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Clearing land for different uses.

More than 3 million acres of commercial woodland were cleared as recently as 1952 and converted to other uses—cropland and pasture, homesites, highways, airfields, and industrial sites. Most of it was on existing farms and ranches. New farms have been made out of forest land ever since colonial times, but little of that is done now. By *James R. Anderson, Adon Poli, and Lawrence A. Reuss*, agricultural economists, Farm Economics Research Division.

FARMERS clear land for several reasons: They cannot buy or rent additional land to add to their tilled areas. They want to enlarge, consolidate, or reshape fields so as to make more efficient use of tractor-drawn equipment. They need to realine fields in order to carry out such conservation practices as contouring. They wish to obtain more land suited to production of crops like tobacco, rice, citrus fruits, and certain vegetables.

The clearing of forests in some areas may be related to improvement of pastures. Land clearing in the southern Piedmont is associated with changes in type of farming, in which greater emphasis is given to livestock production and less to crops, such as cotton, grown for sale. Ranchers in central Florida are clearing land to establish improved pastures that will complement the grazing of native grasses.

Clearing land for farms and homes has been continuous since colonial times. The original forests of the United States covered an estimated 820 million acres, not counting about 84 million acres of arid woodland. Only about 25 million acres were cleared before 1790. About 150 million acres of the eastern forest area had been cleared for farmland by 1880. Much good timber was burned and destroyed because there was no market

for it and the trees stood in the way of cultivation.

An estimated 250 million acres in the originally forested areas east of the Great Plains have been cleared and were farmed in 1958. In the West, 6 million to 7 million acres had to be cleared before they could be irrigated. Unirrigated crops, pastures, and farmsteads in the West take up an additional 25 to 30 million acres of cleared land. Another 30 million acres or more of cleared land are used for cities, roads, and other built-up or developed areas.

Thus about 310 to 320 million acres of originally forested land are now in farming and other nonforest uses.

Probably as much as 75 million acres of formerly cleared land have reverted to forest and brush. An undetermined additional area of idle cleared land that is no longer a part of existing farms is located in the originally forested areas. Some of this idle land is held for urban development. Other idle lands are kept open for recreational and other purposes. Still other areas will revert to forest in time.

Until the early part of the present century, the forest area declined steadily. During the last 50 years in the country as a whole, however, land reverting to forest has exceeded the acreage of land that was being cleared.

The westward migration and the settlement of the prairies led to the abandonment of much farmland in the East. Often it reverted to forest. Substantial increases in production since 1920 have contributed to a relative stability of the area in crops, despite a rapid increase in population.

The boll weevil and economic problems encountered in growing cotton led to some reversion in the South. The westward migration of cotton production contributed particularly to the reversion of cropland to forest in parts of the Southeast.

Parts of the cutover counties in the Lake States proved to be uneconomic for agriculture, and much cropland has been abandoned during the past few decades.

THE PATTERN OF LANDOWNERSHIP tends to control the extent of land clearing and reversion. Extensive forest holdings indicate a growing appreciation of forestry values among owners. Corporations in the pulp, paper, and chemical industries have acquired large tracts and have raised the level of yield of forest products and of timber management. Among the economic factors in this ownership pattern is the desire to insure quantity and quality of the supply of raw materials and to obtain better bargaining power.

It is not probable, however, that a very large net reversion of farmland to forest will occur in the future. It is more likely that clearing of forest land will continue and that some further loss of forested area will occur, despite the economic and technological factors that continue to concentrate production of agricultural commodities on the better lands.

FOREST LAND SUITED to the growing of crops is still available.

The Soil Conservation Service estimated that woodlands and forests occupy 105 million acres that are suited to cultivation and are physically better suited to growing crops than are 90 million acres now used for them.

At least 40 million acres of the present cropland area should be returned to pasture and forestry uses.

The remaining 50 million acres are so subject to erosion that they should be cropped only with great care.

Thus, as far as physical conditions are concerned, opportunity exists for additional clearing of land to help in adjusting the use of land to its physical capabilities. Such shifts in use—particularly shifts to more intensive uses—however, are not necessarily recommended and may not be economically desirable under conditions in 1958.

Three-fourths of the forested area potentially suitable for cropland is in the Southern States. Some of this land was once used for tobacco, cotton, corn, and other cultivated crops. After reverting to forest, some of it was cleared a second or a third time for crops (like tobacco) of high cash value.

If we look more closely at this 105 million acres of forest land, we discover that about 42 million acres is good land that can be farmed with relatively little risk of erosion. It is level to gently rolling, has deep soils that are easy to work, holds water well, and is at least fairly fertile.

Some of this good land is in large forest holdings that are not used primarily for agriculture. A considerable acreage, however, is distributed in small wooded tracts on existing farms. It is this good land on farms that is most readily available for development if the need for farm products warrants its use and if farmers have adequate capital with which to do the clearing. Some of it may also require drainage or irrigation.

The remaining 63 million acres include land that should be cleared and cultivated only if such conservation measures as terracing and stripcropping on slopes and good water management on flat areas are installed.

Whether individual farmers will find it profitable to develop more of this kind of land on their farms will depend on several conditions. Among these are the acreage available for clearing, the

cost of clearing, the use to which the land can be put in terms of the type of farming carried on, the prices of farm products, and the availability of capital.

ALTOGETHER, more than a million acres of land were cleared each year for agriculture from 1946 to 1955. Not included in that total are the acres of rangelands cleared of brush and the land cleared for nonagricultural uses.

A large part of the land cleared for agriculture is in the South. Two sections stand out—the lower Mississippi Valley and central Florida.

In the West, removing desert vegetation is a part of the cost of developing some new land for irrigation.

Brush control is important in the Southwest, particularly Texas, where undesirable woody plants, such as mesquite, scrub oak, and creosote, have invaded native rangelands. Mechanical and chemical controls of various kinds are used in attempts to eradicate them and to control their further spread.

THE MARKED INCREASE in land clearing since the war was stimulated by the favorable prices for farm products immediately after the war. A price-cost squeeze that came later fostered individual action to reduce costs and increase yields. Some farmers who were unable to adjust their farm organization and operations found off-farm employment and converted idle land to forests. Others intensified production on their cropland and pastureland. Still others reduced labor costs by clearing more land for pasture and shifting from crop or general farming to livestock production. Ranchers continued to use available equipment and manpower in slack periods to clear land for more forage.

A further encouragement for land clearing has come from development of new machinery and techniques for rapid, large-scale clearing operations. They make it possible to clear in a few weeks what formerly could be cleared in a year.

For example, at a land-clearing demonstration in Clay County, Fla., in 1952, it took less than 5 hours of machine and operator time for clearing and piling operations on an acre of heavy hammock land. For sparsely timbered flatwood plots from which the salable timber had been cut, it took only about 2 hours of machine and operator time for clearing and piling.

MODERN EQUIPMENT for land clearing has come into widespread use since 1945. Crosscut saws, axes, and crews of men largely have been replaced by heavy equipment and power tools—crawler-type tractors, dozer blades, tree cutters, stumpers, root rakes, brush rakes, bush-and-bog plows, brush choppers, undercutting plows, portable circular saws, and chain saws. Chemical brushkillers, flamethrowers, and mechanical shredders also are used.

The cost of clearing land depends on the density and size of trees and the type of timber stand; whether the timber is salable; the kind of equipment; and drainage, soils, and climate.

Higher wages have tended to make it cheaper to clear land by machine than by older methods. Machine clearing leaves land almost ready for use.

IN THE SOUTH, the major areas of extensive land clearing are in the Coastal Plain and Delta regions. Clearing of brushland for crops and the control of mesquite, oak, and other objectionable brush is done on the rangelands.

Clearing has been going on actively in eastern North Carolina, southwestern Georgia, southwestern Alabama, southeastern Mississippi, southern Louisiana, and the Mississippi River Delta of Arkansas, Louisiana, and Mississippi. In the ridge and flatwoods sections of Florida, much land has been cleared for agriculture, subdivisions, and urban uses.

Timber resources are affected by the location, extent, and type of land clearing and reversion to forest. The acreage of hardwood stands in the upland and Coastal Plain areas has increased

faster than the acreage of pine, except in communities where pulp and turpentine are produced. That is partly because timber cutters and farmers prefer to cut pine trees. Also, hardwood trees are aggressive; they soon appear in the understorey of pine stands. Clearing of bottom lands limits the hardwoods.

Surveys by the Forest Service indicated that an increase of 1.2 million acres, or 11 percent, in forest land occurred in the Piedmont and mountain counties of North Carolina between 1937 and 1956, mainly because of reversion of cropland and pastureland to forest.

The increase in forest land in the Georgia Piedmont in 1936-1954 exceeded that in the mountains. Much farmland has been abandoned since 1935 in the southern uplands of Alabama and the northern uplands of Mississippi.

The clearing of bottom lands along streams and reversion of slopes result in more intensive farming of a smaller acreage of more productive land in some upland areas.

Where only small parcels of land are available for clearing and farm labor has little opportunity for alternative productive employment, hand methods of clearing tend to persist. In the absence of uncleared productive lands, a little clearing may be done on relatively poor sites.

Crops with high gross value of product per acre tend to predominate on newly cleared cropland in the South. These include tobacco in North Carolina; truck crops in the eastern Coastal Plain, Atlantic flatwoods, and Florida peninsula; citrus groves on the ridgetlands and in the Indian River area of Florida; and rice in Arkansas, Louisiana, and Texas.

Acreage restrictions on some crops, such as rice, however, have caused postponement of some land-clearing operations that had been planned. It is customary in central and southern Florida in most years to obtain new land for tomatoes and watermelons in order to minimize the effect of plant

diseases. Much of the land cleared for these crops is converted to pasture in the third year.

Improved pastures also have been established on newly cleared land. A favorable level of beef prices after the war was an important factor. Farmers and ranchers selected sites with light stands of trees and favorable slopes. Bulldozers, heavy choppers, giant chains, chemicals, and other means of eradicating native vegetation were adopted for speed and economy, especially in Florida and the Southern Plains. A decline in the price of beef about 1952 slowed down the pace of clearing for pastures.

Despite lower prices for beef cattle and for many crops, substantial acreages were cleared for agriculture in 1953-1954. About 300 thousand acres were cleared in Florida, 245 thousand acres in Texas, 185 thousand acres in Arkansas, and 115 thousand acres in Kentucky. About 20 thousand acres were cleared in West Virginia.

Large commercial farmers and ranchers acquired their own bulldozers, draglines, and related equipment. Former servicemen and others have gone into the business of doing custom land-development work for farmers, ranchers, grove owners, developers of subdivisions, and others.

Farmers and ranchers who own their own equipment clear land in slack periods and so use available labor and machinery more efficiently. Custom operators work under contract by the job or hour.

No two land-clearing operations are the same. Methods and costs depend on topography, soil types, drainage, salvage of forest products, size and type of equipment, skill of the operators of the machines, and the type, size, and density of cover.

Crawler-type tractors, equipped with dozer or pusher blades, are widely used, although operators usually have available several sizes of tractors and attachments for different situations.

Cutover flatwoods in central Florida usually contain many stumps, scat-

tered sapling pine, and thick palmetto. The operator there may remove stumps with a detachable stumper mounted on a crawler-type tractor. He then pushes and piles the pine trees, using the dozer blade. Finally, he uses an undercutting sweep plow and heavy disk to unearth and chop the palmetto plants. A medium or small crawler tractor with attached blade, stumper, or disk commanded a custom rate of 8 to 10 dollars an hour, with operators, in 1958. The undercutting plow mounted on a patrol cost 10 to 12 dollars an hour. The total cost of clearing was about 30 to 45 dollars an acre, depending on such items as the density of cover.

Sites covered with young trees and plants that can be eradicated by heavy-duty choppers, plows, and disks can be cleared cheaply. Scrub-oak tracts sometimes are chained or cabled at a cost of 5 to 25 dollars an acre—heavy chains or cables are dragged between two tractors through the brush. The preparation of marshlands for crops involves a low cost for land clearing but relatively high costs for ditching, diking, and draining.

Some operators in the sandy areas of the Coastal Plain and flatwoods believe that trees with big taproots are easier to pull or push than are trees with large root systems just below the surface, which are harder to rake, pick up, and burn.

Removing live oak and magnolia, which attain great size in hammocks, is costly and taxes the power of even the larger machines and the ingenuity and patience of the best operators. It costs 100 dollars or more to clear an acre in such places. In clearing for general crops or pasture, these trees are usually deadened and allowed to stand, but in clearing for construction, reservoir sites, and urban and industrial uses, trees of this kind are usually removed.

A clean job of clearing generally is required for crops, groves, and most nonagricultural uses of land. Trees may be cut at the surface of the ground, and

the underground stumps are permitted to remain if the land is to be used for rice, pasture, or other crops that are to be disked, harrowed, rolled, or mowed, rather than put under deep cultivation.

The cost of clearing wooded sites for agricultural purposes in many parts of the South ranges from about 25 to 80 dollars an acre.

The availability of water may grow in importance in the selection of sites to be cleared for new uses.

TO CLEAR LAND in the West, mechanical measures, controlled burning, chemical brushkillers, and desiccants commonly are used when vegetation has to be removed quickly and the use of browse animals would take too long.

The native grasses are permitted to cover the area or are reestablished when the woody vegetation has been removed or is under control. This is the usual procedure when the native species are of the desired type.

When only remnants of the native grasses remain, when they are not of the desired type, or when natural factors are not favorable for rapid natural succession, the cleared areas are seeded to improved, adapted grasses.

Artificial reseeding of grass with tractor-drawn drills or broadcasting by hand and airplane are common in the West. Various mixtures of annual and perennial grasses are used, depending on the kind of land to be reseeded and the owner's preference. The cost is 1 to 8 dollars an acre.

CLEARING OF CUTOVER timberland for grazing is done in places in which commercial forest land and natural grassland are intermingled, as in northwestern California and the Pacific Northwest, when the grazing land is limited.

One way in which a rancher can get enough grazing land and maintain economic balance at the same time is to clear places next to the existing pasture or rangelands.

Clearing cutover timberland calls for

several operations. The first is to cut the trees and brush that remain standing. The tract then is readied for burning. The residue is piled. Fire lines are built. Burning follows.

The rancher gets a permit to burn. Then he selects, within the limitations of the permit, days when wind and moisture allow reasonably clean burns with small danger that the fires will get beyond control. The burning in some States is with State supervision.

Slashing the trees and preparing the land for burning costs 6 to 18 dollars an acre, depending on the density and size of the trees, steepness of terrain, the type of equipment, and the experience of the operator.

The first burn after logging costs the rancher 30 cents to 2 dollars an acre, according to the size of area burned, the kind and amount of slash on the ground, weather, and topography.

The burned tract may be seeded to grass. Seed ordinarily is broadcast by plane or hand. Grasses seeded on cleared timberland mostly are perennial and annual ryegrasses, orchardgrass, and subterranean clover. Mixtures may also contain smaller amounts of seeds of many other grasses and clovers. Costs of seeds and seeding are about 2 to 8 dollars an acre, depending mainly on the kinds of seed used.

Proper management after burning and seeding is important. The number and kind of animals grazed greatly affect the kind of vegetation that will develop and survive.

After a cleared area of timberland has been grazed by sheep or by sheep and cattle for 3 or 4 years, it is reburned to control the woody vegetation that has resprouted. A reburn costs the rancher 60 cents to 3.75 dollars an acre, depending on the success of the first burning, the species of vegetation, and other factors. Reseeding after a reburn is not always necessary. Ordinarily, 2 to 4 reburns, combined with browsing by sheep, are necessary to complete the clearing job.

Total costs of a successful conversion job, including three reburns, may be

10 to 40 dollars an acre. The average total cost of converting an acre of timberland to grassland in northwestern California was 26 dollars in 1958.

BRUSHLAND is cleared in the Western States in places that are covered by brush or woody species but have good enough soil and rain to support good stands of grass.

The sagebrush lands of the Inter-mountain region, the chaparral lands of California, and the juniper-mesquite lands in Arizona and New Mexico, for example, have large acreages that can be improved. Clearing brush is sometimes necessary to maintain the quality of forage on pasture and grazing land.

The improvement job is done by ranchers, associations of ranchers, Indian tribes, and State and Federal agencies.

Steep slopes, rocky soil, or rock outcroppings make mechanical removal nearly impossible. Then the brush is burned or sprayed with a chemical, such as 2,4-D or 2,4,5-T. Costs of applying chemicals have been 3 to 8.50 dollars an acre, depending on the method and the amount of chemical used. Chemicals also are effective as a followup after burning or mechanical clearing.

Level or gently rolling land usually is cleared by plowing, disking, or burning according to the nature of the vegetation, the type of seedbed that is wanted, and costs.

When the land has been cleared, the native grasses may be permitted to re-vegetate the area, or it may be seeded to grass. The type of native grasses, the adaptability of grasses that can be introduced, and the extent to which the vegetation has been removed determine the species. Crested wheatgrass, smooth brome, intermediate wheatgrass, orchardgrass, pubescent wheatgrass, tall wheatgrass, and tall fescue have been used.

Studies by J. R. Bentley and others of the California Forest and Range Experiment Station indicated that it

costs 10 to 20 dollars an acre to uproot and windrow light and medium brush and 20 to 50 dollars an acre of heavy brush. Smashing the brush to the ground for controlled burning costs about half as much as piling it in windrows before burning. Heavy-duty offset disks or disk plows have been used to remove brush cover that is neither too large nor too dense.

Plowing or disking helps make a good seedbed. The seed can be drilled rather than broadcast. Better results ordinarily are had when the seed is covered. Better than average results have been got when the seed has been broadcast after a burning in which the amount of brush was enough to provide an adequate residue of ash.

Controlled burning to clear brushland has been popular in the West. The brush is burned standing in place without prior treatment or after smashing with a bulldozer. It is also burned after it has been piled and windrowed after removal by mechanical process. The procedure for burning brush is similar to the one we described for clearing cutover land. Controlled burning of brush without prior treatment has cost about 40 cents to 3.65 dollars an acre. Burning, including the use of a bulldozer to smash the brush, costs about 2.50 to 15 dollars an acre. Burning is more successful when the brush is knocked down and allowed to dry.

Mesquite and juniper are removed in several ways—hand grubbing, application of kerosene, aerial spraying with chemicals, chaining, and other mechanical processes. Costs are 2.50 to 32 dollars an acre.

Large acreages of sagebrush and other nonforest desert shrub lands in the semiarid regions have been improved for grazing through removal of the sagebrush. That is done by disking, raiiling (dragging heavy rails over the ground), controlled burning, or chemical sprays. The cost of removing sagebrush has been 1 to 8 dollars an acre.

LAND CLEARING in the North is done mainly to develop land for housing,

highways, airfields, and industrial sites and to develop and improve pastureland. Maintaining the existing acreage of permanent pasture may require removal of encroaching trees and brush from time to time. Not much land is cleared for cropland, except that done to enlarge and realine fields.

Clearing small tracts for rural homesites is common in the Northeast. Clearing farm woodland for pasture and for cropland has been scattered throughout the Northern States. In no State, except New York, did the acreage cleared in conservation districts exceed 10 thousand acres in any year between 1952 and 1958. Pennsylvania and Maryland were the only other Northeastern States in which the clearing carried out in the conservation districts amounted to more than 2 thousand acres a year since 1952. Some land is cleared each year in the Corn Belt and Lake States, but only in Minnesota has the acreage cleared exceeded 3 thousand acres a year.

In general, the area of farmland that has reverted to forest in recent years has greatly exceeded the area cleared for pasture and crops in the Northern States. The need for a larger acreage of improved pasture on dairy farms has been a major incentive for the land clearing on farms in the North.

Most farmers contract with custom land developers on an hourly basis to clear their land, as ordinarily they do not have the necessary heavy equipment with which to do a satisfactory job. Most of the clearing is done with crawler-type tractors equipped with dozer blades and rakes.

The forest cover cleared generally varies with the intended land use. Land cleared for agricultural uses usually is cutover land or second-growth hardwood or brush. When land is cleared for residential, industrial, and other related uses, good stands of trees are cleared occasionally.

Approximate costs of clearing forest lands are 40 to 150 dollars an acre. Some costs run much higher for heavy forest stands.