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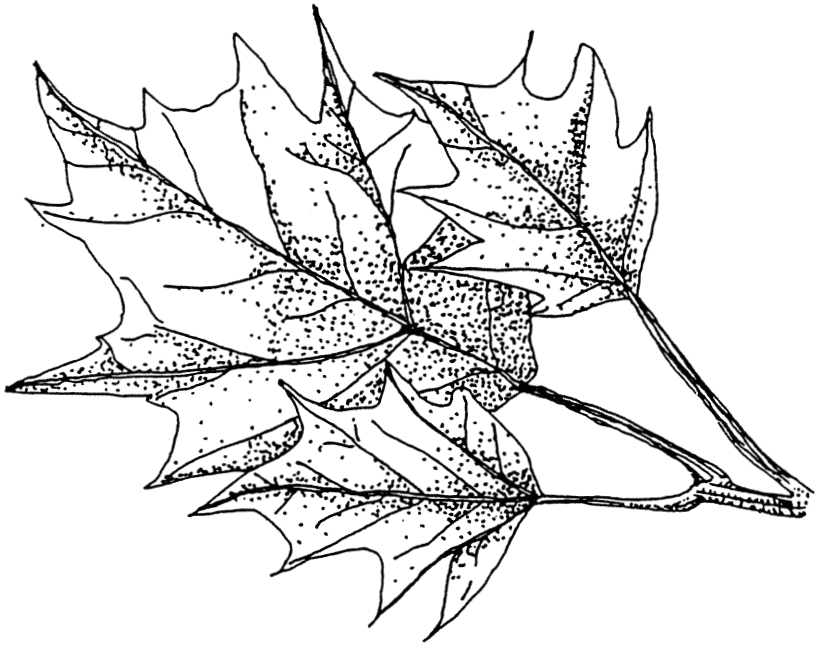
ACCOMPLISHMENTS AND ECONOMIC EVALUATIONS OF THE FORESTRY INCENTIVES PROGRAM: A REVIEW

By

Deborah A. Gaddis, Barry D. New, Frederick W. Cubbage, Robert C. Abt, and Robert J. Moulton



SCFER WORKING PAPER

No. 78

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About the Authors

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EXECUTIVE SUMMARY

The Forestry Incentives Program (FIP) is a federal financial cost-share program that is intended to increase the nation's timber supply by increasing tree planting and timber stand improvement on nonindustrial private forest lands. Timber harvest reductions on public lands in the West, environmental constraints on private lands throughout the U.S., and increased demands for wood fiber continue to prompt concerns about the nation's timber supply. In the 1990 farm bill, sunset provisions were added that would replace FIP with the broader-purpose Stewardship Incentive Program (SIP) by December 31, 1995. This review examines the program accomplishments and economic evaluations of FIP in order to consider the merits of its renewal or incorporation in related federal forestry legislation.

Accomplishments

From its inception in 1974 through 1994, FIP cost-shares of more than $200 million have funded approximately 3.32 million acres of tree planting, 1.45 million acres of timber stand improvement, and 0.27 million acres of site preparation for natural regeneration on the nation's nonindustrial private forest lands. As of 1992, about 73% of the total area of FIP accomplishments occurred in the South, 22% in the Northeast and North Central region, 3% in the Pacific Northwest, and the balance was distributed throughout the country. The South accounted for 90% of the program's tree planting activity, with 10 southern states each planting more than 178,000 acres of trees since 1974. In addition, Oregon and Washington combined planted about 90,000 acres of trees under the program. Timber stand improvement (tsi) practices were distributed throughout most forested states, with 55% in the Northeast and North Central states, and 38% in the South. Arkansas led the nation in tsi, followed by the Midwest states of West Virginia, Missouri, Ohio, and Indiana.

Tree planting cost share expenditures and area treated were greatest in the early 1980s, with more than 200,000 acres planted per year. Recent years have had planting rates of 150,000 to 175,000 acres annually. Tsi cost-share funding and acres treated were greatest in the initial years of the program, and range from about 30,000 to 40,000 acres annually in the last decade. Average government payments per acre for FIP activities increased throughout the 1970s when 75% cost-share rates prevailed. They decreased markedly in the early 1980s as most states changed to a 50% cost-share payment rate. They have increased since then, as inflation has increased treatment costs, decreasing the real FIP appropriations. Secondary impacts of the program have included development of private contracting vendors, increased softwood shares of regional timber supply, and sustaining forest products manufacturing firms.

Economic Impacts

The Forestry Incentives Program was enacted in 1973 to increase the timber supply in the United States. Evaluations of the program indicate that it has been successful and efficient in meeting this objective. Ninety percent of the funds allocated to FIP actually go toward performing practices in the field because the federal and state agencies administer the program as part of their overall responsibility. Timber supply was projected to increase by more than 1 billion cubic feet each year due to the program. Public and private rates of return averaged about 10% for the various public and private accounting criteria, and program benefit-cost ratios consistently exceeded 1.0 by a substantial margin. Federal income taxes on the timber harvests stemming from FIP plantings would eventually be more than double the annual federal FIP expenditures. Some studies found that FIP could create social welfare losses by public intervention, which is consistent with economic theory. The possibility of public funding substituting for private funding (capital substitution) has been examined by several researchers, but only one study found any measurable impacts.

Studies of the 1974 FIP program and 1979 program found substantial increases in softwood timber supply attributable to FIP, and reasonable public and private rates of return for most practices. Other studies have consistently found that FIP contributes to increased forest regeneration on nonindustrial private forest lands, thus increasing timber supplies. Retention rates for FIP have exceeded 92% for the duration of the program. FIP participation has been the greatest in the South, although almost every state has had some activity. Forest landowners who tend to have above average incomes benefit from the program, but expenditures also accrue to small business contractors and vendors, and occur in generally poor counties. Econometric models indicate that increased FIP funding was statistically significant in contributing to tree planting, accounting for perhaps up to 70% of the activity on nonindustrial private forest land that took place in the 1970s. They also found that increased FIP cost share rates would significantly increase tree planting activity, at up to 40% more than the base-level activity in the South.

Overall, the accomplishments of the program and the economic evaluations of its activity indicate that it has been successful at increasing forest planting and improvement practices and is economically efficient. It has increased timber supplies and has provided acceptable financial returns for both the public and for private forest landowners who participate in the program.

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INTRODUCTION

The Forestry Incentives Program (FIP) is a federal financial cost-share assistance program for nonindustrial private forest landowners. The principal purpose of the program is to increase the nation's timber supply by increasing tree planting and timber stand improvement (tsi) on private forest lands. FIP was first authorized in the Agriculture and Consumer Protection Act of 1973. When it wa reauthorized in the 1990 farm bill, sunset provisions were added that would phase out FIP on December 31, 1995 and replace it with the new broader-purpose Stewardship Incentive Program.

Recent summaries and analyses of the U.S. timber situation suggest that the reasons that prompted enactment of FIP two decades ago are even more relevant now. Timber harvest levels on public lands in the West have dropped substantially due to efforts to protect spotted owls and old growth forests. Nonindustrial private forests, mostly in the South, have been suggested as sources to replace timber harvest reductions in the West. In the South, however, softwood timber removals exceed timber growth (Powell et al. 1993)--for the first time since the beginning of this century. And timber demand is projected to increase continuously both domestically and internationally. Most national and international studies have suggested that both increased public programs and private sect market responses will be needed to avert substantial timber price increases, as well as local shortages and closure of some forest products mills.

A review of the effectiveness of the Forestry Incentives Program should help in determining whether it should be renewed or supplanted by similar cost-share provisions in the Stewardship Incentive Program (SIP) in the 1995 farm bill. Some groups believe that a continued or slightly modified FIP program is necessary to ensure adequate future timber supplies. Another alternative might include incorporation of streamlined tree planting and tsi provisions more similar to FIP in the revised stewardship provisions in the 1995 farm bill. This review presents historical data on the FIP program accomplishments and discusses economic evaluations of the program that have been made, i order to provide more information for these deliberations.

PROGRAM ADMINISTRATION

The Forestry Incentives Program (FIP) was authorized by Congress in 1973 "to encourage th development, management, and protection of nonindustrial private forest lands" (PL 93-86, Title XII

1973). The primary intent of this legislation is to increase the production of timber from nonindustrial private forest (NIPF) lands. Qualified owners are offered financial incentives from the federal government for reforestation, timber stand improvement, and site preparation for natural regeneration.

FIP was enacted largely due to the efforts of forestry interest groups, which perceived needs for an exclusive forestry cost-share program. Concern over the decreasing availability of Agricultural Conservation Program (ACP) payments for forestry practices in the 1960s and concerns over timber supply helped prompt passage of the program.

The intent of FIP is to encourage tree planting, natural regeneration, and timber stand improvement on nonindustrial private forest lands with the underlying goal of increasing the quantity and quality of timber and related products from these lands. Although FIP is mostly a timber production program, other resource benefits are to be taken into consideration when implementing FIP practices. The following passage from FIP's enabling legislation, Public Law 93-86 August 10, 1973, captures the original intent of the program:

> Sec. 1009. (a) "In furtherance of the purposes of this title, the Secretary of Agriculture is authorized and directed to develop and carry out a forestry incentives program to encourage the development, management, and protection of nonindustrial private forest lands. The purposes of such a program shall be to encourage landowners to apply practices which will provide for the afforestation of suitable open lands and reforestation of cutover and other nonstocked and understocked forest lands and intensive multiple-purpose management and protection of forest resources so as to provide for production of timber and related benefits."

At the national level, FIP is administered jointly by the U.S. Department of Agriculture (USDA) Forest Service, and the Consolidated Farm Service Agency (CFSA), formerly the Agricultural Stabilization and Conservation Service (ASCS). The Forest Service allocates FIP funds to the states, provides oversight and assures quality control over practice installation and the technical assistance provided by state foresters. CFSA is responsible for accomplishment reporting with assistance from the Forest Service. At the state and local level, state forestry agencies provide technical assistance to program participants by preparing forest management plans, determining the extent of cost-share required, and certifying practice completion. Local CFSA offices are responsible for determining landowner eligibility, processing applications, disbursing cost-share payments, and record keeping.

FIP has kept administrative costs low by cooperation among federal and state agencies. The ASCS/CFSA has not charged for the FIP cases directly, rather covering these expenses through their general operating funds. The USDA Forest Service and State Foresters are limited to a total 10% of FIP appropriations for all program expenses related to providing technical assistance to owners, writing plans, and monitoring practices. Thus 90% of the FIP appropriated dollars actually go to the field for cost-sharing with private landowners.

FIP was reauthorized in 1978 under the Cooperative Forestry Assistance Act (Public Law 95-313, Sec. 4, July 1, 1978). Under the 1990 Farm Bill, The Food Agriculture Conservation and Trade Act, a provision was included to terminate FIP on December 31, 1995 (Public Law 101-624, Sec. 1214, November 28, 1990).

Allocation of FIP Funds

In the original legislation authorizing FIP, Congress established specific criteria for allocating program funds among the states. It charged the Secretary of Agriculture to distribute funds to the states "only after assessing the public benefit incident thereto, and after giving appropriate considerati to..." The number and acreage of commercial forest lands, number of eligible owners, the potential productivity of these lands, and the need for reforestation, timber stand improvement, or other forestry investment on such lands (P.L 93-86 Sec. 1009, par. C). In addition to these considerations, Presiden Nixon added a provision that the program be cost-effective, making the return on the government's investment a prime consideration (Mills et al. 1974).

FIP is a national program with activities in all states, as well as in Puerto Rico. The approximately 25 major forestry states compete for FIP funds based on performance measures, but a minimum amount of FIP funding goes to all states for good forestry projects.

In developing a system for apportioning funds among counties within a given state, state CFSA (formerly ASCS) committees in consultation with State Foresters follow the same criteria followed by USDA in allocating funds to the states. Within states, consideration is also given to the availability of vendor services for tree planting, tsi, and site preparation work, the historic use of cost-sharing funds for forestry practices in the county, existence of forest landowner associations, and factors such as an adverse timber growth-drain ratio in the local area (Forest Farmer 1985). Additional considerations such as the opportunities for enhancing other forest resources and the proximity of the county to majo population centers where land would potentially be converted to non-forest use in the future are found in the former ASCS (now CFSA) FIP Handbook. States have the option of designating that FIP be available in all counties or in selected counties only.

Available Practices

Eligible landowners may apply for FIP cost-share assistance under three practices, FP1-tree planting, FP2-timber stand improvement, and FP3-site preparation for natural regeneration. A fourth category, SF-special forestry practices, allows ASCS and Forest Service officials discretion to provid for a "significant and unique local condition for which national FIP practices are not adequate" (USDA ASCS Handbook 1-FIP Revision 2 1992a).

FP1.– The purpose of FP1 is to establish a stand of trees for timber production and to preserve and improve the environment. Site preparation and tree planting are the primary components. Planting seedlings and direct seeding are authorized. If necessary, cost-share may be authorized for clearing land of unmerchantable trees and brush during site preparation. Weed control during the first year and prescribed burning may also receive cost-share assistance. Erosion control measures performed during site preparation also may be authorized.

Since FIP's primary objective is timber production, cost-sharing is not allowed for planting orchard trees, ornamentals, or Christmas trees. Other requirements and specifications such as eligible species, spacing, stocking rate, site preparation methods, cultivation and weed control standards are set by the local CFSA committee in consultation with the State Forester.

FP2.– The purpose of FP2 is to increase timber growth and quality on sites suitable for producing sawtimber and veneer logs. Timber stand improvement (tsi) activities such as non-commercial thinning, pruning crop trees, chipping, releasing desirable seedlings and young trees, and prescribed burning are eligible. Repeated prescribed burning on the same acreage is not allowed however.

FP3.– The purpose of FP3 is to establish a stand of trees through natural regeneration methods for timber production. Authorized activities include: reducing or eliminating competing vegetation, enhancing soil conditions for natural seeding, and erosion control measures performed as part of the site preparation process. Seed sources of commercially desirable trees must be in adequate supply prior to site preparation. If natural regeneration fails to meet certain standards due to uncontrolled circumstances, cost-sharing may be authorized for one additional treatment.

Additional requirements common to all FIP practices are:

* Landowners must assume responsibility for protecting the practice against destructive fire and grazing, allowing funds to be directed to actual practice implementation rather than for firelines and fences.

* All practices must be maintained for at least 10 years after installation and establishment. If this requirement is not met, CFSA will recover a proportion of the cost-shares paid to the landowner based on the length of time the practice was actually in place.

* Any chemicals used must be federally, state, and locally registered, and applied legally and according to label directions. All other federal and state policies and regulations must be complied with.

* When implementing any FIP practice, care must be taken to protect and maintain water quality and to preserve and improve the overall quality of the environment.

* A forest management plan is required, usually prepared by a Service Forester employed by the state forestry agency under direction of the State Forester. Private forestry consultants may also prepare FIP plans on behalf of the landowner, but cost-share assistance is not available to pay for this service and the plan must be approved by the Service Forester.

* Treatments specified in the forest management plan must provide the most economic, efficient, and effective measures for increasing timber production as well as other associate forest resources.

Cost-Share Rate

The maximum cost-share payment a landowner may receive in any given year is $10,000. The current maximum cost-share rate a landowner may receive under FIP is 65% of the total cost of implementing the practice. State and county level CFSA committees, in consultation with the State Forester, have authority to set cost-share rates below this national maximum within their jurisdiction, but cannot exceed this rate. Over the program's 20 year history, cost-share rates have fluctuated between 50% and 75% in different states.

Most FIP contracts are set up as annual agreements and the landowner is expected to complet the practice within 12 months. Extensions may be granted by the local CFSA committee if the landowner is unable to complete the practice due to unforeseen circumstances such as inclement weather or seedlings being unavailable.

Long-term agreements (LTA's) are an option for large-scale projects over 40 acres in size, which will take longer than one year to complete. Under a LTA, a landowner can plan tree planting and tsi practices over a period of 3 to 10 years and be assured of receiving cost-share funds in future years. The $10,000 maximum annual payment limitation applies to LTA's as well as annual contracts. LTA's allow landowners enrolling large acreages the opportunity to implement practices over one or more years, without having to reapply and enter into a new contract each year.

Eligibility Requirements

To be eligible for participation in FIP, landowners must meet all of the following requirements:

(1) Eligible landowners include individuals, groups, American Indian tribes or other native American groups, associations, and corporations or other legal entities without publicly traded stock. Such owners must not be engaged in the business of manufacturing forest products or providing any type of public utility services. Federal, state, and local governments are also excluded. In addition, FIP is available only to owners of eligible lands and not to tenants.

(2) Landowners cannot own more than 1,000 acres of NIPF land (this was increased from an upper limit of 500 acres at the start of the program). A waiver may be obtained from the Secretary of Agriculture for landowners owning up to 5,000 acres of NIPF land if it is determined that significant public benefit will accrue from FIP cost-share practices.

In addition to landowner eligibility requirements, the land upon which the practice is to be implemented must also meet certain requirements.

(1) The land must be capable of producing a minimum of 50 cubic feet of wood per acre per year.

(2) The land must be capable of supporting tree growth if currently not forested.

(3) A minimum of 10 acres is required for each separate practice cost-shared. This limit became effective in 1977 after an early evaluation of the program's cost effectiveness (Risbrudt and Ellefson 1983).

(4) NIPF land as defined in the ASCS FIP Handbook includes "rural lands with existing tree cover and other lands including cropland, pastureland, surface mined lands, and nonstocked forest land."

Applications and Selection of Landowners

Landowners apply for cost-share assistance under one or more of the available FIP practices by filing an application at the local CFSA office. Once CFSA has determined that the landowner is eligible, the Service Forester determines if the land meets FIP eligibility requirements and whether the practice is needed. The Service Forester will assign a priority rating to the request, based on the cost effectiveness of the practice. For example, high priority practices involve planting trees on marginal cropland, and tree planting and tsi on tracts 40 acres or larger. The Service Forester then prepares a

forest management plan based on the landowner's objectives, outlining specific silvicultural prescriptions required to successfully complete the practice and a time schedule for their implementation. The CFSA committee then decides whether to approve, disapprove, or defer the request for future consideration.

Once a FIP request has been approved, the landowner may begin implementation of the practic as outlined in the forest management plan. Once complete, the landowner notifies CFSA and submits all necessary invoices of costs incurred. CFSA then notifies the Service Forester that the practice has been completed and asks the forester to make a field inspection and certify that the practice was successfully completed. CFSA then disburses the cost-share payment to the landowner. To ensure th practices are being adequately maintained and in compliance for the ten year duration of the contract, CFSA, along with the Service Forester, will periodically make on-site spot checks.

Other Cost-Share Programs

The Forestry Incentives Program is only one of the existing federal cost-share programs designed to encourage tree planting, forest management, and overall resource enhancement of NIPF lands. All of these programs are components of broader U.S. agricultural and forest policy.

The Agricultural Conservation Program (ACP) was developed as a response to the "dust bowl problems of the 1930s as part of the Soil Conservation and Domestic Allotment Act of 1936 and has been reauthorized in various forms over the years. A general farm program designed to encourage resource conservation practices, ACP also includes cost-share assistance for tree planting, timber stan improvement, site preparation for natural regeneration, and wildlife habitat improvement. Unlike FIP however, the general intent of ACP is not to increase timber production, but rather to promote soil an water conservation. Under ACP there is neither a minimum productivity standard nor a minimum acreage limitation, as there is with FIP. Compared with the program's total expenditures, cost-sharing for forestry practices has been fairly limited. From 1960 through 1986, only about 1% to 2% of the annual ACP funds were spent on planting trees and shrubs. However, total forestry accomplishments are significant. During this period, approximately 2.9 million acres were planted in trees and 2.7 milli acres received tsi (Cubbage et al. 1993). From 1987 to 1994, ACP funded about an additional 1.1 million acres of tree planting and 330 thousand acres of tsi.

The Conservation Reserve Program (CRP), originally authorized under the 1985 farm bill, and reauthorized in the 1990 farm bill, was designed to retire highly erodible cropland from agricultural production and place it into permanent vegetation for a period of 10 years. In addition to the primary objective of reducing soil erosion on highly erodible cropland, CRP also seeks to protect the nation's long-term capability to produce food and fiber, reduce sedimentation, improve water quality, enhance wildlife habitat, reduce the production of surplus commodities, and provide income support for farme (Osborn et al. 1990). Landowners or operators are reimbursed a 50% cost-share for establishing gra trees, or wildlife habitat. In addition, they receive annual rental payments for the ten year contract

period to offset income lost from not producing crops on the enrolled land. Rental payments are determined through competitive bidding.

In general, the CFSA has the same administrative role for ACP and CRP as it does for FIP. The USDA Natural Resources Conservation Service (NRCS), formerly the Soil Conservation Service (SCS), is primarily responsible for providing technical assistance to ACP and CRP cooperators, except that the State Foresters are responsible for forestry practices under both programs.

More than 36 million acres of cropland had been enrolled under CRP as of 1994, with about 2.5 million acres planted in trees (Moulton 1994). Tree planting acres comprised 6.8% of the total acreage enrolled in the program, falling short of the 12.5% goal established in 1985. Most of the tree planting has occurred in the South. The 13 southern states enrolled over 90% of the total tree planting acres nationwide. Georgia alone planted 646,000 acres (26% of all tree planting), and Mississippi planted 515,000 acres (21% of all tree planting).

Under the 1990 Farm Bill, CRP was reauthorized and revised. Additional incentives were established to bring more tree planting, specifically hardwood trees, into the program. Contracts and annual rental payments may be extended for up to 15 years for planting hardwood trees. Contracts for softwoods remain at 10 years. Farmers also have the option of converting prior enrolled CRP grass lands to trees and extending the contract period up to 15 years. However, reduced funding levels kept post-1990 tree planting accomplishments--focused mostly on wetlands--relatively small.

The Stewardship Incentive Program (SIP), authorized for the first time under the 1990 Farm Bill, was designed to complement the newly created Forest Stewardship Program (FSP) by offering a broad range of financial incentives to implement multi-resource enhancements recommended in approved Stewardship plans. The Stewardship approach involves total resource management, a much broader intent than that of FIP, which is primarily a timber production program. In 1993, nine cost-share practices were available under SIP: management plan development; reforestation and afforestation; forest and agroforest improvement; windbreak and hedgerow establishment, maintenance, and renovation; soil and water protection and improvement; riparian and wetland protection and improvement; fisheries habitat enhancement; wildlife habitat enhancement; and forest recreation enhancement.

Unlike other USDA cost-share programs, administration of SIP lies with the U.S. Forest Service at the federal level and the State Foresters at the state level. CFSA provides general support by processing applications, disbursing payments, and keeping records. The states have a great deal of autonomy in developing a state stewardship plan tailored to local needs, under the guidance of state stewardship committees. Congress authorized $100 million per year for SIP for fiscal years 1991 through 1995, however actual appropriations were less than $20 million annually for the first two years.

PROGRAM ACCOMPLISHMENTS

From its inception in 1974 through FY 1992, FIP has been responsible for over 4.36 million acres of tree planting, timber stand improvement, and site preparation for natural regeneration on our nation's nonindustrial private forest lands (Table 1). By 1994, this increased to more than 4.6 million acres, including approximately 3.32 million acres of tree planting, 1.45 million acres of timber stand improvement, and 0.27 million acres of site preparation for natural regeneration. Figure 1 summarizes the FIP accomplishments and expenditures from the program inception through 1992. Cumulative U.S program accomplishments are summarized in the first two tables in the Appendix.

The federal government has distributed approximately $202.8 million in FIP cost-shares to ove 123,000 landowners through 1992. The program's greatest success rests with planting over 2.95 million acres of trees (68% of the total acres treated), involving some 78,637 landowners, with a total investment of $166.823 million in cost-share dollars (82% of the total program cost). Tsi and site preparation for natural regeneration comprised smaller shares of accomplishments.

Regional Distribution

We summarized the distribution of FIP activities by USDA Forest Service Region (Figure 2, Table 2). Detailed summaries of the annual and cumulative FIP regional accomplishments by number participants, number of acres, and dollars expended are attached in the Appendix. The Forest Service Region 9 encompasses the Northeastern Area of State and Private Forestry, and is referred to as NA i the Appendix tables and figures. Region 10, Alaska, is not included due to its extremely limited participation in the program.

As indicated in Table 2 and in the detailed breakdowns in the Appendix, a majority of FIP accomplishments have occurred in the South (USDA Forest Service Region 8). The 13 southern state enrolled almost 3.2 million acres in the program, 73% of the total. In the USDA FS Northeastern Are (Region 9), which includes the Northeast and North Central states, 961,828 acres had been enrolled through FY 1992, 22% of the total (Figure 3). Smaller total FIP activities have occurred in the remainder of the nation, but each state has had some activity.

The Southern Region has led the nation in tree planting under FIP, planting over 2.66 million acres, 90% of all tree planting under the program by 1992 (Figure 2). This is not surprising considerir that the South holds one-half of the nation's total NIPF land and produces more than 50% of the nation's annual timber harvest. Ten southern states have each planted more than 178,000 acres of tree under the program (Table 1). North Carolina leads the nation in FIP tree planting accomplishments, with over 323,000 acres.

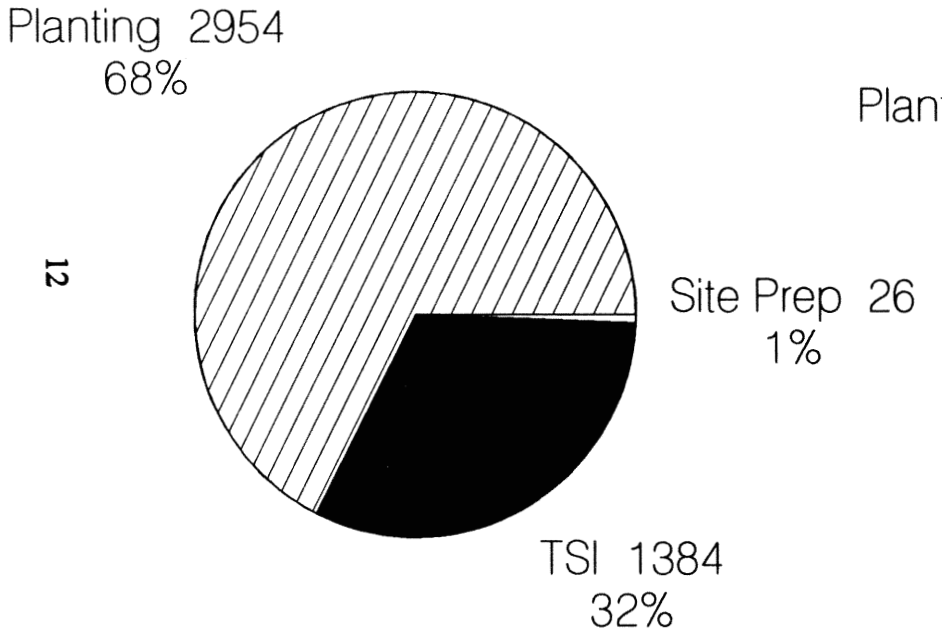
Table 1. FIP Accomplishments By State and Practice 1974-1992

State	FIP Practice			
	Tree Planting	Timber Stand Improvement	Site Preparation	Total
	acres			
Alabama	311,585	32,019	890	344,494
Alaska	0	42	0	42
Arizona	15	2,193	0	2,208
Arkansas	189,661	116,499	7,361	313,521
California	9,710	10,499	0	20,209
Colorado	247	5,365	10	5,622
Connecticut	1,440	8,644	0	10,084
Delaware	6,919	2,155	0	9,074
Florida	262,676	10,114	233	273,023
Georgia	292,558	26,291	1,038	319,887
Hawaii	270	0	0	270
Idaho	1,516	3,558	22	5,096
Illinois	3,576	35,343	591	39,510
Indiana	3,948	79,858	1,807	85,613
Iowa	3,305	8,022	31	11,358
Kansas	705	5,696	0	6,401
Kentucky	9,637	57,933	1,591	69,161
Louisiana	178,290	50,200	2,314	230,804
Maine	8,560	21,977	274	30,811
Maryland	26,141	14,339	121	40,601
Massachusetts	501	38,258	132	38,891
Michigan	30,770	43,762	25	74,557
Minnesota	18,352	13,375	631	32,358
Mississippi	301,120	33,166	1,146	335,382
Missouri	12,650	98,544	15	111,209
Montana	220	5,320	117	5,657
Nebraska	834	2,900	0	3,734
Nevada	526	56	0	582
New Hampshire	199	33,519	897	34,615
New Jersey	1,817	14,371	0	15,558

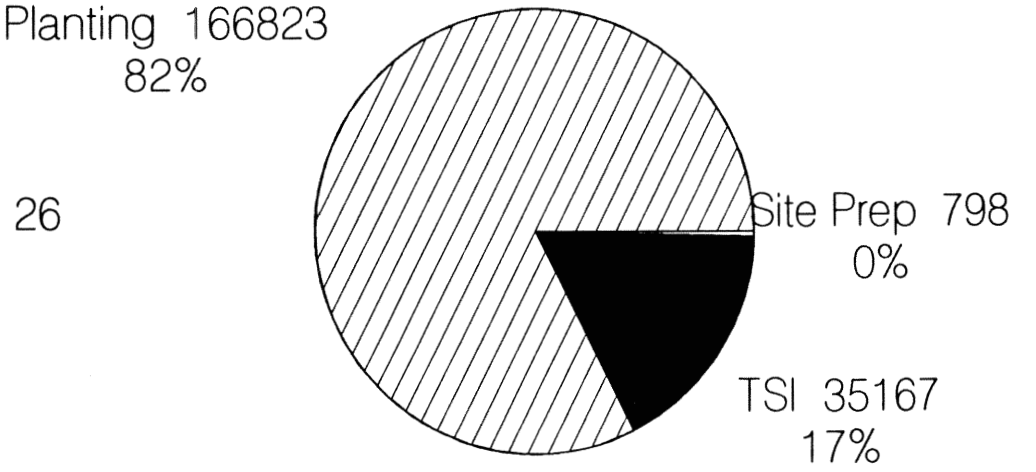
Table 1. FIP Accomplishments By State and Practice 1974-1992 (continued)

State	FIP Practices			
	Tree Planting	Timber Stand Improvement	Site Preparation	Total
	acres			
New Mexico	77	7,423	0	7,500
New York	4,792	68,779	120	73,691
North Carolina	323,414	20,841	796	345,051
North Dakota	280	203	0	483
Ohio	13,946	80,591	1,171	95,708
Oklahoma	19,918	37,406	363	57,687
Oregon	49,779	25,040	0	74,761
Pennsylvania	7,439	40,081	241	47,761
Puerto Rico	1,268	10	0	1,278
Rhode Island	176	2,602	10	2,788
South Carolina	246,083	14,850	312	261,245
South Dakota	69	4,761	0	4,830
Tennessee	30,051	18,520	425	48,996
Texas	178,475	55,192	0	233,667
Utah	43	52	0	95
Vermont	417	24,611	234	25,262
Virginia	316,754	47,933	295	364,982
Washington	40,786	11,942	20	52,748
West Virginia	8,382	100,140	115	108,637
Wisconsin	34,370	34,948	3,146	72,464
Wyoming	47	13,624	0	13,671
Total	2,953,684	1,383,517	26,494	4,363,659

Accomplishments by Practice, 1974-1992



Thousand Acres



Thousand Dollars

Table 2. FIP Accomplishments by Practice and Forest Service Region, 1974-1992

	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 8	Region 9	Region 10	Total
	acres									
Tree Planting	2,016	1,902	92	569	9,980	90,565	2,660,222	188,338		2,953,684
TSI	9,081	32,346	9,616	108	10,499	36,982	520,914	763,929	42	1,383,517
Site Prep. for Nat. Regen.	139	10				20	16,764	9,561		26,494
Total	11,236	34,258	9,708	677	20,479	127,567	3,197,900	961,828	42	4,363,695
% of Total Acres	<1%	<1%	<1%	<1%	<1%	3%	73%	22%	<1%	

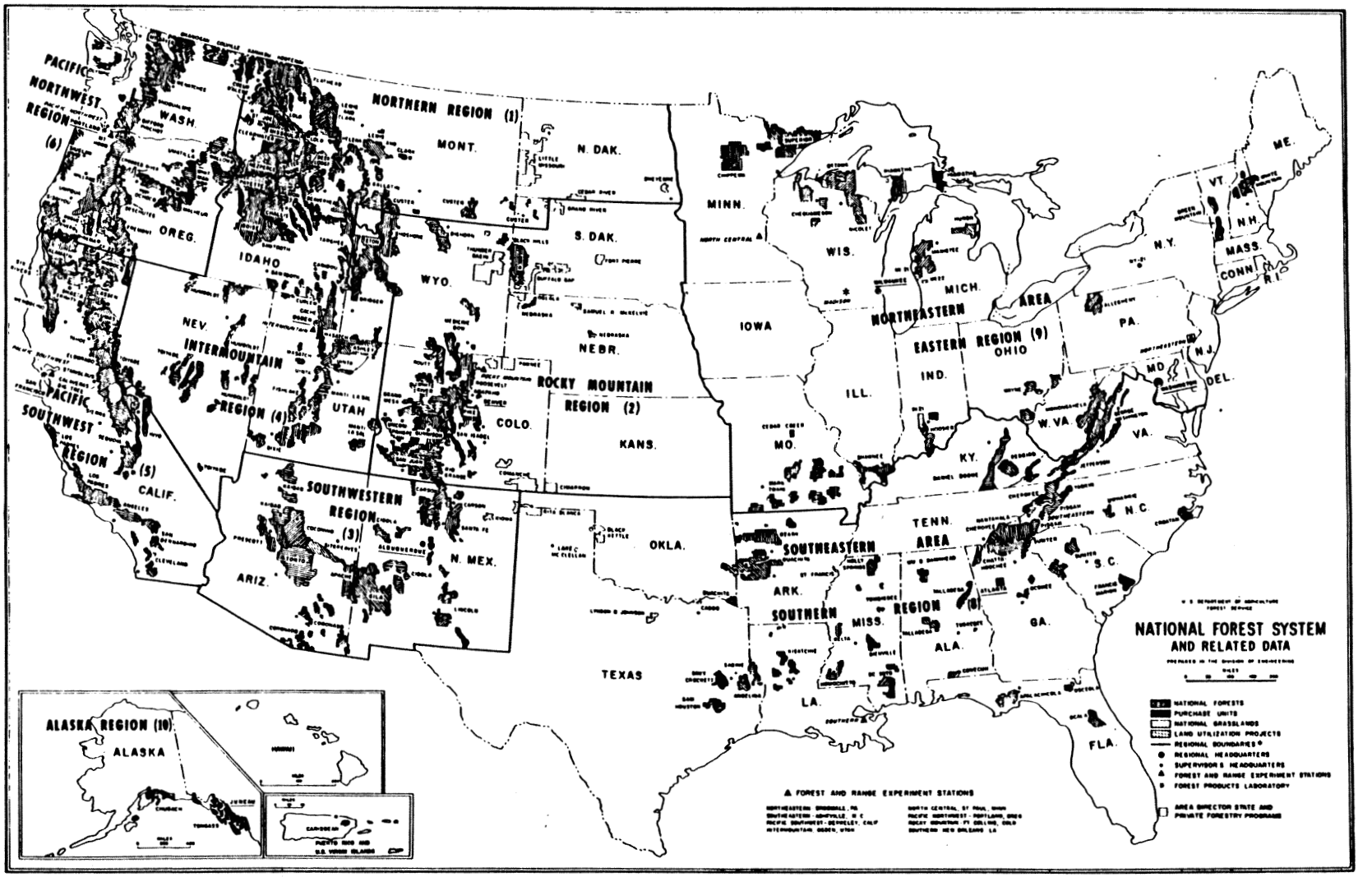
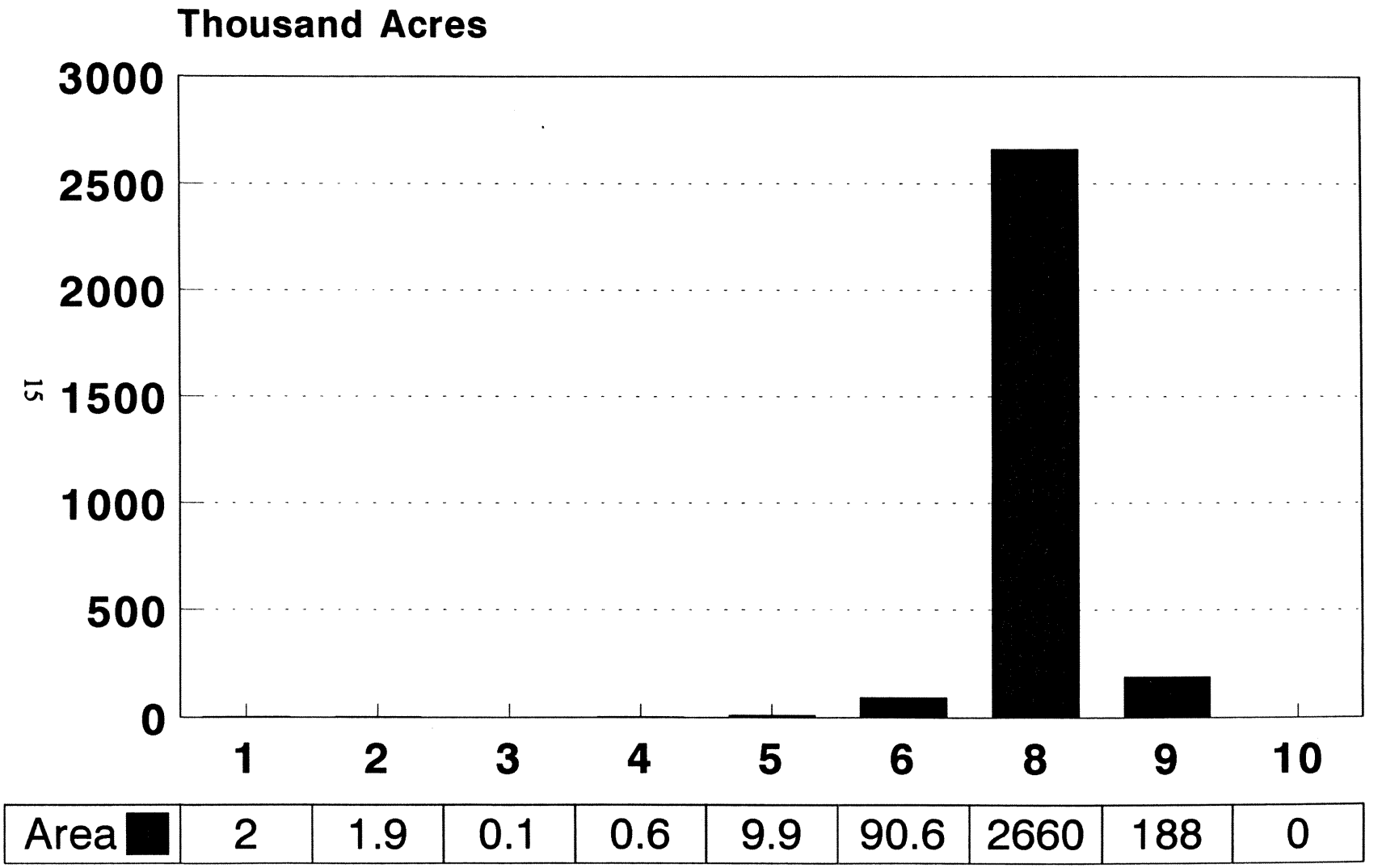


Figure 2. Map of USDA Forest Service Regions

Figure 3. FIP Tree Planting, 1974-1992 Accomplishments by USFS Region



Virginia, Alabama, and Mississippi have all planted over 300,000 acres each. The only other region where FIP has made a significant impact in tree planting has been in the Pacific Northwest. Oregon and Washington combined planted slightly over 90,000 acres of trees under FIP.

As of 1992, timber stand improvement practices have been conducted on 1,383,517 acres, 32% of the total acres treated (Figure 4). About 55% of all tsi has occurred in the Northeastern Area, with 38% in the South. Arkansas leads the nation in timber stand improvement, having treated 116,499 acres, followed by West Virginia, Missouri, Ohio, and Indiana, each with over 75,000 acres of tsi.

Site preparation for natural regeneration (Figure 5) has also occurred primarily in the South--16,764 acres (63% of the total)--and in the Northeast, 9,561 acres (36% of the total). The practice, however, has been small, constituting less than one percent of the total acres treated. Almost 28% of the total acres treated for natural regeneration have occurred in Arkansas (7,361 acres). Wisconsin is the second leading state with 3,146 acres. Louisiana, Indiana, Kentucky, Ohio, Mississippi, and Georgia each treated over 1,000 acres for natural regeneration.

Historical Trends

Tables 3, 4, and 5 summarize the annual FIP accomplishments for tree planting, tsi, and site preparation for natural regeneration, as well as total expenditures, number of participants, and net average cost per acre including the administrative costs. The data and graphs in the Appendix provide regional summaries of this data. The dollar figures are in nominal terms, as expended for that given year. Accounting for inflation would decrease the effective increases in expenditures.

Tree planting cost-share expenditures increased from $6.55 million in 1974 to a peak of $14.8 million in 1981. Tree planting accomplishments peaked in 1980, at 218,960 acres. Only 1979, 1980, and 1981 had tree planting totals exceeding 200,000 acres. Recent years have had planting rates of 150,000 to 175,000 acres. The number of participants has ranged from 3,000 to 4,200 persons since 1982. The average cost-share expenses per acre increased until 1982, and then actually dropped in the early 1980s. This was caused largely by a pervasive decrease in the cost-share rate from 75% to lower rates in many states. Since that drop, costs per acre increased over time again, as one would expect.

Tsi cost-share funding and acres treated were highest in the initial years of the program, and declined fairly consistently until the late 1980s. The participants, acres, and expenditures increased slightly in the 1990s. In this case, average cost per acre increased over time, with no perceptible drop in the early 1980s. FIP site preparation for natural regeneration just began as a separate practice in 1982 and its total accomplishments are extremely small. Its costs per acre averaged only about one-half those of tree planting.

Figure 4. FIP Timber Stand Improvement, 1974-1992 Accomplishments by USFS Region

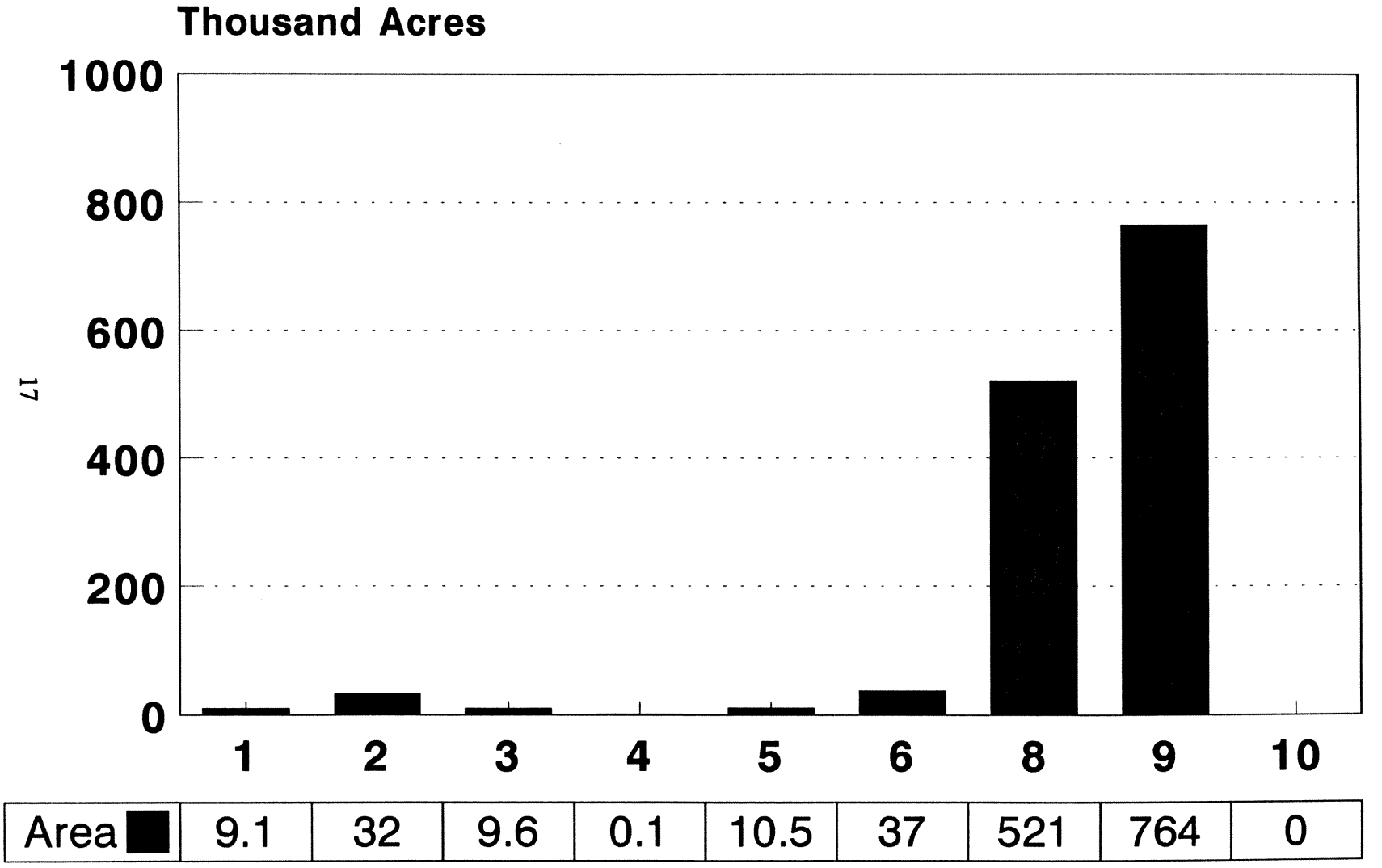


Figure 3. FIP Site Preparation, 1974-1992 Accomplishments by USFS Region

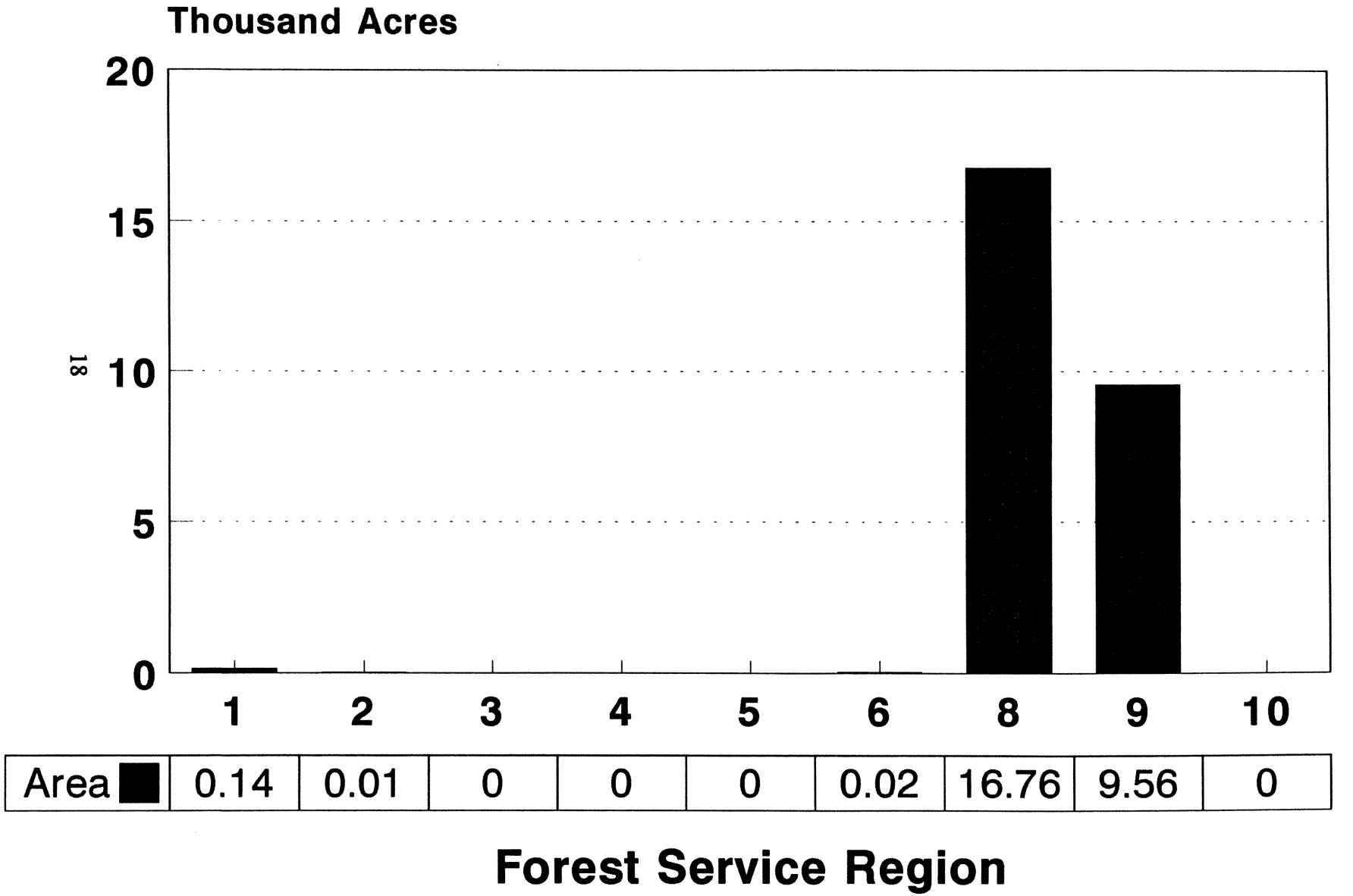


Table 3. FIP Tree Planting, 1974-1992

Year	Acres	$ Cost-Share	Cost-share $ per acre	# Participants
1974	168,005	6,548,510	38.98	n.a.
1975-76	107,509	5,156,741	48.17	5,769
1977	152,750	7,145,640	46.78	5,259
1978	168,814	8,663,349	51.32	5,099
1979	211,987	11,537,856	54.43	5,737
1980	218,960	13,356,971	61.00	6,091
1981	211,218	14,794,482	70.04	6,215
1982	155,181	10,087,195	65.00	4,616
1983	143,333	8,475,622	59.13	4,253
1984	129,959	6,851,333	52.72	3,486
1985	167,307	8,694,799	51.97	4,358
1986	189,978	9,983,720	52.55	4,892
1987	118,455	6,429,540	54.28	3,035
1988	157,410	9,255,538	58.80	4,060
1989	164,133	9,717,160	59.20	4,022
1990	150,717	9,389,663	62.29	3,670
1991	176,201	10,651,194	60.45	4,146
1992	161,767	10,083,871	62.33	3,929
Total (Avg.)	2,953,684	166,823,184	56.48	78,637

Table 4. FIP Timber Stand Improvement, 1974-1992

Year	Acres	$ Cost-Share	Cost-share $ per acre	# Participants
1974	125,357	2,559,133	20.41	n.a.
1975-76	167,873	2,953,136	17.59	5,124
1977	155,158	3,168,685	20.42	4,899
1978	154,082	3,344,141	21.70	4,705
1979	117,585	2,847,306	24.21	4,239
1980	122,980	3,228,985	26.26	4,540
1981	102,602	2,815,462	27.44	3,790
1982	74,321	2,030,366	27.32	2,936
1983	58,353	1,692,628	29.01	2,400
1984	33,345	1,020,498	30.60	1,369
1985	37,133	1,240,501	33.41	1,585
1986	35,830	1,202,082	33.55	1,426
1987	26,138	917,217	35.09	1,001
1988	29,389	1,099,669	37.42	1,100
1989	30,533	1,042,790	34.15	1,012
1990	33,199	1,154,582	34.78	1,094
1991	36,447	1,318,432	36.17	1,247
1992	43,192	1,531,866	35.47	1,243
Total (Avg.)	1,383,517	35,167,479	25.42	43,710

Table 5. FIP Site Preparation for Natural Regeneration, 1982-1992

Year	Acres	$ Cost-Share	Cost-Share $ per acre	# Participants
1982	57	2,759	48.40	4
1983	1,485	34,404	23.17	39
1984	2,326	62,994	27.08	62
1985	2,592	73,573	28.38	75
1986	2,776	76,300	27.49	89
1987	2,514	70,442	28.02	71
1988	2,455	68,314	27.83	67
1989	3,617	108,879	30.10	78
1990	2,811	96,822	34.44	72
1991	2,374	83,309	35.09	81
1992	3,487	120,349	34.51	96
Total (Avg.)	26,494	798,145	30.13	734

Total cost-share funding under FIP has varied in nominal dollar terms from 1974 to 1992, with a peak of $17.6 million in 1981, and has been fairly uniform since 1983 (Table 6, Figure 6). Note that the total expenditures vary slightly from the uniform appropriations for each year, depending on the number of practices enrolled and completed. Thus, total area treated under the program has declined somewhat. This is caused by increasing average treatment costs in face of constant nominal dollar funding and by a shift from the cheaper tsi practice to the more expensive planting practice. Real dollar expenditures (taking out the effect of inflation) have declined substantially as inflation has eroded the purchasing power of the constant appropriation levels from a peak of $10.4 million in 1981 to about $4.3 million in 1992.

Secondary Impacts

Incentive programs such as FIP not only provide direct benefits in the form of cost-shares to participants, but they also provide secondary benefits that are difficult to quantify. In 1993, several State Foresters were contacted to assess the secondary impacts that have resulted from FIP funding in their respective states; some comments are paraphrased below.

Most state foresters support retention of FIP as a supplement to SIP. They note that FIP provides increases in timber supply, revenues associated with sustained yield management, and other less tangible benefits such as the enhancement of aesthetics, soil and water quality, and wildlife habitat. There also has been a correlation between cost-share funding and the development of private vendors providing tree planting services to landowners.

In Virginia, the combination of FIP and a state-funded reforestation cost-share program have created opportunities for the development of private vendors who provide tree planting and herbicide services to private landowners in that state. In addition, the combination of federal and state cost-share programs has resulted in sustaining the pine resource and in the process provided diverse wildlife habitat. Because of administrative funds allocated to the state, four additional forester positions have been secured to provide on-the-ground technical assistance to forest landowners.

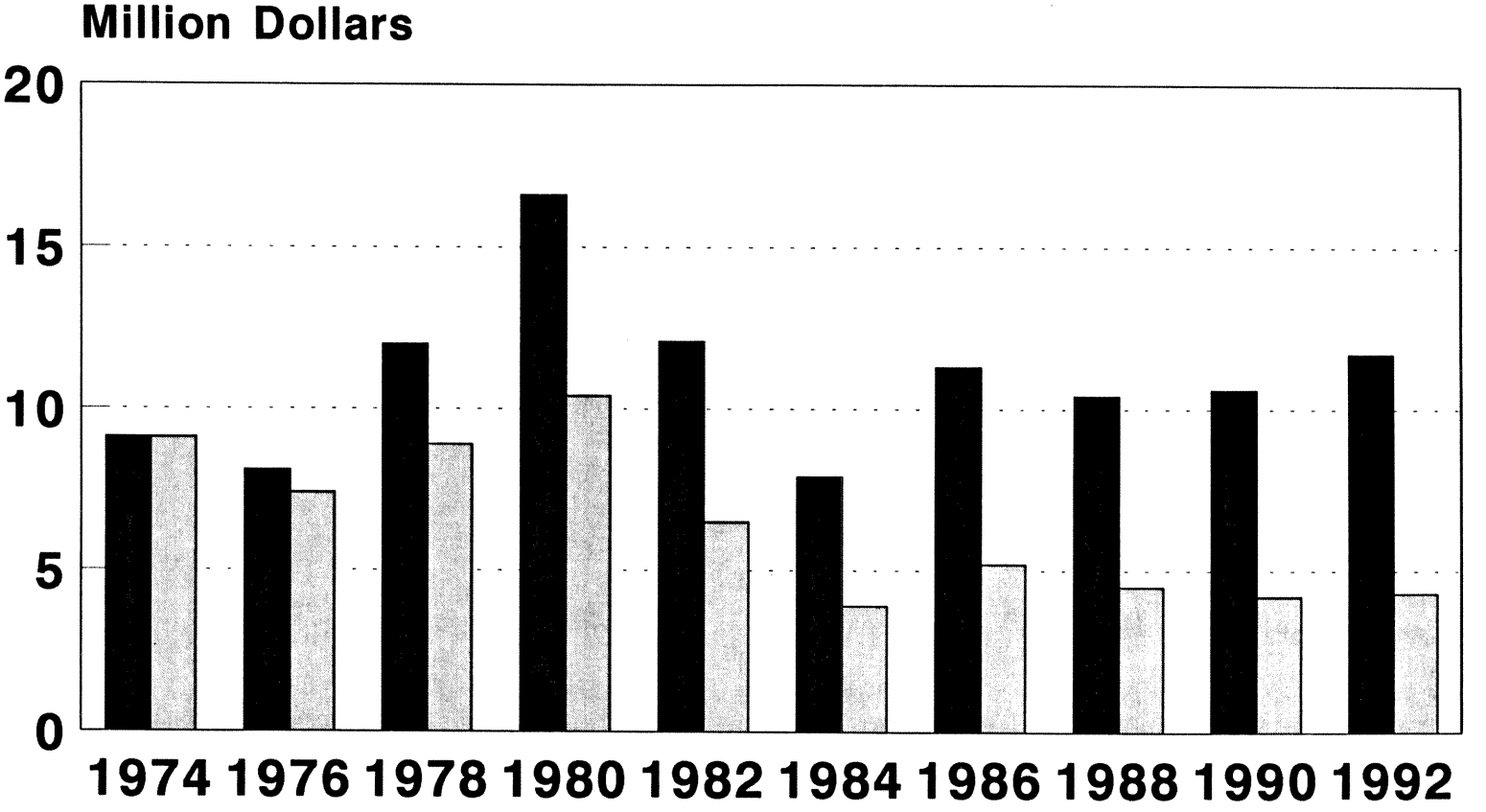
In South Carolina, the State Forester noted a strong correlation between a thriving forest products industry and NIPF timber growers. Spin-off effects of FIP included sustaining site preparation and tree planting vendors, and technical assistance money received by the State Forestry Commission, which supports funding for two to three foresters to administer the program.

To improve program effectiveness, Tennessee instituted a practice priority hierarchy to assure cost-effectiveness of the FIP funds allocated to the state. For instance, bare-land plantings have highest priority and are awarded FIP cost-shares before more expensive site preparation plus tree planting practices. In addition, the state chose to

Table 6. Total FIP Accomplishments, 1974-1992

Year	Acres	$ Cost-Share	Deflated Real Dollars	# Participants
1974	293,362	9,107,643	9,107,643	n.a.
1975-76	275,382	8,109,877	7,399,523	10,893
1977	307,908	10,314,325	8,281,696	10,158
1978	322,896	12,007,490	8,935,303	9,804
1979	329,572	14,385,162	9,856,937	9,976
1980	341,940	16,585,956	10,378,954	10,631
1981	313,820	17,609,944	10,017,939	10,005
1982	229,559	12,120,320	6,492,470	7,556
1983	203,171	10,202,654	5,249,988	6,692
1984	165,630	7,934,825	3,910,948	4,917
1985	207,032	10,008,873	4,757,196	6,018
1986	228,584	11,262,102	5,217,206	6,407
1987	147,107	7,417,199	3,329,498	4,107
1988	189,254	10,423,521	4,503,371	5,227
1989	198,283	10,868,829	4,502,168	5,112
1990	186,727	10,641,067	4,230,157	4,836
1991	215,022	12,052,935	4,624,921	5,474
1992	208,446	11,736,086	4,330,135	5,268
Total	4,363,695	202,788,808	---	123,081

Figure 3.1.1: Total Expenditures, 1974-1992 Selected Years, Nominal and Deflated



	1974	1976	1978	1980	1982	1984	1986	1988	1990	1992
Nominal	9.1	8.1	12	16.6	12.1	7.9	11.3	10.4	10.6	11.7
Deflated	9.1	7.4	8.9	10.4	6.5	3.9	5.2	4.5	4.2	4.3

Year

discontinue funding of hardwood tree planting and hardwood tsi to increase the program's cost-effectiveness. Faced with a lack of forestry vendors at the inception of the program, the Division of Forestry recruited forestry students at the University of Tennessee to form their own vendor crews during undergraduate summer vacations to make money and gain forestry experience helping landowners install FIP practices. Out of this venture, at least two private forestry consulting firms we formed.

Delaware's State Forestry Office reported that FIP has helped increase tree planting contracto from three to five in the past five years, as well as aided expansion of at least one existing contractor's business. To accommodate increased demand for tree planting, additional workers have been hired, from six per crew just five years ago to twelve in 1993. FIP also encouraged more landowners to pla and improve larger acreages than they would have been willing to undertake without cost-share assistance. As a result, whole tree chipping operators and firewood harvesters are now in demand fo to six months per year, up from just one month per year five years ago.

In evaluating the secondary impacts of Virginia's Reforestation of Timberlands Program, a sta funded tree planting cost-share program, Flick and Horton (1981) found that most of the program's vendors were farm laborers who supplemented their incomes during the winter months by planting trees. While average earnings were estimated to be about equal with minimum wage, the authors suggest that even small amounts of supplemental income can make a big difference to individual families, especially in rural counties where the program is most active.

FIP and other cost-share programs have provided an opportunity for many private vendors to form and expand existing businesses. Vendors provide site preparation and tree planting services, herbicide treatments, and tsi work on a fee basis for landowners who are not equipped or perhaps dor have the time or expertise to perform the work on their own. Vendors often offer the only alternative landowners have to get trees planted and to perform tsi and other forestry work, even on modest acreages. Vendor jobs help to stimulate local economies. In 1974, 59 percent of the planting and 38 percent of the nonplanting treatments accomplished under FIP were performed by private vendors (Mills 1976). Vendor services were used on 80 percent of the tree planting contracts in the South in 1974, compared with 25 percent in the Lake States.

PROGRAM EVALUATIONS

FIP performance was to be evaluated and reported to Congress on a periodic basis to fulfill th requirements of the law. The USDA also required early evaluation of FIP, as it does for all new programs, and an interagency Program Development Committee established by the department asked for a thorough evaluation of FIP. Many forestry analysts have also examined the effects of FIP as pa of their individual or cooperative research. Studies have been conducted on the economic efficiency the program, practice retention rates, capital substitution, equity, NIPF behavior and response, and subsidiary effects.

Economic Efficiency

Mills and Cain (1978) analyzed the performance of FIP for 1974, the first year of implementation. A total of $8.3 million in federal funds was spent on this initial cost-share. Program delivery costs estimated at $3.8 million. Private costs were estimated at $3.0 million. Because the primary objective as specified in P.L. 93-86 was for increased timber production, benefits computed in benefit/cost analysis were calculated from expected increases in timber yield. Mills and Cain used marginal analysis to compare the expected timber production returns from implementation of the program with expected timber production returns in the absence of the program (current regime). The current regime was characteristic of the typical management activities undertaken by landowners not receiving assistance funds. Both sequences were assumed to be repeated in perpetuity and discounted back to allow comparison of different time horizons inherent in the regimes. Intense regimes were assumed to result in sawtimber rotations with commercial thinnings included when merchantable.

Taxes were excluded from consideration because they do not affect productivity of investments. Annual management costs were also excluded. Land costs were excluded because the effect would be the same in both regimes and thus would cancel out in calculations. It was assumed that practices were retained through final harvest, follow up treatment was implemented as needed, and subsequent rotations were of the same intensity. Stylized management regimes were developed based on species groupings, site index ranges, geographic regions and initial practice category. Yields were computed in mean annual increment (MAI) in cubic feet per acre per year.

Estimates of future stumpage prices were made for 17 softwood, 23 hardwood and 3 pruned Eastern species and 10 special Western softwood species. Prices were then varied by region to account for logging factors such as accessibility, competition, terrain, and quality. Grade variations for hardwood improvement cuts were included. Predicted future price increases were applied to the data based on trend and regression analysis performed by a variety of sources (Mills and Cain 1978).

All expenditures were analyzed under four different cost options to determine the internal rate of return (IRR), present net worth (PNW), and benefit/cost ratio (B/C) associated with the expected increase in timber yield. These cost options were:

(1) Direct costs: federal and private direct costs.
(2) Total costs: the direct cost plus the program delivery cost per case.
(3) Public costs: federal cost-share plus the program delivery cost per case.
(4) Private costs: landowner direct cost (Mills and Cain 1978).

The returns were evaluated at four different discount rates to test the sensitivity of the findings and to meet evaluation requirements. These rates were:

(1) The Office of Management and Budget's rate of 10%.
(2) The current nominal rate of return of 7-1/2%.
(3) The 1977 Water Resources Council rate of 6-3/8%.
(4) The real rate on government bonds at the time of the study of 3%.

All costs and prices were "real costs," including relative or real price changes and the results can be considered exclusive of inflationary effects. These results are summarized in Table 7.

The direct cost option generated an average IRR of 10.2%. Adding in the delivery costs reduced the IRR to 9.4% for the total cost option. Public costs had a IRR of 10.2% and private costs an IRR of 14.9% (Mills and Cain 1978).

The total B/C ratio was 1.0 or greater in every case except under the total cost option at a 10 discount rate, which generated a B/C ratio of 0.9. For the 6-3/8% discount rate, the B/C ratio ranged from 3.0 for total cost to 16.0 for private costs. The 3% rate showed very high B/C ratios under all cost considerations, ranging from 31.8 for total costs to 114 for private costs (Mills and Cain 1978).

Risbrudt and Ellefson (1983) evaluated the 1979 FIP under the same cost options using discount rates of 10% as required by the Office of Management and Budget, and 7.125% and 4% as directed by the 1982 Forest Service Manual. Costs and stumpage prices used were in real dollars, as was the IRR. Results are shown in Table 8.

The total B/C ratio was 1.0 or greater in every case except under the total cost option at a 10% discount rate which generated a B/C ratio of 0.9. For the 6-3/8% discount rate, the B/C ratio ranged from 3.0 for total cost to 16.0 for private costs. The 3% rate showed very high ratios under all cost considerations, ranging from 31.8 for total costs to 114 for private costs.

Average internal rates of return ranged from 8.26% to 10.94%. Present net worth calculation generated a wide range of values--from $31 to $80 per acre using a 10% discount rate to values great than $1500 per acre using the 4% rate. Total PNW for all lands treated was estimated to range from $8.3 million to $426.8 million depending on cost option and discount rate. All benefit/cost ratios wer greater than 1.0.

More than 40% of all cases achieved the 10% rate of return under all cost options. At least 55% of the cases exceeded the 7.125% hurdle rate for all options and over 72% exceeded the 4% hurdle rate for all options.

Table 7. Aggregate financial returns for the 1974 Forestry Incentives Program by cost treatment option.

	Financial Return Measure					
Cost Option	Average IRR (%)	Real discount rate (%)	Total NPV ($ mill.)	Avg. NPV ($/acre)	Total b/c ratio	Cases earning discount rate (%)
Direct costs (federal & private)	10.2	10	7.9	31	1.9	45
		7-1/2	40.0	122	3.6	67
		6-3/8	54.0	213	5.6	75
		3	605.8	2395	54.2	83
Total costs (federal, private and delivery)	9.4	10	4.4	17	0.9	32
		7-1/2	27.4	108	1.9	53
		6-3/8	50.4	199	3.0	63
		3	602.3	2381	31.8	82
Public costs (federal and delivery)	10.2	10	7.6	30	1.0	39
		7-1/2	30.6	120	2.2	57
		6-3/8	53.6	211	3.5	65
		3	605.4	2394	36.0	82
Private costs (private only)	14.9	10	16.1	64	5.3	69
		7-1/2	39.1	155	10.9	79
		6-3/8	62.1	246	16.0	82
		3	614.0	2428	114.9	83

Source: Mills and Cain 1978.

Table 8. Aggregate financial returns for the 1979 Forestry Incentives Program by cost treatment option.

	Financial Return Measures					
Cost Option	Average IRR (%)	Real discount rate (%)	Total NPV ($ mill.)	Avg. NPV ($/acre)	Total b/c ratio	Cases earning discount rate (%)
Direct costs (federal and private)	8.56	10	10.5	39	1.3	45.3
		7.125	70.2	260	3.6	59.0
		4	418.8	1554	14.1	74.3
Total costs (federal, private and delivery)	8.26	10	8.3	31	1.2	41.1
		7.125	68.0	252	3.3	55.9
		4	416.7	1546	13.1	71.9
Public costs (federal and delivery)	8.85	10	13.2	49	1.5	45.9
		7.125	73.0	271	4.0	57.5
		4	421.6	1564	15.7	72.8
Private costs (private only)	10.94	10	21.4	80	3.3	55.1
		7.125	80.9	300	7.8	65.9
		4	426.8	1583	25.1	75.0

Source: Risbrudt and Ellefson 1983.

Timber Supply

Analysis of the 1974 Forestry Incentives program indicated that expected increases in total yield were 1.04 billion cubic feet (Table 9). About 65% of the increase was from softwood sawtimber and 28% from softwood pulpwood. The remainder (7%) was in hardwood. Approximately 40% of the increase will occur between the years 2020 and 2025 when the loblolly pine plantations reach maturity (assumed to be 45 years). Northern pine plantations will contain 23% of the yield increase when they mature between 100 to 125 years after investment. Pulpwood yield increases, primarily from thinnings, include 33% of the total projected yield increase between 1974 and 1999, and 67% of the total between 2000 and 2025 (Mills and Cain 1978).

An analysis of the 1979 program showed similar results (see Table 10). That year's investments will increase timber yields by 1.3 billion cubic feet. Ninety-three percent of the increase will be from softwoods. Hardwood and softwood sawtimber make up 72% of the total increase, about two-thirds of which will occur in the first quarter of the 21st century. For comparison, the sustained increase of 1.3 billion cubic feet of wood per year would furnish the entire annual harvest of Georgia, which has the highest state removal volumes in the country.

Comparing total effects of 1974 FIP plantings to total timber supplies provided more details on the effects of the program over the long term. As Mills and Cain explain, "Assuming that a similar 0.1% [of the nonindustrial private commercial timberland] could be treated each of the 54 years [average softwood rotation], and assuming that their total output equals the 1974 level on the average, 28% of the annual softwood growing stock removals in this class could be derived each year from 5.4% of the nonindustrial private acreage. . . . [I]f enough similar acres could be located, management of 19% of the nonindustrial private acreage would produce an average annual yield increase equal to the total 1970 removals from this owner class." Since FIP, as a timber production program, typically funds plantations on bare lands or conversions of pine-hardwood stands to pine, this means that intensive culture of a small percentage of lands could produce large outputs, thus allowing a large portion of NIPF lands to be free for less intensive management uses (Mills and Cain 1978).

Brooks (1985) studied the long-term effects of public cost-share programs on private reforestation behavior and future timber supplies. He examined private landowners with respect to reforestation, looking not only at initial landowner response to government cost-share programs but also at indirect effects. Indirect effects of government incentives programs were defined as negative or positive. Negative effects included substitution, 'queuing' (waiting until incentives payments are available), and expectations of future lowered prices as a result of increased timber supplies. Positive effects were defined as increased public knowledge of the incentives programs from their successful usage by the public and increased public confidence in reforestation as an investment.

Table 9. Estimated first rotation yield increases from 1974 Forestry Incentives Program, by product and year.

	Softwoods		Hardwoods		
	million cubic feet				
Year	Sawtimber	Pulpwood	Sawtimber	Pulpwood	Total
1974-2000	3.3	98.1	8.3	10.4	120.1
2001-2025	368.8	199.2	14.6	8.4	590.9
2026-2050	81.4	1.0	33.4	-10.1	105.8
2051-2075	71.8	-1.7	1.3	0.9	72.3
2076-2100	154.4	0.0	-0.1	0.5	154.8
Total	679.7	296.7	57.4	10.1	1043.9

Source: Mills and Cain 1978.

Table 10. Estimated first rotation yield increases from 1979 Forestry Incentives Program, by product and year.

	Softwoods		Hardwoods		
	million cubic feet				
Year	Sawtimber	Pulpwood	Sawtimber	Pulpwood	Total
1979-2000	17.8	132.0	8.7	5.7	164.3
2001-2025	570.2	241.7	20.6	10.2	842.8
2026-2050	100.6	3.1	26.4	4.7	134.8
2051-2075	69.8	-12.8	11.1	-2.9	65.3
2076-2100	102.9	-7.5	13.5	-7.9	101.1
Total	861.3	356.7	80.3	9.9	1308.2

Source: Risbrudt and Ellefson 1983.

Private reforestation in the South was modeled with acres as a dependent variable of a composite reforestation cost index and government cost share payments. Brooks found that each dolla spent on government reforestation cost-share programs resulted in the planting of 0.086 acres in the Southeast and 0.098 acres in the South Central region. The inverse of these acreages gives the public money expended in constant (1967) dollars for each acre planted by NIPFs--$11.69 for the Southeast and $10.51 for the South Central. Comparing these figures to actual average per acre direct expenditures gives an indication of the indirect effects of the FIP program. For the years 1974-1979, the actual expenditure on FIP was $18.84 per acre in constant dollars, a difference of $7.15 per acre f the Southeast and $8.33 for the South Central region.

Future timber supplies were estimated using the Timber Assessment Market Model, a spatial model developed by Haynes and Adams designed to aid in forest policy analysis. Brooks used the model to compare the effects of two different levels of cost-share funding: a baseline of $6.6 million, approximately equal to 1982 payments and an increased level of $33 million. For the baseline case, fewer than 20% of the softwood acres harvested were regenerated, but when the increased level was examined, NIPF regeneration was approximately equal to the annual harvest. The low rate under the baseline corresponds to current practices of NIPFs. Under the increased funding scenario, growth an removals are nearly equal and projected inventories for Southern softwoods are nearly 50% higher th the baseline case. Using these supply projections to analyze future prices leads to impressive results after the year 2000, when timber from FIP plantings begins to come on the market. Under the baselin case, prices continue to rise in an almost linear fashion, while under the increased funding scheme, prices are much lower than if funding continued at the baseline 1982 levels.

Site-Species Effects

Examination of the 1979 investments in particular species and treatment methods showed that 80% of the federal funds were spent on four species-treatment combinations that had an average IRR at least 9%. Southern pine had an IRR of 10.1% for bare land planting and 9.9% for site preparation and planting. Preparing sites for natural regeneration of southern pine and oak-pine generated a retur of 13.0%. The IRR on all practices on Douglas-fir and ponderosa pine was 9.6%. Over 80% of all federal funds spent were invested in these strata, with site preparation and planting of southern pine using more than 63% of the 1979 funds. Certain treatment types and species had very low internal rates of return. Some of these were due to the risk inherent in timber investment and could not be prevented. Others, however, were due to poor technical advice given to landowners or poor application and control of treatments. Timber stand improvement in oak-hickory stands, the major F program in several central region states, averaged only a 4.7% IRR. This low return was explained b use of the program on over-aged stands which could not be expected to respond to treatment (Mills and Cain 1978; Risbrudt et al. 1983a).

Regional Effects

Risbrudt et al. (1983a) estimated that increased sawtimber yields due to the 1979 program would total around 650 million cubic feet in the South, 200 million cubic feet in the North and around 80 million cubic feet on the West Coast. Pulpwood increases would total around 340 million cubic feet in the South and 28 million cubic feet in the North. The West Coast investments would result in a decrease in pulpwood volumes because of the replacement of red alder with Douglas fir. These changes were over the first rotation.

Tax Effects

The amount of tax revenue expected as a result of the increased timber yields. Using a 10% estimate of the average federal tax on timber income, it was estimated that the present value of future tax revenues resulting from the 1979 program is about $42 million or 10% of the PNV of expected timber harvests. This indicates that federal revenues would be about 2 1/2 times the amount of the annual federal program costs. State tax returns from both individual income taxes and severance taxes would also provide significant gains in tax revenues (Risbrudt et al. 1983a).

Another study evaluating the 1979 program found much smaller increases in tax revenues, estimating that each dollar spent on FIP generated $0.96 in tax revenues for federal and state income taxes and state severance taxes (Dicks et al. 1983). State/regional ratios ranged from a low of $0.36 in the North to a high of $1.37 in South Carolina. Long rotation rates in the North lowered the PNV and resulting tax estimates, explaining the lower returns in the region. The computation of these values included capital gains tax benefits which have since been reduced. Federal tax rates have also been reduced by various tax reform programs passed. It may be inferred that the estimated tax returns to the treasury would probably be even higher under current federal (and state) laws.

Social Efficiency

In 1988, an evaluation by Boyd et al. indicated public monies spent on FIP and government technical assistance in North Carolina were "dead weight" social losses. The study began with the assumption that, "if a good or service exchanges in a freely operating and competitive market which includes neither externalities nor non-market values then there can only be net welfare losses from public market intervention". This assumption suggests that almost any government program will create some social inefficiency as defined by welfare economics; Boyd et al. tried to measure this impact. In particular, the authors assume that there is significant social loss to the public from FIP investments which do not lead to harvesting of timber and from the transactions costs associated with program administration.

Boyd et al. (1988) projected a maximum net social loss of $27,000 from North Carolina's 1980 federal and state expenditures of $1.6 million on FIP. Social loss was defined as a situation where public opportunity costs exceed public gain, or where the public monies could be spent on alternative programs with greater return of the $1.6 million expenditures, $147,100 was spent on administration c the program and the remainder distributed to landowners. Landowner payments of $673,400 were regarded as effective or likely to produce timber available for harvest in the future. The remaining $798,000 was regarded as ineffective payments to landowners because the lands regenerated using these funds were assumed to remain unharvested. The assumption here was that landowners uninterested in timber management use FIP funds to invest in reforestation and that "timber-producing NIPF landowners may not aggressively pursue their opportunities to receive FIP payments."

Some of the other assumptions of this study were that all monies were spent on reforestation o pure pine plantations, site index (50 year basis) was 65 for all sites, 'effective' plantations were liquidated at 30 years, and improved managerial knowledge would yield an additional 20% increase. Because of these assumptions, Boyd et al. felt the losses estimated were conservative. These assumptions were not based on studies of actual FIP landowner characteristics.

Boyd et al. estimated the consumer surplus in a range of $162,400 to $873,700 using interest rates of 10% and 4% respectively. This was estimated to be the benefit to buyers of raw materials as well as to final wood products consumers. These transfers were not considered in the computation of net public losses. Net public losses were considered as the sum of administrative costs, 'ineffective' transfer payments and deadweight welfare loss. Deadweight welfare loss was computed ignoring the interdependence of demand and supply for timber over time under the rationale that the impacts of FIP on total timber production is too small in any one year to affect demand.

Brooks (1985) used the TAMM model to estimate changes in consumer and producer surplus. The sum of the consumer and producer surplus can be used to determine net social benefits or costs from a policy decision. Because these changes occur over time, they must be discounted to obtain the estimate of current benefits. Brooks used a 4% and a 10% discount rate to analyze the results of increased reforestation incentives payments for the southern United States. Table 11 shows that increased cost-shares result in markedly increased producer and consumer surplus under both discount rates. After subtracting costs, the benefit/cost ratios were estimated at 16.9 for the 4% rate and 6.6 fo the 10% rate. Under this study, cost-share programs were shown to increase softwood supplies, redu expected timber prices, and benefit producers and consumers in excess of the program costs.

Foster (1982) found significant long term benefits from FIP investments due to the effect on th demand and supply of wood. Specifically, he found that each acre regenerated would generate benefit of over $4,300 from reduced costs of wood products used by society. He calculated this benefit as a compound rate of return between 10.1% and 12.3% using a 35 year rotation.

Table 11. Cumulative, discounted change in producer and consumer surplus as a result of increased reforestation cost-share payments in the South

Interest rate (percent)	1995	2000	2005	2010	2015	Costs[b]	B/C[c]
	----	-----	Million	Dollars	------		
4	73.3	267.3	549.2	2242.7	4870.6	228.7	16.9
10	35.2	112.0	204.0	616.3	1073.1	163.2	6.6

[a] All regions, lumber and plywood markets, discounted to 1982.
[b] Changes in expenditures, 1982-2015, deflated by the cost index and discounted to 1982.
[c] Ratio of cumulative benefits and costs to 2015.
Source: Brooks 1985

Harou (1983) evaluated Massachusetts FIP participation between 1974 and 1977 to determine social efficiency. He determined that FIP investments were efficient at 4% and 6-5/8% social discount rates, with associated B/C ratios of 2.62 and 1.77 respectively. Ninety-five percent of the Massachusetts cost-share funds were spent on precommercial thinnings. Using studies of the ACP program, Harou estimated that 30% of the subsidies were spent on tracts that would have been thinned regardless of the FIP program. Massachusetts has a special forest tax program which significantly lowers land assessments for tax purposes when forest lands are certified by the State Forester as being under a suitable land management plan. Consequently, Harou speculated that FIP efficiency could be improved by giving low priority to FIP funding of landowners registered under other incentives programs, such as the special forest tax program.

Retention Rates

Government-funded forest investment incentive programs have a historically high rate of retention. Williston reported 85% retention rates for the Yazoo-Little Tallahatchie Project in north Mississippi. Alig et al. (1980) reported an 86% retention for Soil Bank plantations in the South and 81% retention of Tennessee Valley plantations. The Agricultural Conservation Program was found to have retention rates of 95%, including successful replantings (Kurtz et al. 1980).

Risbrudt et al. (1983b) reported that about 94% of 1974 FIP acreages were still in the program as of 1981. As expected, they found that forest retention was greater for timber stand improvement than for planting practices. For the U.S. totals, 83% of the cases that included trees planted on bare land were retained in forests. Minor site preparation and planting cases had a retention rate of 78%; major site preparation and planting had a rate of 88%. All the case samples that were site prepared for natural regeneration were retained in forests. Larger tract sizes generally had higher retention rates.

Kurtz et al. (1994) reported that 92% of the acres planted under the FIP program since its implementation have remained in the original forest production, with 5% being reported in another woodland usage. Conversion to nonforest uses occurred on 3% of the FIP acreages. The retained FIP plantings are considered as being in good to excellent silvicultural condition on 96% of the acres. However, there are expectations that approximately 80% of these acres would benefit in the future from additional silvicultural treatments such as suppression of competition.

Capital Substitution

Criticism has been leveled at FIP and other forest incentive programs charging that government funding merely replaces funds that would have been spent by the private investor in reforestation of his or her lands. Royer, Cohen, de Steiguer, and Lee have each studied the problem of capital substitution with conflicting results.

In 1981, a survey of forest landowners who had harvested their timber was undertaken to examine management activities, including reforestation decisions. One aspect of this study was the possibility of capital substitution, examined at two income levels: below and above $25,000 in annual income. Within the lower income group, the regression coefficient, for cost sharing was positive and highly significant, with an elasticity of 1.40. This indicated that these landowners were highly sensitive to cost-share opportunities. The higher income landowners showed a negative and insignificant regression coefficient, indicating that reforestation is not dependent on cost-share funding opportunities for these landowners. Higher income landowners may be substituting public capital for private by using the publicly financed cost-share programs. Since this group contains more than half the southern landowners who used federal and state cost-share programs, the capital this study indicated that the capital substitution problem may be significant (Royer 1985).

Cohen (1983) also developed a model to examine the effects of government subsidies on private forestry investment. Her analysis was based on a wide variety of independent variables, including various federal and state government assistance programs, acres planted by industry, southern pine lumber production, expected stumpage values, cost of plantation establishment, net per capita farm income, alternative rates of return, the indexed crop price for corn and soybeans, and the largest acreage planted in each state. The data covered the years 1964 to 1978. Cohen found that there was a trade-off between public cost-share programs and private forestry investment, with capital substitution rates of public funds for private dollars, ranging from 20% to 100%, depending on the statistical model employed.

de Steiguer (1984) developed an econometric model of reforestation investment behavior to isolate the influence of cost-share programs from other market factors influencing forest investment decisions. His model estimated private capital investment as a function of real personal income, expected sawtimber stumpage prices, alternative rates of return, and government cost-share funds. The result indicated a small negative effect on private investment, but the high standard error made this finding statistically insignificant. Based on these results, capital substitution was not a problem in government assistance programs for reforestation.

Building on Cohen's model, Lee et al. (1992) developed a model using variables that included stumpage price, planting costs, land price, interest rates, and four federal assistance programs--ACP, FIP, CRP, and Soil Bank. Lee evaluated supply and demand equations for NIPF and industrial plantations. Plantation values reflect land values, seedlings, labor, and machinery costs associated with planting. Demand equations examined various factors that affect demand including alternatives to plantations. The effect of cost-share programs on industrial investment in reforestation was the possibility that increased supplies of NIPF timber would indirectly substitute for the need to plant industrial forest lands. The results from the model indicated that industrial planting was significantly higher when cost-share programs were available than when they were not available, the opposite of that expected. The results were not significant, and there was no conclusion that indirect substitution had occurred.

For the NIPF landowner, the influence of cost-share programs could lead to a decrease of non-subsidized plantings (direct substitution of public for private capital) or decrease in non-subsidized plantings in expectation of lower future prices from increased supplies from cost-share plantings (indirect substitution). Results indicated that in neither instance could occurrence of substitution be found. Lee et al. concluded that significant cost-share substitution has not occurred and that cost-shai programs have resulted in increased inventories and future timber supplies.

Equity

The purpose of the Forestry Incentives Program is to assure future timber supplies at reasonab prices. It was not intended as an income redistribution or regional development program, although it has redistributional income effects and regional multiplier effects. Wheatcraft and Ellefson (1983) examined equity considerations in several areas: distribution of funds among states and regions, incor and wealth of program participants, secondary program benefits, and transitional equity. Their findin are paraphrased in this section.

The southern states received over 75% of the 1981 FIP funding, which was typical for all year of the funding program. The remainder was split among the central, northeastern and western states, with only about 1% of the 1981 funds going to the Rocky Mountain and Plains states. Wheatcraft an Ellefson hypothesized that this pattern of regional distribution may be providing a price advantage to southern wood-using industries, at a cost to other regions of the United States, particularly the centra and northeast regions. At the time of this study, the authors postulated that the federal investments in timber supplies on western national forests could be considered to offset the advantage of the souther subsidy payments, although this advantage has clearly dwindled in the 1990s.

Per capita income for each state was compared with the funding levels of the 1981 program. Significantly higher levels of FIP payments were distributed to states with lower income levels. This does indicate government funds are going to lower income states where the funds may generate increased job opportunities and other multiplier effects. An examination of per capita incomes at the county levels did not reflect the same relationship.

Another equity concern is whether FIP monies are subsidizing wealthy landowners who could well afford to invest in reforestation without subsidies. Acres owned by individual landowners serve a proxy measure for landowner wealth. For the 1981 program year, 34% of the treated acres belong to landowners who held between 201 and 500 acres. Landowners who owned more than 500 acres comprised 25% of the FIP acres. Using minimum asset values, Wheatcraft and Ellefson concluded th 59% of the 1981 participants had land assets worth more than $95,000, and 23% had land worth mor than $237,000. The high valuation of land assets, however, does not infer that all landowners had sufficient capital for investment in reforestation. The subsidy provided by FIP and other cost share programs might make investment in reforestation comparable to alternative returns available from oth

investments. However, it seems clear that most of the direct benefits of the FIP program are received by wealthier landowners.

FIP secondary benefits also contribute to equity considerations. Employment opportunities have increased for foresters, consultants, tree planting and site prep contractors, and seedling nursery personnel. Many of these jobs depend on the long-term existence of FIP. Long-term employment in the logging and wood product manufacturing sectors may depend on the timber supplies provided by FIP. Many individuals employed in forestry-related jobs are from the lower-income groups who would be unable to find comparable employment if cost-share programs were reduced and resulting secondary employment opportunities eliminated.

Future increases in timber supply have important secondary impacts as limitations in wood supplies increase prices. Increased supplies due to the FIP cost-shares should decrease prices, or at least should ameliorate price increases. This benefits not only timber dependent industries and their employees but also consumers who will pay less for products made from timber. The regional pattern of FIP payments favors the South, which tends to have lower per capita incomes and fewer job opportunities. Thus, increased timber supplies will not only benefit the nation as a whole, but may be particularly important in helping improve the South's economic climate.

Non-timber benefits from FIP program include wildlife habitat improvement for some species, improved soil protection, effects on global climate, and recreational use. These benefits are difficult to measure, but certainly have positive benefits to society as a whole.

Program changes in FIP would affect certain groups of people more than others. Transitional equity concerns the effect of changes in public policy and how that affects individuals who have made decisions based on the existing policy. Cutting back or eliminating the program could cause financial losses for landowners who included availability of cost share funds as part of their investment decisions. Forestry contractors and nurseries have invested in equipment and assembled a work force in response to FIP and other incentives programs. A concern for equity implies that changes in FIP would be structured so that these operations would suffer minimum losses or be compensated for losses from a major policy shift.

NIPF Behavior/Response

One basic question regarding the FIP cost-share payments, or even other cost-share programs, might indeed be whether they spur tree planting that would not occur otherwise. This is essentially recasting the capital substitution question in even simpler terms. Several econometric studies have examined this question. Examination of southern tree planting accomplishments also can contribute to this inquiry.

Just based on simple prima facie evidence, one would have to conclude that FIP and other tree planting programs were very important in the South, where most plantations exist. In total, FIP (3 million acres), ACP (2.9 [1960-1986] million acres), Soil Bank (2.2 million acres), and CRP (2.5 million acres) accounted for 10 million acres of planted trees, in their duration, with probably 80% occurring in the South. Currently there are about 8.8 million acres of pine plantations on NIPF lands i the South (Powell et al. 1993). Some replanting on NIPF lands has occurred, but the 10 million acres even if reduced substantially to avoid double counting, still accounts for a large share of all current NIPF planted pine acres.

As another example, Lynn Hooven (pers. com., 1994) of the Georgia Forestry Commission collected data on the amount of planting done in eight southern states (AL, FL, MS, NC, SC, TX, VA with federal and state funds compared to total NIPF planting, from 1988 to 1993. In total, reported cost-share planting amounted to 2,618,704 acres and total NIPF planting was 3,911,712 acres. Thus 67% of all the planting in these states was associated with federal or state incentive programs. In the seven states other than Georgia with cost-share programs, reported state assistance was involved with 686,261 acres of tree planting.

Southern Landowner Studies.--Using observations on individual NIPF landowners, Boyd (1983) developed a "probit" model that estimates the probability of investment in timber stand improvement and decisions to harvest timber. Timber management and harvest was considered as a part of landowner's overall utility maximizing decisions where the utility is income and household-produced consumption. Independent variables were knowledge of cost-share programs, technical assistance, income, education, price, farm vs. nonfarm landowners, acreage size, and landowner's distance from land. Knowledge of cost-share programs was found to increase the probability of landowner investing in timber stand improvements by 5.5%. The effect of cost-share knowledge had no significant impact on the probability of harvest.

Many of the econometric models mentioned in the capital substitution analyses examined common characteristics that affect landowner response to cost-share programs. A summary of these models is presented in Table 12. The sign and statistical significance (sign/statistical significance) of each variable is presented for some of the common characteristics of the models. "NA" indicates that the variable was not part of the model. The sign indicates what effect the variable is estimated to hav on reforestation investment. If the variable was found to be statistically significant, "yes" follows the sign. Four of the five models found that cost-share programs had a positive influence on landowners' decision to reforest, although the Lee et al. (1993) results were not statistically significant.

Hardie and Parks (1991) developed a model (Table 13) to estimate the effects of government forest incentives programs on the land management decisions of landowners simultaneously with the number of acres treated. Using an area frame sample of NIPF landowners who harvested timber between January 1, 1971 and May 15, 1981, a base scenario was calculated using the model. The relationship between the estimated probabilities and actual values was very close. The estimated probability of reforestation was 0.30, while the actual percentage of owners who attempted reforestation was 31%. The average acreage actually regenerated was 65 acres, which was the same

Table 12. Comparison of various econometric models of reforestation investment behavior of NIPF landowners.

Independent variable	de Steiguer 1983	Cohen 1984	Royer and Vasievich 1987	Lee et al. 1992	Boyd et al. 1988	Brooks 1985
Cost sharing	-/no	+/yes	+/yes	+/no	+/yes	+/yes
Stumpage prices	+/no	+/yes	pulp+/yes sawtimber -/yes	+/yes	+/no	+/no
Income	+/yes	+/yes	+/yes	NA	+/no	NA
Alternative return	-/yes	-/no	NA	-/yes	NA	NA
R^2	.94	.78	--	.93	.874	.946

Source: modified from de Steiguer 1984.

acreage estimated by using the model. The model predicted that total acreage in the South to receive regeneration treatments was 1.113 million acres. The regeneration acreage reported in the survey was 1.078 million acres, a difference of 3% from the predicted value.

Five different scenarios were used in the model to assess the impact various incentives scheme would have had during the years 1971 to 1981 (Hardie and Parks 1991):

(1) Removal of the cost-share program.

(2) Extension of cost-sharing to all NIPF owners harvesting timber.

(3) Extension of cost-sharing as in (2) and increase rate to 80%.

(4) Extension of cost-sharing as in (2) but decrease rate to 30%.

(5) Restrict cost-sharing to owners receiving payments in the period and decrease rate to 30%.

The predicted effect of eliminating the incentives program was to reduce the probability of NIPF investment in regeneration from 0.30 to 0.10. This shift reduced the acreage regenerated from 1.113 million acres to 316,000 acres. Consequently, it is hypothesized that cost-sharing stimulated more than 70% of the reforestation that took place on southern NIPF lands during the years from 197 to 1981. Under scenario 2, the probability of NIPF reforestation investment changes from 0.30 to 0.5 with an increase in acreage treated to 1.563 million acres. This is an increase of 40% over the base level.

As part of the model, three elasticities were computed: investment decision, acreage response of the representative owner, and acreage response of the total region. Elasticity is defined as "the percentage change in a dependent variable (e.g., probability of reforestation, acres reforested) associated with a 1% change in an independent variable (e.g., net cost of reforestation). When an elasticity exceeds an absolute value of one, the dependent variable is said to be elastic with respect to the independent variable." The investment decision elasticity reflects costs of regeneration, and is negative because an increase in the cost of reforestation reduces the probability of investment in regeneration. The elasticity of acreage response can be either positive or negative since an increase in costs can be compensated for by the effect of public forester assistance under the equation used to compute the measure (Hardie and Parks 1991). In Table 13, the elasticities associated with investmer decisions change according to the percentage of landowners who choose to invest. Under the base case, 30% of the landowners will reforest and a 1% increase in the owner's cost-share rate would decrease probability of investment by 4%. Removal of cost-share programs (Policy Alternative 1) would result in a 6% decrease in probability of reforestation investment. Expansion of cost-share programs to all landowners (Policy Alternative 2) would increase the probability of reforestation to 50% while a 1% increase in cost-share rate would reduce the investment probabilities by 0.8% (Hardi and Parks 1991).

Table 13. Estimates of reforestation probabilities, reforestation acreages, and elasticities resulting from different cost-sharing policy alternatives for the years 1971 to 1981.

	Policy Alternatives					
Estimate	Base	1	2	3	4	5
Probability owner will reforest (in percent)	30.3	10.3	49.5	58.4	22.4	17.3
Average acreage receiving investment (in acres)	65.1	64.9	64.0	72.2	56.8	60.1
Average acreage reforested by all owners (in acres)	27.1	7.7	37.7	48.1	15.1	13.1
Total acreage reforested in South (1971-1981) (in mil. acres)	1.113	0.316	1.563	1.987	0.619	0.532
Total cost to government (in mil. dollars)	122.3	0.0	216.3	246.0	50.9	92.3
Elasticity of investment decision	-4.38	-6.72	-0.77	-.04	-3.30	-5.35
Elasticity of acreage response: representative owner	0.30	0.40	-0.26	-0.68	0.22	0.40
Elasticity of acreage response: total region	-4.08	-6.32	-1.03	-1.08	-3.08	-4.95

Source: Hardie and Parks 1991.

The elasticity of acreage response shows how changes in cost-shares affect changes in overall acreages treated, not simply percentage of landowners investing. Under Policy Alternative 3 where all landowners receive assistance and the rate is increased to 80%, a 1% increase in investment costs lead to a 0.04% decrease in investment probability. However, the 1% increase in costs would have decreased total acreage planted by 1.08%. An increase in costs would have had less effect on the percentage of owners deciding to reforest than it would have on the size of investment or the number acres replanted by landowner.

Overall results of this study indicate that landowners would be more likely to reforest with mo available cost-share programs and with increased cost-share rates. Higher participation levels and higher cost-share reimbursement rates reduce the variability of response to price changes in costs of reforestation.

California Incentives.--Romm and Washburn (1987) studied the effects of coexisting or alternative cost-share programs on nonindustrial private forestry investment, comparing the California Forest Improvement Program (CFIP) to the Forestry Incentives Program. CFIP provides a subsidy of 75% (90% until mid-1984) to landowners for afforestation, timber stand improvement, wildlife and fis habitat enhancement, erosion control, and land management plan preparation. Landowners must manage their property as forestland for at least ten years and place the land in a Timberland Productio Zone, or other binding arrangement. The land management plan applies to the entire land ownership rather than just to the acreage treated. Funding is on a first-come first-served basis and requests have exceeded available funding.

CFIP covers the costs of a wider range of forestry activities and is focused on multiple use of forest land. Funding for CFIP depends on timber market activity, since it is funded by timber sales receipts. CFIP approvals are decided by the State Forester and enforcement powers are based on landowner compliance with the required land management plan, and placing of the land in a forestry zone. Under CFIP, landowners voluntarily surrender more of their private property rights to the pub than do FIP participants (Romm and Washburn 1987). The federal FIP funds, then, might be more favorably received than the state CFIP funds.

The study concluded that in California, FIP participants were not representative of the unassisted NIPF population, providing evidence of that program did encourage additional tree plantin "More than seventy percent of FIP users, almost double the representative proportion, are in groups whose probabilities of investment are predicted to significantly increase in response to a subsidy. . . A subsidy nearly triples their average probability, from 0.33 to 0.92; it increases the average probability the whole population by only 37%." Romm and Washburn also concluded that FIP has been taken advantage of by landowners with specific characteristics as follows:

(1) 70% of FIP participants are over 65 years.

(2) 72% of FIP participants are absentee owners.

(3) Virtually no participants with incomes greater than $50,00 per year.

(4) FIP participants are less likely to invest in forestry without FIP.

CONCLUSIONS

The Forestry Incentives Program has been a forestry cost-share assistance program targeted at nonindustrial private forest (NIPF) landowners, and designed to increase timber production. FIP has helped plant about 3 million acres of trees and perform tsi on about 1.4 million acres of forest land since its inception in 1974, with total expenditures of $202 million. The annual timber supply increases generated by the program could contribute substantially to timber supplies in the nation, particularly in the South.

The annual accomplishments of FIP were the greatest from 1979 to 1981, when nominal and real dollar funding levels were the largest. Since then, tree planting accomplishments have varied around 150,000 acres per year, despite rising nominal cost share rates per acre. However, the timber stand improvement area treated has declined consistently since 1981, and also experienced increased nominal cost-share rates per acre. Thus to date, much of the lost purchasing power of fairly uniform FIP funds could have come at the expense of TSI. Tree planting is more likely to be affected soon if these trends continue, however.

The total accomplishments of FIP can be compared with other federal tree planting programs as well (Table 14). ACP has planted more trees, but has been in existence since 1936. Since FIP's inception, it actually has helped plant much more area and included more tsi than ACP. The old Soil Bank and modern Conservation Reserve Program helped plant almost two million acres of trees each, although they were shorter-lived programs. Similar carbon storage programs could have also planted a large area quickly. But the steady number of acres planted and timber improved under FIP have been the principal long-run tree planting program, and FIP's effectiveness is unlikely to be successfully supplanted by any "crash" short-term carbon/conservation programs, or by more complex multi-purpose programs.

FIP has been, and is likely to continue to be, necessary in some form if the public needs NIPF owners to produce more timber than free markets will supply. Federal and state cost-share programs have accounted for about two-thirds of the acres planted in key southern states in recent years. Most research suggests that FIP and other cost-share funds clearly do elicit more tree planting on NIPF lands. While some substitution of public capital for private funds may occur, it is likely to be minor and certainly not cause for significant concern.

Like all programs, FIP has mixed effects on different owners and regions. The South benefits most from the program, followed by the northern states. This is logical since the South harvests 53% of the nation's softwood timber and 60% of its hardwood timber and has an equally large share of NIPF

Table 14. Tree Planting Accomplishments Under Federal Cost-Share Programs

Title	Acres
FIP (1974-1992)	2,953,684[1]
ACP (1936-1990)	6,945,907[2]
Soil Bank (1956-1960)	2,154,428[3]
CRP (1986-1989)	2,179,300[4]
SIP (1991-1993)	40,9254[5]

[1] Source: USDA Forest Service Internal Reports

[2] Source: USDA, ASCS. 1992. Agricultural Conservation Program: 55 Year Statistical Summary 1936 Through 1990. p. 8. (Includes trees and shrubs planted for forestry purposes and environmental improvement.)

[3] Source: Kurtz et al. 1994. p. 2-1.

[4] Source: Osborn et al. 1990. p. 6. (Data is for signup periods 1-9, March 1986-August 1989.)

[5] Source: USDA Forest Service. 1994. Stewardship Incentive Program: From Inception of Program through 1993 Fiscal Year. p. 23. (Data for SIP-2 Practice, Reforestation and Afforestation only.)

land (Powell et al. 1993). The region also has the most productive private forest land sites as well. Funds from FIP do go to relatively affluent owners, but ones who do not plant as much without the program. The funds are spent in poor regions of the South, and help pay and maintain forestry vendor services in these regions.

FIP was enacted to increase timber supplies in the 1970s based on perceived needs for production of timber on private lands. The problems of growing adequate timber for the nation certainly have grown more acute since the 1970s. Substantial public timber harvest decreases in the West and very tight softwood supplies in the South (Haynes et al. 1993, Cubbage et al. 1994) have increased needs for timber production on NIPF lands. And complex requirements for management plans and multiple purpose management will make it difficult for them to supplant FIP. Thus it does seem reasonable that if timber production on private lands remains crucial to the public welfare, FIP or some other streamlined timber cost-share provisions should be retained in federal program funding and implementation. An examination of the empirical data and research results clearly indicates that elimination of the program will lead to decreased planting, tsi, and timber supplies for the nation, at time that we may well need the wood more than ever. These tradeoffs between wood fiber needs, multiple use mandates, and budget exigencies certainly will provide interesting challenges for policy makers in deliberating reauthorization, modification, or elimination of the Forestry Incentives Program.

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APPENDIX:

TABULAR AND GRAPHICAL SUMMARY

OF FORESTRY INCENTIVES PROGRAM ACCOMLISHMENTS, 1974-1992

U.S. ANNUAL AND CUMULATIVE ACCOMPLISHMENTS

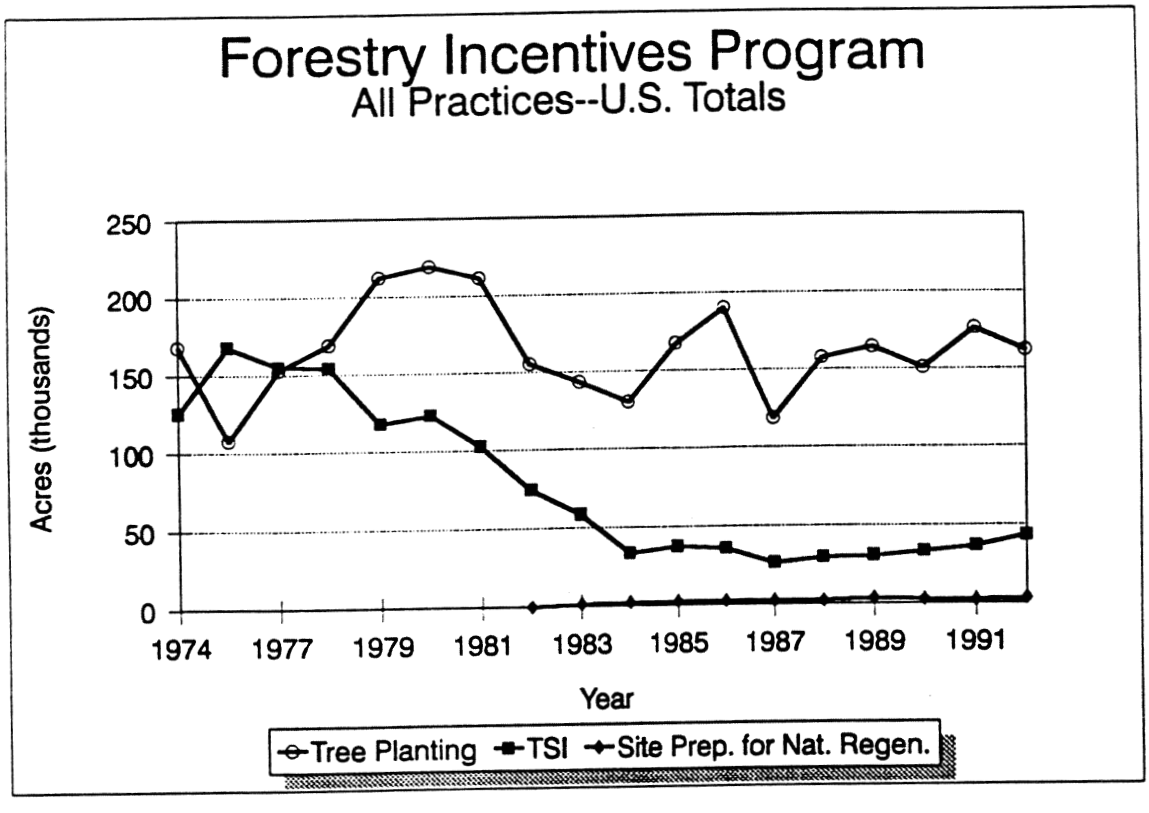
AND REGIONAL DISTRIBUTION BY

PARTICPANTS, ACRES, AND COST SHARE EXPENDITURES

SOURCE: MOULTON AND SNELLGROVE 1993

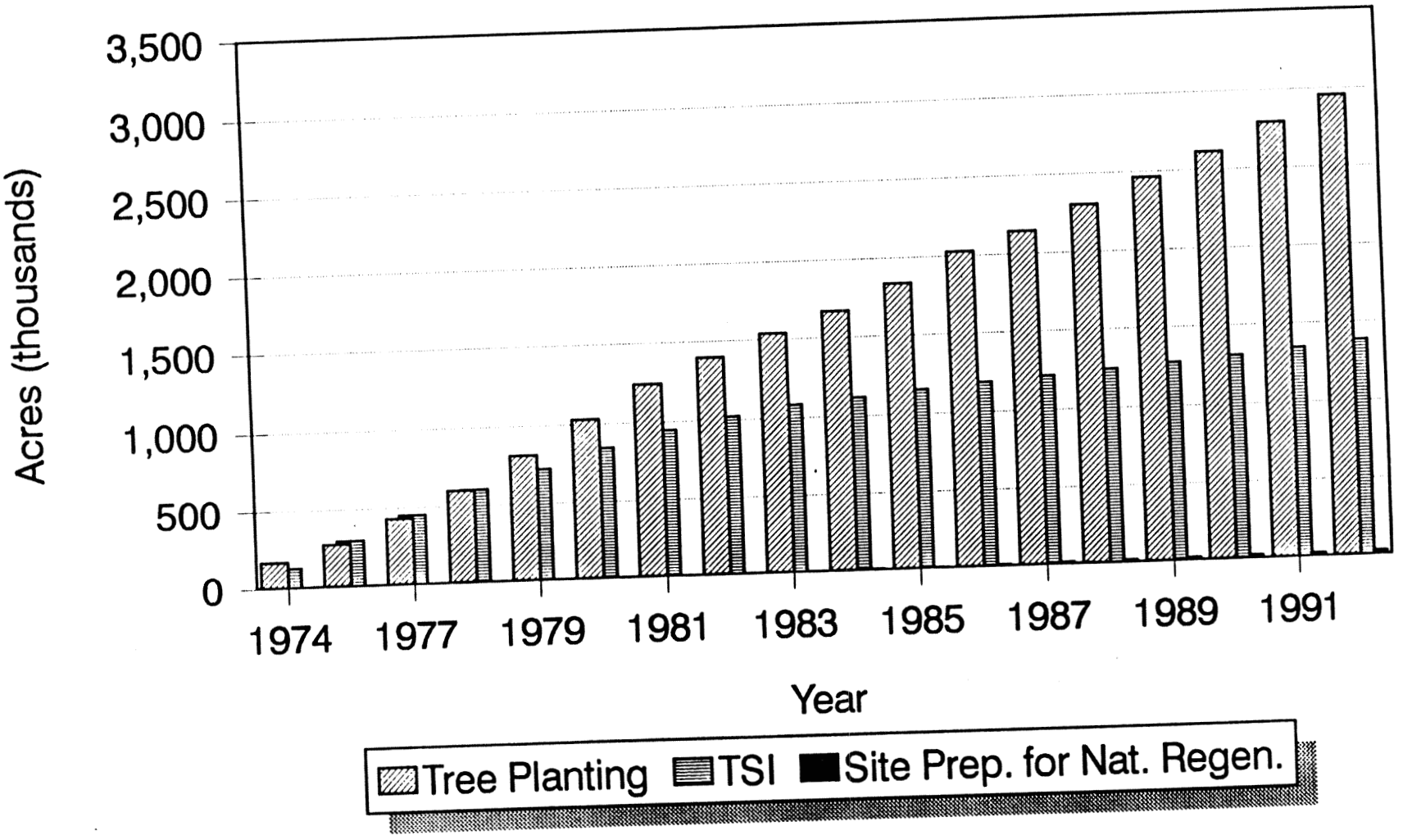
APPENDIX: LIST OF CHARTS AND DATA

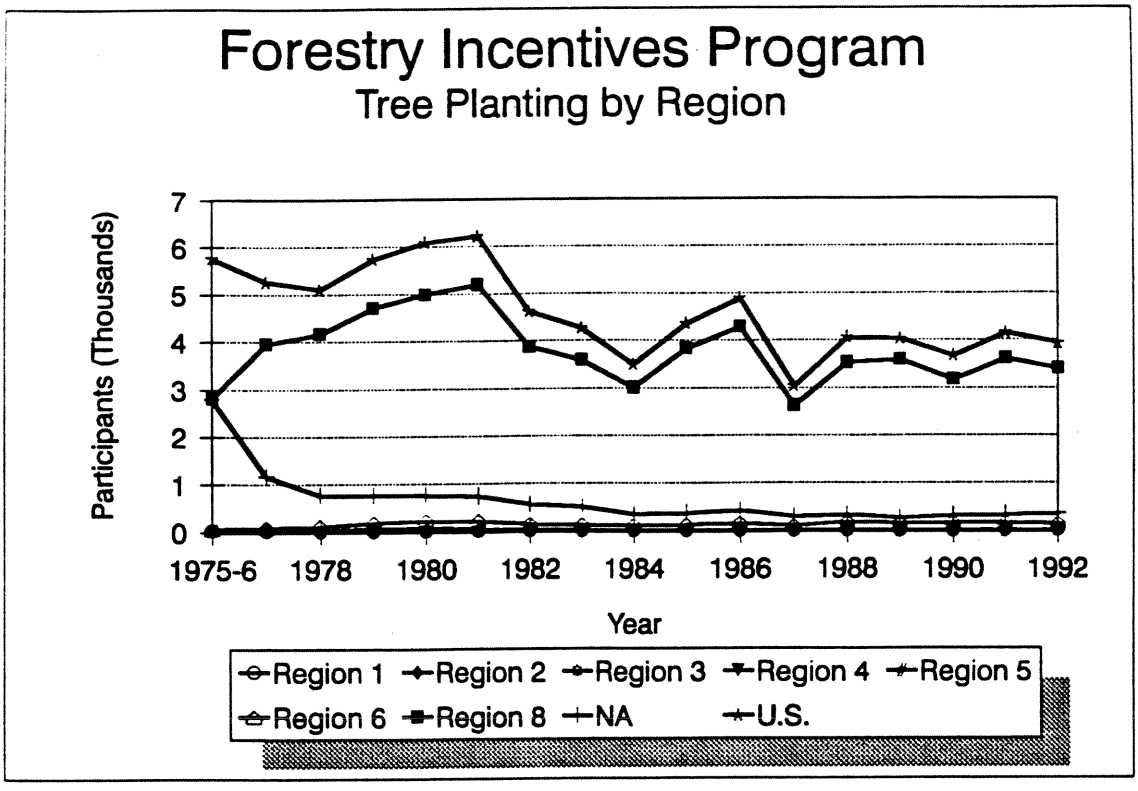
1. U.S. Forestry Incentives Program Annual Accomplishments, All Practices
2. U.S. Forestry Incentives Program Cumulative Accomplishments, All Practices
3. Forestry Incentives Program Tree Planting by Region - Participants
4. Forestry Incentives Program Tree Planting by Region - Acres
5. Forestry Incentives Program Tree Planting by Region - Cost Share Funding
6. Forestry Incentives Program Timber Stand Improvement by Region - Participants
7. Forestry Incentives Program Timber Stand Improvement by Region - Acres
8. Forestry Incentives Program Timber Stand Improvement by Region - Cost Share Funding
9. Forestry Incentives Program Site Preparation for Natural Regeneration - Participants
10. Forestry Incentives Program Site Preparation for Natural Regeneration - Acres
11. Forestry Incentives Program Site Preparation for Natural Regeneration - Cost Share Funding
12. Forestry Incentives Program Cumulative Tree Planting by Region - Participants
13. Forestry Incentives Program Cumulative Tree Planting by Region - Acres
14. Forestry Incentives Program Cumulative Tree Planting by Region - Cost Share Funding
15. Forestry Incentives Program Cumulative Timber Stand Improvement by Region - Participants
16. Forestry Incentives Program Cumulative Timber Stand Improvement by Region - Acres
17. Forestry Incentives Program Cumulative Timber Stand Improvement by Region - Cost Share Funding
18. Forestry Incentives Program Cumulative Site Preparation for Natural Regeneration by Region - Participants
19. Forestry Incentives Program Cumulative Site Preparation for Natural Regeneration by Region - Acres
20. Forestry Incentives Program Cumulative Site Preparation for Natural Regeneration by Region - Cost Share Funding



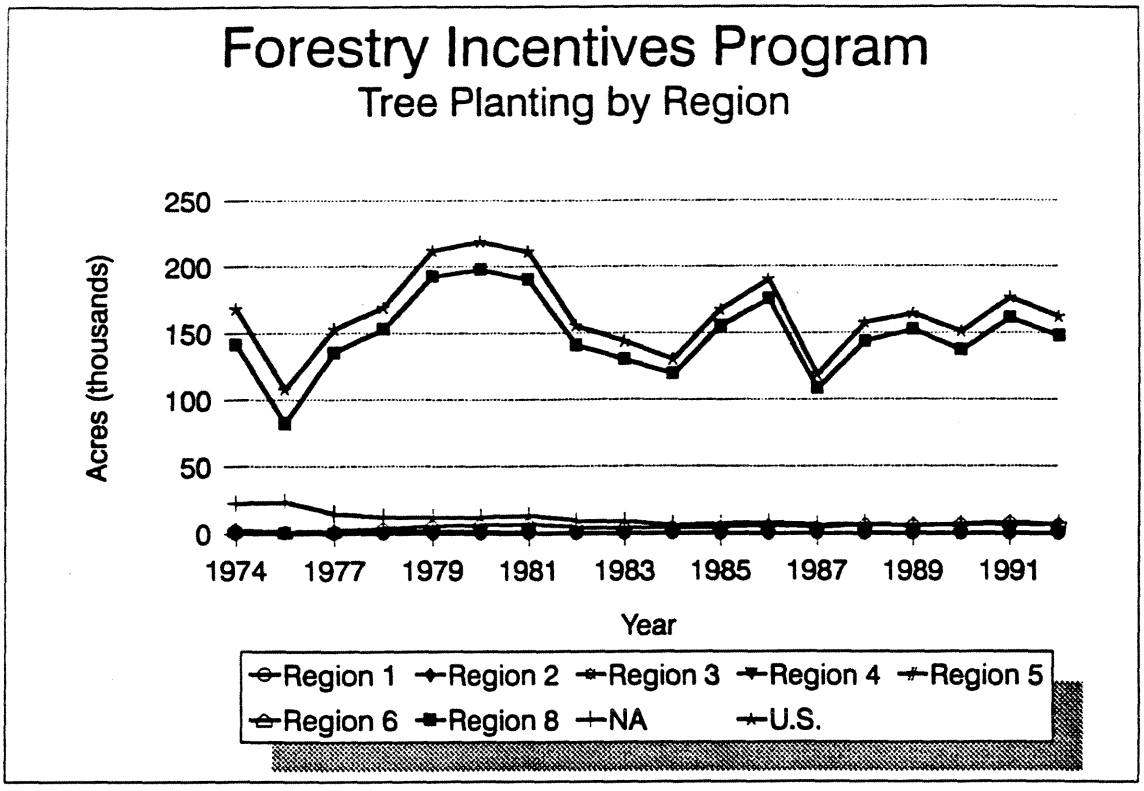
	Tree Planting	TSI	Site Prep. for Natl. Regen.
1974	168,005	125,357	
1975-6	107,509	167,873	
1977	152,750	155,158	
1978	168,814	154,082	
1979	211,987	117,585	
1980	218,960	122,980	
1981	211,218	102,602	
1982	155,181	74,321	57
1983	143,333	58,353	1,485
1984	129,959	33,345	2,326
1985	167,307	37,133	2,592
1986	189,978	35,830	2,776
1987	118,455	26,138	2,514
1988	157,410	29,389	2,455
1989	164,133	30,533	3,617
1990	150,717	33,199	2,811
1991	176,201	36,447	2,374
1992	161,767	43,192	3,487

Forestry Incentives Program
U.S. Cumulative Accomplishment

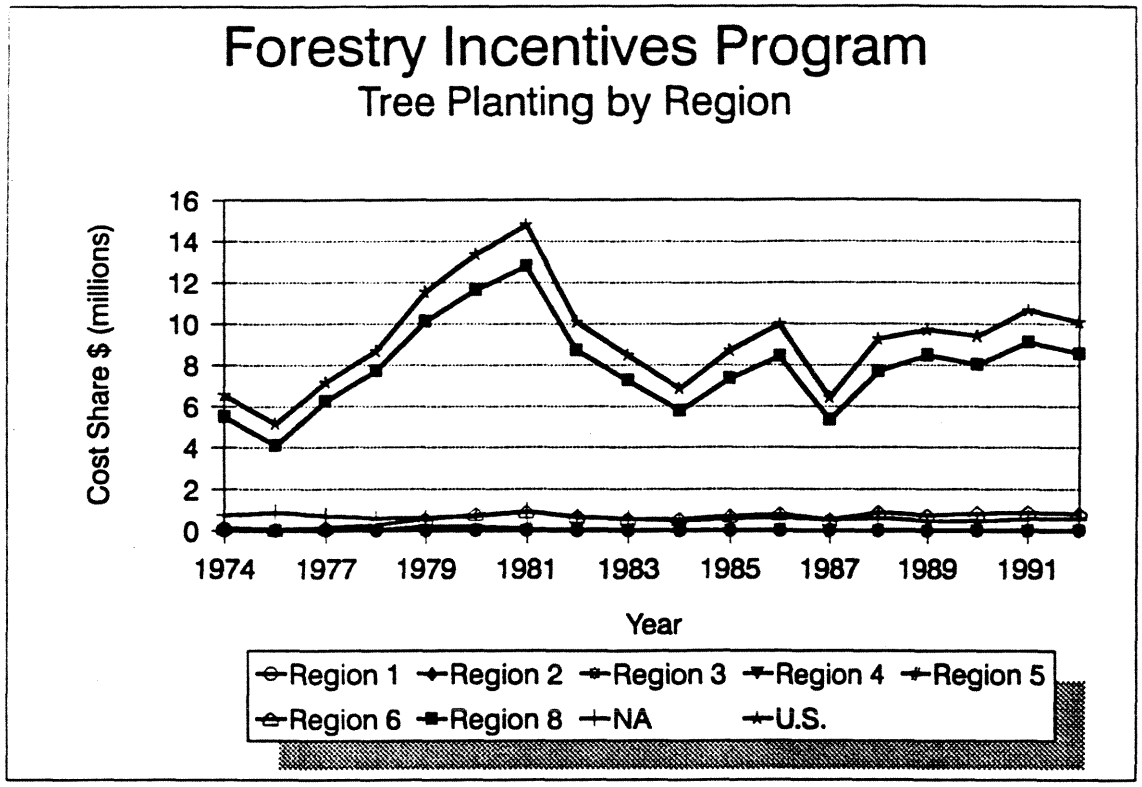




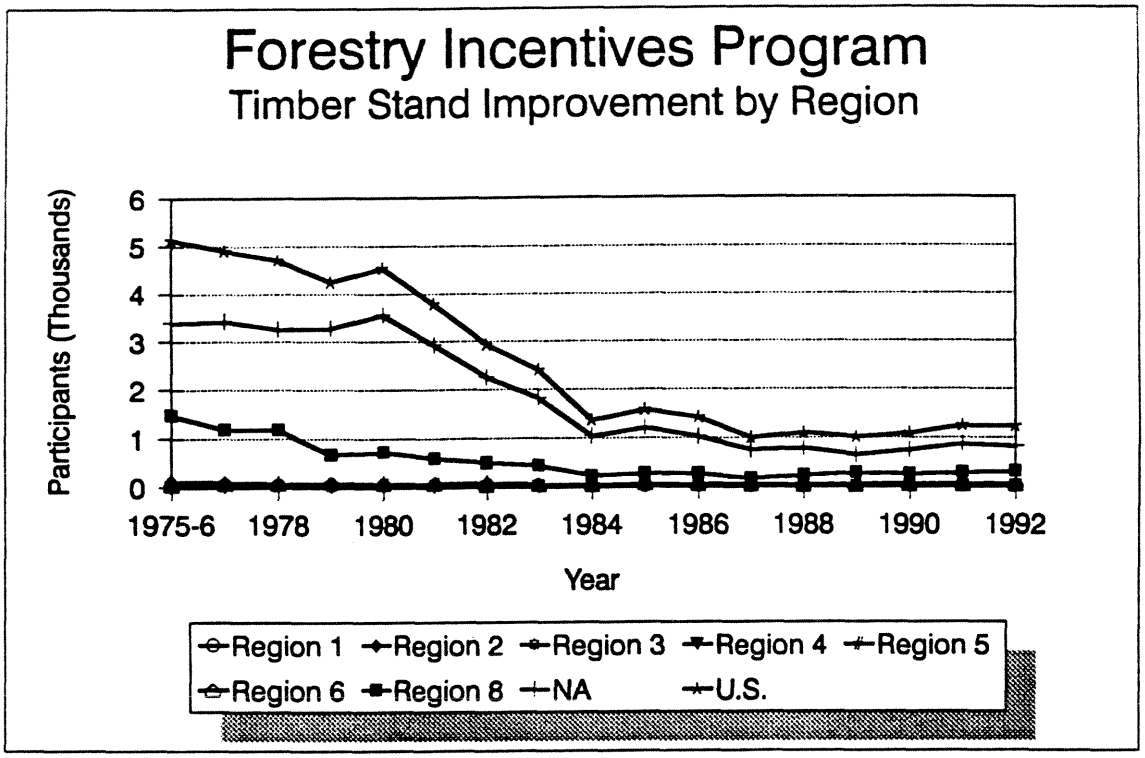
	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 8	NA	U.S.
1975-6	31	51	3	0	24	58	2,813	2,789	5,769
1977	12	26	0	0	18	89	3,953	1,161	5,259
1978	3	13	0	0	29	124	4,163	767	5,099
1979	1	6	0	0	76	189	4,701	764	5,737
1980	4	9	0	0	89	229	4,992	768	6,091
1981	8	10	2	0	47	218	5,194	736	6,215
1982	7	2	1	0	24	150	3,874	558	4,616
1983	6	3	0	2	21	135	3,585	501	4,253
1984	7	2	0	1	9	123	3,001	343	3,486
1985	4	2	0	0	11	133	3,830	378	4,358
1986	5	4	1	2	13	164	4,282	421	4,892
1987	6	2	0	0	3	100	2,625	299	3,035
1988	4	1	0	0	13	187	3,528	327	4,060
1989	4	3	0	0	9	159	3,587	260	4,022
1990	5	1	0	0	4	176	3,168	316	3,670
1991	12	1	0	0	5	177	3,616	335	4,146
1992	15	2	0	0	10	150	3,398	354	3,929



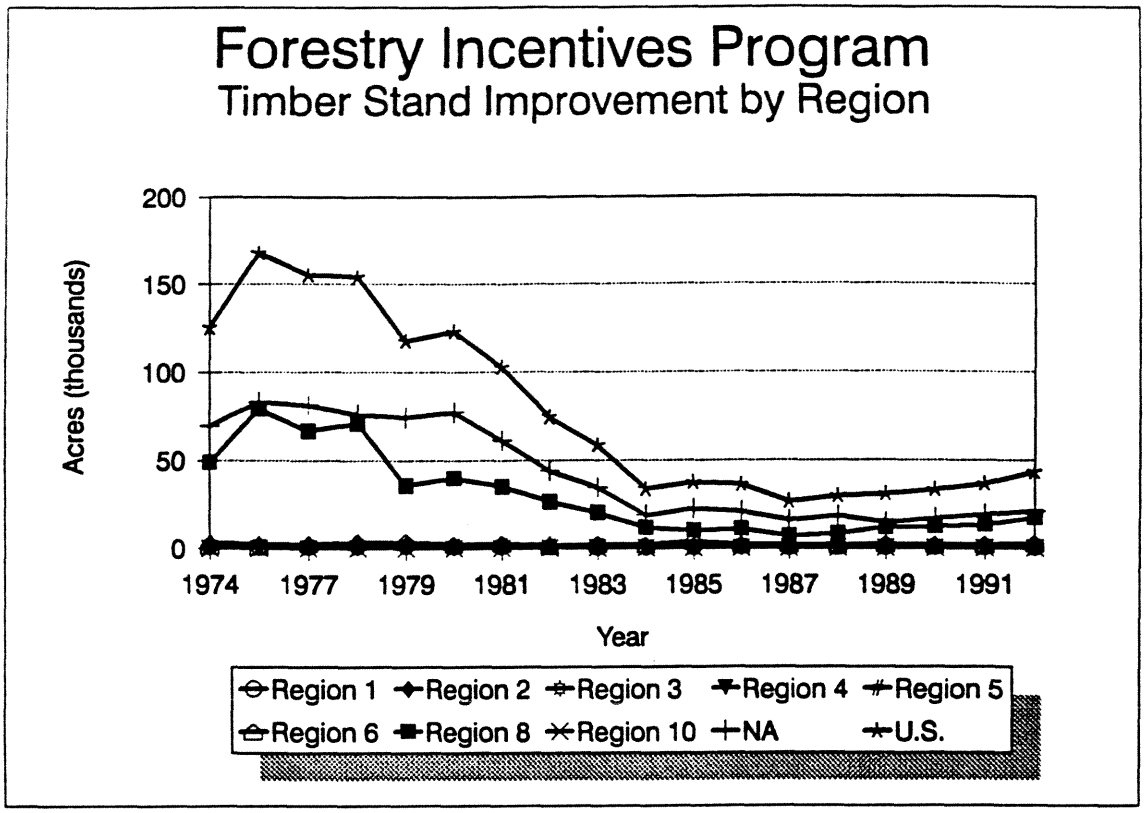
	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 8	NA	U.S.
1974	82	618	14	43	1,015	2,557	141,441	22,235	168,005
1975-6	181	366	38	0	410	1,017	82,049	23,448	107,509
1977	47	223	0	0	424	2,057	135,239	14,760	152,750
1978	12	141	0	0	617	3,569	152,632	11,843	168,814
1979	2	56	0	0	2,052	5,634	192,343	11,900	211,987
1980	63	124	0	0	1,944	6,697	197,890	12,242	218,960
1981	123	109	20	0	867	6,854	190,230	13,015	211,218
1982	108	20	10	0	383	4,823	140,546	9,291	155,181
1983	120	56	0	138	430	3,993	129,806	8,790	143,333
1984	77	18	0	148	258	4,077	119,102	6,279	129,959
1985	88	21	0	0	331	4,528	154,995	7,344	167,307
1986	61	45	10	240	330	5,857	175,174	8,261	189,978
1987	213	28	0	0	39	4,036	108,038	6,101	118,455
1988	61	10	0	0	260	6,681	143,321	7,077	157,410
1989	75	37	0	0	181	6,312	152,115	5,413	164,133
1990	183	10	0	0	176	7,153	136,850	6,345	150,717
1991	146	10	0	0	126	8,255	160,950	6,714	176,201
1992	374	10	0	0	137	6,465	147,501	7,280	161,767



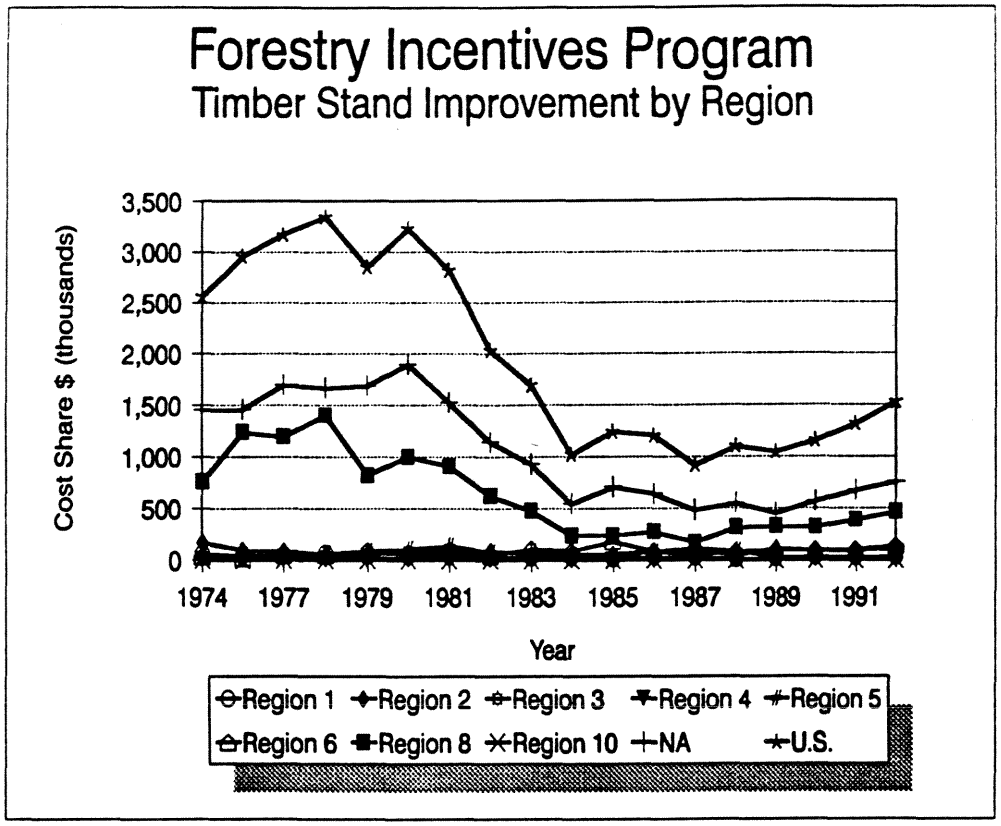
	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 8	NA	U.S.
1974	8,256	54,531	1,630	2,725	70,908	158,206	5,490,790	761,464	6,548,510
1975-6	15,959	29,302	2,819	0	40,809	55,873	4,111,117	900,862	5,156,741
1977	3,857	18,099	0	0	39,738	151,848	6,226,348	705,750	7,145,640
1978	1,157	12,069	0	0	49,565	297,238	7,717,612	585,708	8,663,349
1979	100	7,049	0	0	211,303	555,979	10,119,504	643,921	11,537,856
1980	8,947	13,717	0	0	213,102	789,682	11,628,071	703,452	13,356,971
1981	15,612	9,020	2,064	0	107,162	916,516	12,802,054	942,054	14,794,482
1982	8,513	1,535	1,789	0	52,996	692,457	8,691,173	638,732	10,087,195
1983	13,968	3,348	0	6,171	59,211	558,606	7,250,030	584,288	8,475,622
1984	6,571	1,870	0	8,423	28,584	555,518	5,775,788	474,579	6,851,333
1985	11,831	3,238	0	0	30,797	705,845	7,348,541	594,547	8,694,799
1986	6,012	3,465	1,470	13,190	45,589	819,075	8,426,109	668,810	9,983,720
1987	32,982	2,742	0	0	4,006	523,513	5,343,669	522,628	6,429,540
1988	11,312	830	0	0	38,681	896,813	7,674,159	633,743	9,255,538
1989	9,463	2,788	0	0	31,521	749,672	8,470,447	453,269	9,717,160
1990	24,686	1,335	0	0	24,494	854,709	8,021,250	463,189	9,389,663
1991	17,040	2,000	0	0	26,535	902,753	9,104,709	598,157	10,651,194
1992	48,046	155	0	0	29,141	825,598	8,555,894	625,037	10,083,871



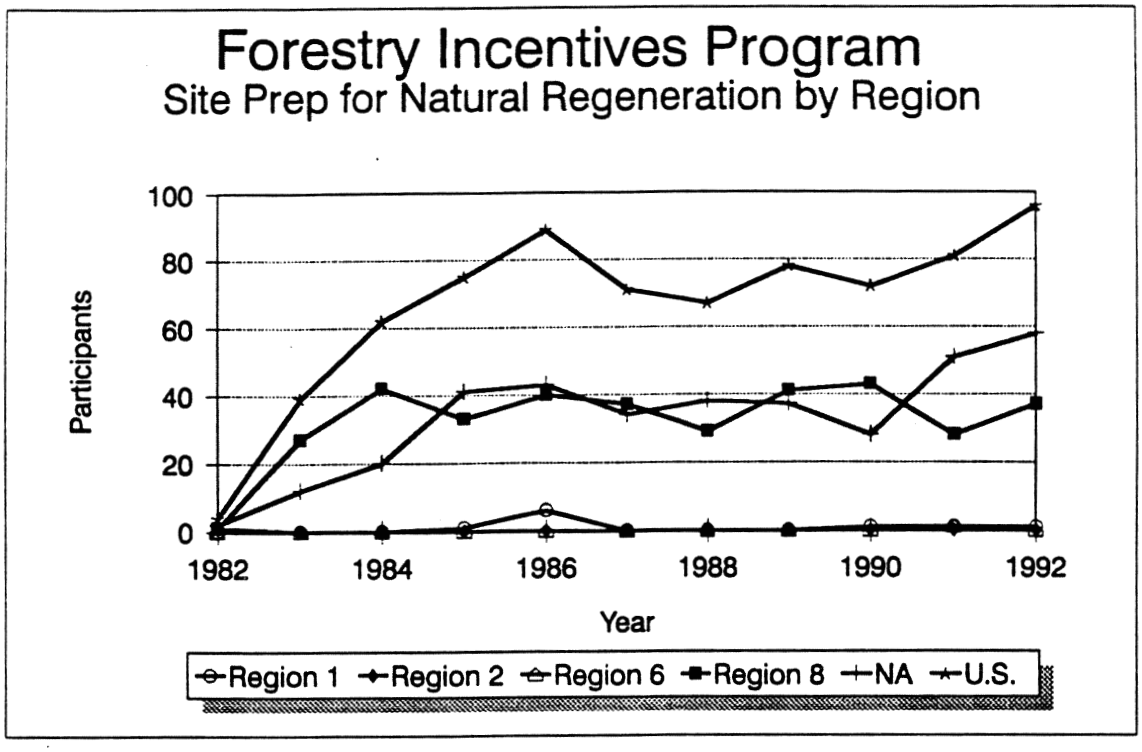
	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 8	NA	U.S.
1975-6	36	126	39	0	22	35	1,477	3,389	5,124
1977	54	101	29	1	23	68	1,191	3,432	4,899
1978	47	83	23	0	31	67	1,191	3,263	4,705
1979	46	64	22	0	52	95	677	3,283	4,239
1980	47	70	11	1	61	61	729	3,560	4,540
1981	49	81	15	1	62	58	599	2,925	3,790
1982	29	82	12	0	39	25	495	2,254	2,936
1983	19	46	10	0	40	36	431	1,818	2,400
1984	19	33	2	1	27	28	217	1,042	1,369
1985	9	34	3	0	21	48	259	1,211	1,585
1986	14	48	1	1	43	34	261	1,024	1,426
1987	4	48	1	0	16	20	160	752	1,001
1988	7	35	7	0	27	17	221	786	1,100
1989	5	56	3	0	13	16	278	641	1,012
1990	11	48	4	0	13	20	251	747	1,094
1991	11	55	4	0	12	21	275	869	1,247
1992	15	62	5	0	12	26	307	816	1,243



	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 8	Region 10	NA	U.S.
1974	1,127	3,207	966	46	617	1,108	48,776	39	69,471	125,357
1975-6	603	2,146	2,116	0	426	719	79,065	0	82,798	167,873
1977	717	2,437	1,697	12	633	2,337	66,443	0	80,882	155,158
1978	817	1,513	1,186	0	739	3,387	70,720	0	75,720	154,082
1979	1,029	1,253	1,097	0	975	3,486	35,557	0	74,188	117,585
1980	873	1,691	508	11	1,062	2,131	39,597	0	77,107	122,980
1981	727	1,919	394	12	1,254	2,385	34,801	0	61,110	102,602
1982	443	2,015	440	0	686	972	26,112	0	43,653	74,321
1983	312	1,114	301	0	704	2,004	19,829	0	34,089	58,353
1984	276	1,318	25	9	451	1,669	11,340	0	18,257	33,345
1985	261	1,125	37	0	328	3,521	9,641	0	22,220	37,133
1986	398	1,844	15	18	715	1,751	10,605	0	20,484	35,830
1987	184	1,768	13	0	331	1,827	6,495	0	15,520	26,138
1988	107	828	173	0	682	1,676	7,867	0	18,056	29,389
1989	214	2,266	77	0	191	2,086	11,571	0	14,128	30,533
1990	362	1,768	373	0	233	1,752	12,045	0	16,666	33,199
1991	284	1,986	155	0	222	1,735	13,134	0	18,931	36,447
1992	347	2,148	43	0	250	2,436	17,316	3	20,649	43,192

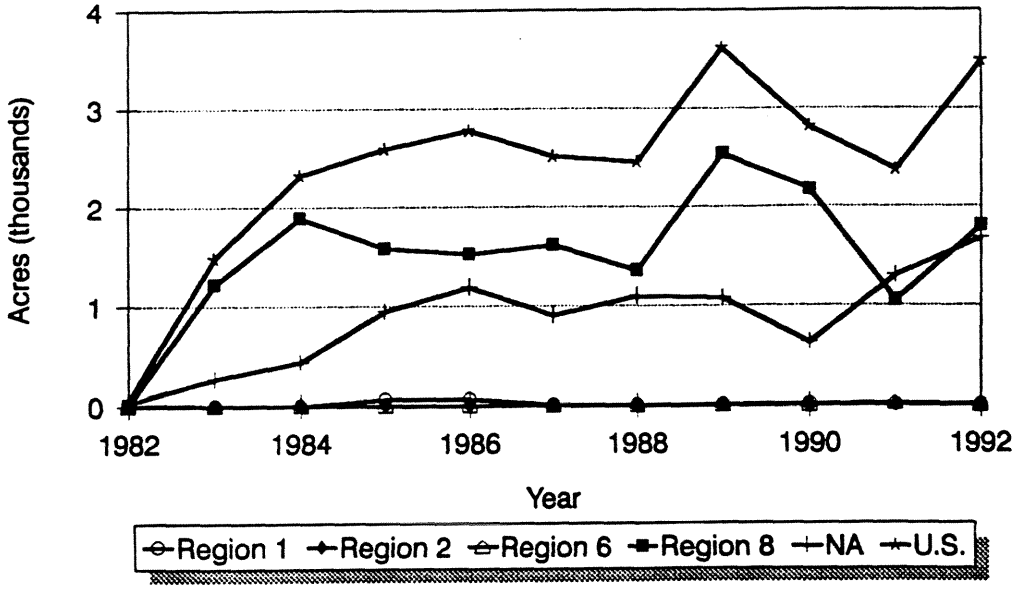


	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 8	Region 10	NA	U.S.
1974	65,785	169,244	25,754	1,460	44,444	36,588	760,046	2,500	1,453,312	2,559,133
975-6	37,489	95,567	54,757	0	46,976	21,048	1,237,764	0	1,459,535	2,953,136
1977	54,251	89,590	43,832	900	38,093	52,350	1,194,327	0	1,695,342	3,168,685
1978	67,702	61,378	32,056	0	64,698	49,150	1,403,549	0	1,665,608	3,344,141
1979	73,500	57,047	30,350	0	92,031	85,046	822,046	0	1,687,286	2,847,306
1980	62,537	73,784	23,283	627	110,474	67,961	997,288	0	1,893,031	3,228,985
1981	56,985	100,818	18,379	371	136,657	71,013	905,487	0	1,525,752	2,815,462
1982	33,772	89,506	21,547	0	79,085	44,976	622,407	0	1,139,073	2,030,366
1983	25,512	58,491	13,398	0	83,209	107,743	477,329	0	926,946	1,692,628
1984	26,856	67,487	661	718	52,858	88,976	236,368	0	546,574	1,020,498
1985	13,811	56,565	2,293	0	41,126	179,466	238,250	0	708,990	1,240,501
1986	29,393	90,669	428	2,310	83,760	84,008	271,953	0	639,561	1,202,082
1987	23,997	87,102	609	0	39,001	114,108	168,579	0	483,821	917,217
1988	8,237	43,785	7,635	0	90,513	81,111	316,365	0	552,023	1,099,669
1989	18,121	115,190	3,060	0	29,746	95,128	329,180	0	452,365	1,042,790
1990	31,011	86,609	19,054	0	35,260	96,100	320,322	0	566,226	1,154,582
1991	27,475	93,797	6,443	0	26,048	100,628	388,915	0	675,126	1,318,432
1992	33,983	111,517	2,810	0	30,263	133,794	465,610	215	753,674	1,531,866

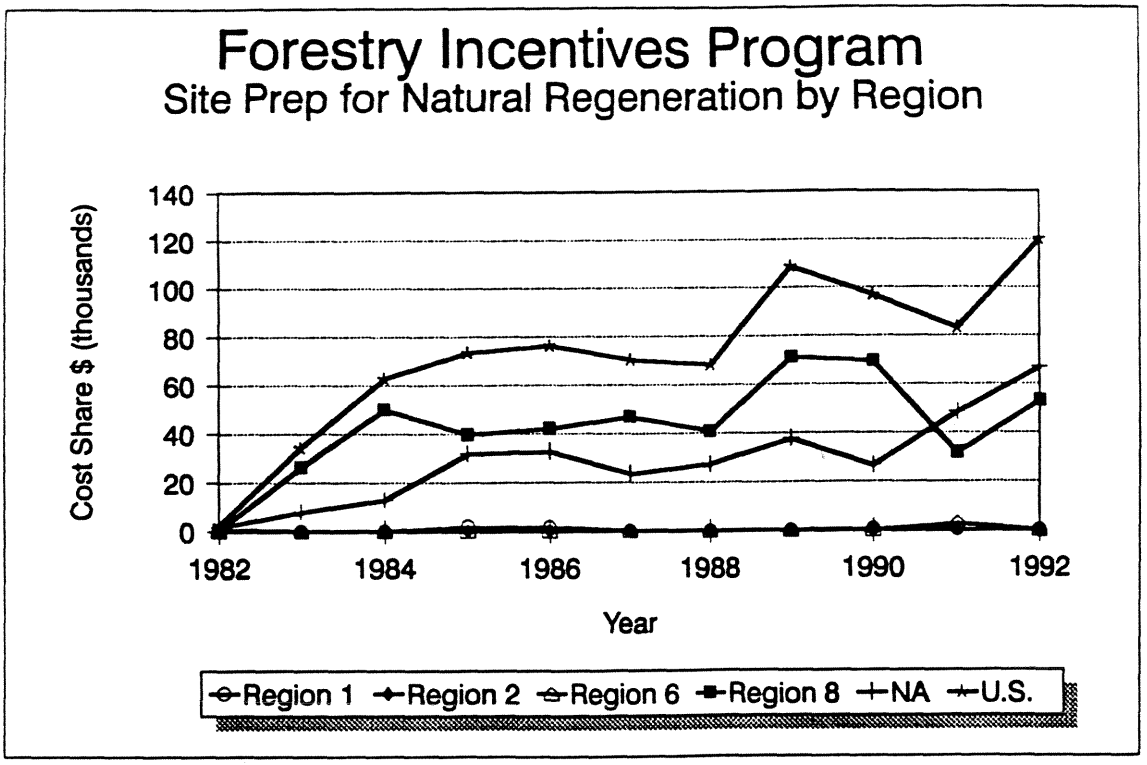


	Region 1	Region 2	Region 6	Region 8	NA	U.S.
1982	0	1	0	1	2	4
1983	0	0	0	27	12	39
1984	0	0	0	42	20	62
1985	1	0	0	33	41	75
1986	6	0	0	40	43	89
1987	0	0	0	37	34	71
1988	0	0	0	29	38	67
1989	0	0	0	41	37	78
1990	1	0	0	43	28	72
1991	1	0	1	28	51	81
1992	1	0	0	37	58	96

Forestry Incentives Program
Site Prep for Natural Regeneration by Region



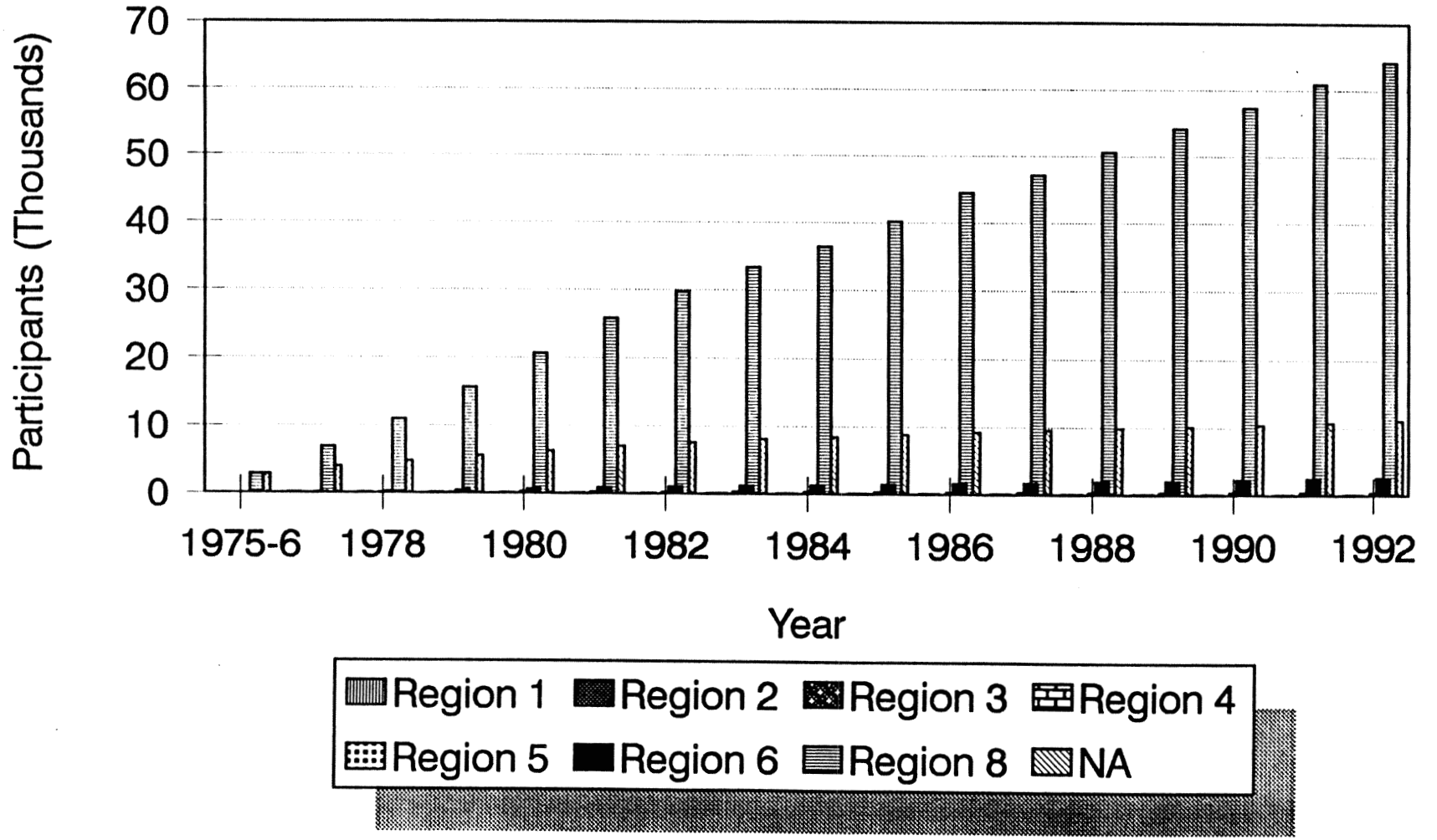
	Region 1	Region 2	Region 6	Region 8	NA	U.S.
1982	0	10	0	14	33	57
1983	0	0	0	1,218	267	1,485
1984	0	0	0	1,890	436	2,326
1985	61	0	0	1,582	949	2,592
1986	64	0	0	1,524	1,188	2,776
1987	0	0	0	1,613	901	2,514
1988	0	0	0	1,356	1,099	2,455
1989	0	0	0	2,541	1,076	3,617
1990	10	0	0	2,173	628	2,811
1991	2	0	20	1,049	1,303	2,374
1992	2	0	0	1,804	1,681	3,487



	Region 1	Region 2	Region 6	Region 8	NA	U.S.
1982	0	780	0	437	1,542	2,759
1983	0	0	0	26,363	8,041	34,404
1984	0	0	0	50,131	12,863	62,994
1985	1,959	0	0	39,711	31,903	73,573
1986	1,551	0	0	42,051	32,698	76,300
1987	0	0	0	46,860	23,582	70,442
1988	0	0	0	40,947	27,367	68,314
1989	0	0	0	71,089	37,790	108,879
1990	511	0	0	69,626	26,685	96,822
1991	278	0	2,802	31,806	48,423	83,309
1992	134	0	0	53,247	66,968	120,349

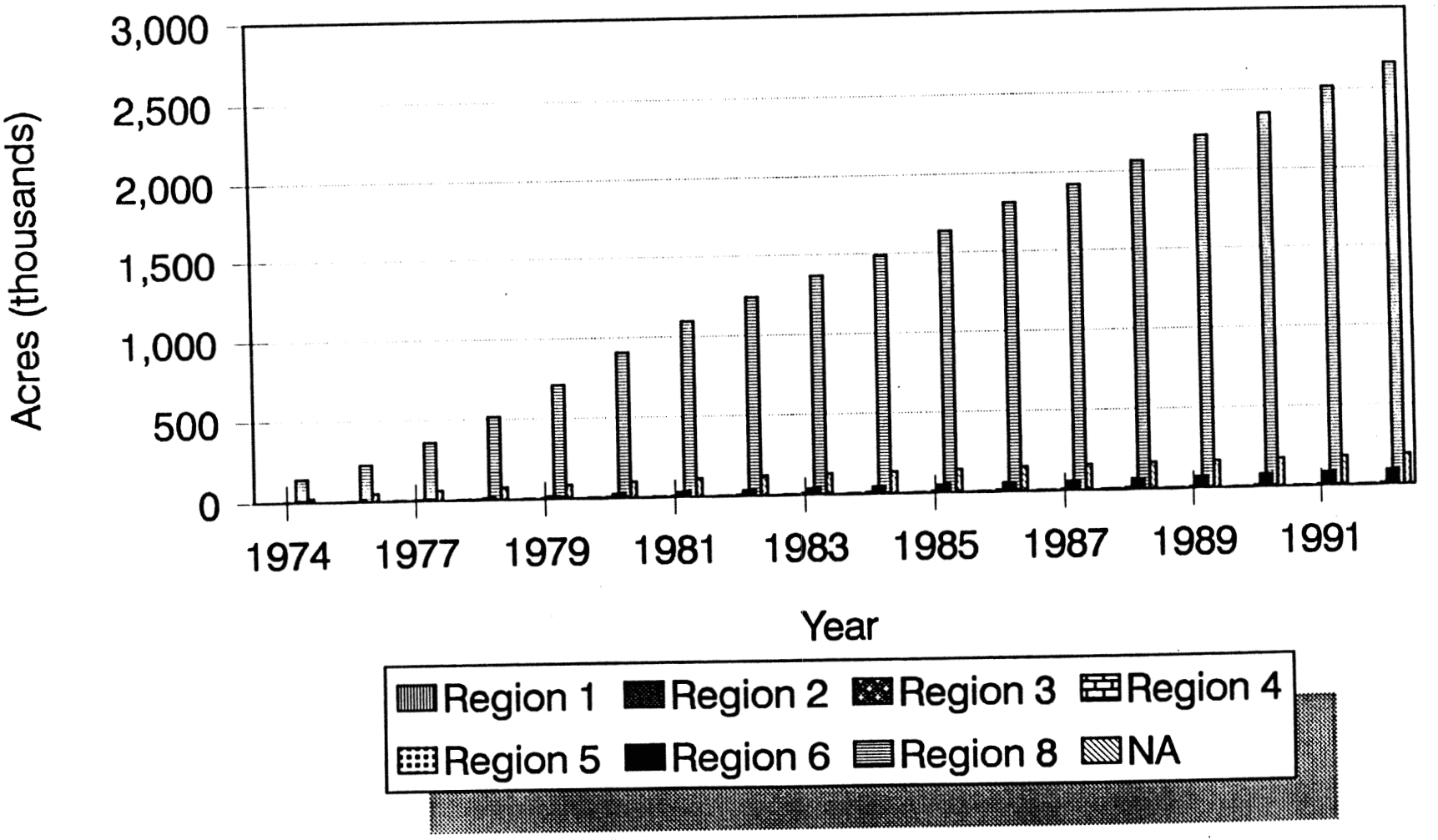
Forestry Incentives Program

Cumulative Tree Planting by Region



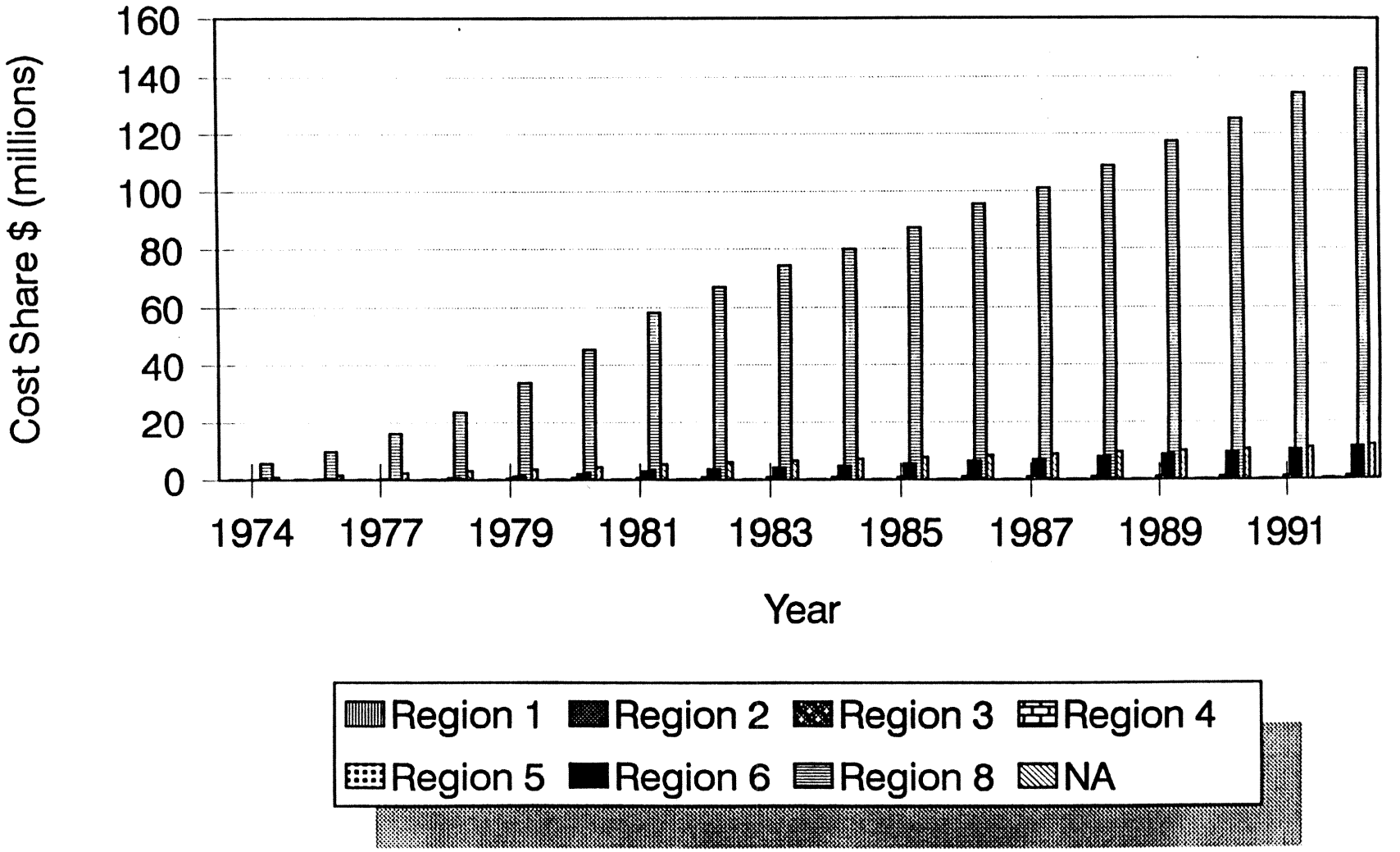
Forestry Incentives Program

Cumulative Tree Planting by Region



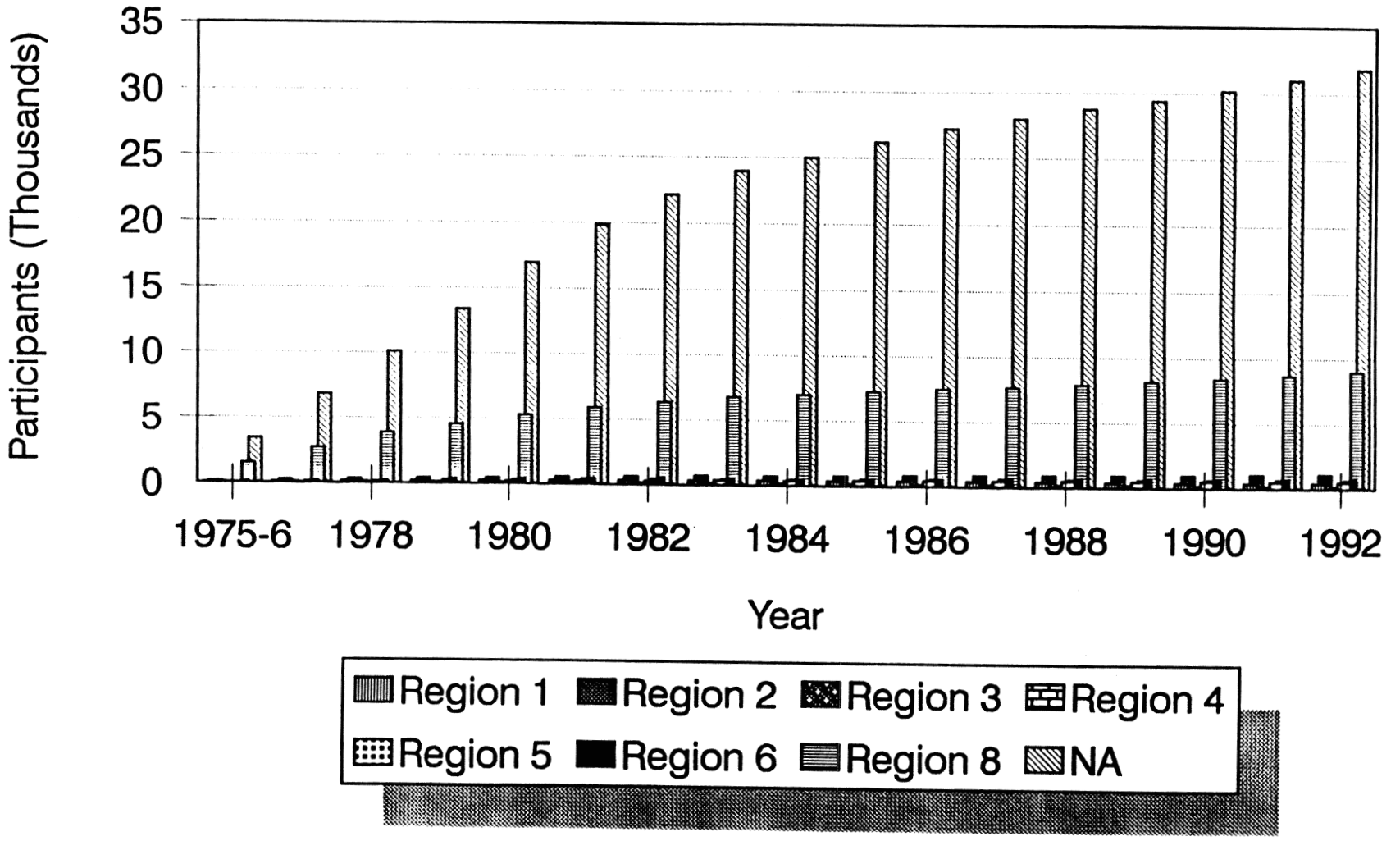
Forestry Incentives Program

Cumulative Tree Planting by Region



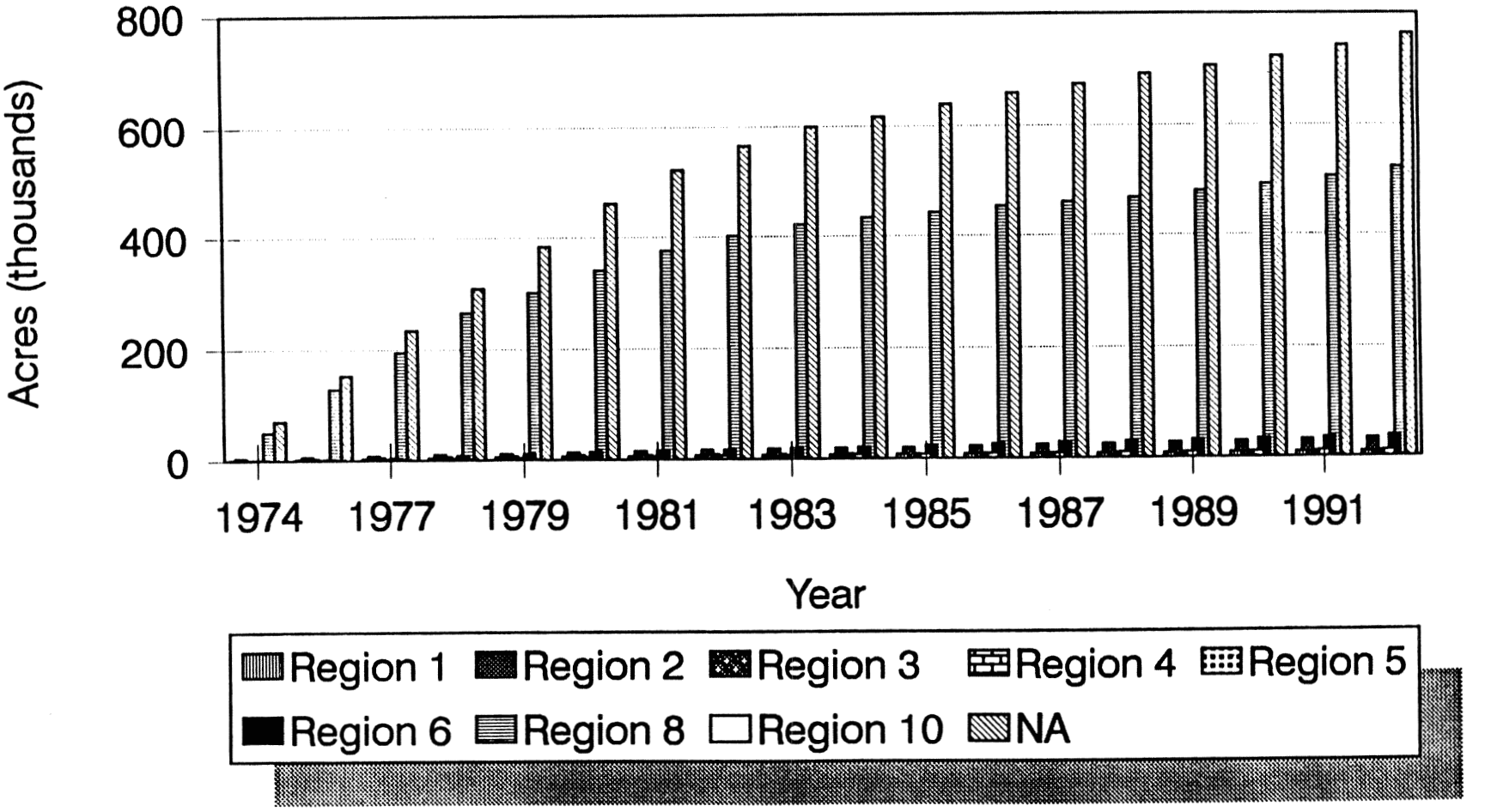
Forestry Incentives Program

Cumulative Timber Stand Improvement by Region



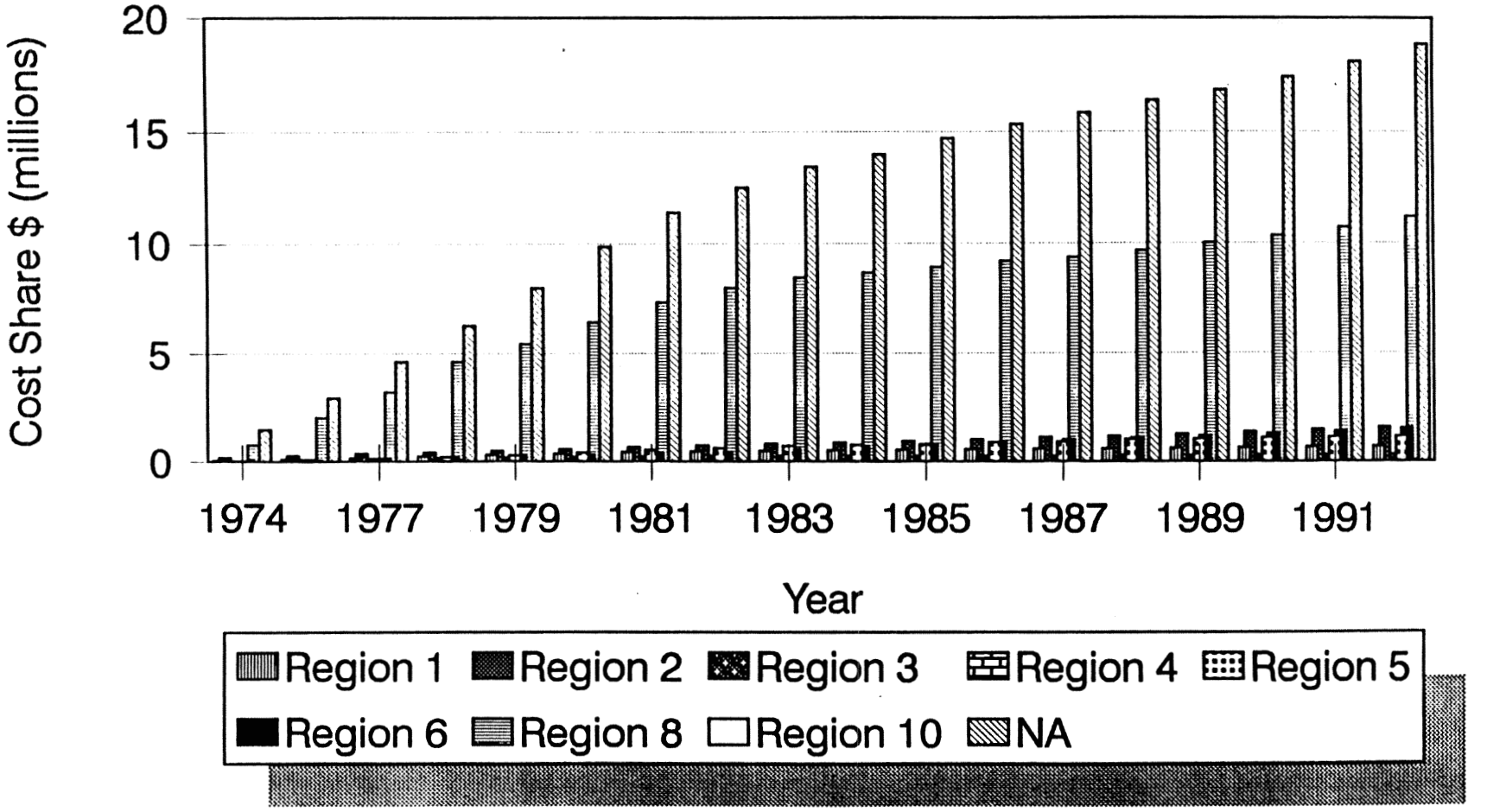
Forestry Incentives Program

Cumulative Timber Stand Improvement by Region



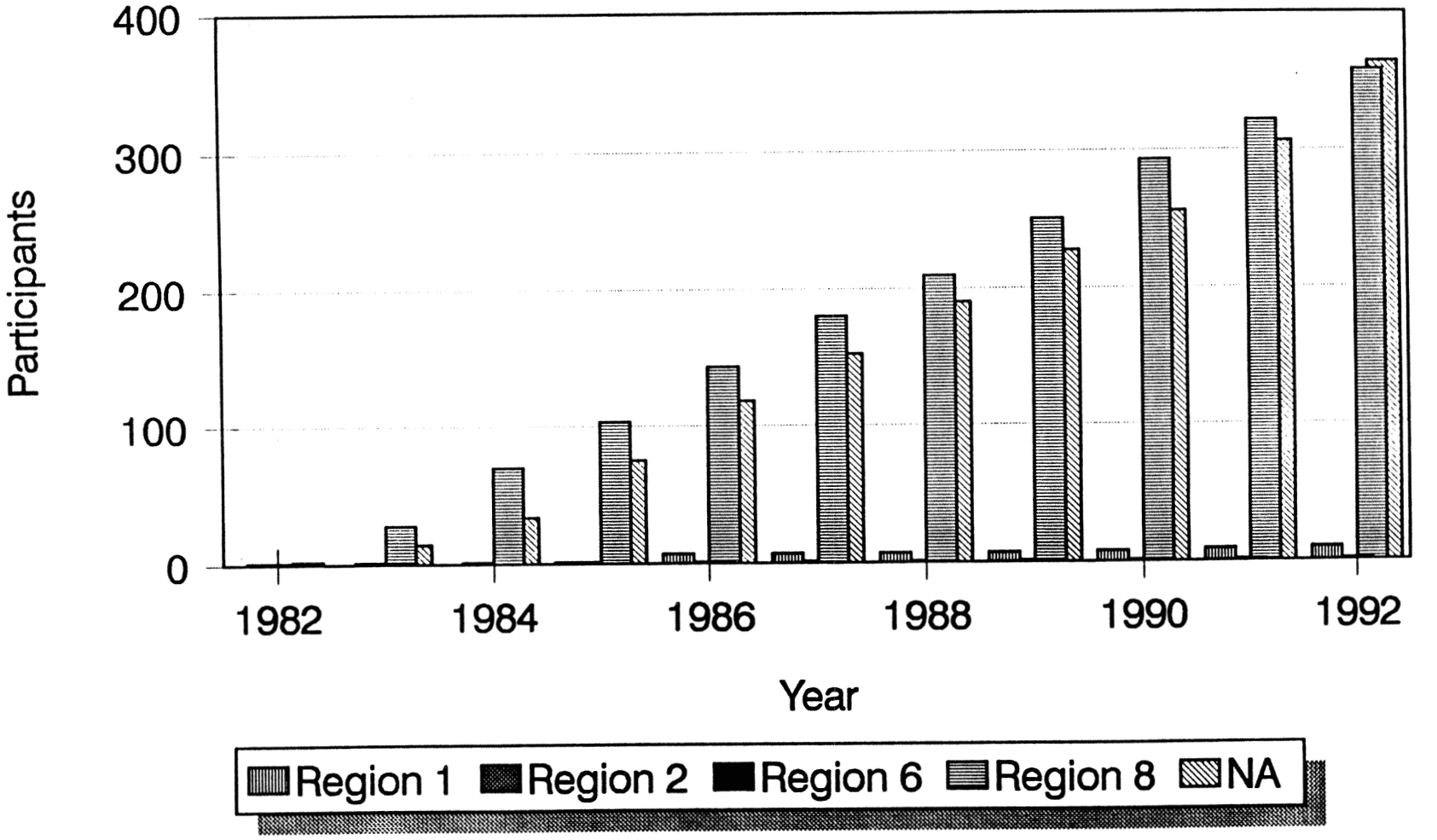
Forestry Incentives Program

Cumulative Timber Stand Improvement by Region

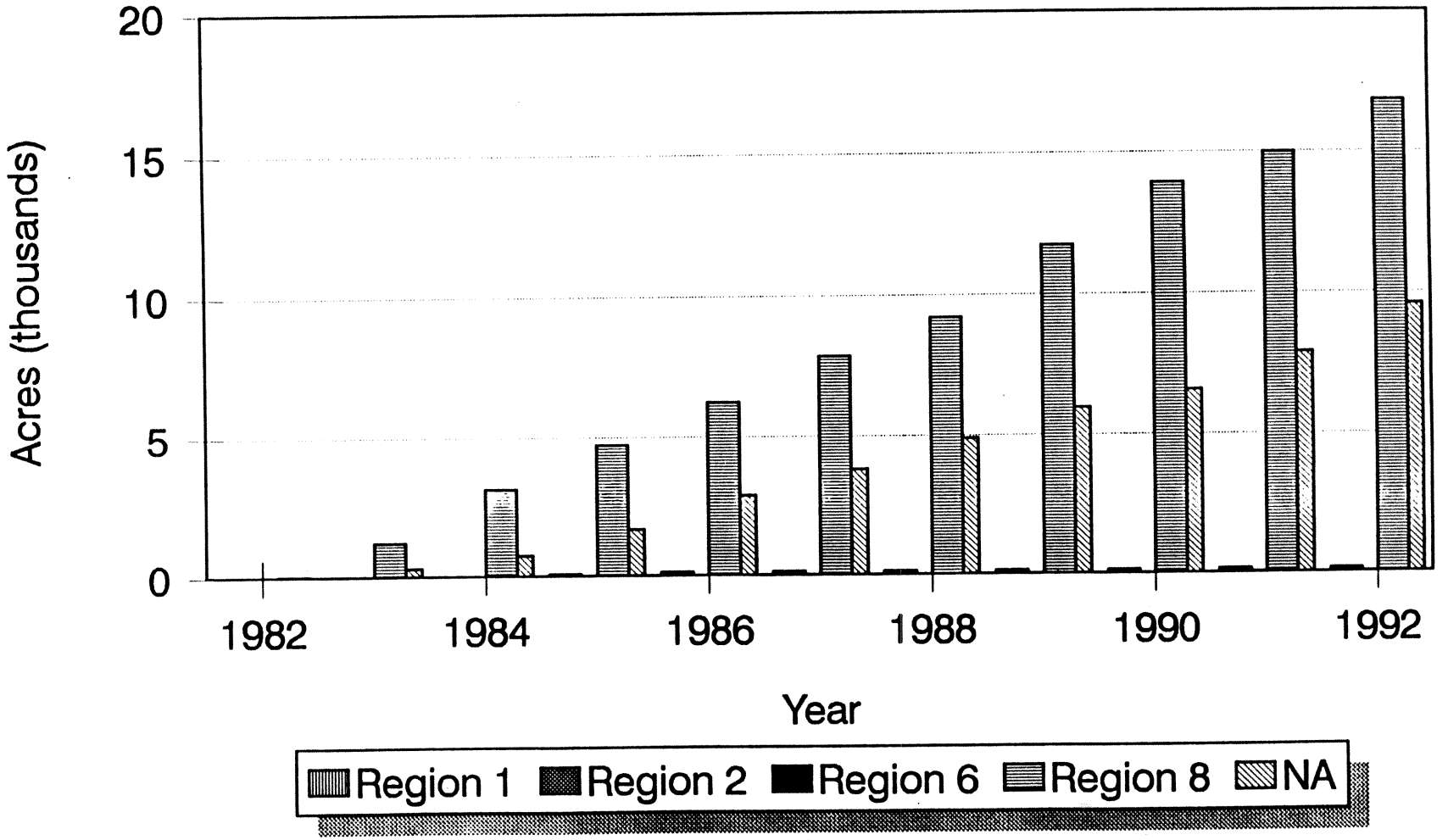


Forestry Incentives Program

Cumulative Site Prep for Natural Regeneration by Region



Forestry Incentives Program
Cumulative Site Prep for Natural Regeneration by Region



Forestry Incentives Program

Cumulative Site Prep for Natural Regeneration by Region