts (best).
- ❑ The inventory establishes permanent plots for timber, wildlife, downed wood, and plants (OK).
- ❑ The monitoring strategies are in step with resource values and maintenance schedules (OK).
- ❑ Data has been updated since monitoring plans were put in place, including previous systems (best).

5. **Implementation**: The landowner and forester are meeting the goals of the management plan. PCEFP assessors will look at the management plan's goals while on the ground to see agreement between stated goals and actions.

- ❑ Priorities of the goals are reflected in the distribution of the effort (best).
- ❑ No one set of goals is put off to facilitate the accomplishment of another, unless there is a "critical path–based" reason (OK).
- ❑ The plan will be reviewed for internal consistency (OK).
- ❑ The landowner has read the plan (OK).

B. Silviculture

The biggest single problem with timber harvesting, relative to the forest ecosystem, is its removal of wood. The trees that contain this wood also contain present and future habitat and soil components of the forest; the more that is harvested, the poorer will be the system for particular species or some soil processes. Our goal for forest management (silviculture) is a sustainable output of high-quality wood, with concurrent production of wildlife trees (snags), downed wood on the forest floor, and forest ecosystem-level structures for habitat, such as canopy or understory.

We are concerned about the sizes of openings and the quality of their edges. The forest management plan should recognize adjacent stands and their biodiversity. Harvesting should encourage the growth of high-value trees over low-value trees, and recognize that present real and relative values of different products will change. An active program of reforestation and vegetation management demonstrates goals of stand improvement. Landowners are encouraged to take advantage of public moneys for fire reduction, thinning, planting, and pruning.

While work is going on, PCEFP foresters should be on-site to guarantee compliance with marking and to halt any unforeseen operations. Remaining trees should be protected during harvest to ensure the health of the residual stand.

Basic Silviculture Management Rules: Leave the stand better than you found it. Remove across size and height classes, favoring thrifty, well-formed, and fast growing trees of all species. Clearcutting and other even-age methods are prohibited, but patch selection is allowed, and encouraged in forest types that are typically even-aged. An inventory and stand growth rate will be evaluated to determine compliance for sustainability. Wildlife trees should be designated and, if possible, created.

1. Marking and Supervision: Before proceeding and to best evaluate the plan on the ground before and after harvest, PCEFP assessors should have the proposed area clearly marked. Tree marks, yarding trails, and site guidelines are recognizable on the ground and are fully followed by the operator during logging. Operators harvest only trees marked for cutting unless unforeseen problems arise. (This is for the PCEFP assessors, so that they can evaluate the plan on the ground, before and after harvest.) An effectively marked plan reduces the danger of accidental soil or ecosystem disturbance during operations.

- ❑ The forester considers yarding and falling practicalities when marking the stand (best).
- ❑ The forester should be on site during falling, to ensure compliance with marking guidelines (best).
- ❑ The forester, if not on site, takes responsibility for the operation on the THP or Notice (OK).

2. Mixed Stand Composition: Stands are maintained in well-stocked, healthy condition. The silvicultural prescription and tree marking will maintain or restore multi-species, multi-aged forest structure, and operations are not based on diameter-limit cutting or high-grading. The resulting forest structure is ecologically sound within the region and locale, as well as within the ownership. The cutting pattern will promote natural regeneration of desired, indigenous species. A mosaic of even-aged patches is appropriate if justified by ecological characteristics. Harvest is designed to retain or recruit large, old trees relative to the existing distribution. Where low stocking or poor stand vigor exists, harvesting or other treatments improve conditions while maintaining a forest structure that includes a component of mature, overmature, and decaying trees. Hardwoods are considered and managed as valuable trees. Group selection harvesting is appropriate for growing trees that are shade-intolerant, such as Ponderosa pine, Douglas fir and Redwood. Ecosystems dominated by fire, blowdown, or pest damage may also be considered suitable candidates for large openings. Unless the landowner has specific goals to the contrary, the majority of forest trees should have adequate growing space, be straight, and have strong, live crowns.

- ❑ Adequate trees will remain on-site as back-ups for the potential old trees (best).
- ❑ After logging, the stand will have all species and ages of trees that naturally exist in the forest, at densities at least greater than 50% of fully stocked for that site and age (best).
- ❑ If old trees are not on the site, the forester will designate those trees that are to age (OK).
- ❑ The forest should retain an average of twenty of its oldest trees per acre. The healthiest and largest 20 trees per acre should be designated (best).
- ❑ In even-age stands, harvest will create a mixture of both even- and uneven-age patches (OK).
- ❑ Individual standing trees are identified as future wildlife habitat, snag, and downed wood, and are considered in the layout of patches and buffers (best).
- ❑ Larger openings are acceptable on north slopes, smaller on south slopes (OK).
- ❑ Openings are designed to mimic nature, in the size and shape of treefalls, small burns, landslides, and pocket infestations (best).
- ❑ Opening of canopy in single tree selection is always less than one mature tree height, across any axis (OK).
- ❑ New trees are planted or otherwise encouraged on the site to represent the next cohort (OK).

- ❑ Older trees, with unique shapes and structures, are preserved for wildlife habitat (OK).
- ❑ Overstocked, diseased, or infested stands, which increase hazards should be improved with thinning and enrichment planting (best).
- ❑ Planting follows logging as soon as possible, using the resulting patches (OK).
- ❑ Planting stock uses seed from the operation's site or close to it (best)
- ❑ Proportions of trees removed follow an "inverse J-curve" distribution for the stand, property, and forest, based on inventory data and marking. This will be true for patch cutting as well (OK).

Fatal Flaw possibility - If the site does not pass the mixed stand composition rules, it will fail PCEFP certification.

3. **Sustained Yield of High-Quality Lumber**: Recognizing expected harvest re-entry frequency, the amount and type of wood removed must be consistent with periodic merchantable growth. For owners that harvest regularly, the running average annual harvest over any 10-year period shall not exceed average annual estimated growth for that period. For owners that harvest infrequently, the volume removed per entry shall be roughly equivalent to cumulative stand growth since the previous harvest entry. On ownerships with depleted stand conditions, harvest is set below growth in order to build back inventory. These rules are meant to ensure that forests are not cut faster than they grow.

- ❑ The landowner shows a pattern of ownership and stewardship in balance with the harvest volume (best).
- ❑ The landowner is making an effort to increase overall productivity in depleted stands, including reduced harvest volume, timber stand improvement, and enrichment planting (best).
- ❑ A sustained yield plan is available for the forest with current growth and yield information (OK).
- ❑ Adjacent buffers areas, at least as large as the harvesting area opening, should separate openings (OK).

Fatal Flaw possibility - If the site does not pass the sustained yield rules, it will fail PCEFP certification.

4. **Slash Treatment**: To reduce fire hazard and improve soil conditions, logging slash is lopped to within 12" of the ground. To reduce erosion, slash is used for energy dissipation and soil protection.

- ❑ Slash is spread onto skid trails and bare soil areas (best).
- ❑ Slash is bucked and pulled into contour windrows on steep slopes, buttressed by remaining stand (best).
- ❑ Slash does not have large air gaps, jutting limbs, or otherwise contribute to the fuel ladder (OK).

C. Ecological Productivity

The mix of logging, roads, planting, fire suppression, stand improvement, and plant collection puts an ecological stress on the forest. That stress combines the loss of mass and nutrients with loss of habitat, a change in soils, and a shift of genetic patterns. We do not know the outcome of all these changes over time. We do know that much of the change and environmental degradation of our forests to date is due to lack of care and foresight. This section puts forward guidelines for enhancing the ecological productivity of forestlands, and addresses pests and diseases, themselves integral parts of the ecosystem.

Planning allows landowners to work with the site's community of plants and animals, promoting local, well-adapted species. Planning for reforestation allows use of locally collected stock. Planning for wildlife connects habitats within and across ownerships. Planning future forest structure builds a forest that grows both wood and habitat. PCEFP believes that biodiversity planning maintains local gene pools and is an important building block in global biodiversity conservation. Because California's temperate rainforest ecosystems are unique, with a great range of variation, we encourage landowners to maintain genetic stocks at watershed and parcel levels. This local action has global consequences. It both lowers the risk of poor regeneration and maintains the planet's genetic pool. PCEFP also recognizes that many forests are lived on, and as homesteads may have orchards, woodlots, or Christmas tree farms. We do see roles for plantation and experimental forestry within the context of the larger landscape. Experimental and exotic plantings will be evaluated on a site-by-site basis.

Pest management is a bit of a struggle for PCEFP. On one hand, we recognize the biodiversity and natural processes represented by insects and disease in the forest; on the other hand, we know that a forest cannot suffer extensive damage to its wood and still commercially yield timber. Further, we understand that many of the species and values which are associated with forests are directly based on the presence of insects and disease, while extensively infested stands become fire hazards, benefiting few resources. Our decision with pests is to take a middle road and maintain a background population of insects and disease, guaranteeing food and habitat for some animals. If a pest or disease outbreak reaches epidemic or hazardous proportions, the landowner should lower risk through selective harvesting of dead and dying trees, within bounds of PCEFP management. Our ideal would be to see a mix of utilization for wood, snags, and downed wood. The landowners should also use physical barriers (such as paint), fire management, and slash management to lower the risk of encouraging pests at epidemic levels.

PCEFP wishes to point out that maintaining forests in a mixed-species, uneven-aged condition lowers the risk of pests or disease harming the entire stand. We do recognize that some forces, such as fire and drought, will increase the susceptibility of all trees to attack. While management can lower risk, it cannot eliminate it entirely.

Basic Rules of Ecological Productivity Management: Forests should retain a mix of native young and old trees, brush, and riparian species across the ownership to maintain stand resilience. The approach to achieving this mix should reflect planning for a suite of seral stages, downed wood, hard and soft snags, insects and diseases, and fire. Manage pests and disease through mixed-species, mixed-age silviculture. When a pest epidemic occurs, use it to enhance both revenue and biodiversity. Consider responses to expected pests, including yarding and silviculture methods.

1. **Biodiversity**: Management of the ownership for timber production protects, maintains, or restores the natural distribution and diversity of flora and fauna indigenous to the area, and maintains or enhances corridors and buffers for biodiversity. Foresters should describe present and future species distribution in terms of basal area, stem diameters, understory, and plantings. Biodiversity goals are described and mapped.

- ❑ Fire is slowly reintroduced into the forest (best).
- ❑ Riparian zones and ridgetops are given special treatments (best).
- ❑ Animal migration and nest patterns are detailed and respected with road and/or area closures (best).
- ❑ Soil mycorrhyzae and their associated species are protected through silvicultural and yarding practices which preserve topsoil, limit the size and exposure of openings, and maintain older trees and downed wood (OK).

Fatal Flaw possibility - If the site does not pass the biodiversity rules, it will fail PCEFP certification.

2. **Pests and Integrated Pest Management**: Practices maintain pests and pathogens at endemic levels. Where pests, pathogens or diseases are significantly reducing forest health, landowners take non-chemical measures to control their spread. Control methods include harvest, slash burning, slash lopping and scattering, and sealing stumps with biodegradable material. Some insect pests may be counteracted with predator introduction, within an integrated pest management scheme.

- ❑ Endemic levels should be noted in the management plan (OK).
- ❑ Harvesting of bug trees must occur within the limits of the sustained yield plan (best).
- ❑ The new habitat created by pest control should fall within the biodiversity plan (best).
- ❑ Pest and pathogen levels are monitored as part of the forest inventory (OK).
- ❑ Regular monitoring can best indicate the success of the control strategies (best).
- ❑ The effectiveness of pest control methods should be monitored separately from other forest inventories (best).

3. Fire: Landowners consider prudent re-introduction of fire into the forest ecosystem; management activities mimic the effects of periodic wildfires; stand conditions are not dominated by the effects of fire exclusion. Fire control, including hazard reduction, is an important part of a prescribed burning program and is addressed separately within the management.

- ❑ A fire management plan is developed, including maps of firelines and burn zones, fuel stick use, recommended burn conditions, and requirements of the local air resources board (best).
- ❑ The forester conducts prescribed burning in small patches, as described in the management plan (best).
- ❑ A chipper or a hydro-axe should be used in patch cuts to reduce slash, build soil, and control erosion. In lieu of a chipper or hydro-axe, lopping slash to below 12" above the ground accomplishes the same objectives (best).
- ❑ Timber stand improvement helps reduce ladder fuels, thins dense stands, and puts all debris no more than 36" off the ground (OK).
- ❑ Residual conifer trees should be pruned up to 30% of their height to reduce the fuel ladder (best).
- ❑ Fire-dependent species can slowly be re-introduced into the forest (OK).

4. Soil: Soil productivity is maintained through adequate nutrient recycling, avoidance of soil compaction, and management for both fungi and rodent populations to encourage soil mycorrhyzal inoculation.

- ❑ Representative species of the entire ecosystem, including brush and grasses, are maintained on the ownership (OK).
- ❑ Limbs and leaves are left on site (OK).
- ❑ Downed large wood is managed according to PCEFP wildlife guidelines (OK).
- ❑ Adequate rodent habitat is maintained on-site, through both large trees and brush areas (OK).
- ❑ Fungi are not overharvested, with reasonable levels determined in cooperation with PCEFP (OK).

D. Wildlife Habitat Management

Much of the degradation that has occurred in California's forests has involved loss of habitat. In removing wood, logging has also removed habitat that is only available in old trees. By taking trees that would have fallen in the future, logging has also restricted the development of on-the-ground habitat. Meanwhile, the old downed logs have decayed, leaving sites with progressively poorer habitat.

Forest management (and mismanagement) has created an abundance of specific habitats, both in cut areas and regrowing stands. Clearcuts provide browse for deer and ideal habitat for ground squirrels. Porcupines and woodrats have found a niche in forest plantations, which create both habitat and a food source. Some plants and animals favor the silted, small riparian areas that result from road crossings and erosion.

PCEFP puts forth the idea that no single habitat in the forest is an ideal, nor should one habitat be created at the expense of another. We would like to take a lesson from European forestry and create desired wildlife habitat where it does not presently exist. We know that a wide diversity of forest environments is necessary for the whole spectrum of forest wildlife, some of which are mutually exclusive, but all of which co-existed prior to industrial forestry. The ultimate answer must lie in landscape-level planning, with each individual owner doing his or her share.

Basic Wildlife Habitat Management Rules: Maintain snags and downed wood. Have a variety of open and dense understories in the forest. Maintain some areas in berry patches, some with downed slash. Promote oaks and other mast-producing species. Take advantage of state and federal programs for wildlife enhancement.

1. Snags: Snag retention and recruitment provide substantial wildlife habitat value. Snags are important habitat for some birds as well as cavity-nesting mammals. Where they are present, forest management actions retain at least 3 snags in excess of 13" DBH per acre. Where absent, landowners identify recruitment trees in areas of management actions.

- ❑ If stands have high levels of stocking, a minimum of 3 snags per acre should be created (best).
- ❑ Old, flat-topped trees are preferred over small trees (best).
- ❑ Patches of snags are preferable to isolated snags (best).
- ❑ Snags are adjacent to or within biodiversity core areas, corridors, and buffers (OK).

Downed Wood: Management actions should leave adequate quantities of downed woody debris, including both large and small pieces. Minimum quantities are 20 tons per acre in the coastal region and 10 tons per acre in the interior region with 2 or more large pieces (greater than 20" in diameter) per acre. Pieces of downed wood should be at least 6 feet long for purposes of this inventory, though broken pieces are recognized to be of significant value as well. Pieces may be in a group, to create "blowdown' habitat.

- ❑ Large, long-lasting pieces are used (best).
- ❑ Downed wood is oriented across the slope to slow erosion (best).
- ❑ Downed wood is away from the roads, to create more viable habitat (OK).
- ❑ Downed wood is of greater variety and density in biodiversity core areas, corridors, and buffers (OK).
- ❑ Slash windrows on contours are a suitable substitute (though not equivalent) to downed wood in some areas (OK).

2. Creating Habitat: Active measures are taken to improve or construct wildlife habitats, such as placement of brush piles, bird boxes, and clay culverts. PCEFP recognizes that while habitat for some species is wanting, other species may be at epidemic or nuisance levels, and must be controlled. We leave this to the discretion of the landowner and forest manager.

- ❑ The forest management plan should note endemic animals for the area and identify habitat elements that are presently missing (best).
- ❑ State, Federal, or non-governmental programs should be incorporated in the forest to enhance wildlife (best).
- ❑ "No Entry" areas and times are established and marked for particular wildlife species, if necessary (best).
- ❑ Wildlife enhancement measures are appropriate for the individual forest (OK).

E. Roads and Trails Management

The largest and most lasting impacts of logging are from the road, landing, and skid trail system. The problem was created long before the present set of forestry laws was created, when land and resources were considered plentiful, and timber was logged as cheaply as possible. These years left the landscape with a legacy of roads in and adjacent to streams, filled draws and washouts, gullies, captured streams, lost soil, and severely degraded aquatic ecosystems. Improving forestry requires correcting the accidents of the past and preventing accidents in the future.

Roads are not easy to fix. They are also expensive to work on. The good news is that a stable road for the ecosystem is also a stable road for the forest landowner. Good roads fail less often, are easier and cheaper to maintain, and are available for all forms of forest access. It is very important for the landowner to consider which roads will be permanent and which roads should be closed or removed. Old roadways can be useful trails or growing space, they can provide skidding access and falling corridors, but they should never be left as active or potential erosion sources.

PCEFP wants landowners to assess the quality of all the roads on their property and to reduce impact as much as feasible. We expect active logging roads to yield some sediment, and we expect landowners to conscientiously drain all their roads.

Basic Road Management Rules: Account for drainage at all points, and assume the worst. Do not allow road configuration to possibly capture streams. Minimize fills, with a preference for seasonal crossings. When you must put in a culvert (or replace an old culvert), use the 50-year flood return interval as a minimum, after considering loss of volume for sediment along the culvert bottom. Outsloped roads are best, and rocked surfaces are good. Do not let concentrated drainage empty onto ridge noses. During the wet season, severely restrict use and provide for active maintenance.

1. **Minimize Road and Trail Lengths**: Road and skid trail network density and layout should be appropriate to provide adequate access for management. Road and trail total length should average less than 200 feet per acre in harvest areas. Roads and skid trails no longer needed are properly closed and revegetated. The road and trail pattern should be a permanent feature, and reflects the method of yarding anticipated for the trees and topography.

- ❑ Road closures include stabilizing old fills and crossings, banking material against unstable cut slopes, and outsloping the road surface (best).
- ❑ Minimum road closures pull out culverts, install no-maintenance drainage structures, and the road entrances are blocked (OK).
- ❑ Revegetation should not include noxious or invasive exotic species (OK).
- ❑ Revegetation follows native species guidelines including grasses (best).

2. **Roads and Streams**: Road drainage structures and watercourse crossings are adequately designed, installed, and maintained to eliminate substantial road and trail surface erosion. Structures are located on a map or aerial photo. Roads should have no potential to divert streams at crossings. Whenever appropriate, road surfaces are outsloped. Roadway surfacing design and maintenance are adequate for minimizing erosion, rilling, and rutting.

- ❑ Stream crossings should be as few as possible with a minimum of road surface drainage area (OK).
- ❑ Stream crossings are designed not to capture high flows when culverts overtop (OK).
- ❑ Road drainage should be planned and marked prior to harvesting (OK).
- ❑ Roads drain their concentrated flows onto energy dissipaters and sediment traps, such as slash, gentle slopes, or into sedimentation basins, and do not carry sediment into watercourses (OK).
- ❑ Rolling dips and outsloping slow concentrated flows by preventing water from accumulating for more than 200' (OK).
- ❑ Rolling dips are preferable to inboard ditches with relief culverts (OK).
- ❑ Roads across steep slopes (<65%) or unavoidable slide areas are single lane and drained away from the highest risk zones (OK).
- ❑ Roads are outsloped and rocked (best).
- ❑ Watering ponds do not harm aquatic habitat (OK).

3. **Road Maintenance**: Roads are maintained so as not to contribute significantly to the deposition of soil into riparian areas and watercourses, or to the loss of productive growing space due to landslides. Roads are graded and watered in summer, if dust abatement is necessary. Road conditions are regularly monitored. The road maintenance rules are meant to eliminate drainage structures that, while OK under the Forest Practice Rules in California, also result in gullying, avoidable sediment delivery to streams, rerouted channels, or neglected small draws.

- ❑ Begin by having the road system evaluated and correct the drainage problems early in the wet season before they compound (best).
- ❑ Road management includes surfacing and use restrictions. The most effective road erosion control is a combination of a good surface, good drainage and no wet season use (best).
- ❑ Rocked fords (wet crossings) are used as alternatives to culverts wherever possible (best).
- ❑ Surfacing should be appropriate to the level of use and erodibility of the surface (best).
- ❑ There should be no conflicting drainage structures, such as inboard ditches on outsloped roads (best).
- ❑ Waterbars and crossdrains should not empty onto ridge noses (OK).
- ❑ Waterbars are not at the bottom of draws (OK).
- ❑ Where gullying has occurred, road and trail drainage is rerouted to prevent continuing erosion (OK).
- ❑ Regraded material is incorporated into the road surface or endhauled, but not sidecast (OK).
- ❑ Old crossings should be re-evaluated, and stabilized or otherwise improved when necessary (best).
- ❑ Old landings are reviewed for adequate drainage (best).

4. **New Roads:** New roads are not constructed in areas of slopes greater than 50%, high surface erosion potential, or significant landslide hazard. New roads are laid out with topographic features to minimize total cut and fill. Except for watercourse crossings, roads are not built in watercourse zones. Existing roads in zones are rebuilt only if a new location would result in less net long-term environmental impact. Reopening old roads and skid trails on steep slopes or areas of high erosion or landslide hazard are strongly discouraged. New roads are generally designed with a 12-foot width on straight-aways, 20 feet on curves, and a maximum slope of 10%, or up to 15% for less than 200 feet of road length.

- ❑ No new roads are built, old roads are improved and used (best).
- ❑ The road system is coordinated with neighboring landowners to reduce the need for new road construction (best).
- ❑ The road system is one-way, to minimize danger, traffic, road widths, and adverse grades (best).
- ❑ Close riparian zone roads that already exist to traffic (best).
- ❑ Material is not sidecast on slopes that are over 50% (OK).

Fatal Flaw possibility - If the site does not pass the new road rules, it will fail PCEFP certification.

F. Yarding

Logging incorporates many different impacts on the land. The activity most people associate with logging problems, however, is yarding. Moving logs from the stump to trucks is difficult work and can be more environmentally damaging with larger trees, steeper slopes, and less trained operators.

PCEFP recognizes that the way a site looks following logging is not necessarily a reflection of environmental damage. Slash, bare soil, and gaps in the canopy are useful elements in forest management and should be thought-through parts of the recovering forest stand. These features, in appropriate amounts, are tools for soil protection, regeneration, and regrowth of the forest.

Yarding practices unfit for the site can produce changes in topography and drainage, areas of bare soil oriented downhill, and gaps in the canopy larger than needed for regeneration. Signs of poor yarding are deep cuts by tractors, logs dragged through watercourses, deep slash deposits, or mounds of bare soil.

Landings, the areas where logs are loaded onto trucks, are important elements in yarding. The placement of landings, or the selective reopening of landings, is a critical choice for the logger. Too many landings remove growing area from the site and disrupt the ecosystem of the growing forest. Too few landings means that logs must be dragged farther or over difficult terrain, creating unnecessary soil and water impacts.

The choices in yarding are bulldozer, skidder, cable, helicopter, feller-buncher, or draft animal. Small cable operations can pull logs to roads, without landings. Animals are currently considered impractical, though oxen were used extensively in the past. Helicopters leave no on-site yarding impact, and are best used with patch cuts, steep slopes, and consideration for wildlife and neighbors. No one system is without drawbacks, but PCEFP is willing to work with landowners to create solutions for their property. PCEFP does not certify feller-buncher systems.

Basic Yarding Rules: Consider that yarding systems are long-term features of the forest. Skid trails should be reused, when in good locations, and planned for future access. Commitment to one system does not exclude other systems in the future, but will ease future operations for the landowner, for the growing stock, and for PCEFP certification.

1. Low Impact Yarding: Yarding system will minimize damage to the residual stand and other forest resources. Yarding routes are flagged on the ground prior to operations. Total layout minimizes site disturbance and the potential for soil erosion. Trees are fallen towards trails and corridors and bucked prior to skidding. Skid trails do not enter watercourse zones. The forester is on the ground and takes responsibility for falling and yarding. A well-planned operation starts with timber falling toward marked yarding routes. Efficient operations have minimum skid trail distances and landings. Opening sizes for yarding systems are consistent with the silvicultural method, and are part of the site's growing space or regeneration access. Cable or helicopter yarding systems should be considered first on steep or erodible slopes.

- ❑ For tractor skidding operations, be one step more cautious than the Forest Practice Rules, limiting tractors to less than 50% slopes, or 35% slopes on areas with High or Extreme erosion hazard, and excluding tractors from riparian zones (OK).
- ❑ Old skid trails in inappropriate streamside locations are not reopened (OK).
- ❑ Skid trails do not cross or follow watercourses (best).
- ❑ Skid trails should drain onto permeable soil and slash, not onto other skid trails (OK).
- ❑ Skid trails enter landings from many directions, so no one route is heavily compacted (OK).
- ❑ Cable yarding corridors are less than 8 feet wide and more than 200 feet apart, except at landings (OK).
- ❑ Erosion control on the cable corridor is a combination of slash and logs to deflect flow, or hand-built waterbars (best).
- ❑ Cable roads are not incised into the soil; logs are flown as much as possible (best).
- ❑ Cull logs are identified on the slope and not yarded (best).
- ❑ Woody debris is turned across the slope wherever possible (best).

Fatal Flaw possibility – if the site does not pass the yarding rules it will fail PCEFP certification.

1. **Small Landings**: Log landings generally do not cover more than 1% of the area harvested. Each landing does not exceed 6,000 square feet. Excavated banks on perimeter of landings do not exceed 6 feet in height. Old landings are adequately stabilized and revegetated, if not contemplated for future use. These general rules limit landings to one of 6,000 square feet (a circular landing 86 feet in diameter) per 14 acres, or a comparable ratio.

- ❑ Old landings in draws are used if, following their use, the watercourse is significantly restored (best).
- ❑ Landing drainage has adequate sediment-stopping potential before entering a watercourse (OK).
- ❑ Upslope landings are favored, but do not monopolize ridgetop sites (best).
- ❑ Natural benches are used, whenever possible (OK).

G. **Stream Protection**

The life in a stream is largely a function of the upslope and upstream inputs to the channel. Vegetation and hillslopes naturally contribute leaves, logs, twigs, branches, topsoil, and insects to streams, forming the base of the in-stream food chain. The width of the riparian zone is related to the maximum height of trees that grow there, or the limits of logs and soil easily moving into the stream. The most harmful inputs to small forest streams are fast runoff, eroded soil, sunlight, and trash, particularly waste oil.

A watercourse and lake protection zone (WLPZ), also called a stream protection zone or riparian buffer strip, is effective at maintaining natural inputs to the stream and reducing detrimental ones. Total harvest and equipment operations are generally limited in this zone, in order to maintain canopy over the stream and reduce compaction of the soil surface. A stream protection zone is effective in separating streams from high-impact areas in a logging operation. It is not effective, however, for reducing impacts from concentrated water and sediment flow, impacts of roads close to the stream, or impacts in the stream upstream or downstream from the protection zone.

All streams require protection, down to the smallest draws (Class III streams), because sediment from these small channels quickly enters larger streams. The best methods for restricting sediment movement are to 1) have many trapping structures in the channel, such as logs, branches, and leaves, and 2) not allow sediment that may move to enter the channel.

Other riparian features which affect the quality of streams are crossings and the culverts through which the stream flows, the location and placement of rocks and woody debris in streams, any altered drainage of the site, and the ability of fish to gain access to and through stream segments. At an ecological level, we also need to consider the biodiversity of native fish, reptiles, insects, and riparian vegetation.

Basic Stream Protection Rules: Be very careful near streams, and give them extra room. Avoid compaction by equipment, leave as many trees as possible, and identify trees for future stream channel structure. No salvage in the stream zone; trees will be left for biodiversity.

1. Stream Flow and Sedimentation: Zone widths are adequate to protect riparian and aquatic resources from sedimentation. Harvest area and roads are designed to protect streams from sediment. Following harvest, accelerated erosion from the property is less than or equal to yield prior to operations.

- ❑ On slopes of 65% or greater, the WLPZ extends to top of slope (best).

- ❑ On slopes of less than 65%, the WLPZ width equals average height of one old-growth tree (best).
- ❑ Class III streams are given the same protection as Class II streams (best).
- ❑ Roads, landings, trails and other sites of sediment generation have been drained conscientiously, to reduce risks of both gullying and sediment transmission (OK).
- ❑ Sediment basins are built where needed to protect Class I and Class II streams (best).
- ❑ Old erosion scars on the property are stabilized and healed to reduce cumulative sedimentation (best).

1. Stream Ecosystem and Stream Shading: Harvesting activity within zones does not harm riparian vegetation and ecological condition; management within zones protects, maintains, and/or restores natural balance of large trees. Canopy closure over Class I and II streams, post-harvest, remains at least 80% of total stream area or full retention where streams have less than 50% total cover. Class III watercourses maintain 50% canopy. Berry bushes and leafy understory don't count as canopy when evaluating shading and stream overstory.

- ❑ Shading stream zone overstory is not cut (best).
- ❑ Ground-disturbing yarding operations are excluded from the stream zone (best).
- ❑ Skid trails and yarding paths in zone do not receive upslope runoff and are fully outsloped or waterbarred, and mulched (OK).
- ❑ Local, native species are planted for canopy enrichment within the stream zone (OK).
- ❑ Mulch adjacent to streams does not contain non-local, native seed (best).
- ❑ Snags within one mature tree height of the stream are retained (OK).
- ❑ Living trees are designated for future stream recruitment (best).
- ❑ All native riparian species are maintained in the WLPZ (best).

Fatal Flaw Possibility – If the site does not pass the stream ecosystem and stream shading rules, it will fail certification.

2. Stream Channel: Fish habitat is maintained or improved, and can be measured through factors such as bed load, suspended load, turbidity, bar and bottom particle size distribution, channel type, pool/riffle ratio, pool filling, bank conditions, and recruitment of large woody debris. Culverts are in-line with stream channels and capable of fish passage for low and high flows.

- ❑ There are regular, deep pools on flowing, fish bearing streams (best).
- ❑ The bottom of the stream has a selection of clean gravel bars, on the bed, and along banks (best).
- ❑ The stream has few deposits of very fine materials or sand, particularly in pools or on top of gravels (best).
- ❑ The channel is not braided (OK).
- ❑ The banks do not show erosion through actively eroding bank faces (OK).
- ❑ Cattle do not graze in the stream (OK).
- ❑ There are old trees and root wads in the stream, and others slated to fall in (best).
- ❑ The stream has a diversity of habitats, with pools and riffles as well as overhanging roots and vegetation (OK).
- ❑ Culverts are at grade for fish, recognizing both annual variation in flows and fish passage requirements (OK).
- ❑ Culverts do not misalign the stream channel (OK).

H. **Restoration**

There are two ways to improve forest conditions. First, one can do the best job possible on all sites when reentering for harvests, as is provided for in the PCEFP rules. Second, one can go to the sites that create the greatest environmental impact and restore them. Together, these practices will slowly improve water quality, wildlife habitat, and soil productivity.

As assessment of any forest should include recognition of severely damaged areas and zones that contribute a disproportionate amount of sediment to watercourses. Improvement of these areas is a goal of PCEFP forestry, for the benefit of the watershed and the community. We believe that a conscientious harvest operation will actively improve areas while it is ongoing, and reduce the total cost of restoration.

Restoration is less expensive when heavy equipment does not have to be moved to the job, planting stock is ready for reforestation, and workers are better supported by bigger contracts. We encourage landowners to capture these efficiencies, as well as take advantage of state and federal cost-share programs. Money is available for both restoration projects and worker training.

Basic Restoration Rules: Identify sites in need of restoration on the ground and in the forest management plan. Be creative about your vision of both problems and solutions. Eroding areas should be addressed as soon as possible, showing a dedication to stewardship on the ownership.

1. Ecological Restoration: Degraded areas have been identified in the field and located on a map or aerial photo. Management actions restore native vegetation and the habitats it provides. This section refers to areas of severe erosion, plantations, or heavily harvested forests. Many of these sites do not need flagging on the ground; they are obvious once described.

- ❑ High-graded forests are planted with local stock of species that were removed (best).
- ❑ High-graded forests are planted with species that were removed (OK).
- ❑ Plantations are replaced, over time, by trees of local stock (best).
- ❑ Plantations are replaced, over time, with locally appropriate species (OK).
- ❑ Severely eroded areas are reclaimed with local seed or seedlings, particularly of brush species (best).

2. **Erosion Control**: Measures are being taken to stabilize areas of active erosion or soil movement. For instance, fills at old watercourse crossings are removed; unnecessary roads are closed, ripped, and recontoured, and original drainage paths are reestablished. The goal of this element is to allow the forest to respond to rain and snow as it did prior to the extensive site changes created by logging and road building. This includes all active landslides, actively eroding old roads, areas of extensive bank erosion, stream captures, and gullies.

- ❑ Descriptions of sites should offer reason for erosion, to be evaluated by PCEFP specialists (OK).
- ❑ The forest management plan has recommended actions for stabilizing sites and re-establishing drainage (best).
- ❑ Site repair occurs during harvest and planting (best).
- ❑ Site repair is consistent with biodiversity goals (best).
- ❑ Site maintenance is outlined in the forest management plan (OK).
- ❑ Site improvement includes only biodegradable or easily removable materials (OK).

I. **Special Resources**

Special Resources are those which are unique to a particular forest area. They include ancient forests, archaeological sites, rare and endangered plants, and the site's aesthetic value. These elements make forest properties special to the landowner, the community, and the public at large. PCEFP holds that the present rules regarding special resources on public and private lands are often not stringent enough, or undergo insufficient field supervision to guarantee the continuing benefits these lands provide. The PCEFP development team has seen archaeological sites run down and views unnecessarily marred. We have seen people log small groves of ancient forest, respecting their monetary value alone, against widespread local opposition. We believe that forests are both personal and community resources, with adequate growth to supply both needs.

Basic Special Resources Rules: Treat special resources like biodiversity cores. Put them in the planning process from the beginning, and develop a plan that works around them, giving buffers from roadway and harvest sites. If sites are discovered during work, incorporate them into the plan. Landowners should designate their own special areas as well, such as trails, picnic areas, particular trees and plants, future homesites, and unmarked archaeological sites.

1. **Ancient Forests**: Areas of ancient forest, 10 acres or more of trees at least 150 years of age, are identified, located on a map or aerial photo, and protected from harvesting. Adequate protective buffers around areas of ancient forests are established (e.g., a width equal to three tree heights of the trees around the area of ancient forest). Stands have more than 70% basal area as old trees. Any stands grown or manipulated under PCEFP do not and will not qualify as ancient forests.

- ❑ These areas should be managed under PCEFP biodiversity requirements as core areas, and be considered within the landscape plan (best).
- ❑ Smaller areas of ancient forests are managed with similar buffers (best).
- ❑ Smaller areas of ancient forests, down to single trees, are protected from harvest and worked into the biodiversity plan (OK).

Fatal Flaw Possibility – If the site does not pass the ancient forest rules it will fail certification.

2. **Special Treatment Zones:** Environmentally sensitive areas include locations of rare plants, animals, fungi, and soils, and are flagged, located on a map or aerial photo, and protected from disturbance by harvesting or equipment. Other special resources may be cultural, social, historical, or personal to the landowner and the property.

- ❑ Buffer width and protection measures will vary according to the particular resource.
- ❑ High-resolution airphotos are used to document features (best).
- ❑ Rare plants and animals are found with the help of state, federal and local societies (OK).
- ❑ Unique "heritage" trees are identified on the ground and in the forest management plan (best).

3. **Archaeology:** To the best of available techniques, archaeological, cultural, and historic sites are identified and protected from damage.

- ❑ Damage protection is a minimum buffer width of 60 feet, and flagging is removed following the operation.
- ❑ Sites discovered during operations are given the same level of protection as previously described sites.
- ❑ The landowner gives information on recent and historical sites, even if they are not presently considered important (OK).

4. **Aesthetics:** Impacts to the aesthetic character of the forest resource are considered when designing and implementing management activities.

- ❑ Viewsheds from public roads are mapped, with recognition of traffic and tourist levels (best).
- ❑ A survey is made of locals regarding individual aesthetic characteristics of the land that are considered community resources (best).
- ❑ Zones of the land are managed primarily for aesthetic reasons (best).
- ❑ Individual trees, meadows, or vistas are specifically managed for aesthetic values (OK).

J. **Community and Economic Stewardship**

Forestry actions are community actions. They affect neighboring landowners, workers on and off the site, and local economies. This section is intended to point out some responsible actions that landowners may undertake to respect workers' and neighbors' rights, and to maintain their land within the context of a productive, self-sustaining community.

The following rules stress domestic use of California timber, promoting workers' rights to work without unfair labor practices, and neighbors' rights to have sufficient notification and feedback to the plan. We believe that a well thought-out plan with community input will benefit the local environment both biologically and socially. Our goal is to have forest management, including timber harvest, a welcome part of communities.

Basic Community and Economic Stewardship Rules: Use local labor paid at a reasonable wage. Don't sell raw lumber to export markets when domestic or local markets are available. Don't polarize the community with practices that strongly impinge on the well-being of neighbors. Neighbors, however, must accommodate some level of environmental change in exchange for local jobs, wood production, and increased benefits from the forest.

1. **Log Exports:** Unfinished logs, burls, or other forest products are not delivered to export markets if suitable, competitive domestic markets exist.

- ❑ Where an exceptional export market exists, the forester makes a good-faith effort to determine a competitive domestic alternative (OK).
- ❑ Lumber is remanufactured to its highest value within the county (best).
- ❑ Whole logs are milled within the state (OK).

2. **Land Stewardship:** Land stewardship is responsible over the long term, and recognizes both the rights of the landowner to generate sufficient revenue to maintain the land and the rights of neighbors to meaningfully affect management decisions.

- ❑ Revenue yielded from harvesting is sufficient for and targeted towards maintenance, monitoring, and restoration of the forest property (best).
- ❑ Local organizations directly affected by operations are given adequate opportunity for input, and are called upon for creative solutions to avoid impasse (best).
- ❑ Adjacent and nearby landowners are given opportunity for input in excess of state minimum requirements (best).
- ❑ Forest property owner is resident within state (OK).

3. **Worker's Rights**: Timber operations are conducted with respect for workers' rights and their role in the community.

- ❑ The ideal operation allows employee participation in shared ownership; similarly, a responsible corporation is an active and contributing part of its community.
- ❑ Processing and harvesting contractors are owned and operated primarily within the county (best).
- ❑ Wage and benefit packages are representative of prevailing local standards (OK).
- ❑ Employment practices are consistent with state and federal laws prohibiting discrimination (OK).

- ❑ Mechanisms exist for resolution of employee grievances (OK).
- ❑ Worker safety is considered and conditions are fair and consistent with local norms (OK).

Fatal Flaw Possibility – If the product does not pass the Worker's rights element it will fail certification.

K. **Tracking PCEFP Commodities**

The guarantee of sustainable forest products is only as good as the tracking system that has followed the products from the woods to the marketplace. While this system is well worked out for lumber, which is presently tracked and graded as it flows to consumers, other products do not yet have established protocols.

PCEFP is responsible for the certification of the operation on the ground and will audit the trail of the logs through shipping and scaling documents. Mill owners will keep the logs separate and will be audited for their conformance. Once the wood leaves the mill, the wood will be followed through brokers to its final destination via purchase orders and shipping information.

Basic Tracking PCEFP Commodities Rules: Records of PCEFP products have to be open for audit at all stages of transport from forest to market. PCEFP's audit of records will be confidential with all parties in the custody chain.

1. **Chain of Custody:** Landowners, truckers, mill operators, brokers, wholesalers, retailers, and any other individuals in the chain of custody for PCEFP are forthcoming with documents for auditing and open facilities for inspection.

- ❑ Harvesting practices allow monitoring and tracking of wood "from the stump to the truck" (OK).
- ❑ PCEFP products will receive labeling that accompanies them into and through the mill, where they are stored separately (OK).
- ❑ Documentation for shipping and receiving of PCEFP products is available at all storage, processing, and distribution points (OK).

Fatal Flaw Possibility – If the product does not pass the Chain of Custody element, it will fail certification.

CREDITS: This document was prepared by the PCEFP committee of the Institute for Sustainable Forestry. ISF belongs to a consortium of small certification organizations across the United States that coordinate the Smartwood Program. Text and ideas came from many different individuals and references are available upon request. We acknowledge the direct contributions of the Rainforest Alliance – Smart Wood Certification Program, and the Lake States Regional Guidelines for Assessing National Forest Management – Smartwood Certification Program. Thanks to all others who have contributed to defining sustainable forestry. We thank the Compton Foundation and True North Foundation for their generous and timely support in producing this document and developing PCEPF guidelines. Technical assistance from Georgia Long and the ISF Staff, and from Dominic Roques. Editing by Tracy Katelman and Kathy Glass. Executive Director of ISF: Jude Wait, Program and Project Director: Walter Smith, the ISF PCEFP Committee: Mark Andre, Kenneth Baldwin, Bruce Bingham, Bill Eastwood, Fred Euphrat, Dave Kahan, John Laboyteaux, Toney Mengual, Kim Rodriguez, Harry Vaughn, Evaluation System: Robert Hrubes, Ph.D., RPF and Handbook Author: Fred Euphrat, Ph.D., RPF.

L. The Evaluation Checklist - Evaluation Procedures: The following checklist is designed for field use along with the PCEFP Landowner and Forester Handbook. The handbook gives details for elements itemized in the checklist. Every category should be scored on a scale of –10 to +10, with 0 as a neutral score. The handbook gives recommendations for *best* (10) and *OK* (0). Practices that are "less than OK" should receive negative scores. If an element has a fatal flaw possibility, the evaluator must consider if the spirit and intention of the PCEFP review process has been violated in this category. If the site possesses a fatal flaw possibility, (marked with an FFP), the site must fail the review process. Each section receives a total score, and those totals are summed at the end of the process. Scores range from negative to positive to detail where the landowner, forester, logger or contractor may improve their practices to better grow sustainable forests, streams, and communities. PCEFP welcomes input into the evaluation process, and may be contacted through the Institute for Sustainable Forestry in Redway, CA.

A. Forest and Watershed Management

1. **Management Plan:** Resource data and descriptions in the management plan are accurate and complete. The plan describes expected management actions and resulting future forest conditions projecting 50 and 100 years out. **Score: ____**
2. **Fire Management:** The ownership has implemented a fuels management and fire suppression plan. When appropriate, the landowner establishes a system of fire access roads and fuel breaks. **Score: ____**
3. **Watershed Management:** Planned management activities consider and accommodate landscape-level resource conditions on neighboring properties. Harvesting results in less than 15% of he watershed in forest clearings or forest stands less than 10 years old. **Score: ____**
4. **Monitoring:** A program is in place to update resource data (e.g., timber, wildlife and plant inventory data) to monitor resource conditions over time, and to adapt management strategies to reduce environmental impact based on the data collected. **Score: ____**
5. **Implementation: L**andowner and forester are meeting the management plan goals .**Score: ___**

Total Score for Forest and Watershed Management: ____

A. Silviculture

1. **Marking and Supervision:** The proposed harvest area, if any, is clearly marked to allow adequate pre-harvest evaluation. Tree marks, yarding trails and site guidelines are recognizable on the ground and are fully followed by the operator during logging. Operators harvest only trees marked for cutting unless unforeseen problems arise. **Score: ____**
2. **Mixed Stand Composition (FFP):** Stands are maintained in well-stocked, healthy condition. The silvicultural prescription and tree marking will maintain or restore multi-species, multi-aged forest structure, and operations are not based on diameter-limit cutting or high-grading. The resulting forest structure is ecologically sound within the region and locale, as well as within the ownership. The cutting pattern will promote natural regeneration of desired, indigenous species. A mosaic of even-aged patches is appropriate if justified by ecological characteristics. Harvest is designed to retain or recruit large, old trees relative to the existing distribution. Where low stocking or poor stand vigor exists, harvesting or other treatments improve conditions while maintaining a forest structure that includes a component of mature, overmature, and decaying trees. **Score: ____**
3. **Sustained Yield of Good Lumber (FFP):** Recognizing expected harvest re-entry frequency, the amount and type of wood removed must be consistent with periodic merchantable growth. For owners that harvest regularly, the running average annual harvest over any 10-year period shall not exceed average annual estimated growth for that period. For owners that harvest infrequently, the volume removed per entry shall be roughly equivalent to cumulative stand growth since the previous harvest entry. On ownerships with depleted stand conditions, harvest is set below growth in order to build back inventory. **Score: ____**
4. **Slash Treatment:** To reduce fire hazards and improve soil conditions, slash is lopped to within 12" of the ground. To reduce erosion, slash is used for energy dissipation and soil protection. **Score: ____ Total Score for Silviculture: ____**

B. Ecological Productivity

1. **Biodiversity (FFP):** Management of the ownership for timber production protects, maintains, or restores the natural distribution and diversity of flora and fauna indigenous to the area, and maintains or enhances corridors and buffers for biodiversity. **Score: ____**

2. **Pests and IPM:** Practices maintain pests and pathogens at endemic levels. Where pests, pathogens or diseases are significantly reducing forest health, landowners take non-chemical measures to control their spread. **Score: ____**
3. **Fire:** Landowners should consider prudent re-introduction of fire into the forest ecosystem. Management activities should mimic the effects of periodic wildfires so that the effects of fire exclusion do not dominate stand conditions. **Score: ____**
4. **Soil:** Soil productivity is maintained through adequate nutrient recycling, avoidance of soil compaction, and management for both fungi and rodent populations to encourage soil mycorrhyzal inoculation.

Score: ____ Total Score for Ecological Productivity: ____

C. Wildlife Habitat

1. **Snags:** Snag retention and recruitment is sufficient to provide substantial wildlife habitat value. Snags are important habitat for some birds as well as cavity-nesting mammals. Where they are present, forest management actions retain at least 3 snags in excess of 13" DBH per acre. Where absent, landowners identify recruitment trees in areas of management actions. **Score: ____**
2. **Downed Wood:** Management actions should leave adequate quantities of downed woody debris, including both large and small pieces. Minimum quantities are 20 tons per acre in the coastal region and 10 tons per acre in the interior region with 2 or more large pieces (greater than 20" in diameter) per acre. **Score: ____**
3. **Creating Habitat:** Active measures are taken to improve or construct wildlife habitats, such as placement of brush piles, bird boxes, and clay culverts. **Score: ____ Total Score for Wildlife Habitat: ____**

D. Roads and Trails

1. **Minimize Road and Trail Lengths:** Road and skid trail network density and layout should be appropriate to provide adequate access for management. Road and trail total length should average less than 200 feet per acre in harvest areas. Roads and skid trails no longer needed are properly closed and revegetated. **Score: ____**
2. **Roads and Streams:** Road drainage structures and watercourse crossings are adequately designed, installed, and maintained to eliminate substantial road and trail surface erosion. Structures are located on a map or aerial photo. Roads should have no potential to divert streams at crossings. Whenever appropriate, road surfaces are outsloped. Roadway surfacing design and maintenance are adequate for minimizing erosion, rilling, and rutting. **Score: ____**
3. **Road Maintenance:** Roads are maintained so as not to contribute significantly to the deposition of soil into riparian areas and watercourses, or to the loss of productive growing space due to landslides. Roads are graded and watered in summer, if dust abatement is necessary. Road conditions are regularly monitored. **Score: ____**
4. **New Roads (FFP):** New roads are not constructed in areas of slopes greater than 50%, high surface erosion potential, or significant landslide hazard. New roads are laid out with topographic features to minimize total cut and fill. Except for watercourse crossings, roads are not built in watercourse zones. Existing roads in zones are rebuilt only if a new location would result in greater net long-term environmental impact. **Score: ____ Total Score for Roads and Trails: ____**

E. Yarding

1. **Low-Impact Yarding (FFP):** Yarding system will minimize damage to the residual stand and other forest resources. Yarding routes are flagged on the ground prior to operations. Total layout minimizes site disturbance and the potential for soil erosion. Trees are fallen towards trails and corridors and bucked prior to skidding. Skid trails do not enter watercourse zones. **Score: ____**
2. **Small Landings:** Landings generally cover less than 1% of the area harvested. Each landing does not exceed 6,000 square feet. Excavated banks on perimeter of landings do not exceed 6 feet in height. Old landings are adequately stabilized and revegetated, if not contemplated for future use. **Score: ____ Total Score for Yarding: ____**

F. Stream Protection

1. **Stream Flow and Sedimentation:** Zone widths are adequate to protect riparian and aquatic resources from sedimentation. Harvest area and roads are designed to protect streams from sediment. Following harvest, accelerated erosion is less than or equal to yield prior to operations. **Score: ____**
2. **Stream Ecosystem and Stream Shading (FFP):** Canopy closure over Class I and II streams, post-harvest, remains at least 80% of total stream are or full retention where streams have less than 50% total cover. Class III watercourses maintain 50% canopy. **Score:____**
3. **Stream Channel:** Fish habitat is maintained or improved, and can be measured through factors such as bed load, suspended load, turbidity, bar and bottom particle size distribution, channel type, pool/riffle ratio, pool filling, bank conditions, and recruitment of large woody debris. Culverts are in-line with stream channels and capable of fish passage for low and high flows. **Score:____**

Total Score for Stream Protection: ____

G. Restoration

1. **Ecological Restoration:** Degraded areas have been identified in the field and located on a map or aerial photo. Management actions restore native vegetation and the habitats it provides.

Score: ____

2. **Erosion Control:** Measures are being taken to stabilize areas of active erosion or soil movement. For instance, fills at old watercourse crossings are removed; unnecessary roads are closed, ripped, and recontoured, and original drainage paths are reestablished. **Score: ____**

Total Score for Restoration: ____

H. Special Resources

1. **Ancient Forests (FFP):** Areas of ancient forest, 10 acres or more of trees at least 150 years of age, are identified, located on a map or aerial photo, and protected from harvesting. Adequate protective buffers around areas of ancient forests are established (e.g., a width equal to three tree heights of the trees around the area of ancient forest). **Score: ____**
2. **Special Treatment Zones:** Environmentally sensitive areas include locations of rare plants, animals, fungi, and soils, and are flagged, located on a map or aerial photo, and protected from disturbance by harvesting or equipment. Other special resources may be cultural, social, historical, or personal to the landowner and the property. **Score: ____**
3 **Archaeology:** To the best of available techniques, archaeological, cultural, and historic sites are identified and protected from damage. **Score: ____**
4 **Aesthetics:** Impacts to the aesthetic character of the forest resource are considered when designing and implementing management activities. **Score: ____ Total Score for Special Resources: ____**

I. Community and Economic Stewardship

1. **Log Exports:** Unfinished logs, burls, or other forest products are not delivered to export markets if suitable, competitive domestic markets exist. **Score: ____**
2. **Land Stewardship:** Land stewardship is responsible over the long term, and recognizes both the rights of the landowner to generate sufficient revenue to maintain the land and the rights of neighbors to meaningfully affect management decisions. **Score: ____**
3. **Workers' Rights (FFP):** Timber operations are conducted with respect for workers' rights and their role in the community. **Score: ____**

Total Score for Community and Economic Stewardship: ____

J. Tracking PCEFP Commodities

1. **Chain of Custody:** Landowners, truckers, mill operators, brokers, wholesalers, retailers, and any other individuals in the chain of custody for PCEFP are forthcoming with documents for auditing and open facilities for inspection. **Score: ____**

Total Score for Tracking PCEFP Commodities: ____ PCEFP Calculation and Final Score: _____ Grand Total Score: _____

Appendix C: Restoration Forestry Magazine & Newspaper Articles

Against the Grain - How Home Depot and Activists Joined To Cut Logging Abuse

If a Tree Falls in the Forest, The Small, Powerful FSC Wants to Have Its Say - Sniffing the Cedar Lumber

The Wall Street Journal - September 26, 2000 Front Page By Jim Carlton, Staff Reporter

On St. Patrick's Day last year, strange announcements began blaring from the intercoms of several dozen Home Depot Inc. stores around the U.S.

"Attention shoppers, on aisle seven you'll find mahogany ripped from the heart of the Amazon," declared one. Flummoxed store managers raced through the aisles trying to apprehend the environmental activists behind the stunt, who had gained access codes for the intercoms. After months of such antics, Home Depot in August last year bowed to their demands to stop selling wood chopped from endangered forests – and, instead, to stock wood products certified by something called the Forest Stewardship Council, or FSC.

If you aren't familiar with the FSC yet, chances are you soon will be. Based in a weathered Mexican mansion with just 15 full-time employees, the seven-year old organization has nonetheless amassed extraordinary power within the world's timber industry. With its flair for Hollywood-style self-promotion and world-class diplomatic skills, the FSC has managed to get radical environmentalists and leaders of some of America's most strait-laced corporations to agree on a common agenda.

A Green Agenda

And what an agenda it is: The FSC hopes someday to make it impossible for loggers to sell wood products in the U.S. and abroad if they don't bear the organization's seal of approval. That means the trees can't be harvested in a way that threatens the health of forests, or of endangered plants or animals within those forests. The logging companies mustn't pollute rivers, employ too much herbicide or leave hillsides exposed to erosion. And they must tread carefully on the rights of workers, especially indigenous peoples.

The FSC has already made surprising progress. Other big wood-products chains have followed Home Depot's lead: Wickes Inc.'s big lumber unit embraced FSC standards last November, followed by Lowe's Inc., the No. 2 home-improvement retailer, last month, and window-making giant Andersen Corp. this month. All told, retailers that together sell well over one-fifth of all wood used in America's home-remodeling market have signed on, while the acceptance level in Europe is even higher. Industry executives say the movement is quickly reaching critical mass, and could soon make it a liability for wood-products producers not to have the FSC imprimatur:

"There is no question that the FSC has absolutely changed the fabric of the industry," says Catherine Mater, a forest-products consultant in Corvallis, Oregon.

Not everyone thinks the change is for the better. Most of the large timber companies in the U.S., worried that the FSC is too extreme, have banded together to create a rival certification group, kicking off a public-relations war. The FSC has responded with advertisements in People and Playboy magazines featuring actor Pierce Brosnan and singer Olivia Newton-John as spokespeople. Some environmental groups, meanwhile, complain that the FSC is soft on loggers.

At the center of the storm is an Oxford-trained forester named Timothy Synnott, who serves as FSC's executive director. Hardly a rabble-rouser, the 57-year-old Mr. Synnott is a soft-spoken Briton who spends much of his time shuttling around the globe, acting as a diplomat for the FSC's controversial policies.

He is quick to disassociate himself from last year's sneak attacks on Home Depot – although he doesn't criticize them, either – noting that the intercom hijackers were from a group called the Rainforest Action Network. It's easy to understand his ambivalence: So widespread is FSC's reach that both San Francisco-based Rainforest Action and Home Depot belong to the organization.

"Our members operate in the ways they think best," says Mr. Synnott.

That's part of the appeal. When he helped create the group in 1993, he and his colleagues aimed for maximum inclusiveness. That means eco-activists such as Greenpeace and Friends of the Earth rub elbows with the likes of home-furnishings retailer Inter IKEA Systems BV and Swedish paper giant AssiDoman AG, whose staff ecologist is FSC's current president. The eclectic mix of 300 members doesn't hurt when it comes to fund raising: Both the European Commission and the World Wildlife Fund, as well as a number of private foundations, contribute to the FSC's $2 million annual budget.

Based in Oaxaca – because of the southern Mexican city's location between forests of the Northern and Southern hemispheres – the FSC operates on a shoestring. Its nine investigators travel extensively, auditing the work of nine independent forestry-consulting firms around the globe that do the certification reviews.

It's harrowing work. While inspecting forests, Mr. Synnott has been charged by gorillas and elephants in Africa and flanked by machine-gun-toting bodyguards in a rebel-infested part of the Philippines. He also has lost colleagues in the line of duty. Early last year, a team of three FSC certifiers died in a traffic accident while doing forest work in Cameroon.

"There are many hazards in working in the forest, especially in the tropics, where roads, weather and the quality of driving are all in question," says Mr. Synnott.

Working the boardrooms of corporate America holds its own hazards. An early problem FSC faced was one of credibility. Plenty of companies were happy to mouth support fro FSC's ideals, but few were actually willing to take the next step and adjust their procurement policies. This left FSC staffers with few cards to play in trying to persuade logging companies to undergo the rigors – and expense – of obtaining certification.

Home Depot, the nation's largest home-improvement chain, was the most important nut to crack. The Atlanta-based retailer initially balked at implementing FSC guidelines. The lag, say Home Depot executives, was caused by the company's methodical efforts to wean its suppliers and customers from endangered wood species and other environmentally unsound products. Activists, meanwhile, wanted action in days, not years.

"They gave us lip service of all sorts," says Randy Hayes, Rainforest Action's president.

After weighing a boycott call against Home Depot, Rainforest Action opted, instead, for a protest campaign of theatrical hijinks. The reason: So few retailers carried certified wood products that a boycott, without consumer alternatives, would surely fail, strategists reasoned.

So Rainforest Action enlisted celebrities to speak out, bought newspaper ads and dispatched activists in white lab coats into

Home Depot stores across America to educate shoppers, guerilla-style, on the evils of tainted wood. Says Mr. Hayes: "It was like good cop/bad cop. We were the FSC's bad cop."

Home Depot, feeling unfairly treated, bristled. "Our goals are not far apart," wrote Suzanne Apple, Home Depot's vice-president of environmental programs, in a 1998 letter to Rainforest Action organizers. "Unfortunately … our resources have been depleted by the calls and letters that your action has generated."

"Ethical Shoplifting"

The campaign culminated at Home Depot's annual shareholder meeting last year in Atlanta. With the company's directors and major shareholders in town, the activists made big headlines with a self-described "ethical shoplifting" spree at Home Depot's flagship store downtown. As the paparazzi – and store managers – watched, activists, accompanied by Chief Qwatsinas of British Columbia's Nuxalk Indian tribe, filled a cart of Canadian cedar from Home Depot's shelves and tried to wheel it outside without paying. Thwarted by store security officials, they then delivered some purchased timber to the Atlanta offices of the Federal Bureau of Investigation, where the chief, sniffing the boards in full headdress, proclaimed them stolen from tribal lands. An annoyed special agent promised to investigate, but the activists never heard back.

In August last year, Home Depot cried uncle: It announced it would phase out sales of the most endangered species of wood and give preference to FSC-certified products whenever they were available. Home Depot officials insist the protest didn't affect their change of heart.

"It was very much a business decision to say, "Look, we sell a lot of wood and we want to make sure we will have wood to come for a long time," says Ms. Apple, the company's environmental specialist. Home Depot is working the FSC products into its 1,050 stores gradually, citing limited supplies of the certified wood. For example, the retailer says stores in select markets such as Seattle are already selling several FSC-certified products, such as lumber and grill handles, while at least one brand of FSC plywood is being distributed nationally. The company says it hasn't set time or numeric goals on its FSC program, but pledges to back the campaign with advertising, both in the stores and in the media.

For Leo Stolyarov, a retired engineer perusing the lumber aisle in a Colma, California Home Depot, the idea sounds good. "Even if it would cost me more money, I would choose FSC-certified wood, because everybody has to do their own small job in protecting the environment," he says.

Home Depot's embrace of FSC standards has started to ripple far and wide. One telling example: the Montealban door factory outside Oaxaca. A half-mile-long behemoth that churns out more doors than any other plant in Mexico, Montealban sells to distributors around the world, including some Home Depot suppliers.

Toxic Sawmill

Because he gets a better price for the doors that go to Home Depot, factory owner Eloy Borgio Abascal decided last year to expand the relationship by getting FSC certification. But he was told he would first have to lean on his supplier to shape up. This meant paying an extra 15% to lure regional sawmills into the program.

One such sawmill belongs to a tribe of Zapoteca Indians in the nearby Sierra Norte Mountains, home of much of the oak and pine used by Montealban. Although an FSC inspector found the Zapotecas were managing their 50,000-acre forest well, their sawmills reeked of toxic chemicals. What's more, the carpentry-shop workers weren't wearing any protective gear, and sawdust wafted into the air without any ventilation. The inspector gave them a year to upgrade safety conditions, or no FSC certificate. Count on Montealban's Mr. Borgio to keep the pressure on: "If we want to continue our business, we need certification," he says.

Such chain reactions have let the FSC expand the area under its approval to more than 45 million acres – about the size of New England – from two million acres five years ago. The FSC designation can now be found from the vast temperate forests of Scandinavia to the jungles of equatorial countries such as Bolivia and Indonesia. The progress isn't good enough for everyone, and the FSC spends a lot of time toeing the line between radical environmentalist who don't want any logging and the timber industry, which bridles at restrictions that hurt profits.

In the African country of Gabon, for instance, environmentalists howled after an FSC certificate was issued for a tropical rainforest owned by the French logging company Leroy Gabon. The company, a unit of Germany's Glunz AG, wanted to log in a virgin forest that housed endangered lowland gorillas. Friends of the Earth of Britain and Germany's Save the Rainforest branded the certification "betrayal." The FSC investigated, and concluded a contractor had issued the certificate prematurely, although it pointed out that the company was planning to implement a habitat-protection program. Nor does industry always cooperate. Earlier this year, the big Canadian forestry firm J.D. Irving Ltd. Renounced its FSC certification in Canada's Maritime provinces after FSC officials endorsed standards in the region that the company considered too stringent, including a plan to curtail certain chemicals in forest management. Mr. Synnott says only a dozen or so of the group's 200 forest certifications have ever been cancelled for whatever reason.

In the U.S., most of the largest timber companies have created the rival Sustainable Forestry Initiative, or SFI, which covers about 60 million acres of North American timberland. "The problem with the FSC is that their standards are determined by environmentalists sitting in an office somewhere," says W. Henson Moore, chief executive officer of the American Forest and Paper Association, a trade group for the U.S. timber industry.

But FSC supporters say SFI and similar industry groups lack credibility because they're largely self-policed and have less-stringent standards. For example, FSC standards curtail the use of herbicides, while SFI's do not. "It's the fox watching the henhouse," says Kate Heaton, senior forestry specialist with the Natural Resources Defense Council, an environmental group based in New York that is an FSC member. Though the SFI has 10 times more U.S. acreage under certification than the FSC, the disparity is misleading, environmentalists say, because adherence to the SFI standards is mandatory for members of the American Forest and Paper Association. For their part, SFI supporters argue their standards are just as rigorous as the FSC's.

So far, the big retailers have tilted toward the FSC. Executives of Home Depot and Lowe's Cos. say they prefer FSC certification to SFI's imprimatur because of the FSC''s independence. And FSC has global reach, whereas SFI covers mainly American forests.

The FSC, meanwhile, puts its outside certifiers on the hot seat, too. In California's High Sierra, for example, three burly woodsmen in jeans and work boots fidgeted anxiously recently, as a pair of FSC auditors inspected logging practices in a forest 100 miles northeast of Sacramento. Scientific Certification Systems Inc., an Oakland, California firm, had already determined that Applied Forest Management is running the 22,000-acre forest in an environmentally sound way. But the two FSC auditors who wended their way over hill and hollow, scanning stumps and streambeds for environmental taboos, such as herbicides and soil erosion, weren't convinced. Rounding a bend into a grove of towering Douglas Fir trees, FSC inspector Cristian Vallejos admired a cutting technique that has culled smaller, more densely clustered trees to benefit taller, sturdier ones. A few miles on, however, he frowned at a five-acre patch where loggers recently cleared a swath of hillside hit by wildfire – a practice FSC discourages in most cases because it can add to erosion.

An Applied Forest Management executive explained that the fire was so intense that it left only charred tree debris, which had to be removed for planting and future fire-control purposes. Robert Hrubes, senior vice president of Scientific Certifications, leapt to his defense. "We don't certify perfect forests," he said. "We certify exemplary forests."

A Forest to Conserve and Harvest **Santa Rosa Press Democrat -** Nov 23, 1997 by Richard A. Wilson

In 1890, John Muir almost single-handedly convinced Congress to pass legislation creating Yosemite National Park.

Two years later he co-founded the Sierra Club. Then in 1897 – exactly 100 years ago – he wrote an article for Atlantic Monthly titled "The American Forests." Our greatest preservationist wrote, "The state woodlands should not be allowed to lie idle, but should be made to produce as much timber as possible without spoiling them." Muir claimed that a wisely managed harvest of mature trees would keep the forests "a never failing fountain of wealth and beauty."

John Muir believed that some lands should be preserved in their wild and natural state. But he also recognized that other lands are most appropriately managed for conservation, through utilization and renewal.

Perhaps Califonia's best example of what Muir referred to as "the state woodlands" is the state forest system. While Oregon has 10 times more state forest acreage than California, and Washington has 50 times the acreage, neither state has anything quite like the crown jewel of California's system: Jackson Demonstration State Forest in Mendocino County.

Jackson Forest celebrates its 50th anniversary this year. Stretching from just west of Willits to within a mile of the Mendocino coast on the Highway 20 corridor, the 50,000-acre forest comprises more than two-thirds of California's state forest acreage. It also comprises some of the richest and best-managed forest in the world.

But it wasn't always that way. In 1942 an alarming report to the state Legislature characterized this land as "cutover, burned over and otherwise denuded in such a manner as to jeopardize its watershed value." The report went on to urge Gov. Earl Warren to acquire the land to rescue it for multiple-use development, "including the preservation of soil and watershed cover, production of future forest crops, protection of wildlife, and development of recreational facilities."

Warren supported a proposal from state Sen. George Biggar of Covelo to allocate $1.5 million to purchase the "depleted" lands from the Caspar Lumber Co. This would prove to be one of the best investments California taxpayers ever made.

Today, Jackson Forest is one of the preeminent public working demonstration forests in the world, unique among publicly owned forests in the redwood region with its multiple use, conservation-management approach. It attracts more than 60,000 recreation visitors per year, including 15,000 overnight campers. But it differs from state and national parks in that public access is also permitted for such activities as plant collecting, hunting and the purchase of various forest products, all concurrent with recreation, education and the management of the timber resource.

The guiding management philosophy is to conduct innovative demonstrations, experiments and education in forest management while achieving sustained production of timber through the application of sound forest-management techniques.

Jackson Forest is the site of some of the best-documented and longest-running watershed and forest growth studies anywhere, and is visited annually by scientists from around the world. It is also used regularly as a field learning laboratory by teachers and students from schools like University of California, Berkeley, Humboldt State University, Sonoma State University, College of the Redwoods, Mendocino College and Santa Rosa Junior College, to name a few.

The forest also provides educational opportunities for family forest owners, as well as for younger learners. For example, in the past 12 years foresters have worked with local elementary school teachers to develop a five-week watershed conservation instructional program in which students receive classroom lessons in ecology and biology, then are brought into the forest to apply those lessons and care for the real, living watershed ecosystems of the Big and Noyo rivers.

The role of state forests as public learning institutions is especially important because too many of the forest lands in California have been poorly managed. Our best hope for reversing this trend is to train tomorrow's land stewards – whether scientists or landowners – in best management practices. Best management practices are needed not only for timber management, but also for maximizing forest health and fire safety; for enhancing wildlife, water quality and stream habitat; and for teaching children about ecosystems and conservation.

To develop best management practices, however, their need to be places where classroom learning can be applied to real forests and watersheds. Jackson Forest is such a place. It is also a place where we can demonstrate the connections between healthy forests, a sound local economy and the role of forestry in the social fabric of rural communities. Of course, all of these good intentions mean nothing unless the forest's resources are sustainable. Sustainable forestry simply means harvesting no more trees than we grow, while maintaining or improving the long-term health of the forest ecosystem.

Annual tree growth significantly exceeds harvest. As a result, the forest is able to yield quality timber while growing increasing numbers of mature trees. This approach reflects the very long view we have taken for sustaining the forest resources on Jackson and ensures that the forest is both biologically healthy and economically sound. This management approach has allowed the volume of healthy trees in Jackson Forest to more than triple in the 50 years since the California Department of Forestry began managing these lands, despite an annual harvest of mature timber.

Photographs of these lands taken in the 1940's leave no doubt that the health of this forest ecosystem has steadily improved since the creation of the state forest. There is more vegetative cover, less erosion and better wildlife habitat. One of the most important demonstrations is that sustainable conservation management is also good business. Consider that in the past 50 years, even as growing stocks have more than tripled, timber management activities have generated more than $160 million in public revenues.

This is more than 100 times the original investment, and does not include the economic benefits of an estimated 250 full-time, private sector jobs supported by forest management activities. An additional benefit is the yield tax revenue that is returned year after year to local government. In 1996 alone, Mendocino County received $600,000 in yield tax revenues from the purchasers of Jackson Forest timber. More than half of that total was earmarked for the county's public schools.

Of course there has been controversy. It is a fact of modern life, especially in California, that the harvesting of trees is not universally applauded. But we should remember that these lands were not wild or pristine when the state purchased them. In the words of the Legislature, they had been "exhausted and depleted." When the state purchased the lands in 1947, it was not to preserve them in a cutover state, but to bring them under professional protection and conservation management. The law creating the forest specifically directed the state to "rehabilitate and reforest" these lands, to make them "fully productive."

Thanks to the foresight of the Legislature half a century ago, Jackson Forest today is a prime example of John Muir's vision. By managing for a sustainable harvest while maintaining healthy stands of mature trees, it is a living demonstration of the "never failing fountain of wealth and beauty" that Muir wrote about exactly 100 years ago.

Richard A. Wilson is director of the California Department of Forestry. He owns a ranch in Covelo and has been active in Mendocino County conservation issues for 40 years.

SONOMA LAND TRUST news LETTER
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Restorative Forestry at Little Creek

However we feel about timber harvest, we can hardly avoid the use of wood products. Reduce, reuse and recycle as we will, there's still the fence or planter box that needs to be built, the dry rot repair that can't be put off, the addition to accommodate a growing family or business. When we use wood products, we want to know that they have been harvested responsibly. Project Manager Aimee Carroll writes here about a new conservation easement which speaks to that concern.

Then and Now

In December 2000, SLT recorded its first "restorative forestry" easement, protecting 40 acres up in Sonoma County's rugged north country near Annapolis. Once an old-growth north coast coniferous forest, the land was heavily logged during the fifties and today is a tangled mass of tanoak, poison oak, and manzanita.

Tomorrow

But the land will look different in the future, thanks to the efforts of Little Creek landowners Warren and Joan Linney. The Linneys and their restoration forestry partners are working to renew the land and restore the forest to its previous glory as a mature and complex native north coast coniferous ecosystem. This restoration project will allow an undisturbed old growth-quality stand to develop in the riparian zone along Little Creek, while other portions of the property will be sustainably harvested.

Little Creek photo by Raul Hernandez

What does "Restorative Forestry" mean, anyway?

"Restorative Forestry is sustainable forestry plus," says Raul Hernandez, a staff member of Old Growth Again (OGA), the nonprofit forest restoration organization that is partnering with the Linneys on the Little Creek project. OGA is currently working its forest restoration artistry on 400 acres in Sonoma and Mendocino counties.

Raul describes the ethic of OGA this way: "We use no chemicals for the thinning process, and we set aside 15% percent of the land to return to old growth. The remaining 85% will be a productive forest with some old growth and lots of mature trees for cover." Thinning of tanoak and other vegetation is done by hand with

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A matter of long term commitment

When an office survey about the meaning of "old growth" yielded no consensus and we wondered whether we could really talk about restoring old growth, we went to our local forestry expert, Dr. Fred Euphrat, principal of Earth, Soil and Water and host of Native Sonoma. Here's what he said.

Old growth...

It's a subjective, fuzzy term.

Original vegetation may mean what was here when the Euro-Americans showed.

That could be old growth. In that case, it's trees that are 250 yrs old in the West, down to 150 if you like. In the East.... Well... ? 400? years?

Old growth may mean big trees. 250 year-old redwoods are generally big, but sometimes they're smallish. Sequeira [Red Hill Ranch] had small 250 year old trees. Big trees may also be young. Most of the honkin' doug-fir here are less than 200 but more than 36 inches diameter.

Generally, 36-inch diameter is considered 'having old growth characteristics.' These include mossy canopies, dead trees in the stand (aha! now it's a stand! I thought we were talking trees....oh).

The Forest Service uses a term 'roadless areas' which are 'unentered' or limited entry stands. The young trees in these areas may be

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Restorative Forestry at Little Creek from page 1

chainsaws, and the tanoak is cut for firewood. Proceeds from the sale of this firewood fund some of OGA's operating expenses. Existing conifer seedlings are given maximum light to encourage their growth. Additional conifer seedlings, purchased from a commercial nursery, are planted out during work parties where landowners and OGA staff bring their families together to share food and renew the forest.

This restoration method, while labor-intensive during the first few years, can yield significant returns down the road. According to Raul, "If we fully restore the ecological productivity of this land, we can make a decent return by harvesting only a portion of what grows every 10 years."

Long term commitment from page 1

the results of fire or other successional events. Young trees in an old growth forest....? But all old folks were young once.

SO.. and I do know what you're talking about... Growing old growth is not WRONG or even ODD. It's RIGHT. We can easily grow old growth forests and treees. It's just a matter of long term commitment. See people as a successional element.

Hey, does this have to do with Hernandez and OGA? If so, he's a client. I must say I have preached 'Grow old growth' for years.

Marin Independent Journal

July 16, 2001

MONDAY

Marin County, California

A new start for old growth

Painstaking effort restores once-clear-cut plot to bring back redwood forest

By Rick Polito
IJ reporter

RAUL HERNANDEZ wants to give old growth a new spin.

Hernandez and co-visionary Frank Marrero of Fairfax are the sweat and spirit behind a project to restore forest plots ravaged by clear-cut logging to old-growth conditions. On 40 acres of impossibly rugged, ridiculously steep coastal Sonoma County mountainside, Hernandez, Marrero and a handful of day laborers have taken an inch-by-back-breaking-inch approach to forest management.

"We can rehabilitate the species composition and completely transform it in 20 years," Hernandez says.

The work is almost spiritual. Marrero calls it a "gift to this life."

That gift comes at a price, a sweaty, bone-aching, muscle-tearing price. "You've got to manage every inch of it," Hernandez says.

The two men, who met in a San Rafael Buddhist monastery in the mid-1980s, call their effort Old Growth Again and are at-

IJ photo/Marian Little Utley

money from such agencies as the California Department of Forestry.

Hernandez, 42, and Marrero, 49, hope to create sustainable forests that could be logged selectively over decades, producing valuable wood while preserving a healthy, beautiful habitat.

They are passionate about their cause.

Hernandez left behind an executive-track career in newspaper management at the Miami Tribune. Marrero has owned restaurants, written books and taught school but now works part time so he can give back to the land.

They're passionate, but they have to be. As Marrero says, "It is brutal, only-fools-do-it work."

When the land they have just finished "restoring" was logged around 1960, the loggers chopped down everything and took out the best trees. The forest was then left to grow back on its own, re-creating itself as a completely different habitat, overgrown with tanoak trees, a thick tangle of vegetation choking off the firs and redwood conifers that made up the original old-growth environment.

"Instead of these big, spaced-out trees, you have trees everywhere," Hernandez says.

The effort started seven years ago at their Sonoma County site — up a maze of increasingly rocky, rutted, steep dirt roads above Sea Ranch — when the two men built a cabin to live in during the work. The floor and walls came from a single tree left behind by the loggers three decades before. The ceiling they tore out of a chicken coop in Sebastopol. All the materials were carried by hand down a serpentine trail they etched into the steep hillside

"We built this cabin with two hammers and a dull saw," Marrero says.

With the cabin finished, they began educating themselves about forestry. Hernandez devoured books and traveled to seminars, earning himself a dirty-fingernails degree in forest management.

Then they went to work.

Using small hand tools and sweat, the two men crawled over the 40 acres, cutting down the thick stands of tanoak and hauling the trunks out by hand to be used as firewood. The leaves and smaller branches were left on the ground to decay and feed the land. "Each branch was consciously laid down," Marrero says.

Taking it a step further, they climbed on ladders to prune back limbs on the remaining firs and redwoods, lifting the canopy from the choked, bush-like growth they had found.

In the realm of "before" and "after," "before" was a mess. Impossibly thick, Marrero called it "the opacity zone."

"It was good habitat for rodents," Hernandez explains — "and nothing else," he adds.

The restoration, a painful process, took two years to finish what they could of the 40 acres (stream banks were deemed too fragile to work). The result is an open, idealized woodland, free of the tangled underbrush. The redwoods are receiving light. More are being planted.

Animal species long absent are coming back, Hernandez says. "The birds love it."

The work was just a first step. Hernandez and Marrero now plan to manage the plot of land, bringing back the redwood forest that once flourished here. The original old-growth forest was probably 90 percent conifers, Hernandez explains. Even after years of work pulling out the tanoak, the percentage is still 45 percent.

"Hopefully, we'll get it back to 90 percent," Hernandez says.

In time, decades from now, they will be able to carefully harvest good-quality old-growth wood, leaving enough behind that the logging is truly sustainable.

It's a huge departure from what foresters call "the industrial model."

"The industrial forestry model is: Cut and then leave it till you cut again," Hernandez says.

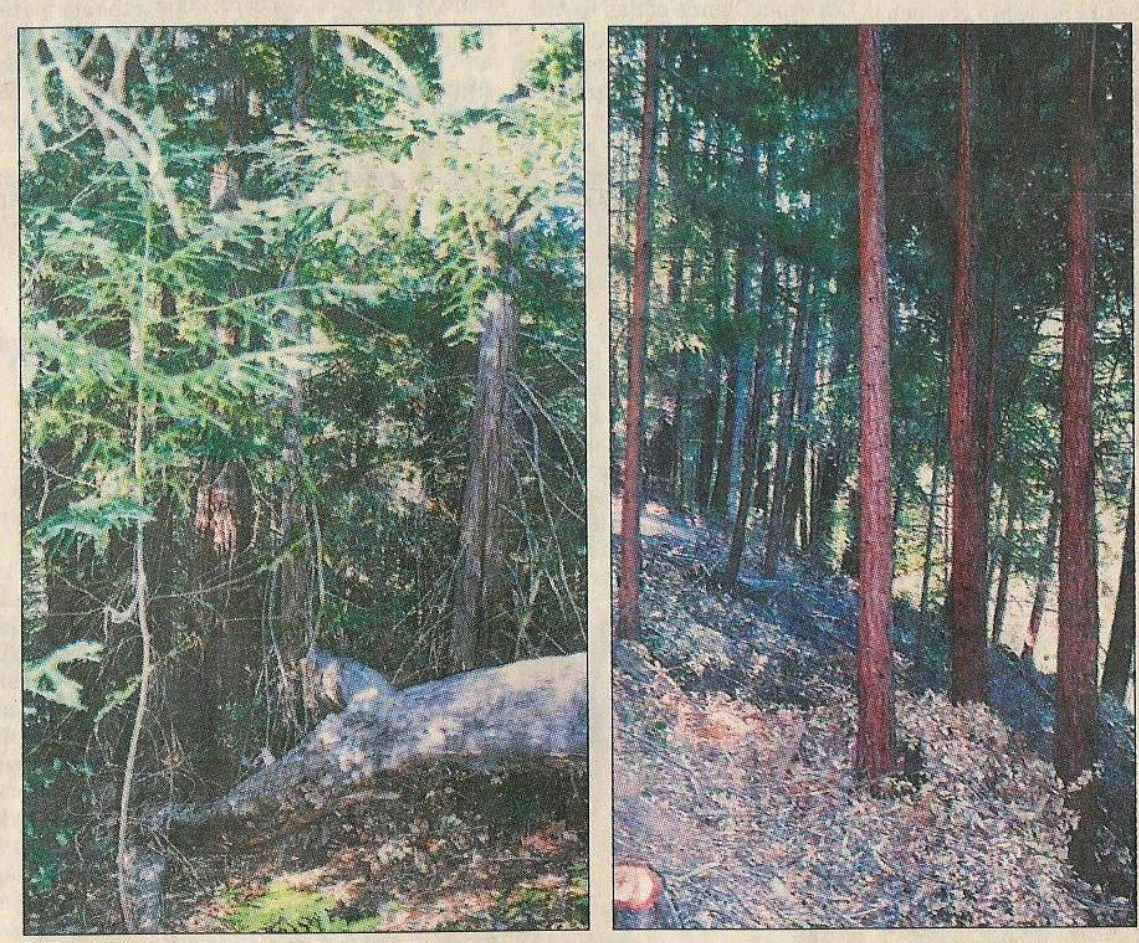
It's a noble aim, but it's no way to make a living.

See Vision, page E2

cial purposes. Marrero's 6-year-old son Salem is lifted off the ground atop an old growth redwood bench.

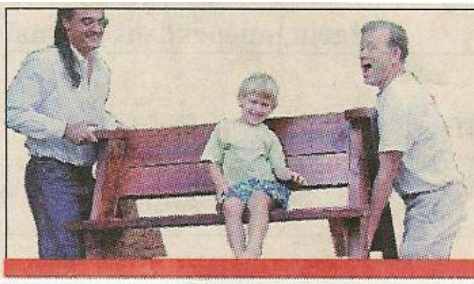
HOW TO HELP

To find out more about Old Growth Again, logon to the Web site at www.oldgrowthagain.org or call 707-495-4955.



Photos courtesy of Old Growth Again

BEFORE AND AFTER: At left, the forest floor as it regrew after clear-cut logging. At right, the habitat restored to encourage old-growth conditions.



Giving old growth a new start

LIFESTYLES E1

Vision

From page E1

Hernandez calls himself a "full-time beggar." Marrero remarks that they live "from grant to grant."

One of their most recent grants came through Jill Butler's office. Butler is a forest assistance coordinator for the California Department of Forestry. She helps landowners who want to improve the woodlands. She's impressed with the Old Growth Again project.

"The work they're doing — we'd like to see a lot more of it done throughout the North Coast," Butler says.

Taking out the tanoak and thick underbrush helps in fire prevention, Butler says, and could restore the old-growth habitat, "allowing the redwoods and firs to regain dominance."

And the big timber and land companies are not going to do it.

The restoration will only be done by people who take it on as a near-to spiritual pursuit, Butler explains. "I see that as where sustainable forestry is really going to happen, on private pieces of property, with landowners who are managing it not just for financial need," she says. "I don't ever expect to see that model on industrial land. You can't justify managing that way on a financial basis."

To plan on a century-long continuum, landowners need the "resources and the vision," Butler says.

Hernandez and Marrero have plenty of vision.

The resources they're figuring out as they go along.

They got a grant last year from the Tides Foundation. The CDF money helps. The cabin runs on solar power and the two men live simply when they are there. Last month, Hernandez paid his laborers with his own income tax refund.

They've also built and sold some furniture milled from the "buckskins," logs left behind by the original logging crews but neither man is getting rich. Marrero still works three days a week as an electrician to support his old growth habit.

The long term outlook is no less austere.

Hernandez wants to find other plots of battered forest land and work the same magic again. The hope is that ultra-patient investors can buy the land and hire Hernandez's sweat and expertise to invest for the long term. Along the way, the property owners would sign conservation pacts surrendering the right to develop or "over-log" the land. Giving up those rights might allow them to depreciate the land and seek income tax advantages, but anybody looking for a tax loophole should come with loftier ideals.

"Nobody has made any money these tax deals yet," Hernandez notes.

They are already working on a neighboring plot owned by an individual and Hernandez is always scouting out more potential purchases. There will always be more land than money.

"There is redwood land that needs to be restored from here to Oregon."

Buyers are hard to come by. Few people in today's market are invested in returns a century from now. The only sure thing now is hard work.

The kind of hard work that turned a tangle of undergrowth and brush on a Sonoma hillside into a canopied space of thriving redwood woodland.

And put a new spin on Old Growth.

Contact Richard Polito via e-mail at polito@marinij.com.

Appendix D: 45 Acre Study: Changes in tree size distribution over 100 yrs using POI 1