FROM OKRA TO OAK: REFORESTATION OF ABANDONED AGRICULTURAL FIELDS IN THE LOWER MISSISSIPPI ALLUVIAL VALLEY

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ABSTRACT

There has been a tremendous upsurge in interest in reforestation of bottomland hardwoods. In the lower Mississippi alluvial valley, reforestation projects are occurring on a large scale on abandoned agricultural fields, often in conjunction with state or federal cost-share programs. This paper describes some of the cost share programs used to establish bottomland hardwoods, in particular oaks. The reforestation techniques of direct seeding hard mast or planting bareroot seedlings ate discussed along with estimates of establishment costs.

INTRODUCTION

Forested wetlands changes in the southern United States may have come full circle. The Lower Mississippi Alluvial Valley (LMAV) has undergone the most widespread loss of bottomland hardwood forests in the United States. As much as 90 percent of the loss of bottomland hardwood forests in the LMAV has been due to conversion to agriculture (MacDonald et al. 1979; Department of the Interior 1988). Some of the expansive bottomland hardwood forests cleared and drained for agriculture are now being scrutinized as to their potential of providing multiple use commodities. A national shortage of raw materials for wood products has driven the demand and interest of developing and managing southern forestlands. Private landowners in the LMAV are committing to managing their lands for a broad array of values, which include a sustainable wood supply, wildlife habitat. clean water, and forest recreation such as hunting and fishing. Thus, reforestation is increasing, primarily for environmental and socioeconomic reasons.

Between the early 1800s and 1935, about one-half of the original forests were cleared. A later surge in forest clearing for agriculture took place in the 1960s and 1970s in response to a rise in soybean prices (Stemitzke 1976). When prices eventually fell, land that was marginal for agriculture because it was still subject to spring and early summer backwater flooding became idle. These are the lands that are now available for reforestation. In a publication released by the Mississippi State University Cooperative Extension Service (1995) forestry was reported as the leader in MS agriculture production, with an estimated production value of $1,109 million, a record high. In 1996, a sluggish pulpwood market dropped forestry to the number two spot behind poultry in Mississippi farm commodities (pets. comm., Bob Daniels, Extension Forestry Specialist, Mississippi State University). Mississippi State University extension experts noted that the South is becoming the wood basket of the nation, and although the forestry industry slumped slightly in 1996, it remains big business in the state and ranks number seven nationally.

No single person or institution could tackle reforestation challenges alone. Communication must be magnified between the scientists who develop new technology information, the landowners who may be in need of such information, and the natural resource professionals who will help bridge the gap between these two groups

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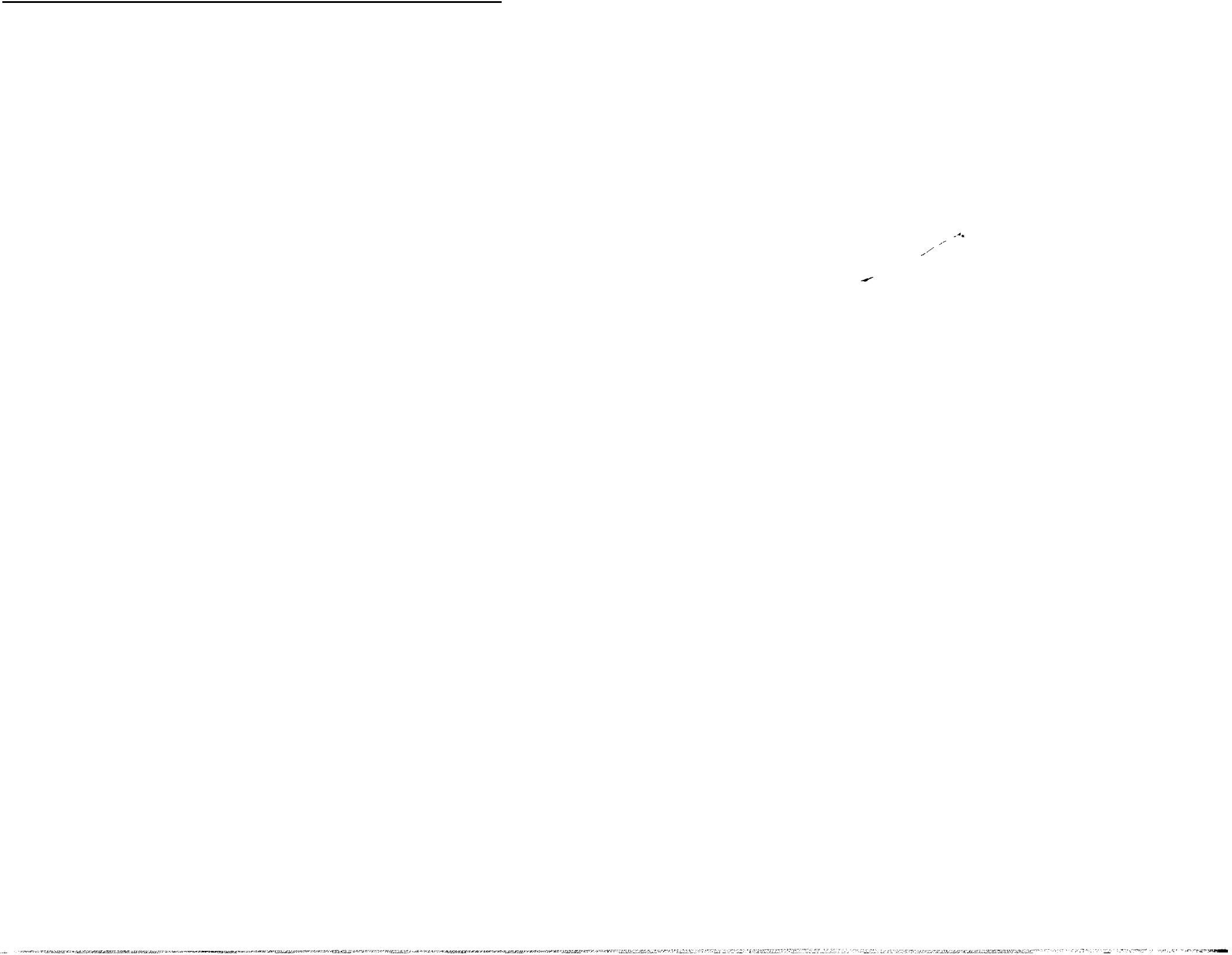

(Baldwin and Haymond 1994). Sollie (1965) found that Mississippi landowners who have had more contact with agricultural and forestry agencies were more likely to adopt new forestry practices than those who had few such contacts. Strategies vary by landowner objectives and are driven mainly by public programs supporting reforestation for water quality protection and wetlands restoration. We provide a summary of public and private programs supporting reforestation of economically marginal farmland and include examples of reforestation programs which involve various partnerships and that have different objectives. Estimates of the cost of these efforts are also presented.

REFORESTATION POTENTIAL

Although restoration is taking place throughout the South, it is predominantly occurring in the LMAV states of Louisiana, Mississippi and Arkansas. Reforestation in the LMAV is driven primarily by the acquisition of land by public agencies to enlarge federal wildlife refuges and to mitigate or offset wetland losses due to construction for flood control. State programs also play a role, as do public policy initiatives such as the Wetland Reserve Program (WRP) on private land. Industry has also been increasing their interest in private land reforestation. Through 1995, approximately 74,000 hectares (183,000 acres) are under reforestation plans, mostly on private land (Table 1). Reforestation will increase over the next 10 years, so that 181,655 hectares (448,689 acres) should be in reforestation schemes in the LMAV, primarily in the states of Mississippi, Louisiana and Arkansas.

Table 1. Actual and potential afforestation in the Lower Mississippi Alluvial Valley, by program and agency.

Program	Agency	Area (acres)[1]		
		1995	Planned to 2005	Total
Wildlife Refuges	US Fish & Wildlife Service	12,795	24,700	37,495
Wetland Mitigation	Army corps of Engineers	5,002	23,959	28,961
State Agencies	MS, LA, AR	33,345	100,035	133,380
Wetlands Reserve Program	Natural Resources Conservation Service	130,910	117,943	248,853
Total		182,052	266,637	448,689

'Estimates furnished by participants at the Workshop on "Artificial Regeneration of Bottomland Hardwoods: Reforestation/Restoration Research Needs", held May 1 l-12, 1995 in Stoneville, MS.

PUBLIC LAND PROGRAMS

In 1987, the United States Fish and Wildlife Service (FWS) began an aggressive program in the LMAV to restore bottomland hardwood ecosystems (Haynes et al. 1993). This effort was not limited to existing wildlife refuges, and included reforestation of private lands and foreclosed farmland transferred to the FWS from the Farmers Home Administration, another federal agency. To date, the FWS had planted, or contracted for planting more than 12,000 hectares (29,640 acres) in the southern U.S. They anticipate planting an additional 12,000 hectares through 1998, mostly within the LMAV (Table 1), for a total of 15,180 hectares (37,494 acres).

An extensive, least-cost strategy dominates on public lands such as those managed by the FWS. The primary interest of the FWS is a self-healing ecosystem (R. Haynes, FWS, pers. comm., May 1995). Wildlife has been

the usual management objective. With a limited budget for reforestation, the FWS strategy has been to reforest the most land, at the lowest unit cost per hectare. Both planting of seedlings and diit seeding of hard mast species such as oaks and pecans have been employed. Plantings have been on wider spacing than used in industrial plantations. The goal is to guarantee the hard-mast component by establishing as few as 200 oaks per hectare (8 1 per acre) to serve as a seed source over time (Allen 1990; Haynes et al. 1993). The FWS will dii seed oak and pecan at rates anywhere from 2470-3952 per hectare (1000 to 1600 per acre), and estimates the cost, including their labor of seed collection and planting, fuel, and other incidentals, at $87-$143 per hectare ($35.50-$58 per acre) (Lamar Dorris, pers. comm. April 1996). Seedlings planted are usually obtained from a private nursery, at a cost of approximately $180 for 1000 seedlings. Wider spacing is used by FWS when planting seedlings, often 3.66 by 3.66 meters (12 by 12 feet). No site preparation is done, and the estimated total planting costs are $247 per hectare ($100 per acre), which includes approximately $131 per hectare ($53 per acre) for plant material! As shown in table 2, the federal agencies have been able to reforest at a slightly lower cost than that reported on average due to fewer stems per acre being planted as compared to other reforestation efforts.

Table 2. Comparison of the cost in dollars per acre of direct-seeding (sow) versus planting seedlings (plant) of oaks in the LMAV (Source: Data are from Lamar Dorris, US Fish & Wildlife Service; Ramon Callahan, NRCS; Bullard et al. 1992; Forest Landowner 1996).

Agency/ reforestation method	Site Preparation: disking and/or subsoiling	Operation: sowing acorns or planting seedlings	Materials: acorns or seedlings	Total
FWS sow	$5.50 - 8.00	$30.00 - 50.00	$0	$35.50 - 58.00
FWS plant	$0	$40.00 - 45.00	$40.00 - 55.00	$80.00 - 100.00
NRCS sow	$14.00	—— $40.00 ——		$54.00
NRCS plant	$14.00	—— $150.00 ——		$164.00
LMAV sow	$5.00	$35.00	$25.00	$65.00
LMAV plant	$5.00	$35.00	$115.00	$155.00

The Army Corps of Engineers is restoring bottomland hardwood forests to mitigate fish and wildlife habitat losses caused by water resources projects, primarily construction for flood control. Approximately 2,600 hectares (6,422 acres) of former cropland have been reforested in the Yazoo River Basin, a tributary of the Mississippi River. By the year 2000, an additional 10,000 hectares (24,700 acres) will be reforested to meet legal requirements for wetland loss mitigation. One ambitious mitigation project is the Lake George property in the Yazoo River Basin in Mississippi (US Army Corps of Engineers 1989).

Water resource projects often cause impacts to forested wetlands. By law, these impacts must be mitigated by restoration or creation of wetlands elsewhere. The Vicksburg District of the Army Corps of Engineers uses reforestation of frequently flooded (2-year recurrence interval) farmland to meet statutory requirements. Their reforestation commitment is significant (Table 1). The 3,563 hectare (8,800 acre) Lake George Wildlife/Wetland Restoration Project in the Yazoo River Basin is just one example. Once reforestation is complete, the area will be managed by the Mississippi Department of Wildlife, Fisheries and Parks for game management. The project will also provide a wildlife travel corridor between two larger parcels of natural forest, the Delta National Forest and the Panther Swamp National Wildlife Refuge.

The area represents the typical conditions found in many reforestation sites. The project site is generally level. The predominant soils are of the Sharkey-Forestdale Association which are poorly drained clayey soils. The site is subject to backwater flooding in winter and spring, most frequently in April and May. Poor drainage can cause flooding during periods of prolonged precipitation even at low river stages. Approximately 2,200 hectares (5,434 acres) were planted through 199411995.

The agency's strategy has been to treat the wettest sites first, leaving drier sites in active agriculture to lower overall project costs by revenue from leasing. This also controls weeds, thereby keeping site preparation costs low. Contractors are used to plant seedlings and to direct seed, although direct seeding has been minimal due to the frequency of late season flooding. Container seedlings are also being planted in an attempt to extend the planting window. They have better developed root and shoot systems and may be more tolerant to adverse conditions. In the 1995/96 planting season at Lake George and two other sites nearby, contractors treated about 1,700 hectares (4,199 acres), mostly with bareroot seedlings. About one-third will be containerized seedlings. Bareroot seedlings will be planted at 3.66 by 3.66 m spacing (12 by 12 feet) (746 seedlings per hectare, 302 per acre), and container seedlings at a wider spacing (4.27 m by 4.27 m, 14 by 14 feet, or 548 seedlings per hectare, 222 per acre). Contracted cost for seedlings is lower than nursery prices (bareroot seedlings have averaged $135 per 1000 seedlings). Container seedlings have averaged twice as expensive as bareroot, $298 per 1000 seedlings (Table 3). Only 5 percent of the area to be treated will be direct seeded. Scientists from the USDA Forest Service at the Center for Bottomiand Hardwoods Research in Stoneville, MS, are working with Corps personnel to aid in establishing guidelines for species selection, as well as planting techniques which focus on spacing and weed control.

Table 3. Average price (dollars per 1000 seedlings) of seedlings from state forest nurseries in eight southern states, as compared to costs for genetically improved pine seedlings (Source: S. Newton, Forest Fanner 1995, p. 24-25, 39, 42).

Species	Cost ($ per 1000 seedlings)
Quercus spp. - bareroot	165
Other hardwoods - bareroot	152
Populus deltoides cuttings	175
Pinus taeda - bareroot	32
Pinus taeda - container	57

State government agencies also have undertaken ambitious restoration projects. More than 2,000 hectares (4,940 acres) near Monroe, Louisiana are being restored by the Louisiana Department of Wildlife and Fisheries (Savage 1989; Newling 1990). The Mississippi Department of Wildlife, Fisheries and Parks is restoring more than 400 hectares (988 acres) near Greenwood, MS (Newling 1990). Participants at a recent workshop estimated at total of 54,000 hectares (133,380 acres) are scheduled for reforestation by state agencies in Mississippi, Louisiana and Arkansas (J. Stanturf, unpublished data).

Aithough the demand for cost-share assistance has been steadily increasing since the mid 1980's, Congress has, in recent years. substantially reduced funding for federal cost-share programs for tree planting. In 1996 funding for the Forestry Incentive Program (FIP) in Mississippi was $232,944; the preceding five-year annual funding average was $794,437. Tree planting expenditures in 1996 under the Agricultural Conservation Program (ACP) were $80,402; the preceding five-year annual funding average was $569,971.

The federal Conservation Reserve Program (CRP) began in 1980 to subsidize establishing permanent vegetative cover on erodible cropland. When reauthorized by Congress as part of the 1985 Food Security Act (popularly known as the Farm Bill), the CRP included wetlands converted to croplands (Kennedy 1990). A landowner participating in CRP reserves the land for 10 years in return for reimbursement of some reforestation costs and an annual per hectare payment. By the ninth enrollment year (1989), more than 20,000 hectares (49,400 acres) of wetlands in the LMAV were placed into the CRP (The Nature Conservancy 1992). An unknown portion of this land was reforested, thus Table 1 does not include an estimate of CRP land.

The Wetlands Reserve, Program (WRP) was included in the 1990 Farm Bill and set a maximum sign up of 400,000 hectares (988,000 acres) nationwide. A pilot program in 1992 in eight states was expanded to 20 states in 1994. Three states in the LMAV - Mississippi, Louisiana and Arkansas - were included. More land was submitted in these three states (200,000 hectares, 49,400 acres) than could be accepted because of financial limitations on the program. In 1995, Congress authorized an additional $92 million. The federal Natural Resources Conservation Service administers the program and expects a total of 100,750 hectares (248,852 acres) to be reforested in the LMAV by 2005 (Table 1). In return for a permanent easement that removes the land from agricultural production, the government shares the cost of reforestation and provides a one-time payment based upon the fair market agricultural value of the land. The landowner has three years to reforest land placed in the program.

The amount of cost share received depends on the sign-up year. The 1995 sign-up allocated up to a maximum of $370.50 per hectare ($150 per acre) for planting seedlings and $98.80 per hectare ($40 per acre) for direct seediig, which includes both operational and material costs (Table 2). An additional $34.58 per hectare ($I4 per acre) is appropriated for site preparation, which consists of either disking or subsoiling (Table 2).

The WRP emphasis is restoration of forested wetlands functions and values to attain wildlife habitat, protection and improvement of water quality, attenuation of water flows due to flooding, and protection and enhancement of wetlands. Private landowners who utilize WRP to reforest marginal cropland with the intention of generating income through future timber harvesting will be disappointed, unless they are prepared to invest in denser planting. The WRP will only reimburse reforestation costs for 741 stems per hectare (302 per acre), which is not suitable for commercial forest management. In order to be deemed successful, only 125 hard mast producing stems per acre are required at year three. A 1996-1997 survey of the 1992 WPR contracts in 13 west central Mississippi counties found only 9 percent of the total reforested land met the requirement of 125 hard mast stems per acre (C. Schweitzer, unpublished data). The stocking that will result from typical WRP reforestation schemes will not be sufficient to support a pulpwood thinning at age 20 or 30 (J. Goelz, USDA Forest Service, pers. comm., May 1995). Furthermore, it is uncertain whether landowners will be allowed to harvest WRP plantings. Although an "official" interpretation of the language of the easement has not been made, public opinion is not generally supportive of harvesting and vegetation manipulation.

OTHER PRIVATE EFFORTS

Many private efforts that do not depend on federal cost-sharing programs have focused on hardwood plantations for producing fiber. Fitler Managed Forest near Onward, Mississippi comprises 4,000 hectares (9,880 acres) of eastern cottonwood plantations. Fitler is owned by Crown Vantage Corporation (formerly James River Timber Corp.) and is intensively managed for pulpwood production. Regardless of soil type, cottonwood yields on a pulpwood rotation have been greater than any other plantation-grown bottomland hardwood. Establishment costs are high because cottonwood is extremely intolerant of shade and very demanding of nutrients and moisture. Site preparation, fertilization and insect and weed control results in a total of $583 per hectare ($236 per acre) establishment costs (Table 4). About $185 per hectare ($75 per acre) of that cost was for the cottonwood cuttings. The Crown Vantage Corporation offers cost-sharing programs to landowners within the woodshed of

their mill in St. Francisville, Louisiana, who are willing to reforest marginal agricultural land. Often landowners are interested in reforestation to create wildlife habitat. in addition to fiber production. For example, Baxter Land Company, a large farming operation in Desha and Chicot Counties, Arkansas, recently planted 140 hectares (346 acres) of cottonwood on low-lying cropland. Their objectives were erosion control, financial return from timber, and increased wildlife habitat (The Plantation 1994). Landowners in their program agree to give Crown Vantage first right of refusal for the timber at rotation (10 years), at market value. Net income from a 10-year rotation is $873 per hectare ($353 per acre) with no contract, and $1058 per hectare ($428 per acre) under contract. Internal rates of return are 4% and 10%. All costs are estimates of what a private landowner would have to pay to contract for silvicultural operations.

BOTTOMLAND HARDWOOD RESTORATION RESEARCH

There are currently a number of applied research efforts for investigating bottomland hardwood restoration techniques. One such project is a collaborative effort between federal agencies, forest industry and universities

Table 4. Typical cottonwood plantation establishment costs for a private landowner (Source: J. Portwood, Crown Vantage Corp., pers. comm. July 1995).

Operation	US $ per hectare	US $ per acre	Equipment needs
Site preparation, disking	62	25	120 hp tractor and disk
Subsoiling (to 5 1 cm)(20 in)	25	10	120 hp tractor and disk
Fertilizer (112 kg-N ha^{-1} liquid) (100 lb-N a^{-1} liquid)	30	12	90 hp tractor and applicator
Marking	12	5	90 hp tractor and disk
Hand Planting (labor plus $187 ha^{-1} for material)($76 a^{-1})	208	84	
Pre-Emergent Herbicide Spraying (Band-spray (15 cm)(6 in) over tops of dormant cuttings with oxyfluorofen, 1.2 kg ha^{-1} (1 lb a^{-1}) active ingredient mixed with 0.9 kg ha^{-1} (0.8 lb a^{-1}) active ingredient of glyphosate, with a non-ionic surfactant)	62	25	90 hp tractor and spray boom
Mechanical Cultivation Year 1	86	35	90 hp tractor and disk
Basal Spray Herbicides (Basal spray with oxyfluorofen, 0.9 kg ha-' active ingredient) (0.8 lb a')	37	15	90 hp tractor and spray rig
Insect Control (Tops of trees sprayed with carbanyl, 0.6 kg ha^{-1} (0.5 lb a') active ingredient, in August to control cottonwood leaf beetle)	12	5	90 hp tractor and spray rig
Mechanical Cultivation Year 2	49	20	90 hp tractor and disk
Maximum Total Costs to Private Landowner	583	236	

including USFWS, National Biological Service, USDA Forest Service Center for Bottomland Hardwood Research, Natural Resources Conservation Service, US Army Corps of Engineers-Waterways Experiment Station, MS State University, Stephen F. Austin University, National Council of the Paper Industry for Air and Stream Improvement, International Paper, Westvaco, Georgia-Pacific, Anderson-Tully and Crown Vantage Corporation.

Research projects are being conducted on a 820 hectare (2,025 acre) former agriculture field in Sharkey County, MS. The bottomland hardwood research includes studying the effects of flooding, site preparation and planting methods on survival and growth of bottomland hardwoods; examining mycorrhizal inoculation on planting stock types in establishing oak: evaluating the natural invasion of woody species onto old field sites; comparing soil and atmospheric conditions in open field and mature forest sites and relating these environmental conditions to survival, growth, and physiology of oak; and combining short-term and long-term rotation species (e.g. cottonwood and oak) for restoration and timber products. The results of this work should prove to be valuable for reforestation programs such as the WRP, and other private and public efforts.

SUMMARY

The South is involved in a major change which is shifting mass production to flexible specialization and networking production to obtain the greatest output. Those involved in reforestation in the LMAV have planned their own short-term goals, with the realization that their actions do not exist in a vacuum. Connecting these goals is a major obstacle. For example, a compromise between federal and private industry programs could ultimately benefit both. Companies could provide forest marketing expertise and materials, while federal programs ease the burden of delayed returns, allowing plenteous land to be used in production of a needed commodity. Government intervention in private regulation may be reformed and become more attuned with the flexibility and versatility of these specialized systems. Instead of subsidizing marginal production on these lands, efforts (and moneys) could be spent converting them into a demanded product.

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