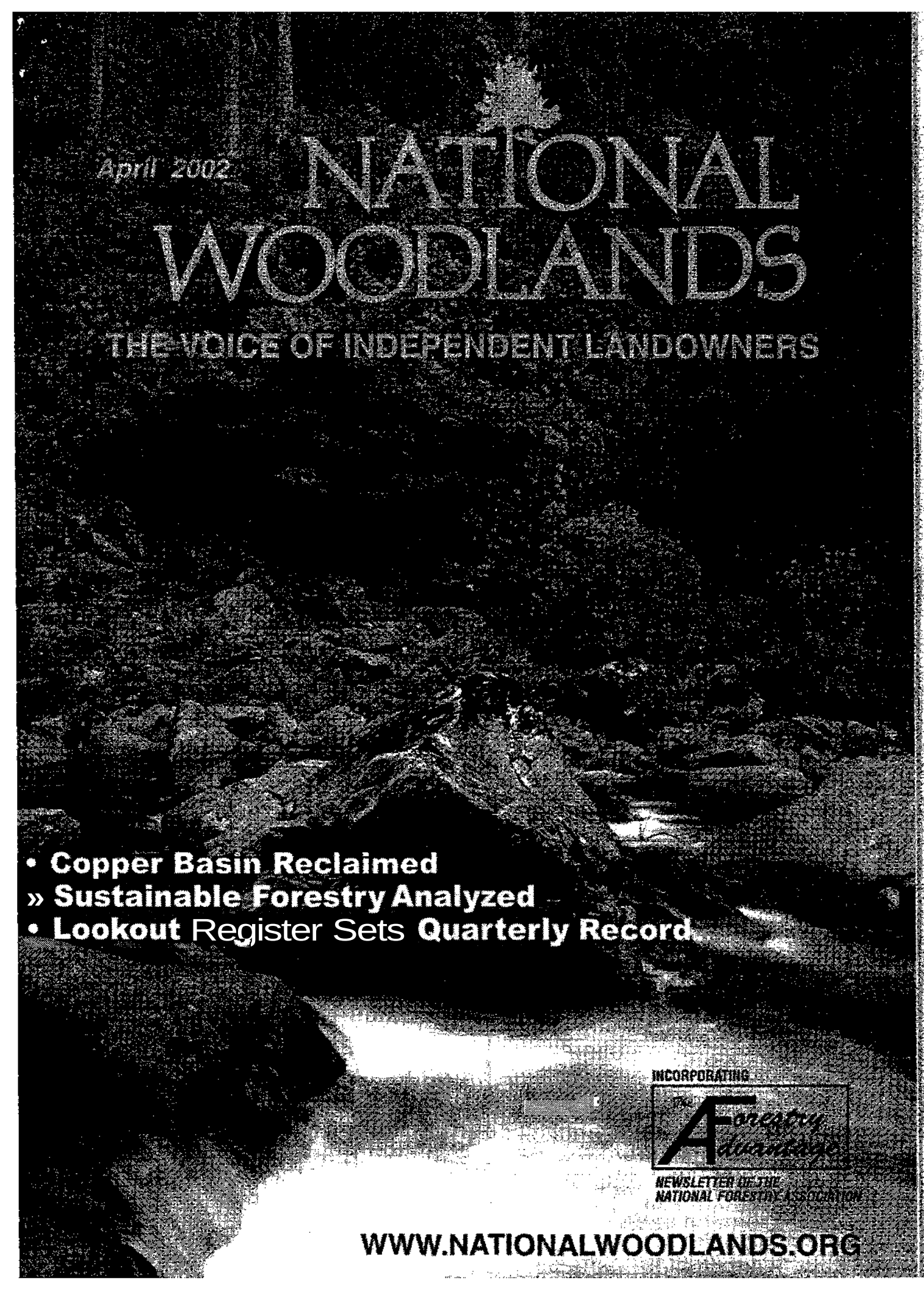
April 2002
NATIONAL WOODLANDS
THE VOICE OF INDEPENDENT LANDOWNERS
• Copper Basin Reclaimed
» Sustainable Forestry Analyzed
• Lookout Register Sets Quarterly Record
INCORPORATING
The Forestry Advantage
NEWSLETTER OF THE NATIONAL FORESTRY ASSOCIATION
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NATIONAL WOODLANDS

THE MAGAZINE OF THE *NATIONAL WOODLAND OWNERS ASSOCIATION*

Volume 25, Number 2 *April 2002*

www.nwoa.net

Contents

Front Cover: The endless natural cycles that shape our world can be interrupted temporarily by the hand of man, as this month's article about the devastation and subsequent reclaimation of North Georgia's Copper Basin recounts. But regardless of mankind's mark on this world, it pays to bear in mind that this stream flowed and these trees flowered long before people came on the scene, and they will continue to do so long after we are gone.
Digital image by Photodisc

NATIONAL WOODLANDS is published by American Resources Inc. for the National Woodland Owners Association to promote the wise use of America's forest resources. Subscribers include landowners, professionals in the natural resources disciplines, companies and individuals associated with the forest products industry, libraries, government agencies, and other people who have an interest in forestry.

NATIONAL WOODLANDS (ISSN 0279-9812), April 2002, Volume 25, No. 2. Published quarterly, in January, April, July and October by American Resources, Inc. for the National Woodland Owners Association, 374 Maple Ave. E., Suite 310, Vienna, VA 22180-4751; tel. (703) 255-2700. U.S. subscriptions: $25.00 for one year or $45.00 for two years, through membership in National Woodland Owners Association; sustaining member rates are $35.00 per year, $60.00 for two years. For delivery to Canada, Europe, and most International addresses, add an additional $10 for postage. Back issues, if available, are $3.00 each, postage paid. Editorial offices: P.O. Box 332, Old Forge, NY 13420, FAX (315) 369-3736. Periodicals postage paid at Vienna, Virginia, and additional mailing offices.

POSTMASTER: Please send changes of address to National Woodlands, 374 Maple Ave. East, Suite 310, Vienna, Virginia 22180-4751.

The Readers Respond.....

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Dear Dr. Argow:

Here is something that should be made very clear to forestland owners who are contemplating a Wetland Reserve Program (WRP). It is taken from a letter from USDA to a consultant forester.

"A timber harvest maybe an acceptable compatible use under WRP and is subject to review provisions of the Compatible Use process. Section 514.21(c) of the WRP manual states that a timber harvest will only be considered 'where, wildlife experts have documented the technical necessity to remove individually marked trees as a wildlife and wetland measure, for the specific purpose of protecting and enhancing optimum wildlife habitat and wetland functions and values, especially for migratory birds and at risk species.' Currently the Natural Resource Conservation service (NRCS) is not approving any timber harvests as an approved compatible use under the WRP."

I feel this position is not adequately explained to those enrolling in the program.

John A Gibbs
Beaver and Bedrock Tree Farm
Richville, New York

Dear Keith:

I enjoyed the January *National Woodlands;* good piece on American holly. The European holly has escaped the commercial plantings in this area, and is becoming naturalized, along with such pests as "English" ivy *(Hedera helix).*

The Danaher Lookout was built during the period 1948-53 when we were at the nearby Institute of Forest Genetics about three miles to the west. It was on a site well selected for coverage and easy access, and, I believe, donated by the Michigan California Lumber Co.

Your item in the Conservation News Digest on sudden oak death confirms a truism that I have been slow to realize. Those of us who have been involved in breeding better trees have, with few exceptions, overlooked the simple fact that the most important attribute of a tree is to be alive.

Dick Bingham's capture of resistance to blister rust of western white pine and Zobel's and others' similar result with fusiform rust of loblolly pine are examples. A recent well-illustrated publication, The Return of the Giants" from the University of Idaho describes Bingham's work.

I grew up in a region where the usual aspect of eastern white pine was a bush created by the attacks of the white pine weevil *(Pissodes strobi).* Sitka spruce, throughout most of its range has been

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Copper Basin, on the Georgia-Tennessee border, as it appeared prior to 1973.

Industrial Destruction Reversed at Copper Basin

by Edward A. Johnson*

Editor's Note: *The history of the Copper Basin, located on the Georgia-Tennessee border, is an example of perhaps one of our nation's worst environmental excesses. It is also quite possibly one of our greatest recovery success stories. This article explores the reasons for the destruction of the Copper Basin forest beginning with the dawn of the Industrial Revolution in this country, and some of the remedies applied.*

Copper Find Denudes Copper Basin

The area known today as Copper Basin existed as a wild forest from the arrival of the first European until well into the 19th Century. The period 1800-1907 starts with no mining and with little forest disturbance on the Copper Basin forest, but eventually brings striking changes in biological diversity, habitat, environment, forest resource use and research. This period also saw a change in metallurgy from smelting to milling, and flotation of ores and construction of flotation plants, roasters, sintering plants, and reverberatory furnaces. In both the metal furnace and refinery plant the fuel used was charcoal and wood. Clearcutting of the forest was one of the chief causes for surface erosion of the soil in the Basin in this period.

Copper was discovered in the Basin in 1843. Mining operations began in 1847. Since there were no roads, this ore was taken out on the backs of mules following Cherokee Indian trails to the railroad at Dalton, Georgia. The high-grade ore was 25 to 35 percent copper. Fourteen surface mines were opened in 1850-1854. They depended solely on wagon transportation. It is reported that 500 teams of 4-6 horses and mules were used in hauling boards and feed in the basin. There was a ferry on the Ocoee River at Tumbling Creek where two wheel oxcarts from Ellijay, Georgia carried salt, green coffee, calico, flannels, powder, lead and rope.

Cornish miners with expertise in driving vertical shafts in the ore body began arriving in 1854. This was followed by underground quarrying known as underhand stopping. Before the start of the Civil War, 1,000 people were employed by the mining companies with 500 concentrated in Ducktown. A good deal of vegetation had been cut for mining operations as well as for residential use. During the Civil War (1862-1865) however, the mines were idle and forest vegetation was permitted to grow back.

After 1866, the local wood supply for charcoal was being exhausted. Additional cordwood was needed for stationary engines, in roasting ore, and mine timbers for the newer underground workings. Also, additional teams for hauling copper had to be secured. During the period 1865-1876, 30,000 acres of prime hardwood forest had been cleared. Again in 1877-1890 there was limited mining activity due to the low price for copper, allowing some coppice stands to grow back.

This second growth of wood indicated that the soil was still productive and that many of the root systems were alive. This was an early example for the comeback of the forest. A pontoon bridge was built across the Ocoee River at Edwards Ferry (Copperbill and Fightingtown Creek) for recovering cordwood being floated down the Toccoa River from Fannin

**Edward A. Johnson completed a distinguished career as a research forester with the U.S. Forest Service. Several of his assigments brought him to the Copper Basin. This article will be followed by a sequel describing the unusual impact of the introduction of the steel beavertrap on the forest in the area.*

County, Georgia. Each year the excessive cutting of forest vegetation expanded and radiated out from the mining and residential demands placed on it by the communities of Copperbill, Ducktown, Isabella and McCaysville.

Since much of the forest cover had been cut from the central part of the mining area by 1870, there were now considerable areas of grass and other vegetation available for grazing by miner's milk cows, cattle, sheep, oxen, horses and mules. Grazing was more intense closer to miners' homes and the towns. Each year some nonresident cattle were released in the spring to graze on the broomsedge vegetation, and were rounded up in the fall. Some areas, especially around springs, were overgrazed, causing soil compaction. The County of Polk was declared an open range.

Starting 1876, the open roasting of green ore to remove the sulfur content was initiated. This process consisted of using a clay floor on which a bed of cordwood was placed, followed by the green ore.

The importance of wood in the everyday economy was illustrated by those in charge of smelter Operations, who put a priority on obtaining wood and charcoal. Monthly reports listed expenditures for labor, materials (wood) hauling, number of bushels of charcoal bought, price per bushel, number of cords of wood bought, as well as cords from company lands, and price per cord in each instance. During this period, one mining company consumed 15,000 to 20,000 cords of wood and 500,000 bushels of charcoal. The conversion factor is one cord of wood to produce 40 bushels of charcoal. Both living and fume-killed trees were taken for fuel.

Late in 1887, construction crews installed a railroad that connected with the Marietta Branch to Atlanta, and the L&N to Knoxville. Regularly-scheduled passenger and freight trains that burned coal went into service on August 18, 1890.

With the coming of the railroad, the period of 1892 to 1904 was marked by substantial changes that affected the use of wood and charcoal. Larger furnaces were constructed and the roasting of green ore was increased by adding three large yards for the removal of sulfur. The roasting yards each covered an area of half a mile long and about 100 or more feet wide. Several hundred open sheds, roughly 60 to 40 feet long were built in each yard to protect fires from the weather.

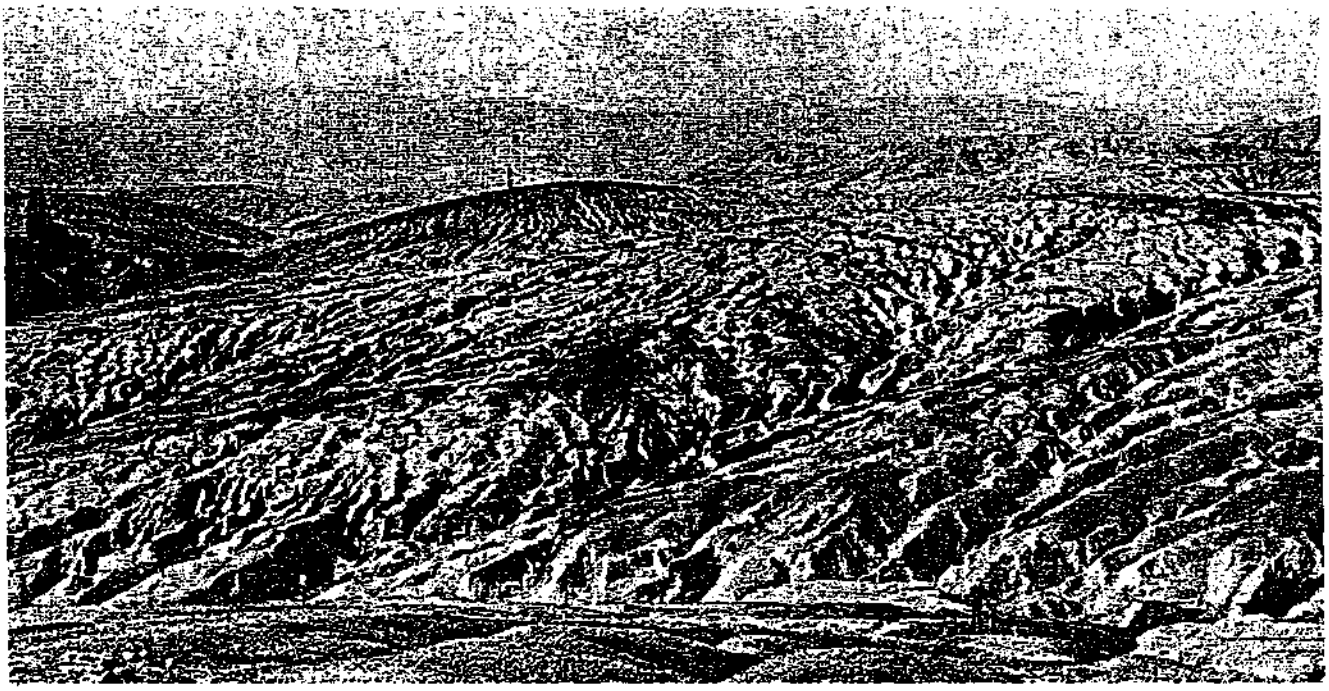
The method of operation was to spread a fine layer of ore on the ground beneath the shed and upon this, to stack a layer of cordwood two to three feet high. Finally, a pile of coarse green ore would be placed on top to a depth of two to three feet. Each fire was allowed to burn from 60 to 90 days, giving off dense clouds of smoke and sulfur fumes. On windy days the wood smoke and sulfur spread out to the limits of the denuded area. On still, damp days and nights, the wood smoke settled and hung close to the ground in a thick cloud.

Workers in Copperhill, Ducktown, and Isabella commonly used lanterns going to work in the morning and leaving in the afternoon, because of the heavy smoke and smog. The maximum damage to vegetation, cars, barbed wire fences, screens, buildings, and painted surfaces occurred during the ten-year period when open-roasting methods were used and the four to five years prior to the conversion of sulfur dioxide to sulfuric acid. So much vegetation was damaged that it was reported that whips used to discipline boys and girls were difficult to obtain.

Tall stacks were erected in 1902 to dissipate the smoke and fumes from the furnaces. These were designed so that the pollution would mix with enough air so by the tine it reached the soil, it would be so diluted that it was not highly destructive to living things. But at the higher discharge elevations, the smoke was simply carried to greater distances and injured the most susceptible plant growth over a larger area. During this period it was reported barbed wire would last about four years, with the lifespan of telephone wire at about six years.

In 1904 there were only two live trees near Isabella. A few stumps were still visible. They gradually rotted out, were washed away as the rains gullied some hillsides, or were dug out for fuel for roasting green ore. After 1904 open air roasting

Copper Basin as it appears today.



In places, Copper Basin resembled a scene from another planet.

was discontinued and more modern smelting methods began.

New Century, New Problems and New Ideas

The third century of the Copper Basin covers the period from around 1907 to 1999. It started with the smelting method, then shifted to blast furnaces equipped with stacks which turned the gas was lose at even higher altitudes. This resulted in the pollution of an even greater area.

The first sulfuric acid plant began operating in 1907 and it featured the largest chamber acid plant in the world. This plant operated on sulfur gases from ore and copper mattee from smelting to flotation of the ores. The construction of flotation plant roasters, sintering plants and reverbertory furnaces provided a product for the steel industry. These plants produced blister copper, sulfuric acid, iron sinter, copper sulfate (bluestone), copper fungicides, slag and a small amount of zinc and gold.

The 1912 forest inventory done by professional forester R. F. Hemingway illustrates the tree reproduction and second growth characteristics of the fume-affected areas of mixed hardwood and pine, and demonstrates the inherent fertility of the undergrowth vegetation sites. His inventory provided important early information useful in perpetuating the prime hardwood forest. The shape of the completely denuded area shows that the fumes spread out to the north, east, and west, but did not reach very far south.

The fresh, moist conditions of the ground cover in the coves offered great protection to the merchantable timber and soil in the affected area. On the higher ridges and slopes, on the other hand, the forest was moreopen, with the ground cover and soil less moist. Fires around the Copper Basin were more severe as there was a large amount of standing and dead timber killed by sulfur fumes from two smelting plants in the vicinity. The sulfur smoke wiped out all vegetation, except for a few grasses, within a radius of 4 to 5 miles of the smelter, and destroyed merchantable timber and second growth up to a radius of 25 miles.

In a distance of 4.5 to 14 miles, the smelters had more or less impact on all streams flowing south to the Ocoee, and on short streams flowing north into the river, and on Rough Creek in Georgia up to the junction of two forks. Since the ridges are more exposed, the impact was more pronounced on them than on lower slopes and in coves.

When the sulfur smoke leaves a stack, it forms clouds that gather moisture as they travel, with a filmy layer on the outside. When these clouds strike an obstruction, this filmy layer breaks and the sulfur dioxide unites with the moisture on or in the leaves, thus forming sulphurous acid. This then becomes sulfuric acid, which enters and poisons a tree.

First the leaves fade, appear pinched and slightly crumbled, and then turn reddish brown. Holes soon appear in the leaves and before the end of the growing season, most fall to the ground.

The following is a list of the most badly affected species in order of sensitivity to the sulfur smoke: White Pine; Yellow Pine; Chestnut Oak; Hemlock; Black Oak; Chestnut.

In 1912 the standing White Pine in the area was especially well preserved with very sound heartwood. In 1939 sizeable dead White Pine were visible on north facing slopes along the Ocoee, enroute to Dam No. 2 along US 64.

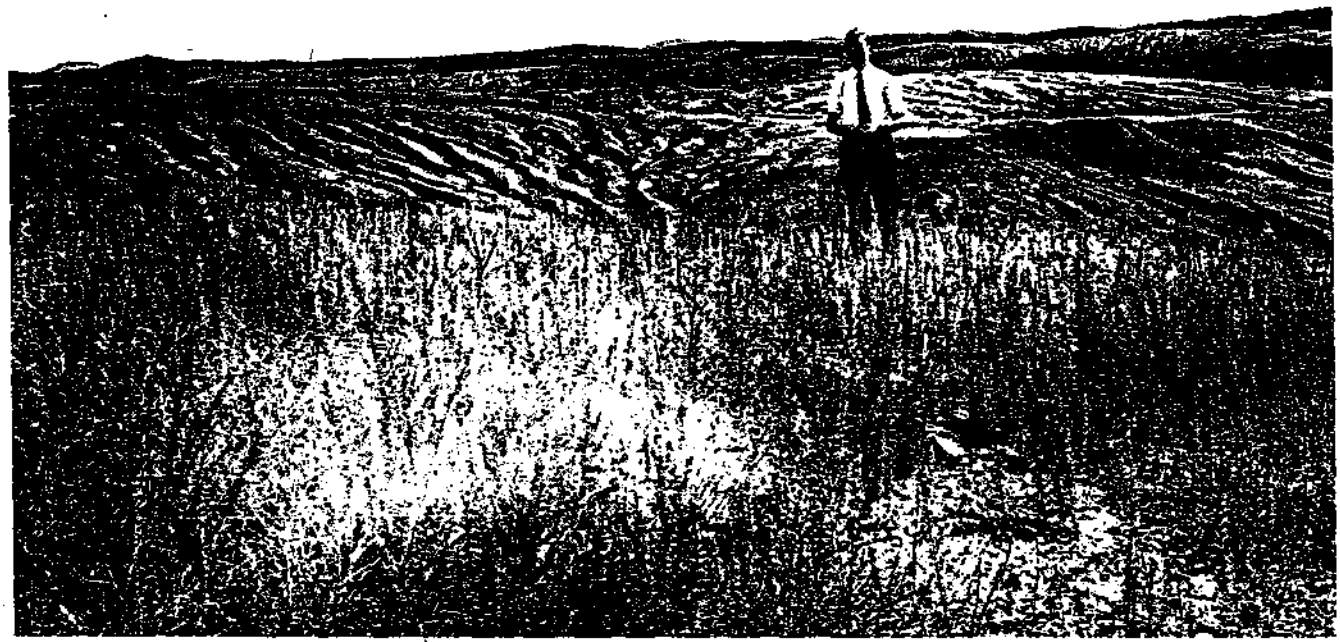
Yellow Poplar, Maple, Red Oak and the Gums are apparently not affected. By 1915, two companies had installed plants to convert sulfur dioxide to sulfuric acid, resulting in a dramatic drop in the release of sulfur gases.

A Recovery Plan is Hatched

In 1929 at the request of the Ducktown Sulfur, Copper and Iron Company, Dr. Charles R. Hursh, a forest ecologist with the Forest Service's Appalachian Forest Experiment station in Asheville, North Carolina, prepared a report with a plan for restoration of the Copper Basin. He suggested that returns from timber production in the Copper Basin would depend upon future markets and upon the quality of timber that would be produced. Since the basin lies in a region of sufficient rainfall, trees can be grown successfully from planting, and can be depended upon to furnish adequate protection to the soil.

In 1930 the Department of Agriculture sent Extension ForesterG. B. Shivery from the State of Tennessee to Ducktown to secure cooperation in the reforestation program. Eleven species of hardwood and pine were planted in fenced sites in the barren area around Isabella 1930 and 1931. Survival success of the 24,900 seedlings was reported. This study suggested there was more inherent soil fertility in the B and C soil horizons of the barren area.

In 1938 the Tennessee Copper Company planted Red and Norway Pine from Michigan in fenced areas, with a cover



This 1939 photo shows *Lespedeza Serecia* planted near Red and Norway pine trees.

crop of rye grass that seeded itself for several years. There was also a separate site seeded with *Lespedeza serecia.*

In the seventh growing season, the black locust developed a closed canopy cover that began to shade and kill the lower branches. There was good dove hunting as a result. Pruning of the locust was suggested by the Appalachian Station's forest management researchers. In 1939 Pine tree seedlings were planted by TVA along US 64 west of Five Points in orderto evaluate adaptability of several pine species to the soils in the Basin.

The effect on vegetation changes in modifying elements of the general climate were experienced by local citizens learning to fly from the one airport in the 1930 and 1940s. Starting over the forested Tumbling Creek on a fixed northeast bearing and altitude toward Pack Gap on Standbury Mountain, travelers could see distinct changes from forest to grass to barren areas.

In 1941 the Tennessee Copper Company began planting kudzu and in the period 1942to 1944, used tractors with post

(Continued on page 29)

land Cooperative Extension provides information on how to monitor for voles and options for control. It is an available online in a draft format at www.natural resources.umd.edu

PA Landowner Educates With Demo Forest/Website

Forest management demonstration areas are located across Pennsylvania. Tree Farmer George Freeman has a Forest Stewardship Demonstration area on his property in Clarion County. The site developed in cooperation with Penn State's Forest Resources Cooperative Extension is one of six Forest Stewardship Demonstration areas in Pennsylvania.

If you can't see it in person, you can visit the Freeman Tree Farm online at http://www.virtualforest.psu.edu. On this virtual tour, visitors see maps and photographs taken at the Tree Farm and demonstration area. Written descriptions accompany the photographs of the demonstration site and compare different harvesting techniques. Another part of the Web site evaluates the Freeman Tree Farm using specific criteria and indicators of sustainability (the Montreal Process).

Managing forest resources is a complex issue in Pennsylvania. Since private forest landowners hold over sixty percent of Pennsylvania's 17 million acres of forestland, the management of these private lands has a large impact on the overall sustainability of forest resources in the Commonwealth.

Forest management demonstration areas give visitors an opportunity to see different management techniques firsthand, and allow landowners and citizens to make informed decisions.

The sites demonstrate that with proper planning and careful management, private forest landowners can maintain vigorous, healthy, and productive forests. For information about forest demonstration sites in your area, contact the Pennsylvania Bureau of Forestry service forester assigned to your county.

For information about how to contact your service forester or for a list of free forest stewardship publications, call the Pennsylvania Forest Stewardship Program at 1-800-235-WISE (toll-free).

The Pennsylvania Forest Stewardship Program provides private forestland owners with information and assistance to promote healthy and productive forests. Its sponsors include the Pennsylvania Bureau of Forestry and USDA Forest Service, in partnership with the Penn State's Forest Resources Extension.

COPPER BASIN

(Continued from page 13)

hole diggers for excavating holes at regular intervals in which to plant kudzu cuttings. Each hole was backfilled with a mix of fertilizer, lime, and top soil. Plantings were concentrated on sites that could be seen from Tennessee Hwy 40 from Copperhill to 5 Points and east on US 64 towards Angelicio Gap.

Loblolly Pines planted in 1946 and 1947 on Watershed 5 and 6 had growth with crowns that deposited needles. In 1999 and 2001 there was a profitable business harvesting pine straw and hauling it to Atlanta to be sold as mulch. This site is within one mile of the former wood-fired ore roasting in the early 1900s and provides an example of nature healing a barren area. The residual B and C soil horizon started restoring a forest landscape and with the assistance of 240 feet of precipitation between 1946 and 2000, a large amount of sulfur and minerals in the soil was leached out.

The County of Polk discontinued the open range grazing practices in 1943. The revegetation of the CCC Camp project area required a resurvey of the Georgia-Tennessee state line to control cattle use in the grassed and gullied areas where a tree planting program was to be initiated. Reference markers of the original survey were needed to identify the line on the ground to facilitate the construction of a standard four-wire and post fence around the area. Pine tree seedlings were planted by World War I veterans and younger CCC enrollees in the period from November 24, 1941, to April 1942. The CCC was limited to a small area of the 1,000 acre Camp Project Area from the Georgia State Line north to the Camp Project access road.

More than 140 years of mining and forestry activities closed down in July 1987. The Tennessee Copper Company's successors were Cities Service in 1963, Tennessee Chemical Company in 1982, BIT Manufacturing Inc. in 1990 and Intertrade Holdings Inc. in 1999. In the period 1941-1999, records indicate that 17.38 million trees and shrubs were planted. In 1984 there were 12,612 acres identified as unreclaimed lands largely in areas of high sulfur concentration and exposed C soil horizons. It is expected the remaining work and maintenance will be completed by 2005.

The source of funding (direct dollars) for the Cooperative Copper Basin Reclamation Project (1984-2000) has been determined by revegetation work, required site preparation, establishing a stable ground cover and planting with a soil moisture slurry to help overcome the droughty site conditions. A follow-up aerial broadcast application of fertilizer is conducted about the third growing season after the initial treatment.

The recorded forest-wide reoccurrence of an uneven aged, or "all age" forest canopy types composed of mixed species generated by gap phase reproduction has demonstrated for the Southern Appalachians that canopy types are a product of site quality. The species composition of the canopy types, the biodiversity of the understory vegetation living and growing from the soil, including aquatic vegetative plants, animals, and birds were not determined by cycles of disturbance, but spatial variables of slope, elevation, edaphic, and aspect.

Now that the former barren areas and grassland areas have an initial healing crop of trees, the goal should be a permanent unevenaged forest ecosystem composed of types generated by "gap phase" reproduction in restoring a compatible biological diversity, habitat, environment, and forest resource use.

Looking to the future management strategies for eight common forest management issues are essential in protecting and improving the quality of life in the Copper Basin. They are: fire; capital enhancements; environmental education; habitat restoration/exotic animal and plant management; litter and illegal dumping; science strategy; recreation strategy; and workforce diversity.