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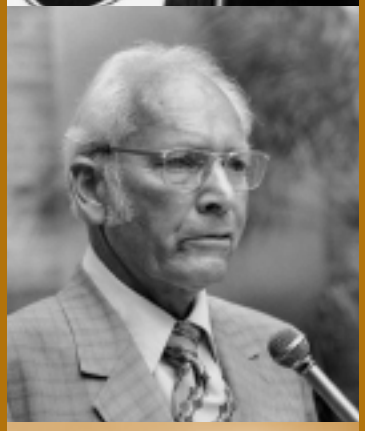
HISTORY AND EVALUATION OF THE McINTIRE-STENNIS COOPERATIVE FORESTRY RESEARCH PROGRAM



Forest and Wildlife Research Center

Research Bulletin

The Forest and Wildlife Research Center at Mississippi State University was established by the Mississippi Legislature with the passage of the renewable Natural Resources Research Act of 1994. The mission of the Center is to conduct research and technical assistance programs relevant to the efficient management and utilization of the forest, wildlife, and fisheries of the state and region, and the protection and enhancement of the natural environment associated with these resources. The FWRC scientists conduct this research in laboratories and forests administered by the University and cooperating agencies and industries throughout the country. Research results are made available to potential users through the University's educational program and through Center publications such as this, which are directed as appropriate to forest landowners and managers, manufacturers and users of forest products, leaders of government and industry, the scientific community, and the general public. Dr. Bob L. Karr is director of the Forest and Wildlife Research Center.

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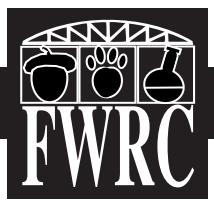

Research Bulletin FO 269

FOREST AND WILDLIFE RESEARCH CENTER

Mississippi State University

HISTORY and EVALUATION of the McINTIRE-STENNIS COOPERATIVE FORESTRY RESEARCH PROGRAM

Don H. Thompson, Northeast Mississippi Community College
and Steven H. Bullard, Mississippi State University

2004

Forest and Wildlife Research Center
Mississippi State University

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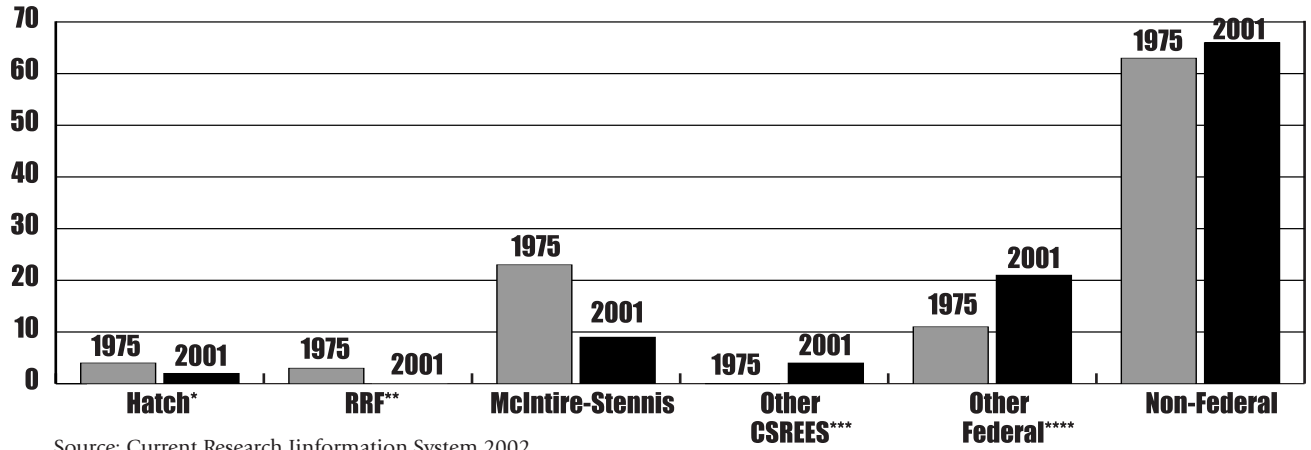
INTRODUCTION

On October 10, 1962, President John Kennedy signed PL 87-788 (Appendix A) now known as the McIntire-Stennis Cooperative Forestry Research Program. After 40 years, this formula-based cooperative program continues to provide the base support for much of the forestry research conducted at 65 public forestry institutions. While still important, the proportion of McIntire-Stennis research sponsored over this time period has decreased. Other funding sources, such as competitive grants through the Cooperative State Research, Education, and Extension Service and other government agencies along with special grants appropriated by Congress, now finance a higher proportion of forestry research as shown in Figure 1. The level of funding from non-federal sources has increased slightly.

This evaluation is an attempt to determine whether the decline in support is due to an "internal" failure of the program to meet its goals and objectives or "external" pressures from influences of other more "popular" funding sources. Most of the forestry leaders who fought for its passage and implementation are now gone. Few today in forestry research know of the extensive efforts exerted by earlier forestry leaders to establish the McIntire-Stennis program. This history provides a tribute to the dedication of earlier forestry leaders, and at the same time, demonstrates a possible path for renewal of their efforts to increase the level of forestry research.

President John F. Kennedy (R) is shown with Senator Stennis (L) a few weeks after taking office in February 1961. During his campaign President Kennedy pledged to support forestry and forestry research. He signed PL 78-877 on October 10, 1962. This law was later named the McIntire-Stennis Cooperative Forestry Research Program (Picture courtesy of the Congressional and Political Research Center, Mississippi State University Libraries)

Figure 1 Percentages of Forestry Research Funds Received from Various Sources in FY 1975 and FY 2001 by McIntire-Stennis Institutions



Source: Current Research Iinformation System 2002
* Hatch Act Funds
**Regional Research Funds (Specified portion of Hatch Funds)
***Competitive and Special Grants administered by Cooperative State Research, Education, and Extension Service (CSREES)
****Funds from other federal agencies

In 1926, the Special Committee on Forest Research of the Washington Section of the Society of American Foresters suggested that the knowledge about forest development could be built by trial and error or through research conducted by highly trained investigators (Clapp 1926). After a full study of forest research, Clapp (1926, p. 206) concluded, "The big national problem of forest research has been attacked in a halting, desultory way without adequate resources, organization, suitably trained men, or the means of training men."

Prior to 1928 forestry research was carried out on university forests at Harvard, Yale, the University of Minnesota, the University of Michigan, Michigan State College, and Cornell. When teaching duties allowed, at some institutions, research projects were conducted in cooperation with USDA Forest Service personnel. (Kaufert and Cummings 1955).

According to Kaufert and Cummings (1955, p. 55) $2.6 million was spent on forestry research in 1928, and by 1953, $45.4 million was expended. They predicted that at least $200 million would be necessary to maintain the requisite level of research in 1978.

Westveld (1954, p. 85) reported that in 1934, one-half of the fourteen accredited forestry schools had research budgets. Between 1945 and 1951, forest research was initiated at 15 forestry schools, 11 of which were land grant colleges. Land grant colleges were established by the Morrill Act of 1862 (7 U.S.C. ßß 301-308) to provide a "well rounded" publicly funded education for those students unable to attend expensive private colleges. Agricultural research was funded at the land grant institutions through the Hatch Act of 1887 (7 U.S.C. ßß361a et. seq).

In 1951, forty-four institutions had forest research programs (Westveld 1954, p. 88). While the number of institutions conducting forestry research more than doubled in the three-year period from 1951 to 1954, the funding of forestry research was low compared to other research areas. Westveld (1954, p. 86) suggested that the large area (69 percent) of the country occupied by forests justified additional funds for forestry research.

In 1952, agricultural experiment stations received $12,857,000 with only $137,000 or just over one percent going to forestry research (Kaufert and Cummings, 1955, p. 64). At four accredited forestry schools the forestry research budget was less than 0.5 percent of the experiment station budget (Westveld 1954 p. 86). The land grant institutions were a logical choice for additional research funding since 33 of 40 universities providing both forestry instruction and conducting research were in the land grant system.

The low level of forestry research funding prompted Kaufert and Cummings (1955, p.47) to suggest that forestry schools should be more "aggressive and imaginative" in competing with agriculture. Forestry research was an eligible area of research in the Hatch Act. However, many experiment station directors felt that they would be penalized if they used Hatch funds for anything other than agricultural research. With the low priority for forestry research at the land grant schools, forestry schools not connected with experiment stations were

Representative Clifford G. McIntire was the Republican Congressman from Maine from 1951-1964. When contacted by Dr. Albert Nutting, Director of the School of Forest Resources at the University of Maine, about the need for institutional research funding, Representative McIntire helped to craft the initial legislation. He considered the McIntire-Stennis Act as his major congressional accomplishment. (Picture courtesy of the Forest History Society, Durham, NC)

often carrying out more forest research. Funds expended by industry, the USDA Forest Service, and state agencies increased to boost forestry research. The states provided about 60 percent of the institutional forestry research funds in 1951 (Westveld 1954). According to a Society of American Foresters' study (SAF 1962, p. 868), institutional research funds increased from $1.2 million in fiscal year 1951 to $6.5 million in 1960. In 1953, twenty-five accredited forestry schools spent $1.7 million on forestry research, and by fiscal year 1959-1960 over $3.9 million was utilized by those institutions for forestry research (SAF 1962, p. 868). While the level of funding for forestry research was improving, additional funds were needed by the institutions.

Initial Attempts to Increase Institutional Funding

In 1956, the Department of Agriculture formed a Committee on Research Evaluation, later known as the CORE committee, to determine the status of research in agriculture (Westveld 1962; Harper 1972). For the first time, forestry deans were represented at the national level in meetings between the land grant colleges and USDA (Harper 1978). Following the CORE meeting, the Council of Forestry School Executives (COFSE) established a forest research subcommittee to study current research and recommend changes to meet future research goals. COFSE was an organization composed of forestry school deans and department heads. Serving on this forest research subcommittee were: R. H. Westveld, chairman, G. A. Garrett, Frank H. Kaufert, W. F. McCulloch, R. J. Preston, H. L. Shirley, and Henry Vaux.

Westveld's committee attended a conference in Washington, D.C. in February 1957 as a guest of the Experiment Station Committee on Organization and Policy (ESCOP) to seek additional institutional forest research funds (Fletcher 1961). The subcommittee representing land grant colleges sympathized with the low level of funding for forestry research, but little was gained as agricultural interests dominated the 1957 meeting of the CORE Committee (Westveld 1962). In a meeting on June 4, 1957, Westveld and R J. Preston representing COFSE met with Assistant Secretary of Agriculture Peterson, V. L. Harper, USDA Forest Service Research Chief, and E. C. Elting, Deputy Director for Experiment Stations in the Agricultural Research Service (Westveld 1962; Kallander 1986). Prior to the meeting, the COFSE research committee developed the following possibilities for increased funding of institutional forestry research: (1) increase the Hatch Act appropriations with the additional appropriations going to forestry research; (2) obtain a special appropriation under the Hatch Act; (3) amend the McSweeney-McNary Act to make payments for forestry research at educational institutions; and (4) increase USDA Forest Service appropriations for grants to educational institutions for forestry research. The McSweeny-McNary Act (16 U.S.C. ßß581, 581a, 581a-1, 581b-581I) established the USDA Forest Service research stations and provided for other research activities.

When the COFSE group met with USDA officials, Assistant Agriculture Secretary Peterson explained that forestry research funding must be increased, but not at the expense of agricultural research. Peterson felt that increasing Hatch Act funds for forestry research was not a good idea, but he did suggest that COFSE continue to meet with the USDA and the USDA Forest Service. To maintain the ties to the experiment stations, the COFSE research committee sought a liaison between the directors of ESCOP and COFSE.

At the ESCOP meeting held on November 9, 1957, in Denver, Frank Kaufert, representing COFSE, presented forestry's need for additional research funds (Westveld 1962). As in the previous meeting, they found sympathetic ears but opposition to increased funding through the Hatch Act. However, the ESCOP members had no opposition to amending the McSweeney-McNary

Dr. V.L. Harper was the Deputy Chief for Research in the USDA Forest Service from 1951-1965. He was instrumental in the passage of the McIntire-Stennis program and was considered by Senator John C. Stennis as the "father of that [McIntire-Stennis] movement." (Picture courtesy of the Forest History Society, Durham, NC)

Act to obtain additional contract funds from the USDA Forest Service. At the meeting with the Experiment Station Section of the American Association of Land Grant Colleges and State Universities (AALGCSU) in Denver on November 12, 1957, Kaufert sought possible recognition of forestry as a committee in this organization. According to Kerr (1987), this group in 1965 adopted its present name, the National Association of State Universities and Land Grant Colleges (NASULGC). However, forestry school officials would later decline this arrangement. As the experiment station directors and the forestry school leaders could not find common ground, other approaches were sought to increase funding for forestry research.

According to Westveld (1962), several forestry school executives made the needs for forestry research known to their Congressmen. F.H. Kaufert contacted Senators Thye and Humphrey of Minnesota about amending the McSweeney-McNary Act and R. J. Preston talked with Congressman Cooley of North Carolina, chairman of the House Agriculture Committee. Congressman Cooley felt that a new bill, especially if it promoted forest products research and graduate school training, would have a better chance of passage than amending the McSweeney-McNary Act. The COFSE Research Committee advised Congressman Cooley to proceed, and on March 19, 1958, H.R. 11495 was introduced to give the Secretary of Agriculture the authority to contract with educational institutions for forestry research. This bill provided $5 million each year for 5 years. On April 25, 1958, Senator Neuberger of Oregon, Senator Javits of New York, Senator Morse of Oregon, Senator Allott of Colorado, Senators Mansfield and Murray of Montana, and Senator Proxmire of Wisconsin introduced S. 3709, a companion bill to H. R. 11495. Westveld discussed the pending legislation with Congressman Curtis of Missouri. Curtis introduced H. R. 12592, which eliminated the $5 million appropriation in each of the five years, because Curtis wanted to gradually increase the level of funding to encourage an efficient expansion of forestry research. Although Curtis believed that the Department of Agriculture had the authority under present laws to contract with the institutions, he hoped that hearings on the subject would focus Congress's attention on the need for forestry research.

The Council of the Society of American Foresters encouraged support of the pending legislation to increase funding and appointed representatives to appear before congressional hearings for the proposed bills to increase contractual arrangements between the Department of Agriculture and forestry schools (Westveld 1962). On June 6, 1958, Acting Agriculture Secretary True Morse informed Congressman Cooley that the Department had existing authority to contract with forestry schools, thus negating the pending legislation. On June 30, 1958, three members of the Research Committee met with Congressman Cooley, USDA Forest Service Chief R. H. McArdle, and USDA Forest Service Research Chief V. L. Harper to determine future actions and judge Agriculture

Secretary Benson's response for additional research funds. Benson believed that additional cooperative funds for forestry school research would be considered along with the other funding requests. Only marginal gains were made when the cooperative grant program for FY 1962 increased to $500,000 compared to prior amounts ranging from $100,000 to $150,000 per year. The "political" procedures used by COFSE to seek funds were questioned by its members (Westveld 1963, p. 7).

The Cooperative Forestry Research Program

Some members of the research committee of the Council of Forestry School Executives, believing that their committee had overstepped its bounds in influencing legislation, voted for its dissolution. To distance themselves from any political association, they passed a resolution asking the Council of the Society of American Foresters to continue the committee's efforts to seek additional federal funding for forestry research (Westveld 1962). According to reports of the Committee on Forestry Research (SAF 1958), the Chairman of the Council of Forestry School Executives, Henry Vaux, at the September 1958 SAF meeting asked that a standing Committee on Forestry Research be appointed by the Council of the Society of American Foresters to: (1) report needs of forestry schools to ESCOP and AALGCSU; (2) testify to support necessary legislation; and (3) inform Congress about forestry research needs. At the first meeting in November 1959, the committee began by assessing the current state of research, looking at the pressing problems, deciding which areas needed the most help, and finally suggesting remedies to relieve the shortcomings in forestry research. Because of their efforts, ESCOP with the agreement of AALGCSU decided to ask for an additional $14 million in Hatch Act appropriations with $5 million marked for forestry. However, with large crop surpluses in January 1960, President Eisenhower only recommended a $1 million increase in Hatch, and Congress adopted his recommendation. To better focus on forestry research in the land grant institutions, a new organization was established.

Fletcher (1961) reported the establishment of an independent informal group, the Working Committee on Forestry at Land Grant Colleges, with Westveld as chairman, Kaufert as vice-chairman, and Preston as secretary. In November 1960 the Working Committee on Forestry at Land Grant Colleges adopted a new name and became the Commission on Forestry at Land Grant Institutions with Westveld, chairman; Preston, vice chairman; and Fletcher, secretary. Later an advisory committee was formed from each of the ESCOP regions with McCulloch of Oregon State, Stoltenberg of Iowa State, DeVall of Auburn, and Nutting of the University of Maine as committee members. The Commission reported that in 1961 President Kennedy approved an increase in Hatch Act funds of $3 million. At the Congressional hearings, Representative Jamie Whitten, Chairman of the Sub-Committee on Appropriations in the House of Representatives, told the Commission that the Hatch formula was outdated and that they should look for additional funds from other sources (Westveld 1963). New legislation providing funds specifically for forestry research appeared to be the only solution for the funding dilemma.

In 1961 Harper (1972) was asked by T. Earl Price, Agricultural Experiment Station Director at Oregon State to assist in finding a method to improve forestry school research funding. Harper had been very successful in increasing the funding of forestry research in the USDA Forest Service, and he believed that a new cooperative program could bring institutional forestry research to the same level. To institute a cooperative program, Harper needed congressional support.

In 1961, Director A. D. Nutting of the School of Forest Resources at the University of

Maine and the Northeastern representative to the Commission on Forestry at Land Grant and Other Institutions, asked Congressman Clifford McIntire of Maine to support a formula-based appropriation bill for institutional forestry research. Westveld, Elting, and Harper then met with Congressman McIntire to discuss the legislation. At about the same time Robert Clapp, Dean of the School of Forestry at Mississippi State University conferred with Senator John C. Stennis of Mississippi on a similar bill (Kallander 1986).

W. C. Libby, Dean of the College of Agriculture at the University of Maine, and George F. Dow, Director of the Maine Agricultural Experiment Station, assisted Nutting in developing the language of the bill for Congressman McIntire's approval (Sullivan and Burks 1969). Reynolds Florence, a lawyer in the Department of Agriculture, studied the Hatch Act and using the Hatch Act as a guide, edited the initial bill that was presented to McIntire in the summer of 1961 (Harper 1972).

Harper, a determined participant in the earlier attempts to obtain funding, kept both Senator Stennis and Congressman McIntire informed of the Department of Agriculture's positions on new legislation as they continued to seek a successful funding mechanism for forestry research (Clapp 1971). As a behind the scene facilitator, Harper was politically well situated, often having breakfast with Senator Stennis on Saturday mornings (Arnold 1994). When the time for introduction of a bill was at hand, Harper suggested that Stennis introduce a bill identical to Congressman McIntire's (Huff to Stennis, personal communication August 10, 1961, Stennis Collection, Series 33, Box 66, Folder 23. Congressional and Political Research Center, Mississippi State University Libraries).

On August 7, 1961, Congressman McIntire introduced a bill (HR 8535) entitled, "Forestry Research." During discussions he commented, "I believe that this legislation is a constructive step in assuring this country of a stronger program of forestry research. It would also strengthen our schools of forestry upon which this country depends for the training of those who will manage these resources in the future" (*Congressional Record* 87th Cong, 1st sess., 107, pt. 11:14731). The bill was referred to the Agriculture Committee chaired by Congressman Cooley of North Carolina and the Subcommittee on Forests where Congressman George Grant of Alabama was the Chairman. Congressman McIntire was the ranking minority member of this Subcommittee (Sullivan and Burks 1969).

Senator John C. Stennis was the Democratic Senator from Mississippi from 1947-1988. During his long tenure in the Senate he was a strong supporter of forestry and especially forestry research. For his efforts, the USDA Forest Service named him "Champion of Forestry" at the tenth anniversary celebration of the McIntire-Stennis Cooperative Forestry Research Program. (Picture courtesy of the Congressional and Political Research Center, Mississippi State University Libraries)

On August 11, 1961, Senator Stennis introduced in the 87th Congress on behalf of himself and Mississippi Senator Eastland, an identical bill (S2403), entitled "Assistance to the States for Forestry Research Program." (*Cong. Rec.* 87th Cong. 1st sess. 107, pt. 12:15504). Other identical bills were introduced by Congressman McMillan of South Carolina (HR 9219), Congresswoman May of Washington (HR 9220), Congressman Grant of Alabama (HR 9274), Congressman Moulder of Missouri (HR 9545), and Congressman Matthew of Florida (HR 10835). Senator Stennis, pleased with the overall Senate support of the bill, reiterated in his comments that additional forest research was needed to insure that future forests meet the needs of the Nation (*Cong. Rec.* 87th Cong. 1st sess. 107, pt. 12:15505). In the Senate, the bill (S.2403) was referred to the Committee on

Agriculture and Forestry. At the October 1961 meeting of the Commission on Forestry at Land Grant Institutions in Minneapolis, 35 representatives from 28 states unanimously endorsed the bill in principle (Westveld 1962; DeVall to Stennis, 25 October 1961, Stennis Collection, Series 33, Box 66, Folder 23, MSU). In order to include institutions that were not land grant, but that had forestry schools, the Commission changed its name to the Commission on Forestry at Land Grant and Other Institutions (Westveld 1963).

Even though most in the forestry community supported the bill in principle, some believed that the subsidized research would be controlled by the USDA Forest Service. USDA Forest Service officials stated that they did not initiate the legislation, but only helped in its crafting and that they would welcome cooperation with the state institutions in conducting forestry research (Fletcher 1961). Others in the forestry profession believed that research should be supported by state governments, companies in the forest products industries, and forest users rather than the federal government (Hall 1962). In addition, Hall wanted a maximum funding limit and a cutoff date for the funding.

Forest industry wanted to limit funding to one-half of USDA Forest Service research appropriations and have an advisory board from forestry school deans and directors along with an advisory committee from public agencies and forest industry representatives. Ralph Hodges, a lobbyist for the National Lumber Manufacturers Association, believed that the USDA Forest Service would control the program. Harper (1972) suggested administration by a "non-action agency". The changes were approved at the 1962 National Lumber Manufacturers Association meeting (Kallander 1986).

On July 23, 1962, testimony was held before the House Agriculture Subcommittee on Forestry to consider the Forestry Research bill (HR 8535) where Senator Stennis and Congressman McIntire testified in favor of the legislation. Their testimony was followed by favorable reports from: Harper of the USDA Forest Service; W.C. Hammerle for the Association of State Foresters; George F. Dow, representing the legislative committee of ESCOP; Ralph C. Wible, State Forester of Pennsylvania; Austin H. Wilkins for the Association of State Foresters; Westveld, Kallander, Nutting, Fletcher, and Preston for the Commission on Forestry at Land Grant and Other State Institutions; T. H. Mullen for the American Pulp and Paper Association; John R. Metering of the Society of American Foresters; and J. Walter Meyers with Forest Farmers Association (Westveld 1963). From the hearing and other inputs, the original bill filed in 1961 was changed. The Department of Agriculture believed that the administration of the program should not require the creation of another bureau, but could be handled by the Cooperative State Experiment Station Service (U.S. House 1962b; Harper 1972). Forest industry wanted a seven member rather than a five member Advisory Board with the requirement that all members be forestry school officials (U. S. House 1962a).

In his 1962 testimony on HR 8535 before the U.S. House Subcommittee on Forestry, Harper (U. S. House 1962a, p. 12) presented estimates of forestry research expenditures. Approximately $94.6 million was spent on forestry research by state, federal, and private entities. Of this amount $23.4 million (24.7 percent) was spent by the federal government, $62 million (65.5 percent) by private industry, $7 million (7.4 percent) by colleges and universities, and $2.2 million (2.3 percent) by other agencies. With their lower level of funding, the colleges and universities could not educate the numbers of research scientists needed for government agencies and private industries. For the five previous years an average of 41 Ph.D. degrees in forestry were awarded annually. Harper estimated that the awarding of four times that number of doctoral degrees would be necessary to address future needs.

On July 25, 1962, Congressman McIntire incorporated the suggested changes in the initial legislation and introduced the revised bill (HR 12688), "Cooperative Forestry Research" in the second session of the 87th Congress (U. S. House 1962b). On July 30, 1962, the Cooperative Forestry Research bill was approved by the House Agriculture Committee. On August 3, 1962, Senator Stennis introduced a bill (S3609), "Assistance to States in Carrying on Program of Forestry Research," on behalf of himself, Senator Eastland, and Senator Aiken. S3609 was identical to Congressman McIntire's HR 12688. Senator Stennis wanted Senator Eastland's co-sponsorship as he was chairman of the Senate Subcommittee on Soil Conservation and Forestry. Bipartisan support was accomplished with the co-sponsorship of Vermont Republican Senator George Aiken (Harper 1972). Senator Stennis and Senator Aiken served 12 years together on the National Forest Reservation Committee. This committee approved all of the purchases and land exchanges of the USDA Forest Service (John C. Stennis Oral History Transcripts, Folder 1, Stennis Collection, MSU). On August 6, 1962, the House considered Congressman McIntire's bill HR 12688 which was recommended by Subcommittee Chairman Grant with Congressman McIntire listed as the single sponsor due to his work on the bill (Sullivan and Burkes 1969). After reading the bill with comments by Congressman McIntire, ten Congressmen spoke in support of the bill. The bill passed with a two-thirds majority and a motion to reconsider was tabled (*Cong. Rec.* 87th Cong. 2nd sess. 108, pt. 12:15632).

In the Senate (S3609), "Assistance to States in Carrying on Program of Forestry Research," was referred to the Senate Agriculture Subcommittee on Soil Conservation and Forestry on August 13, 1962, and to the full Senate Agriculture Committee on August 15, 1962. Since HR 12688 had passed the House as a "clean bill" with no amendments, the Committee adopted HR 12688 rather than the identical Senate Bill, S3609, introduced by Senator Stennis and others earlier (U.S. Senate 1962). However, the Senate Agriculture and Forestry Committee offered two amendments to the House bill. On September 25, 1962, Senator Mike Mansfield called HR 12688 to the floor with the two amendments. The amendments were agreed to, and his motion to reconsider the vote passed (*Cong. Rec.* 87th Cong. 2nd sess. 108, pt. 15:20680). One amendment allowed for non-state supported universities to be eligible for funds. The other amendment permitted any school official, not just a forestry school official, to serve on the Advisory Board. The bill with the amendments passed, but the vote to reconsider was placed on the calendar for further action.

On September 28, 1962, Senator Mike Mansfield asked that HR 12688, McIntire's Bill, be reconsidered, and no objections were raised to bringing the Bill to the floor (*Cong. Rec.* 87th Cong. 2nd sess. 108, pt. 16: 21184). Senator Jordan of North Carolina supported the amendment for private forestry school funding so that the forestry school at Duke would be eligible (Harper 1972), but he did not speak for the

Dr. Rutherford W. Westveld (L) presents a copy of the Forestry School's newsletter, Missouri Log*, which was dedicated to Representative McIntire (C) and Senator Stennis (R). Dr. Westveld was the Director of the School of Forestry at the University of Missouri. He united the forestry schools in their efforts to secure federal forestry research funding as chairman of the Commission on Forestry at Land Grant and Other Institutions. (Picture courtesy of University of Missouri Archives)*

amendments (*Cong. Rec.* 87th Cong. 2nd sess. 108, pt. 16:21184). A note in Senator Stennis' files reminded him to talk with Senator Jordan before the "Research Bill" came up for discussion (Stennis Collection, Series 33, Box 266, Folder 79, pt. 1, MSU). If they talked an agreement could have been reached. Senator Stennis spoke for the Bill without the amendments stating that any changes to the already passed HR 12688 would not have time to be acted upon by the House before Congress adjourned since most of the House sub-committee had gone back to their home states. Congressman McIntire had returned to Maine to campaign (Stennis Collection, Series 33, Box 266, Folder 79, pt. 1, MSU). Senator Stennis remarked that "such legislation would go a long way toward developing a research program for the furtherance of forestry in America" (*Cong. Rec.* 87th Cong. 2nd sess. 108, pt. 16:21185). Senator Morse from Oregon spoke in favor of the Bill without the amendments. Even though he agreed with the purpose of the legislation, Senator Proxmire from Wisconsin spoke against the Bill. His state would be barred from having a member on the Advisory Board, and he did not feel that Yale and Duke should be ineligible. In replying to Senator Proxmire, Senator Stennis reiterated his earlier stated concerns regarding the time factor saying that changes could be made later. He reminded Senator Proxmire that he had recently supported major funding in Senator Proxmire's state for the USDA Forest Service's Forest Products Laboratory. The amendments, voted in bloc, were defeated, and HR 12688 was passed by the Senate. In a legislative move to prevent further consideration of the matter, Stennis made a motion to have the vote reconsidered, and Senator Morse made a motion to table Senator Stennis' motion of reconsideration, and the motion was tabled. Senator Stennis, according to Harper (1972), saved the bill on the Senate floor.

The legislation became Public Law 87-788 on October 10, 1962, when President John F. Kennedy signed the legislation. Harper (1972) reported that a White House staff member initially delayed presidential approval because he considered agricultural research unreliable and formula funding an inefficient method of disbursing research funds. After telling Harper that he [Harper] would later regret the legislation, he reluctantly agreed to recommend the legislation. The Secretary of Agriculture, Orville Freeman, (U.S. House 1962b; U.S. Senate 1962) recommended that the President approve the Act, and after explaining the Act's potential for additional forestry research and training quoted from one of President Kennedy's speeches made in 1961, "One of our most important natural resources and one of our most neglected is our forestland" Kennedy further stated the need to "Expand forestry research, too long neglected". In keeping with the legislative custom, PL 87-788 was named after its sponsors and became known as the McIntire-Stennis Cooperative Forestry Research Program (Harper 1972).

The new program was a culmination of a long effort by forestry leaders who saw a need for improving institutional research. In an interview prior to the program's tenth anniversary in 1972, Senator Stennis commented that Harper "was really the father of that [McIntire-Stennis] movement" (Clapp 1971). Harper (1972) acknowledged that Westveld was the "stem-winder" who rallied the support of the forestry school leaders. Congressman McIntire hoped that the new forestry legislation he co-sponsored would aid in his re-election, but he was defeated. Congressman McIntire considered the legislation as his most important contribution in Congress (NAPFSC 1986). He continued to lobby for enhanced funding for the McIntire-Stennis program while he served with the American Farm Bureau Federation in Washington, D.C. Senator Stennis commented at the tenth anniversary of the program that Congressman McIntire should be given more credit than he for the successes of the program (*Cong. Rec.* 92nd Cong. 2nd sess. 118, pt. 13:16897).

One of the Senate amendments that was defeated would have allowed private forestry schools to be eligible for funding. Stennis explained to the Senate that the House was divided on that issue and the use of federal funds for private institutions would create a controversy that would overshadow the intended legislation (*Cong. Rec.* 87th Cong. 2nd sess. 108, pt. 15:21184). Two private forestry schools, Yale and Duke were not too concerned as they believed that the level of funding would be minimal. In addition, they did not want federal control of their research (Smith 1990).

The passage of the legislation was a "grass roots" effort with the institutional leaders pushing until their goal was reached. Compromises were necessary to reach that goal. The USDA Forest Service relinquished the administration of the program as a concession to forest industry. Buckman (1994), a former USDA Forest Service deputy chief for research speculated that forest industry's distrust of the USDA Forest Service dated back to Gifford Pinchot's suggestions to regulate forest practices on private as well as public lands. Buckman believed that the cooperation between the USDA Forest Service and the forestry institutions was better because of the decision to have another agency administer the program.

For the passage of the legislation, appropriate leaders appeared to be at the right place at the right time. Westveld was credited with gaining consensus and support from the forestry institutions. Harper was the one who made everything come together with Stennis' trust and a compelling influence on his employer, the USDA Forest Service. Positive input from supporters in the congressional hearings indicated that the intended legislation was favored by stakeholders. The initial appropriation of $1 million was much lower than anticipated. However, they considered the amount as a "one time" funding for a new program and concentrated on implementation.

Program Implementation

The legislation provided for a Cooperative Forestry Research Advisory Board and a Cooperative Forestry Research Advisory Committee. Forestry school leaders would be members of the Board while the Committee would be composed of state, federal, and industry leaders. The McIntire-Stennis Program was administered by the Cooperative State Experimental Station Service (CSESS) within the U. S. Department of Agriculture (USDA) and was considered to be "coequal" to the research programs for agriculture funded under the Hatch Act, which was also administered by this agency (U.S. House 1962b). In 1963 CSESS (Westveld and Kaufert 1964) was renamed the Cooperative State Research Service (CSRS). The Commission on Forestry at Land Grant and Other Institutions under the chairmanship of R. H. Westveld, former chairman of the Commission on Forestry at Land-Grant Institutions, was the driving force in organizing the forestry school leaders for passage of the legislation and implementation of the program. After passage, Commission members served as an "Interim Committee" to "advise and consult with the Secretary of Agriculture" in the implementation of the program (Commission on Forestry at Land Grant and Other Institutions 1962, Minutes). Members of the interim committee were: Chairman R. H. Westveld, Director of Forestry at the University of Missouri; Vice-Chairman R. J. Preston, North Carolina State University; Secretary Peter W. Fletcher, Director of the School of Forestry at Pennsylvania State University; R. M. Kallander, Administrator, Forest Research Laboratory at Oregon State University; Carl Stoltenberg, Iowa State University; A. D. Nutting, Director of Forestry, University of Maine; and W. B. DeVall, Department Head, Auburn University (Commission on Forestry at Land Grant and Other Institutions 1962, Minutes; Westveld and Kaufert 1964). In addition, F. H. Kaufert, Director of the Minnesota School of Forestry and Commission member, served as Acting Assistant

Administrator of the McIntire-Stennis Program (Kallander 1986). The group of forestry leaders who saw their efforts become law also had input in implementation by recommending: 1) the funding formula; 2) research project evaluations; and 3) selection of the Advisory Committee (Westveld and Kaufert 1964).

In 1964 the Commission of Forestry at Land Grant and Other Institutions became the Association of State College and University Forestry Research Organizations (ASCUFRO). In addition to testifying annually before appropriation committees in the House of Representatives and Senate, ASCUFRO funded annual reports for the program from 1964 to 1975 that provided progress information. In 1971 CSRS developed productivity indexes for individual McIntire-Stennis institutions. Stennis (ASCUFRO files, 1977) requested information on program successes from the institutions to present to other decision makers to support increased funding. However, Huddy (1979) provides the only formal evaluation of the program. More recently the National Research Council (1990, 2002) and the National Association of Professional Forestry Schools and Colleges (NAPFSC) made recommendations and provided support for the program. NAPFSC was organized in 1980 and replaced ASCUFRO as the supporter of McIntire-Stennis and other institutional forestry research programs.

1967 Cooperative Forestry Research Advisory Board and Cooperative State Research Service-(Seated L to R): Director Donald P. Duncan, School of Forestry, University of Missouri; Dean Ernest W. Wohletz, College of Forestry, Wildlife and Range Sciences, University of Idaho; Dr. T.C. Byerly, Administrator, Cooperative State Research Service (CSRS), USDA; Director Albert P. Nutting, Advisory Board Chairman, School of Forestry, University of Maine; Professor Wilbur D. DeVall, Head, Department of Forestry, Auburn University, Assistant Dean Rudolph M. Kallander, School of Forestry, Oregon State University. (Standing L to R): Director Frank H. Kaufert, School of Forestry, University of Minnesota; Dr. Philip N. Joranson, Agricultural Administrator, Cooperative Forestry Research, CSRS; Mr. William H. Cummings, Principal Forester, CSRS; Mr. George F. Burks, Assistant Administrator, Cooperative Forestry Research, CSRS; and Dean Richard J. Preston, School of Forest Resources, North Carolina State University. (Picture from Forestry Research Progress in 1967, *McIntire-Stennis Cooperative Forestry Research Program, Cooperative State Research Service, USDA)*

Evaluation Theory

Evaluations may be classified as *ex ante* or *ex post* (Rossi, Freeman, and Lipsey 1998); formative or summative (Posavac and Carey 1996); and quantitative or qualitative (Babbie 2001; Bednarz 1985; Rossi, Freeman, and Lipsey 1998). Since an *ex ante* evaluation determines the need prior to program establishment, this type of evaluation is not needed for an established program. For this program an *ex post* approach, which evaluates an established program, will be used. The formative evaluation is often used to make changes in an ongoing program, while the summative evaluation determines whether a program should be continued. This evaluation, using stakeholder input, attempts to determine the program's progress in meeting its goals and also seeks suggestions for improvement from its stakeholders. Evaluations may also be described as quantitative or qualitative, where quantitative data is the "dominant method" of the "positivist" approach, while qualitative evaluation belongs to the "ethomethodologist" or "interpretivist" (Bednarz 1985). Quantitative information can be expressed numerically whereas qualitative information uses observations, interviews, and other methods which are not readily summarized numerically. To minimize the argument between evaluative camps, the mixed method (Greene and Caracelli 1997), which combines qualitative and quantitative data, will be used in this study.

A nonequivalent group, such as the USDA Forest Service, is often used in the quasi-experimental approach to outcome evaluation (Posavac and Carey 1997). While some stakeholders considered this comparison problematic, comparative attempts were made since the USDA Forest Service conducts public forestry research and possibly competes with the McIntire-Stennis program for funding.

Stakeholders

Stakeholders are defined by Rossi, Freeman, and Lipsey (1998, p. 448) as, "individuals, groups, or organizations having a significant interest in how well a program functions." The McIntire-Stennis stakeholders include the U.S. Congress; John C. Stennis Institute of Government at Mississippi State University; Cooperative State Research, Education, and Extension Service (CSREES) in USDA ; Forestry Research Advisory Council (FRAC) advisors to the Secretary of Agriculture; National Association of Professional Forestry Schools and Colleges (NAPFSC); McIntire-Stennis eligible institutions and their forestry representatives; researchers; graduate students; state extension services; state legislatures; forest industry; forest landowners; and the public. Working to improve the efficiency of local governments in Mississippi, the John C. Stennis Institute of Government at Mississippi State University was a logical choice to sponsor this evaluation.

This study used input from the John C. Stennis Institute of Government at Mississippi State University, Cooperative State Research, Education, and Extension Service (CSREES) in USDA, Forestry Research Advisory Council (FRAC), advisors to the Secretary of Agriculture, members of National Association of Professional Forestry Schools and Colleges (NAPFSC) and a focus group from Mississippi State University to develop the evaluation plan and questionnaire. Forestry Representatives at the McIntire-Stennis eligible institutions received the questionnaire.

Questionnaire Procedures

NAPFSC provided the names and addresses of their members (M. Bates, per. comm. August 22, 2002). Using the NAPFSC information, CSREES indicated the McIntire-Stennis Forestry Representative (FR) at each of the institutions (B. Post, per. comm. September 5, 2002). In most forestry institutions, the FR is the dean, director, or department head. On October 10, 2002, the 40th anniversary of the program, the questionnaire was mailed to the FR at each of the eligible institutions. A procedure similar to the "Total Design System" recommended by Dillman (2000) was used for the survey instrument. Data requested from the institutions was from FY 1997 through FY 2001. Forty institutions returned their questionnaires, a response rate of 61.5 percent.

Focus Group Results

The focus group met at Mississippi State University on July 16, 2002, to discuss the impact of the McIntire-Stennis program on institutional forestry research and to review the proposed questionnaire. Focus group participants were: Dr. Douglas Richards, Head, Department of Forestry; Dr. Warren Thompson, Dean Emeritus, College of Forest Resources; Dr. J. Charles Lee, Interim MSU President and previous Vice-President for Agriculture, Forestry, and Veterinary Medicine; and Dr. Rodney Foil, former Vice President for Agriculture, Forestry, and Veterinary Medicine; and former Interim Administrator of CSREES, USDA.

All participants were not aware of the original goals explicitly presented by Senator Stennis to: 1) increase forestry research in protection, production, and utilization; 2) involve other disciplines in forestry research; and 3) provide future research scientists. However, they could not disagree with those goals. For them, the earlier program goals to increase forest productivity were probably more commercial than current goals, which should be more holistic in promoting environmental considerations. Initially ineligible, some wildlife and fisheries research is now funded.

The needs of forestry school deans for additional funds to conduct research and the USDA Forest Service's demand for additional researchers with training in disciplines that they lacked helped in getting the legislation passed. Twenty of the thirty forestry schools in the country before program passage were instructional with little or no on-going research.

The passage of the McIntire-Stennis Act gave the forestry schools legitimacy and a mission on university campuses. The funding match required by the program brought additional state funds into the forestry programs. The growth of the agriculture and forestry programs within the institutions due to the new McIntire-Stennis program and existing Hatch program benefited institutional development. Without the program, approximately ten states would not have begun forestry schools at that time. The program provided flexibility for administrators to fund research. Prior to the passage of the program, forestry instructors were often not able to attend seminars and other meetings to discuss and present their research findings. By upgrading staff and providing better-equipped laboratories, the program aided undergraduate forestry programs as well. Research subsidized teaching as resources were taken from research to support teaching.

The McIntire-Stennis program separated the institutions from the USDA Forest Service by recognizing the forestry schools as legitimate research entities. Critics of the program believed the USDA Forest Service was the premier research agency. Consequently, they believed that distributing research funds for local needs would not allow national priorities to be addressed. With the reorganization of the Cooperative State Research Service (CSRS) to form the Cooperative State Research, Education, and Extension Service (CSREES) in 1994, the emphasis on the McIntire-Stennis program was diluted by the additional extension and education programs. Staff increases in CSREES supporting other types of funding, such as competitive grants, reduced emphasis on formula funded programs.

The focus group made the following suggestions and issued the following challenges to be considered in evaluating the McIntire-Stennis program:

- Evaluation of research in a university complex will be difficult since both institutional driven funding and investigative funding approaches must be

considered. Some of the increased productivity of research is due to increased accountability for faculty tenure and promotion. This increased productivity is not due to funds but to institutional influences.

- What are the goals of the McIntire-Stennis program today?
- A statistical picture of institutional forestry research capabilities could be determined by looking at the numbers of forestry faculty in 1960 compared to 2000.
- For the number of degrees earned, the institutions might be queried about how many degrees they would grant without the McIntire-Stennis program.
- Compare the McIntire-Stennis program with the Hatch program.
- Using National Science Foundation data, how does forestry research in 2000 differ from 1960 with background from the National Research Council's Forestry Research: Mandate for Change (1990)?
- Although contributions of the McIntire-Stennis program may be difficult to isolate, logical reasoning would imply that its research did have an impact.
- NAPFSC should sponsor and support the evaluation with the Forestry Research Advisory Council giving direction.

Questionnaire Responses

Goal Measurements

One of the initial steps in public program evaluation is the determination of goals and objectives of the program by the program stakeholders (Rossi, Freeman, and Lipsey 1998). As stakeholders who receive McIntire-Stennis funds, the 65 public forestry institutions eligible for McIntire-Stennis funding considered the program's goals and objectives. With a lack of explicit program goals given in the legislation, they were asked to rank the program goals given by Senator John C. Stennis in a hearing before the U.S. House Sub-Committee on Forests of the Committee on Agriculture on July 23, 1962 (U.S. House 1962a), and to suggest alternative goals for the program.

Senator Stennis' goals for the program were to:

1) increase research in forest production, protection, and utilization;
2) involve other disciplines in forestry research; and
3) provide future research scientists.

Based on the responses from the ques-

Table 1 Institutional Stakeholder Output Measurement Preferences

Output Measures	Median Rank (1 = Most Preferred)
Number of research projects completed	3
Number of publications/patents	1
Number of graduate degrees conferred	2
Extent of interdisciplinary research	4
Amount of matching funds support (Leveraging)	6
Comparisons of initial program outputs to present program outputs	6
Comparisons of program outputs with USDA Forest Service and other research programs	4

tionnaire, the current institutional stakeholders agreed with Stennis' goals in the order listed with the additional goal of forest sustainability. With agreed upon goals, measuring how well the goals are being met is the next step in program evaluation (Rossi, Freeman, and Lipsey 1998).

With program goals developed, methods to measure the outputs and outcomes of the program can be determined. The institutional stakeholders' preferences for output and outcome measurements are shown in Table 1 and Table 2. Outputs are the products of research such as publications, projects, degrees, etc., while outcomes attempt to determine the impact the program had on solving the problems it was passed to address. In other words, outcomes measure the changes in "the real world" caused by the program.

Since a rank of one indicates the most preferred, those measurements with the lowest median values are more preferred than those measurements with the higher medians. For the measurement of outputs the number of publications/patents and the number of graduate degrees ranked the highest, while for outcome measurements, project case studies and the amount of research leveraged by the program were ranked highest. Comparisons of McIntire-Stennis research with that of the USDA Forest Service rated the lowest in both output and outcome measurements.

Table 2 Institutional Stakeholders' Outcome Measurement Preferences

Outcome Measurements	Median Rank (1 = Most Preferred)
Economic assessments of research (quantitative measures such as B/C, Consumer surplus, etc.)	3
Project case studies of successful research (qualitative studies that describe the benefits of the program)	2
Mixed method (both quantitative and qualitative)	3
Comparisons of research outcomes with USDA Forest Service and other research programs	5
Amount of total research leveraged by McIntire-Stennis Program	2

Funding

The program is formula funded through annual appropriations in the U.S. Department of Agriculture (USDA) budget. The annual appropriation is distributed to eligible institutions by the Cooperative State Research, Education, and Extension Service (CSREES) by a formula that is based on three state variables (Appendix B). The variables and their respective weights are:

1. The area of non-federal forestland (40 percent). These areas for each state are obtained from U.S. Forest Service Forest and Inventory Analysis (FIA) data (Column B in Appendix B).
2. Removals from growing stock (40 percent) in each state. This information is also obtained from FIA summaries (Column C in Appendix B).
3. Amount of non-federal matching funds (20 percent). Non-federal funding data is derived from annual reports (CSRS-OD-`1233) submitted by the institutions (Column D in Appendix B).
4. Each state receives a $25,000 base allotment (Column F in Appendix B).

The calculations for funding distribu-

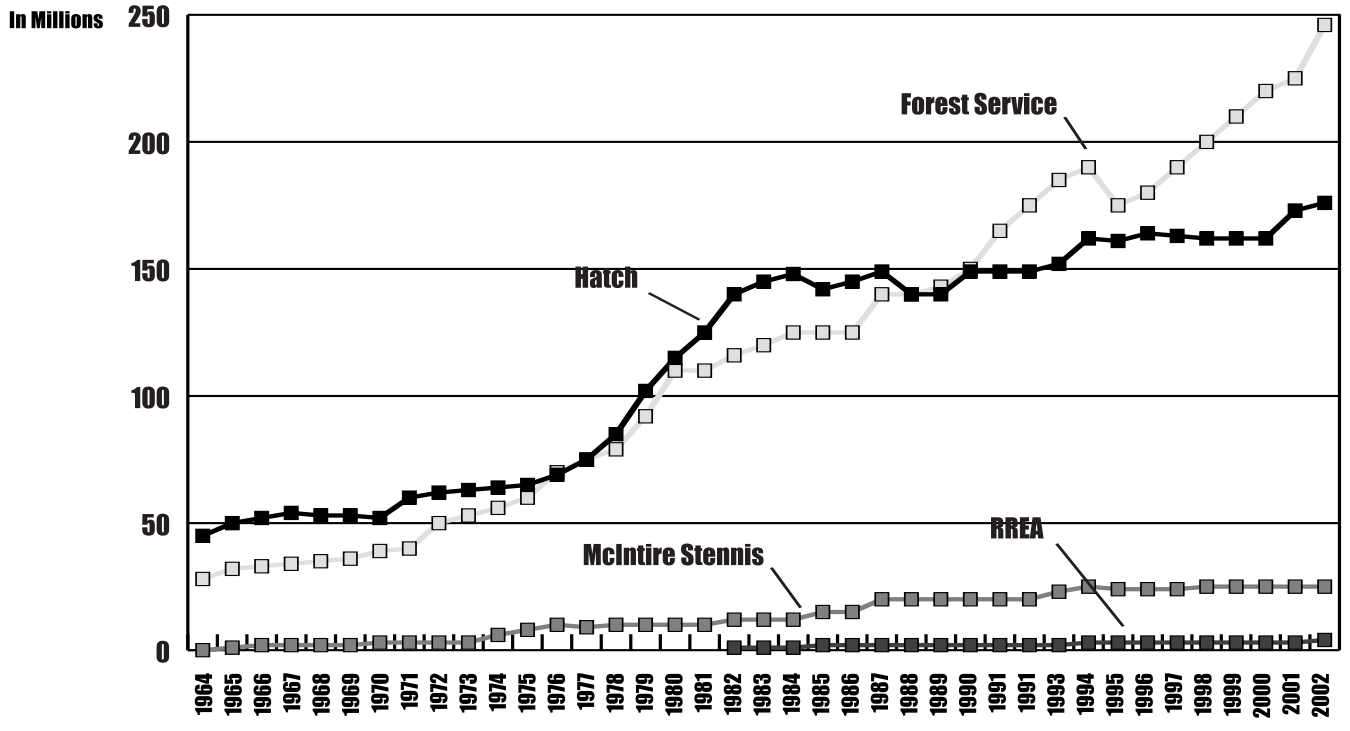
tions are developed by CSREES's computer program, REGIS, which limits the yearly amount of increase or decrease in funding ranks. A three percent administrative fee is deducted from the McIntire-Stennis appropriation along with any congressionally mandated deductions. In FY 1999, 2.47 percent was deducted for Small Business Administration and Bio-Technology Risk Assessment programs. The division of funds in those states with more than one eligible institution is determined by the state governor's representative and is shown in Appendix C (Table C. 1). The procedure using rankings based on sums of ranks for distribution for a sample state, Mississippi, is also shown in Appendix C.

Eligible institutions for McIntire-Stennis Cooperative Forestry Research Program are "land-grant colleges or agricultural experiment stations established under the Morrill Act of July 2, 1862 (7 U.S.C. 301 et seq.) as amended and the Hatch Act of March 2, 1887 (7 U.S.C. 361a-I) as amended, and other State-supported colleges and universities offering graduate training in the sciences basic to forestry and having a forestry school" (16 U.S.C. 582 a-2). "A 'forestry school' is defined as an academic unit offering a state-approved graduate curriculum leading as a minimum, to a Master of Science in forestry or a Master of Forestry" (USDA 2000, p. 2). Appendix D lists the current McIntire-Stennis eligible institutions along with their FY 2002 McIntire-Stennis funding.

Historic funding for the McIntire-Stennis and other federal programs is shown in Figure 2.

Compared to increases in USDA Forest Service research, funding of McIntire-Stennis has been relatively level. The Hatch Act funding increased at a higher rate than the McIntire-Stennis program initially, but has been relatively level over the past two decades. The RREA program started later than the McIntire-Stennis program, with very small increases since

Figure 2 Funding for Federal Forestry Research and Extension Programs from 1964 through 2002



Source: CRIS; USDA Forest Service; and NRC 2002.

implementation. In addition, non-land grant institutions receiving McIntire-Stennis funds are not eligible to receive RREA funds for technology transfer. Specifically, the Renewable Resources Extension Act (RREA), passed in 1978, requires forestry research and forestry extension coordination in those institutions receiving RREA funds.

According to 16 USCS ß 1673 (a), "the State director and the administrative heads of extension for eligible colleges and universities shall consult and seek agreement with the administrative technical representatives and the forestry representatives provided for by the Secretary [of Agriculture] in implementation of the Act of October 10, 1962" [McIntire-Stennis Act].

Forestry extension existed prior to the passage of RREA. The Smith-Lever Act passed in 1914 provided extension to the land grant colleges established under the Morrill Act of 1862. This act provided the means for extension to provide technology transfer for research developed at the state agricultural experiment stations funded by the Hatch Act of 1887. After passage of the Clark-McNary Act in 1924, forestry extension was established in 31 states within five years. The Norris-Doxey Cooperative Farm Forestry Act of 1937 provided additional support for forestry extension allowing for 68 extension foresters in 45 states and a territory (Hamilton and Biles 1998). This research investigated the coordination between the RREA program and the McIntire-Stennis program.

RREA is a formula funding program with the funding appropriated "according to the respective capabilities of their private forests and rangelands for yielding renewable resources and relative needs for such resources identified in the periodic Renewable Resource Assessment provided for in section 3 of the Forest and Rangelands Renewable Resources Planning Act of 1974" (16 USCS ß 1675). RREA is authorized to be funded at $15 million, but appropriations have been much less.

Institutions receiving McIntire-Stennis funds that are not land grant, and therefore ineligible for RREA and other extension funds, have other systems of technology transfer.

Formula Fairness

The formula has been discussed many times in ASCUFRO meetings as well as the Cooperative Forestry Research Advisory Board and Advisory Committee meetings (ASCUFRO files). At the Cooperative Forestry Research Advisory Board meeting in 1972, former Congressman McIntire stated that any changes to the formula must be "carefully disciplined" (School of Forest Resources files, Box 106, A-80-37, Folder 1, Special Collections, MSU Libraries). His advice was valid as the Cooperative Forestry Research Advisory Board and Advisory Committee in 1973 sought to change the commercial forestland provision in the formula to include federal forestland. The Office of General Counsel ruled that was not McIntire's intent in the law and denied that change. While the law gives the Secretary of Agriculture the authority to determine the apportionment of the program funds, based on past challenges, any change in the formula would probably require legislative action.

To determine the current concerns among institutional stakeholders, the fairness of the formula was addressed with the following question: Do you consider the formula fair and not in need of change? The agreement with the fairness of the formula is shown in Table 3.

The response to this question indicates that concern still exists over the fairness of the formula. Over one-half of the respondents, however, agree or strongly agree that the formula is fair and not in need of any changes. Since the amount that an institution receives could influence their seeking any changes, Table 4 provides the level of funding currently received by the institutions responding to this

Table 3 Level of Agreement with Fairness of the McIntire-Stennis Formula

Level of Agreement	Count	Percent
Strongly disagree	5	13
Disagree	7	18
Agree	11	28
Strongly agree	16	41

question.

One-third of the institutions in the top 20 funding level agreed or strongly agreed that the formula was fair and not in need of change. Over 20 percent of the institutions in the lower level of funding also agreed or strongly agreed that the formula was fair. A slight majority in the middle funding level also considered the formula fair and not in need of change.

Individual responses to the questions varied with some suggesting that the non-federal contribution be dropped while others suggested that its weight in the formula be increased. Most of the comments suggested considering all forestland or forest cover as a factor rather than commercial forestland. Urban forests as well as other forest values such as recreation, wildlife, water quality, water management, fire management and livestock grazing were mentioned. When regions are considered, the responses to the questionnaire were representative with the Northeast institutions having a slightly lower response rate. The response rates and the geographical locations of the institutions are shown in Table 5.

Table 4 Funding Rank and Agreement Level on Fairness of McIntire-Stennis Formula

Funding Rank	Strongly Disagree		Disagree		Agree		Strongly Agree	
	No.	%	No.	%	No.	%	No.	%
Top 20	-	-	2	5.1	3	7.7	10	25.6
Mid 20	3	7.7	1	2.5	3	7.7	2	5.1
Lower 25	2	5.1	4	10.3	5	12.8	4	10.3

Table 5 Questionnaire Responses from the Geographical Areas

	Location and Response Rate			
	Northeast %	North Central %	South %	West %
Institutional Location	22	23	26	29
Response Rate	15	25	28	32

Fund Allocation and Proportionality

Within the institutions, McIntire-Stennis funds can be allocated as needed. The allocations reported by the questionnaire respondents are shown in Table 6.

Table 6 Current Institutional Allocation of McIntire-Stennis Funds

Fund Allocation	Percentage
Scientists' salaries	41
Administration	9
Graduate students	17
Equipment	4
Operating funds	17
Travel	4
Other	7

Table 7 shows the proportion of forestry research funds received from the McIntire-Stennis program.

Table 7 Count and Percentage of the Institutional Forestry Research Budget Provided by the McIntire-Stennis Program

Percentage of research budget provided by McIntire-Stennis	Count	Percentage
< 10 %	20	50
1-20%	9	22.5
1-30%	3	7.5
31-40%	2	5
41-50%	5	12.5
> 51%	1	2.5

Funding Source Preference

One-half of the respondents reported that the McIntire-Stennis funds provided less than 10 percent of their research budgets. However, the program provides a portion of the salary of many researchers who are available to seek other funding sources. Table 8 shows the current institutional preferences for research funds.

Table 8 Preferences for Sources for Research Funds

Type of Funding	Median Rank [1 = Most Preferred]
Formula funding	2
Competitive grants	2
Cooperative grants	3
Special grants	4
Combination	4

Formula funds and competitive grants are preferred while a combination of funding sources and special grants are the least preferred. Cooperative grants remain intermediate in preference. Most of the respondents reported that formula funds provided the infrastructure and flexibility that allowed them to have competent faculty who could secure competitive grants to increase the quality of research. Formula funds were necessary for the long-term research needed in forestry, and the leveraging capacity of formula funds was often presented as a positive impact. In addition, formula funds were closely tied with stakeholder groups to address local needs.

Competitive grants were reported to use interdisciplinary researchers and were favored due to their peer review, but the success ratio for grants could be low with resultant loss in faculty effectiveness. One response was that, "Competitive grants and industry funds tend to

flow to the most talented scientists." On the other hand, some institutions believed that due to their size they were not able to secure competitive grants.

Some respondents supported a combination or "portfolio" of funding sources. The diversity of funding sources maintained research continuity even as the level of support from various sources changed. Cooperative grants were favored because they addressed specific issues, but often failed to pay for indirect expenses. While special grants were the least favorite funding source, 36 percent considered them equitable as shown in Table 9.

Table 9 Survey Responses to the Question of Equitability of Special Grants

Are Special Grants equitable?	Count	Percentage
Yes	14	36
No	13	33
Uncertain	12	31

Program Impediments

The failure of the funding for the McIntire-Stennis program to keep pace with increases in other funding sources for forestry research is sometimes blamed on various impediments. The respondents reported on possible impediments shown in Table 10.

Several respondents reported that the program was meeting its goals with no impediments. However, over 90 percent of those responding made suggestions for reducing program impediments. The lack of sufficient funding was the most often mentioned congressional impediment. Many of the respondents believed that Congress needed more information about the program and its successes. They faulted CSREES for its failure to educate

Table 10 Possible McIntire-Stennis Program Impediments

Possible Impediment	Count	Percentage
Congress	21	57
CSREES	10	27
Other	6	16

Congress and the Office of Management and Budget (OMB) about the McIntire-Stennis program. The competition for research funds with the USDA Forest Service was another impediment that could be solved by funding the program at its authorized level, or by "moving it to a position in the budget which does not threaten the USDA Forest Service's budget." This might be accomplished by putting both research programs in the same appropriations committees, but this move might not raise the total appropriation for forestry research. The level of funding for the USDA Forest Service was initially higher than the funds appropriated for the McIntire-Stennis fund. However, for the FY 1980 to FY 2000 period, the funding changes in both programs are correlated (correlation coefficient = .97). The change to the interior appropriation committee would only benefit the program if the funding level for McIntire-Stennis was raised from the present 10 percent of USDA Forest Service research budget to a higher percentage.

Since the program is administered by USDA, one respondent considered the program impeded by politically appointed administrators with agricultural interests. The focus group also pointed to a lack of support in USDA due to increased interest in other programs.

Project Selection

An earlier evaluation of the administration of the program (Huddy 1979) recommended national prioritization of the McIntire-Stennis research projects. The current institutional preferences for project selections are shown in Table 11.

Table 11 Institutional Preferences for Research Project Selection

Selection based on:	Count	Percentage
Local or state needs	27	71
National needs	1	3
Combination of national and local/state	7	18
Regional needs	1	3
Faculty needs	2	5

Almost three-fourths wanted their projects to be selected based on local or state needs with 18 percent in favor of a combination of national and local or state based project selection. Only three percent wanted the selection of projects based solely on national priorities. Since the McIntire-Stennis program is federally funded, the institutions were asked to provide justification for federally supported forestry research at land grant institutions.

Justification for use of Federal Funds for Forestry Research at Public Institutions

Many of the reasons given by the respondents reinforced the goals of the McIntire-Stennis program. One of the respondent's comments was: "Forestry is a national issue that transcends even regional collaboration. The impacts affect the environmental and economic welfare of the U.S." and "Forest products are essential to the security and well being of the nation" were typical of the responses. Within the institutions, federal support provides "a reliable base level of funding that can be leveraged with funds from other sources to provide a continuity of essential research across broad regions. This base is essential to maintain a cadre of scientists capable of providing the scientific support for the country's sustainable forest resource. Additionally forests are a long-term resource that requires foresight and research that often demands investment in research that may take several years to produce results."

The program increased state support of forestry research. The requirement for matching funds forced some states to increase funding to forestry schools. Over the last five years (FY 1997-FY 2001) state funds have provided over 44 percent of the non-federal funds used for matching McIntire-Stennis funding. One institution reported that the program maintained forestry research while state support fell.

For those recommending determining projects by national priorities, the priorities should have "sufficient breadth" to cover the needs to address local, state, regional as well as national needs. From a political standpoint the state needs must be addressed, but with "guidance provided by national needs" in order to maintain "advocacy and support in Congress."

One respondent commented that the research agenda should be set "by those willing to pay for the research." Public institutions should remember their overall mission when they direct their research away from public needs to research funded by private sources that may not benefit the public.

By allowing stakeholder input, the program addresses local needs that insure sustainable forests. One of the comments of the recent study on forestry research capacity (NRC 2002, p. 79) suggests that "if more competitive approaches were used by universities and state institutions for the allocation of formula-based

McIntire-Stennis funds, the opportunities for improving the quality and accountability of research funded will be greater."

Use of Peer Review within Institutions for Project Selection

Peer review of local projects has been suggested as a way to improve the project selection process in the McIntire-Stennis program (NRC 2002). Over 67 percent of the institutions responding to the questionnaire used peer review within the institution to determine McIntire-Stennis research projects. The use of peer review within the institution as a standard procedure could increase public confidence in the program. In some cases the selection is within the institution and in others stakeholders review the projects prior to selection. In one institution, "Proposals are requested, they are peer reviewed (including stakeholder input), proposals are ranked based on peer review and stakeholder input and awards are made." This procedure is much like that used for the awarding of competitive grants. In another institution, "Projects are peer-reviewed by a selected committee for each project; comments are made and incorporated into the proposal; a seminar is then presented by the investigator to our faculty for discussion and input. After successful completion of this process, the [d]ean then approves the proposal and forwards it to CSREES." In many institutions the proposals are sent out for review by outside experts.

The number of institutions using peer review for project selection is shown in Table 12.

Other institutions not using a peer review system rely on deans and agricultural experiment station directors to choose projects to be funded. The McIntire-Stennis funds are often provided to new faculty to allow them to gain research experience before relying on competitive grants for their research. The replies indicate that in most institutions, the selection of projects involves some form of peer review as well as stakeholder input.

Table 12 Use of Peer Review by Program Institutions in Choosing Research Projects

Is Peer Review Used ?	Count	Percentage
Yes	27	67.5
No	13	32.5

Research Reporting

The Current Research Information System (CRIS) in USDA is both a reporting and accounting system for the McIntire-Stennis program as well as the other types of funding used by the institutions. Since the information on degrees and publications, which are outputs of the program, were not readily available on the current CRIS system, input from the institutions was requested to determine if CRIS was impeding program goal measurements. The survey results are shown in Table 13.

The majority of users are satisfied with the current system. Some of those not satisfied suggested that the system should be simplified for better use by scientists. Others suggested a link to the World Wide Web (WWW) and

Table 13 Counts And Percentages of Respondents on the Effectiveness of CRIS in Providing Adequate Information for Program Goal Measurement

Does CRIS provide adequate information ?	Count	Percentage
Yes	22	56
No	10	26
Uncertain	7	18

faculty web sites where the research could be published or further explained. One respondent expressed the need for a system more amenable to forestry research rather than agriculture. A few of the respondents felt that the system was of little use and should be terminated. Currently CRIS plans to make reporting changes, and they should solicit stakeholder input to address some of the problems.

Levels of Coordination

Before research can be used, it must be presented to potential users. Within the land grant system, one of the methods of forestry research transfer is through the Renewable Resources Extension Act (RREA) program. The levels of coordination between McIntire-Stennis research programs and RREA are shown in Table 14.

Table 14 Level of Coordination Between McIntire-Stennis Research and RREA in Institutions Receiving RREA Funds

Level of Coordination	Count	Percentage
Well coordinated	4	14
Adequately coordinated	7	25
Somewhat coordinated	9	32
Not coordinated	7	25
Do not know	1	4

As mentioned earlier, some of the institutions are not land grant institutions; therefore, they do not receive RREA funds. Thirty-nine percent of the respondents considered themselves well or adequately coordinated with their technology transfer unit. One of the recommendations to solve this problem was to provide RREA funds to all of the institutions receiving McIntire-Stennis funds to improve technology transfer. More funds and additional specialists were mentioned as two possible methods to improve technology transfer. In many states the number of forestry specialists is considerably lower than the number of agricultural specialists even though forestry provides significantly more income to landowners than does agriculture. One comment summarizes this subject by stating, "I don't have time to write an essay. However, technology transfer is improved by having an effective extension specialist whose interests are matched with the research that is ongoing-research that directly impacts the community and industry. Therefore, funding for more extension specialists would be a big help. Currently, researchers provide outreach to the community and the industry taking away from their time for research and instruction."

In addition to increased funding for specialists, more communication between researchers and specialists is suggested. As one respondent commented, "Put the people in the same building and get them talking to each other."

To investigate the level of interaction between technology transfer and research, the institutions were asked to report the number of research projects suggested by their extension forestry program that became McIntire-Stennis funded research projects during the FY 1997 through FY 2001 period. The responses ranged from "none" to "all" with most reporting less than five.

Another area of research coordination is with the USDA Forest Service. Initially the program worked closely with the USDA Forest Service so that research was coordinated and met national goals. In many cases that same cooperation exists at individual institutions. The level of coordination between the USDA Forest Service and the institutions is shown in Table 15.

Table 15 Level of Coordination between McIntire-Stennis Research Programs and USDA Forest Service Research

Level of Coordination	Count	Percentage
Well coordinated	4	10.3
Adequately coordinated	13	33.3
Somewhat coordinated	11	28.2
Not coordinated	11	28.2

Forty-three percent of the respondents consider their research either well or adequately coordinated with that of the USDA Forest Service. One administrator stated that "Many of our forestry faculty work closely with USFS researchers on various projects. The scientists are working on projects of common goals, and often collaborate to get extramural funds in the grants area. All of my faculty participate in collaborations with partner agencies, both federal and state. The McIntire-Stennis funding helps leverage these partner supported projects." Another states that the cooperation with the USDA Forest Service "Works well at our institution." With the institutions and the USDA Forest Service accounting for over three-fourths of the funds expended on forestry research in 1998 (NRC 2002), their coordination insures a more effective and efficient use of research funds.

Getting USDA Forest Service researchers and institutional researchers together was mentioned by several respondents. Annual workshops and seminars were suggested to improve coordination. Having USDA Forest Service researchers on advisory committees, and the creation of joint research projects could provide increased coordination. On the national level, the suggestion was made to have the USDA Forest Service, CSREES, and the universities "engage in joint programming at the national level to present a unified program to Congress and USDA." Currently the Forestry Research Advisory Council (FRAC) is responsible for this presentation to the Secretary of Agriculture. Action by USDA on FRAC's advice is not mandatory.

Several respondents mentioned that funds should be provided to the USDA Forest Service specifically to match McIntire-Stennis dollars, and this cooperative arrangement would provide an incentive for working together. While the providing of funds could help coordination, the wishes of one respondent that "They could stop by for a visit" would be a first step in improving coordination at some institutions.

Level of Interdisciplinary Research

The level of interdisciplinary research was another output measure of how well the McIntire-Stennis program was meeting its goals. The level of interdisciplinary participation in forestry research sponsored by the program is shown in Table 16.

Interdisciplinary research is conducted at most of the institutions responding to the survey. Seventeen percent reported no interdisciplinary research. Over one-third of the respondents report some disciplinary research

Table 16 The Count and Percentage of McIntire-Stennis Projects (FY 1997 Through FY 2001) Involving Scientists from Other Disciplines

Range of other discipline research	Count	Percentage
None	6	17
1–25%	15	42
26–50%	5	14
51–75%	4	11
76–100%	6	17

Table 17 Graduate Degrees Awarded at Forestry Institutions

	McIntire-Stennis Funded		Total Forestry Degrees
Degree	Number	Percent of Total	Number
M.S.	610	35	1727
Ph.D.	238	37	628

while 28 percent report that over one-half of their forestry research involves other disciplines.

Degrees Awarded

As one of the goals agreed upon by the institutional stakeholders, the graduate degrees earned in forestry and the graduate degrees that were partially or fully funded by the McIntire-Stennis program are reported in Table 17.

Over one-third of the graduate forestry degrees awarded from FY 1997 through FY 2001 were partially or fully funded by the McIntire-Stennis program. This level provides positive evidence that one of the goals of the program is being fulfilled. Of the degrees reported, over one-half were estimates rather than actual counts. With the commingling of funds for research projects, determining the degrees earned from McIntire-Stennis projects could be problematic. However, the total number of graduate forestry degrees awarded in the past five years should be readily available, since graduate degrees are a major output of a research institution.

USDA Forest Service Comparisons

To compare the productivity or outputs of research produced by the McIntire-Stennis program with that of the USDA Forest Service the number of publications, projects, cost per publication and cost per scientist were determined (Table 19) based on the information shown in Table 20. Over the five year period from FY 1997 through FY 2001, McIntire-Stennis funding increased about 6.8 percent in current terms while USDA Forest Service funding increased 27.4 percent (Table 18).

USDA Forest Service researchers are producing approximately one additional publication per scientist at an average cost over the five

Table 18 McIntire-Stennis and USDA Forest Service Publications, Funds, SYs and FTEs for FY 1997 through FY 2001

Year	McIntire-Stennis Pubs	McIntire-Stennis SYs	McIntire-Stennis Funds	McIntire-Stennis + Leveraged Funds	USDA Forest Service Pubs	USDA Forest Service FTE's	USDA Forest Service Funds
1997	1140	384	$19,373,000	$105,141,000	2616	642	$179,800,000
1998	1165	376	$19,374,000	$110,979,000	2718	633	$187,800,000
1999	1254	406	$20,733,000	$122,931,000	2505	653*	$197,400,000
2000	1229	420	$20,688,000	$130,294,000	3156	841	$217,700,000
2001	927	406	$20,686,000	$135,931,000	2837	743	$229,100,000
Average	1143	398	$20,171,000	$121,055,000	2766	702	$202,360,000

Source: CRIS 2002, NRC 2002; L. Jones (per. comm. November 22, 2002, USFS)

* Estimated

year period of $73 M compared to $106 M for the McIntire-Stennis researchers or at a cost that is almost 45 percent lower. The cost for an SY in the McIntire-Stennis program is about five percent higher than that of the USDA Forest Service. However, when the broad mission of educational institutions is considered, i.e., when both instruction and research are considered, the lower number of publications per scientist and the subsequently higher resulting publication costs may not allow for valid comparison between the two. For this reason, the institutional stakeholders did not rank this comparison highly.

Historically, the USDA Forest Service publications have been less expensive to produce than the McIntire-Stennis publications. In FY 1973 the USDA Forest Service reported 1407 publications while the McIntire-Stennis program reported approximately 500 publications (ASCUFRO files 1973; USDA 1973) for a total of 1907 publications. USDA Forest Service research funding in 1973 was $61.143 million and McIntire-Stennis funding was $4.994 million. With the 4:1 non-federal to McIntire-Stennis match in 1973 (ASCUFRO files 1973), the program was responsible for $24.970 million of institutional research. Therefore, the cost of a McIntire-Stennis publication in FY 1973 was $49,940 while the cost of a USDA Forest Service publication was approximately $6,500 or 13 percent less at $43,456 per publication. When the ratios of USDA Forest Service to McIntire-Stennis publications from 1970 through 1972 are compared to the current period they are similar. For the earlier period the ratio was 2.88:1, and for the current period the ratio is 2.42:1, showing a slight improvement in the productivity of the McIntire-Stennis program.

In addition, neither the USDA Forest Service nor McIntire-Stennis institutions report to CRIS in a format that allows the number of peer reviewed publications to be conpared. Peer reviewed publications are often considered to be a more valid measure of research productivity than non-peer reviewed publications. One additional reason for the lower reported number of publications in the McIntire-Stennis program is that the research project may be completed before the research is published.

Obtaining comparative data was difficult since the USDA Forest Service currently doesn't report their accomplishments to CRIS. While the institutions do report to CRIS, a summary of publications is not available. By request, CRIS (A. Moore per. comm. August 6, 2002) supplied the citation information in a number of columns of

Table 19 Comparisons of Outputs and Costs for McIntire-Stennis and USDA Forest Service Research

	McIntire-Stennis			USDA Forest Service		
Year	Pubs/SY	Cost/Pub	Cost/SY	Pubs/FTE	Cost/Pub	Cost/FTE
1997	2.97	$92,229	$273,805	4.07	$68,731	$280,062
1998	3.10	$96,261	$295,157	4.29	$69,095	$296,682
1999	3.09	$98,031	$302,786	3.84	$78,802	$302,297
2000	2.93	$106,016	$310,224	3.75	$68,980	$258,859
2001	2.28	$146,635	$334,805	3.82	$80,754	$308,345
Average	2.87	$105,910	$303,853	3.94	$73,149	$288,098

an Excel® spreadsheet. Each row on the spreadsheet represented the project report for periods covering FY 1997 through FY 2001. Over 15,000 publications were reported. Since the same publications were often reported each year that the project was active, the duplicates in the spreadsheet were deleted. A comparison between the average number of McIntire-Stennis and USDA Forest Service publications (Table 20) for the periods FY 1970 through FY 1972 and FY 1997 through 2001 demonstrates the changes in research focus. For the McIntire-Stennis publications, the Research Problem Area (RPA) classifications used for the initial period (FY 1970 -FY 1972) were the basis for classifications of publications in the latter period. The choice of classification was based on project titles. The RPA classification now used by CRIS indicates that over 50 percent of the McIntire-Stennis publications are in RPA 123, "Management of Forest Resources" (D. Unglesbee per. comm. August 1, 2002, CRIS). Since the current RPA classification 123 combines many of the initial RPAs, the current RPA classification was not used. The USDA Forest Service publications for the latter period were adapted from the categories shown in the NRC publication, National Capacity in Forestry Research (2002, p. 50). The averages for the USDA Forest Service are from three years (FY 1996 through FY 1998) rather than the FY 1997 through FY 2001 period because project classification was discontinued (L. Jones per. comm. November 22, 2002, USFS).

Table 20 demonstrates that McIntire-Stennis research provided publications in as many areas as did the USDA Forest Service. Some changes in research directions are evident, however.

The "biology and culture of timber management" research remained constant in the USDA Forest Service for both periods but increased in the McIntire-Stennis program. Greater increases occurred in "factors of the environment" for both groups by factors of five for USDA Forest Service and a factor of six for McIntire-Stennis research. Increases of this magnitude provide additional evidence that forest sustainability should be considered as a goal of the program. Further evidence of sustainability is provided by increases in publications in the "multiple use potential of forestland and evaluation of forestry programs" areas. Evaluative input and societal impacts of forestry programs and practices increased in the latter period as researchers responded to the public's concern of forest management topics.

In the initial period, one-fourth of the USDA Forest Service publications was based on research on the control of insects and diseases. While the number of publications on insect and disease control remained constant, slightly over 11 percent of the publications were in this area in the current period. McIntire-Stennis publications on insects and diseases increased by a factor of 1.8 when the current period is compared to the initial period.

While the number of USDA Forest Service and McIntire-Stennis publications increased in the "providing improved forest products" category, their percentages declined. This decline could present problems, as many small forestry firms cannot afford research and must depend on publicly funded research (Bullard 1986). Publications on recreation decreased for both research institutions, but both produced more wildlife publications in the current period. For wildlife publications, the USDA Forest Service produced 14 times as many publications in the current period as they did in the initial period while McIntire-Stennis publications increased by a factor of 4.

Table 20 The Average Number and Percentage of Publications for the USDA Forest Service and McIntire-Stennis Program for Initial and Current Periods

Research Area and Research Problem Area (RPA)	FS 70-72		FS 96-98		M/S 70-72		M/S 97-01	
	No.	%	No.	%	No.	%	No.	%
Biology, culture, and management of forests and timber-related crops (RPA 111)	138	12.0	366	13.2	93	23.4	147	12.9
New and improved forest products (RPA 401)	192	16.7	249	9.0	68	17.1	74	6.5
Control of insects and diseases affecting forests (RPA 201 and 202)	310	27.0	311	11.2	63	15.8	116	10.2
Factors of the Environment, Biology (RPA 101,102,104,105,108)	98	8.5	543	19.5	32	8.0	185	16.2
Fur bearing animals, wildlife, fish, and other marine life (RPA 904)	28	2.4	392	14.1	30	7.5	125	11
Genetics and breeding of forest trees (RPA 301)	41	3.6	0	0	28	7.0	43	3.8
Outdoor recreation (RPA 902)	23	2.0	16	.6	19	4.8	36	3.2
Economics of timber production (RPA 303)	30	2.6	139	5	14	3.5	33	2.9
Appraisal of forest and range resources (RPA 110)	49	4.3	175	6.3	13	3.3	53	4.6
Improvement of range resources (RPA 112)	20	1.7	0	0	6	1.5	6	.5
Remote sensing (RPA 113)	7	.6	0	0	6	1.5	62	5.4
Trees to enhance rural and urban development (RPA 905)	5	.4	42	1.5	5	1.3	15	1.3
Development of markets and efficient marketing of timber and related products (RPA 502)	6	.5	0	0	5	1.3	17	1.5
Supply, demand, price-forest products (RPA 513)	29	2.5	0	0	4	1.0	15	1.3
Protection of plants, animals, and man from pollution (RPA 214, 901)	43	3.7	136	4.9	4	1.0	26	2.3
Adaptation to weather and weather modification (RPA 109)	20	1.7	82	2.9	2	.5	17	1.5
New and improved forest engineering systems (RPA 302)	26	2.3	61	2	2	.5	38	3.3
Multiple use potential of forest land and evaluation of forestry programs (RPA 903)	0	0.0	162	5.8	2	.5	104	9.1
Grades and standards of forest products (RPA 512)	0	0.0	0	0	1	.3	0	0
Housing for rural and urban families (RPA 801)	6	.5	0	0	1	.3	0	0
Reducing fire losses (RPA 203)	68	5.9	109	3.9	0	0.0	1	1.0
Improving income opportunities (RPA 907)	9	.8	0	0	0	0.0	20	1.7
Total	1148	100	2780	100	398	100	1143	100

Adapted from: Annual Progress Reports of the McIntire-Stennis Cooperative Forestry Research Program 1970-1972; CRIS 1997-2001; USDA Forest Service Research Accomplished Reports 1970-1972; NRC 2002.

Case studies were chosen as one of the preferred methods for evaluating program impacts. Case studies from five institutions are presented to aid in determining the program's impacts.

Connecticut Agricultural Experiment Station

Background

The Connecticut Agricultural Experiment Station was established in 1875 as the first agricultural experiment station in the country. The station was initially located on the Yale campus, but had no connection with Yale. In addition to its original location at New Haven, Connecticut, a branch called the Valley Experiment Station, is located at Windsor, Connecticut. With no official connection to the Connecticut Agricultural Experiment Station (AES), the University of Connecticut is the state's land grant college with an experiment station at Storrs, Connecticut. The Connecticut AES cooperates with both the University of Connecticut and Yale in research and extension activities.

Early research at the Connecticut Agricultural Experiment Station was in analytical chemistry and the verification of fertilizers sold to farmers. Hybrid corn was developed at the station. Today it continues to be involved in consumer protection in its inspection of food and agricultural industries. Some of the early research was on the benefits of vitamin A. In keeping with the need to improve the public's health, the station is currently conducting research on lyme disease.

The Research Problem

An introduced insect, the hemlock woolly adelgid (*Adelges tsugae*), provided a challenge to researcher Dr. Mark McClure, an entomologist, at the Valley Laboratory. Using McIntire-Stennis funds, Dr. McClure began seeking a control for this insect that threatened the eastern and Carolina hemlocks in 1985. The hemlocks are important commercial and ornamental species throughout the eastern United States. At the time Dr. McClure began his research, few attempts had been made to control this insect. Initially, he developed insecticide recommendations to use on ornamental plantings. Recognizing that insecticides presented environmental hazards and could not be used for widespread control measures, Dr. McClure sought biological controls for the adelgid. Without any natural enemies of the adelgid, Dr. McClure traveled to Japan in 1992 using McIntire-Stennis funds for a two-month expedition in search of predators in the adelgid's indigenous territory. Bringing back the thousands of insects and mites was problematic due to quarantine regulations, but he was successful in meeting the necessary requirements. The first few years of research were devoted to learning the biology of the adelgid and its enemies. The initial research suggested that a mite, *Diapterobates humeralis*, and an unnamed beetle showed promise as possible control agents. The mite attacks the adelgid's eggs causing them to fall harmlessly to the ground while the beetle attacks all stages of the adelgid.

To determine the possibilities of control, methods of rearing the predators for possible large-scale releases were needed. Dr. McClure and his staff began to generate these procedures. Initial releases were made in 1995. Once the means of producing the predators were successfully established, others began to take an

interest in his work. McIntire-Stennis funds were the initial funds available for the research that in the beginning was of little interest to anyone but Dr. McClure.

The USDA Forest Service, using cooperative agreements, entered the research and helped with the mass rearing of the predacious beetle and mite. The Phillip Alampi Beneficial Insect Rearing Laboratory in New Jersey, and later a private rearing facility, Eco-Science Solutions, in Pennsylvania reared the volume of insects needed for release in additional areas for evaluations. The control of the hemlock woolly adelgid is complex. For the predators to be successful the weather conditions must favor their reproduction and at the same time reduce the adelgid's numbers to a manageable level. If the population of adelgids is reduced significantly by low temperatures, the predators may suffer as their food supply is impacted. In addition, hemlock site quality also influences the tree's susceptibility for attack. According to Dr. McClure other natural enemies may be needed to control this pest. Results from some of the release areas have been positive with a reduction in adelgid populations while other areas present mixed results. The research has moved from Connecticut to twelve other states. Under the supervision of the USDA Forest Service, the states of Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, North Carolina, Pennsylvania, Rhode Island, Tennessee, West Virginia, and Virginia have cooperated in the bio-control program. The expansion of this research to other states demonstrates the flexibility of the McIntire-Stennis program in addressing local or regional problems long before the problems draw the interest of those setting national priorities for competitive grants.

Technology Transfer

Without a university or extension organization, the transfer of research results from the Connecticut Agricultural Experiment Station could be problematic. The Connecticut Agricultural Experiment Station manages to convey its research results to the ultimate end-users through researcher involvement. While Dr. McClure has been working on the same project for a number of years, he has not spent all of his time cloistered in the laboratory.

The motto shown on the Connecticut Agricultural Experiment Station letterhead, "Putting Science to Work for Society" is indicative of the importance the station places on providing research results to end-users. From 1994 through 2000, Dr. McClure answered from 700 to almost 1,300 inquiries annually on the adelgid. During the same period, he averaged about 50 media interviews on the adelgid problem. To give those in the industry a better perspective of the insect's damage and its control, he made over 20 presentations per year to professionals. While they cooperate with the University of Connecticut with technology transfer, additional extension specialists in the land-grant system could allow Dr. McClure to spend more time in research.

The Benefits of Formula Funded Research

Until about 10 years ago the Connecticut Agricultural Experiment Station relied on formula funds (Hatch and McIntire-Stennis) and state appropriations for all of their research funding. They reasoned that the time spent chasing elusive grants could be better spent doing research. The failure of formula funds to keep pace with inflation, however, and reductions in state funding have forced them to seek funding through competitive grants. According to Dr. McClure, the lack of preliminary data

would have precluded obtaining a grant for the initial research on the woolly hemlock adelgid.

In an era when national priorities for forestry research change frequently, causing researchers to continually adapt their interests to the available funding, Dr. McClure's research stands apart. His search for a biological control for the hemlock woolly adelgid would have been difficult had he relied on obtaining competitive grants. Providing researchers, like Dr. McClure, the ability to continue to seek solutions to a problem in one area is essential and made possible by the flexibility of the McIntire-Stennis program.

Iowa State University

Background

Iowa State University, established in 1858 and located in Ames, is the nation's oldest land grant college. After passage of the Morrill Act in 1862 establishing the land grant colleges, Iowa was the first state to fulfill the requirements of the law. Beginning in 1858 as Iowa Agricultural College and Model Farm, the name was changed to Iowa State College of Agriculture and Mechanic Arts in 1898. In 1959 the institution obtained its present name, Iowa State University of Science and Technology. Forestry research is conducted in the Department of Natural Resource Ecology and Management and the Iowa State Agricultural Experiment Station.

To meet the earlier demands for increased agricultural production, most of the timber in Iowa's productive bottomlands was harvested, including that growing on the banks of creeks and streams. Little thought was given to sedimentation resulting from erosion or the reduction in water quality due to runoff from fertilizer and pesticide applications to adjacent fields. In the 1970's the search for new energy sources prompted Iowa State forestry researchers to consider biomass production on agricultural lands. Since the widespread conversion of farmlands to energy plantations using *Populus* and *Alnus* species was not palatable to Iowa farmers, the planting of riparian areas was considered. At about the same time, the public's concern for improved water quality was responsible for the creation of the Leopold Center for Sustainable Agriculture at Iowa State. In 1991 biomass researchers formed the Agroecology Issue Team to develop techniques for re-establishing riparian buffers along streams to improve water quality. They used "multi-species riparian buffers, constructed or restored strategically placed wetlands, stream bank bioengineering systems, riparian livestock grazing systems, and in-stream structures to improve the water and biotic quality of streams and riparian areas" (J. Kelly per. comm. March 12, 2003). For the initial research they used McIntire-Stennis funds to begin a research project along Bear Creek in northern Iowa in 1993 with the goal of producing "best management practices" for agricultural landowners. For the first two years approximately $60,000 of "seed money" provided by the McIntire-Stennis program was devoted to the project led by Dr. R.C. Shultz. Soon after the seed money from the McIntire-Stennis program showed the success of the research, other funds were made available. Competitive grants were obtained from USDA's NRI program and from the United States Environmental Protection Agency (USEPA). However, without the preliminary data provided by the McIntire-Stennis research these grants would have been difficult to obtain.

Stakeholder Input

Landowners were major stakeholders in improving water quality who provided test sites for the research. With an initial 12 cooperators in the early 1990s, the number of demonstrations grew to over 100 near the end of the project. Initially over 20 farmers and 25

consultants including the Iowa Department of Natural Resources, Illinois Water Survey, Missouri Department of Conservation, USDA's Natural Resource Conservation Service (NRCS), USDA's Farm Service Agency, and the USDA Forest Service participated. Other organizations providing input included Trees Forever, Pheasants Forever, Heart of Iowa Cooperative, Hertz Farm Management, and Iowa Cattlemen's Association.

NRCS quickly realized that the research and demonstration areas could be used to show landowners how to install riparian forest buffers. Iowa State research provided landowners with the best species of woody plants as well as grasses and forbs along with planting widths necessary to protect water quality in nearby streams. In addition, Iowa State provided an electronic spreadsheet to allow landowners to determine economic benefits of participating in the riparian buffer program. By October 2002, over 52,000 acres were enrolled in the riparian buffer program in Iowa. Nationwide over 460,000 acres were enrolled.

Technology Transfer

Technology transfer from this research has been tremendous through the Iowa State Extension Service and the many partners who joined. In addition to seven extension publications, a series of four bulletins, *Stewards of Our Streams,* found wide use. A quarterly newsletter, *Riparian Buffer News,* began publication in 2002.

To better deliver information to those working with the public, over 25 workshops were offered to natural resource professionals in Iowa. As the research was applicable to other states, eight presentations were made in Minnesota, Missouri, and Arkansas, with an additional four workshops for the American Farm Bureau's Annual Heroes Workshop. Over 230 poster or oral presentations were also made at various meetings in the state.

The demonstration area on Bear Creek was the subject of a video and a high definition DVD, and provided a stage for over 160 tours enabling landowners and government agency professionals to see the benefits of the research. A communications toolkit entitled *Tried Buffers Yet?* was developed in partnership with the National Conservation Buffer Initiative. The research prompted the Iowa Buffer Initiative sponsored by Trees Forever, a non-profit organization, founded in 1989 to support those groups and individuals in projects for planting and tree care. Trees Forever helped with demonstration projects in Iowa and eventually expanded their work into Illinois. The Iowa State researchers are working with the University of Missouri in a project to study impacts of buffer strips on waters flowing into Mark Twain Reservoir. According to Dr. J. Michael Kelly, former Chair and Professor, for the Department of Natural Resource Ecology and Management at Iowa State, *"I know of no other research that has had the widespread impact on water quality than that done here at Iowa State."* The NRCS used the demonstrations for videos to show benefits of riparian buffers. Iowa State produced a PowerPoint® presentation for "Buffer Training Sessions" for a three-day session to promote the benefits of riparian buffers.

Research Outputs

The research has produced over 21 refereed publications. The project continues to provide opportunities for graduate students to earn degrees. During the project's tenure 22 Master's and 6 Ph.D. students conducted research in related areas. At this time 18 M.S. degrees and 3 Ph.D. degrees have been earned from this work. Over the life of the research projects, more than 25 scientists from many fields participated. Within the college they came from the departments of Botany, Animal

Science, Biosystems Engineering, Geological and Atmospheric Sciences, Agriculture, and Natural Resources and Ecology. The USDA Agriculture Research Service National Soil Tilth Laboratory at Ames, Iowa also participated in the research. The use of scientists from many departments within the institution provides evidence that this McIntire-Stennis sponsored project includes substantial interdisciplinary research.

Fund Leveraging

With an initial input of $60,000 in McIntire-Stennis funds over two years, Iowa State forestry researchers were able to secure over $3.5 million in external funding. Grants were obtained from the USDA NRI Competitive Grants Program, the USDA/USEPA Sustainable Agriculture Research and Education Competitive Grants Program, US Geological Survey Water Resources Research Regional Competitive Grants Program, USEPA/Iowa Department of Natural Resources Section 319 Nonpoint Source Water Quality Project Awards, University of Missouri collaborator on USDA Agricultural Research Service -Agroforestry Practices, and the Systems of Family Farms Program. The ability of the McIntire-Stennis program to provide a base for researchers to use to obtain competitive grants is shown by this project. Without the McIntire-Stennis "seed money", what started as a local project on streamside buffers might not have become the model for the rest of the country.

Award Winning Research

The accomplishments of this research have been recognized within the state and nationally. In 1998 the project was awarded the National Riparian Buffer and Demonstration Area by USDA, and in 1999 the Environmental Protection Agency presented the project with the National Restoration Demonstration Watershed Award. On the state level, the project was given the Key Research Partner Award for the 1997-2002 period by the Trees Forever organization. In 2000 the Division of Soil Conservation and the Iowa State Soil Conservation Committee recognized the project with the Soil Conservation Award. In 2002 the Agroecology Issue Team received the Iowa State University College of Agriculture Team Award. In 1998 the Agroecology Issue Team was awarded the Ada Hayden Conservation Education Award by the Iowa Association of Naturalists and the Iowa Conservation Education Council. The receipt of many awards provides evidence that public and other important stakeholders feel that this research is having an impact.

Research Impacts

According to Conservation Reserve Program reports (USDA 2002) the 460,385.3 acres devoted to riparian buffer strips nationwide were installed at an average cost of $452 per acre for a total federal expenditure of over $208 million. In Iowa the 52,013.2 acres cost over $23 million. If the costs of the program are considered as the minimal value of improved water quality to the public, then the initial investment provided by the McIntire-Stennis program is meager compared to the benefits. About $30,000 or 18 percent of Iowa State's McIntire-Stennis funds were allocated annually to the riparian buffer project (J. Kelly per. comm. March 12, 2003). From FY 1990 through FY 2002 Iowa State received slightly over $3 million in McIntire-Stennis funds. Using the same proportional funding of 18 percent for the riparian study, the McIntire-Stennis program would provide approximately $540,000 for the 12 year period. Using the assumption that 18 percent of the $23 million that Iowa citizens enjoy in cleaner water can be attributed to the McIntire-Stennis program, the benefit-cost ratio of the research to Iowans is

7.7:1. If the benefits received nationally are considered (94 million acres at a value of $42.5 million), using the same assumption that 18 percent of the benefits can be attributed to the 18 percent contribution of the program to the research, the benefit-cost ratio for the national riparian buffer project jumps to 79:1.

As the public becomes more concerned with environmental issues such as water quality, the research funded by the McIntire-Stennis program at Iowa State has become increasingly important. What started as research on sediment remediation for a local stream in northern Iowa is now the national model for riparian buffer strips.

Mississippi State University

Background

Mississippi State University, founded in 1878, is a land-grant institution located in the east central part of Mississippi adjacent to the city of Starkville. With a fall 2002 enrollment of 12,873 undergraduate students and 2,979 graduate students, MSU offers a broad range of courses of study. As a land grant university in a rural state, both agriculture and forestry are major areas of research. The Departments of Forestry, Wildlife and Fisheries, and Forest Products form the College of Forest Resources, which is in the Division of Agriculture, Forestry, and Veterinary Medicine. All departments offer B.S., M.S. degrees, and the Ph.D. degree is offered in forest resources at the College level. Research is conducted through the Forest and Wildlife Research Center that was created as a separately funded state agency by the Mississippi Legislature in 1994.

The Department of Forestry currently has 19 researchers and 9 extension foresters. The project suggested for a case study is active and known as "Forest Resource Identification, Characterization, and Management with Spatial Information Technologies" (CRIS accession number 0172980). The research uses light detection and ranging (LIDAR) imagery along with other remote sensing tools to determine species composition and important tree measurements for forest inventories. Wildlife habitat suitability can also be determined using these technologies.

This project was started in January 1997 by Dr. D. L. Evans, the Principal Investigator. As a new faculty member, Dr. Evans chose this project based on his interests and the need for a better method to assess the forest resources of the state and region. After selection, the research proposal was reviewed by others in the Forest and Wildlife Research Center and forestry professionals who needed current forest resource information. Forestry professionals provided stakeholder input on the project to insure that their needs would be met by the research. This input was obtained at meetings, in telephone conversations, and from presentations on the research project.

Fund Leveraging

McIntire-Stennis funds were used to leverage grants from NASA and other cooperators for the project. With about $366,000 of McIntire-Stennis funds over a six-year period, $2 million in funds from other sources was leveraged. Had the McIntire-Stennis funds not been available initially to provide for a portion of the principal investigator's salary, the opportunity to conduct this research might not have been possible.

Graduate Degrees

In addition to providing research to improve the forest resource, graduate students are important outputs of the McIntire-Stennis program. For this study, 12 graduate students were involved. Three doctoral students continue to work on the project along with three students working on M.S. degrees. Six of the

students have received M.S. degrees through the project's research.

Publications

Publications are a measure of research outputs. Twenty-four publications have been produced from the project. Through a cooperative agreement with the USDA Forest Service, LIDAR research in Washington and Idaho provides additional data on species composition that will allow other areas of the country to benefit from this project. Within the Mississippi State University system, an interdisciplinary cooperative agreement with the Engineering Research Center may produce inventory programs using the LIDAR imagery as a virtual reality mechanism.

Technology Transfer

The results of this research are presented in publications and at conferences. Many natural resource professionals interested in the project have visited Mississippi State University to learn more and provide input. According to former Director of the Forest and Wildlife Research Center, Dr. Sam Foster, the research produced an operational model from a four county pilot study that is the basis for an improved state timber inventory system.

Research Impacts

The success of this project inspired the Mississippi Legislature to establish the Mississippi Institute for Forest Inventory. The Institute will operate the program, while Mississippi State University provides research and development for the system. The research also created interest in other states. The state of Texas is currently assessing techniques developed by the research. Louisiana State University scientists are cooperating with Mississippi State University in developing a procedure for demonstrating the research findings. A forest industry firm is conducting an operational test of the system developed for LIDAR data analysis.

Determining the monetary value of research in advance, *ex ante*, is difficult. McIntire-Stennis funds contributed about $366,000 while the extramural funds were approximately $2 million. In Mississippi, forestry and wildlife are two very important resources. The forest products industry, with a higher pay scale than most of Mississippi's jobs, employs about 5 percent of the workforce with an annual payroll over $1.8 billion (Munn and Henderson 2002, p.2).

Forest inventories based on the USDA Forest Service's Forest Inventory and Analysis (FIA) are not current since the field inventory procedures require physically revisiting a grid of permanent plots covering the state. The cycle period for updated inventories ranges from seven to ten years. Forest industries and others need current information for future planning in an industry where the production cycle from stand regeneration to harvest is long. Without current production information, industries may be reluctant to expand and may move to other areas.

The new information that the "Forest Resource Identification, Characterization, and Management with Spatial Information Technologies" project will provide to those making natural resource decisions on forestry and wildlife issues comes at a six-year cost of approximately $2.5 million or less than $.5 million annually. With a forest products industry in Mississippi generating over $14.8 billion in total output annually with over $6.5 billion annually in value-added products (Munn and Henderson 2002, p.4), the $366,000 expended on this research to help the industry and other users of natural resources make better decisions appears to be a good investment of McIntire-Stennis funds.

Virginia Polytechnic Institute and State University

Background

Located in the Southern Appalachians in Blacksburg, Virginia Tech began in 1851 as an Episcopal Methodist academy called the Olin and Preston Institute. After the passage of the Morrill Act in 1862 establishing the land grant college system, the state legislature established the Virginia Agricultural and Mechanical College in 1872 with the purchase of the land and buildings of the original academy. With an initial enrollment of 132, today over 25,000 students study in its eight colleges of agriculture, architecture, arts/sciences, business, human resources/education, engineering, natural resources, and veterinary medicine. Virginia Tech ranks in the top 50 research institutions in the nation.

Within the Department of Wood Science and Forest Products, Dr. A.L. Hammett serves on the staff of the Center for Forest Products Marketing and Management and is the director of the non-timber forest products (NTFP) program. Timber products are important, but the other non-timber resources provided by the forests are often of equal or greater importance.

The early settlers in the Appalachian region of the eastern United States utilized the forests for most of their needs. Medicinal plants provided remedies for medical care while fruits and nuts were important food sources. Even though synthetic products have replaced many of the traditional forest products, there is a need to document or rediscover the benefits of earlier lifestyles.

"Increasing Markets for Sustainably Produced Non-Timber Forest Products from Central Appalachia" provides research to learn from and maintain traditional ways, enhance the region's income, and at the same time insure the sustainability of the products and the region's forest resource. Although the research targets Appalachia, the results may be generalized both nationally and internationally. Most McIntire-Stennis utilization projects are focused on one or a few timber products. This project is unique as it covers many varied NTFPs including edible, decorative, and medicinal products as well as specialty wood products.

Stakeholder Input

The wide range of products involved in the project necessitated input from a large number of stakeholders including harvesters, processors, consumers, foundations, economic development groups, and resource managers. Both focus group meetings in local communities and interviews with stakeholders were used to determine initial research questions that the project should address. In other regions of the world, non-timber forest products have continued to be an important component of daily lives and country or regional economies. This project's goal is to raise the awareness of NTFPs in Appalachia. Lessons learned from Southeast Asia and Africa have shown that non-timber forest product enterprises are often more important than those based on timber. Communication with other regions allowed for improved technology transfer here and abroad. For overseas studies, the U.S. Agency for International Development was a partner. In this country, agencies such as the USDA Forest Service, and the Appalachian Regional Commission, and at Virginia Tech the Department of Urban Affairs and Regional Planning, Appalachian Studies Program and the Department of Geography have all collaborated.

When the results of this project are utilized, the income of the region will improve. Since some individuals deriving a portion or all of their income from non-timber forest products may be in the lower income brackets, the supplemental income is important. Due to their limited funds for research and lack of a formal organization, the small businesses would not be able to afford a research project of this

magnitude. Since many of the plants desired by the market are endangered, the public benefits from this research will help sustain the future supply of native species. With the increased demand for non-timber forest products, this project provides an opportunity to supply markets previously unknown to Appalachian residents.

Most non-timber forest enterprises are not capital intensive, enabling citizens to have a small business without large expenditures for working capital, equipment, inventory, and supplies. NTFPs offer potential profitable niche businesses providing income in a local area where traditional industries such as coal mining are declining. To ensure maximum benefit to local economies, the project also developed partnerships with several non-governmental organizations such as the Craig County (Virginia) Rural Partnership and Total Action Against Poverty of Roanoke, VA. (Davis 2002). The overall market for many of the NTFPs is not small. For instance, forest based dietary supplements command a multi-million dollar a year business. In Virginia, a $60 million market exists for all non-timber forest products (A. Hammett per. comm. April 8, 2003).

Technology Transfer

According to the Principal Investigator of the project, Dr. A. L. Hammett, "There is a shortage of information about these products [non-timber forest products] and their markets, so we are working hard to disseminate the information necessary for the sustainable management and marketing of non-timber resources" (Davis 2002). The project provides needed information through publications, workshops, and a web site (www.sfp.forprod.vt.edu/).

Twenty *Specialty Forest Products Fact Sheets*, (Virginia Tech 2003), were distributed to landowners and entrepreneurs as part of a series, provided through projects with the Top of Ozarks Resource Conservation and Development, Missouri Department of Conservation, and the USDA Forest Service. In addition, collaboration with other states demonstrates the generalization of this research that began as a pilot study in Southwest Virginia and is now widely available within and outside the region and in several countries.

Since medicinal plants provide over 40 percent of the ingredients of the prescription drug industry, including treatments for cancer, leukemia, and heart disease, sustainable medicinal plant production methods are essential. Over 250 people from five states attended a series of five workshops at Camp Mitchell in New Castle, VA to present information on several NTFPs, including forest-grown medicinal plants (Davis 2002). At the workshops, the participants took part in "hands on" demonstrations to find the proper forest site and learn how to plant, harvest, and market medicinal plants. Virginia provided about 10 percent of the U.S. ginseng harvest of 76 tons with a value of $76 million in 1993 (Hammett, per. comm. April 8, 2003). A naturalized ginseng stand, if properly tended, can supply roots for several decades. Other medicinal plants for which workshops provided information included Echinacea, goldenseal, and St. John's Wort.

The World Wide Web (WWW) provides another important method of technology transfer, allowing access to the results of the project. The Virginia Tech Non-Timber Forest Products website (http://www.sfp.forprod.vt.edu) has been a valuable technology transfer tool. The web site contains information on the product areas, forums for buyers and sellers, publications, fact sheets, tutorials, links to other related sites, workshop schedules, and a valuable source of suggestions and input. The utility of the web site is shown by its 3,500 visits per month from potential users of the project's research.

In addition to providing input for beginning a non-timber forest products enterprise, the research provided information to resource

managers on maintaining the sustainability of the enterprises. Most of the management plans developed by the USDA Forest Service for the National Forests lack procedures for assessing and regulating the collection of non-timber products on public lands (Chamberlain et al. 2002). In addition to the many extension publications and web based information, journal articles also extend the results of this research. NTFP research has produced over 25 publications for professional journals and proceedings.

Graduate Students

The project has fostered several graduate research projects with four M.S. degrees and one Ph.D. degree earned from the NTFP research. Technical and invited lectures have been presented at over 30 venues during the life of this project. Three of those receiving degrees continue to work with NTFPs. The program produced one research scientist who continues the research on NTFPs for the USDA Forest Service. The McIntire-Stennis program provided a new scientist as well as experience in a relatively new area of resource management.

Through the well-used website, publications, and graduate degrees, the McIntire-Stennis program continues to provide information for those who depend on "nature" for a portion of their income. The research has also demonstrated methods to work with "nature" in maintaining the sustainability of the NTFP resource.

Oregon State University

Background

Oregon State University, located in Corvallis, Oregon, originated in 1858 as a small private academy named Corvallis College. Initially the Methodist Episcopal Church supported the school. About 1865, college courses in arts and sciences were added to the curriculum. The college added agriculture courses in 1869 to comply with the provisions of the Morrill Act of 1862 in order to receive public support as a land grant institution. The three baccalaureate degrees awarded in 1870 were the first degrees in the West from a state-assisted institution. The name was changed to Oregon Agricultural College in 1885 when the college was fully supported by state funds. In the 1920's the name was again changed to Oregon State College and in 1961 the present name, Oregon State University, was assumed.

Initial Impacts of the McIntire-Stennis Program

After World War II, a logging engineering program was established at Oregon State University. In 1968 the forestry administration sought a research component for the logging engineering program, but state funds were not available. With the aid of private and other public funds and major support of the McIntire-Stennis program, forest engineering research was added. According to the Director of Forestry Research at that time, Assistant Dean Rudy Kallander, *"Had it not been for the additional financial support from this source [McIntire-Stennis], we might not have had the courage to begin what has become an outstanding research program with numerous side-benefits that continue to aid the cause of good forest management for both the timber and non-timber values"* (Kallander to Stennis, June 6, 1977, ASCUFRO files).

Integrated Forest Protection Project

The McIntire-Stennis program continues to benefit forest management through research projects such as, "Integrated Forest Protection" (CRIS Accession Number 0134168). In the past, most of the insects and diseases impacting forests were considered independently. Today,

an ecosystem approach to forest management necessitates a broader view of forest health. The research needed to address an ecosystem concept requires input from many disciplines.

In this project, ecologists, entomologists, pathologists, weed scientists, zoologists, silviculturists, and fire researchers, developed an integrated forest protection research, education, and extension program. Douglas-fir is a major species providing timber products, wildlife habitat and aesthetics in old growth forests. In the past, trees damaged by natural disturbances such as fire or windstorms were harvested. Today, harvesting may not be an option in protected stands that are damaged by natural forces, but the damage sometimes creates an ideal environment for insect and disease epidemics.

The Douglas-fir beetle (*Dendroctonus pseudotsugae*) often takes advantage of natural and man-made disturbances to attack Douglas-fir. Building on existing knowledge of Douglas-fir beetle behavioral ecology, one component of the Integrated Forest Protection project was the development of pheromone-based management strategies. This research focused on two complementary strategies: 1) using aggregation pheromones to attract beetles to traps and baited trees where they could be destroyed, and 2) using antiaggregation pheromones to prevent beetle attacks on high-valued trees and stands. The antiaggregation pheromone, 3-methylcyclohex-2-en-1-one (MCH), was applied operationally to Douglas-fir stands with success. An EPA label was obtained in 1999 to allow this treatment to be used to protect high-value stands. In 2000, capsules containing MCH were applied in Washington, Oregon, Idaho, Montana, and Wyoming to over 200,000 acres of high value Douglas-fir stands saving millions of dollars worth of timber. This research at Oregon State provided a new treatment that can be safely used to help maintain healthy forests.

Hazard rating models were developed for other insects such as the western pine shoot borer and the Sitka spruce weevil, a defoliator of spruces and white pine. The hazard rating models give foresters early warnings to thin stands or apply other control measures to minimize damage. For example, the research has shown that thinning ponderosa pine during Pandora moth outbreaks can reduce stand damage by removing host trees. The relationships between dwarf mistletoe and the predisposition of Douglas-fir to bark beetle attack is a part of the integrated forest protection research. Trees with dwarf mistletoe may be killed by baiting them with the aggregation pheromones.

Often more subtle than insects in their attacks, diseases also play a significant part in forest health. The project investigated the impacts of *Armillaria* and annosus root diseases to forest stands from various harvesting techniques. The research results suggested that the frequent cutting cycle necessary for uneven-aged management may exacerbate the spread of root diseases due to harvesting injuries.

Technology Transfer

Results of the McIntire-Stennis sponsored research at Oregon State provided a basis for the Department of Forest Science's course in integrated forest protection. The course has been taught 12 times with about 10 students in each class. This type of technology transfer provides students with science-based instruction that they can apply after graduation.

Technology transfer for this project is enhanced at Oregon State because one of the principal investigators, Dr. G. M. Filip, is both a scientist and an Extension specialist. He presents workshops to private landowners using the results of the Integrated Forest Protection program to help maintain the health of forestlands. At the same time he receives feedback from the landowners on their forest health problems. Future research projects in the

program can address landowners' specific problems and concerns.

Scientists in the Integrated Forest Protection project share their work with other government agencies and forest industries. For example, a 1988 fire in Wyoming's Shoshone National Forest created an ideal setting for a Douglas-fir beetle outbreak. With the expected loss of between 40 and 70 percent of the basal area of Douglas-fir, an application of MCH was used to protect these high value stands. The optimal MCH rates for the application were based on the 1995 results of this McIntire-Stennis project.

Research Outputs

Graduate students and publications are two of the outputs used to measure how well the McIntire-Stennis program is meeting it goals. The Integrated Forest Protection project provided outputs to meet both goals. With over 70 peer reviewed and outreach publications generated by this research project, results and recommendations are delivered to those who can apply the research findings.

Based on the project's research, 13 M.S. degrees and 2 Ph.D. degrees were earned by graduate students. Since the project encompassed the disciplines of entomology, pathology, and silviculture, their programs provided a holistic view of forest health. Because the USDA Forest Service seeks employees with a broad background to diagnose problems and make recommendations for private forest landowners, four of the graduates now work for that agency. One graduate is a forest health specialist with a state forestry agency.

Forest Health

Current discussions on the health of the nation's forests generate considerable interest and debate. The Healthy Forest Restoration Act signed into law in 2003 is an important example of enhanced public interest in this issue. Understanding the interactions between diseases, insects, and silvicultural practices is fundamental to promoting forest health. As this information is used by resource managers, the public will benefit from sustainable forest resources.

CONCLUSIONS

The focus group and questionnaire applied in this evaluation of the McIntire-Stennis program provide information on the thoughts of current stakeholders about the program. By consensus, the goals proposed by Senator Stennis at the Congressional Hearings for the programs in 1962 are the current goals. Sustainability should be added to the research goals of protection, production, and utilization. Publications are the preferred method of measuring outputs while case studies and the leveraging of research funds provide the qualitative and quantitative information necessary for outcome measurements.

The majority of institutional stakeholders were satisfied with the distribution formula and CRIS. Coordination with extension and the USDA Forest Service could be improved. Both Congress and CSREES were noted as possible impediments to the program. Increased appropriations and increased education of Congress by CSREES were presented as possible solutions to the impediments.

Most of the institutional stakeholders preferred local or state selections of research projects with consideration of national and regional needs. The majority of those responding to the survey use a peer reviewed system that often includes input from their stakeholders to select projects. In keeping with research as the major goal of the program, the institutional stakeholders spend slightly over 40 percent of the McIntire-Stennis funds on scientists' salaries. Special grants received mixed assessments as 36 percent considered them their least favorable form of research funding, but at the same time, 40 percent of the respondents also considered them fair. When funding is taken into account, science and politics are closely related.

While most institutions receive less than 10 percent of their research funds from the McIntire-Stennis program, they consider it a very important base for their research. This base allows them to have the infrastructure to seek additional funds from competitive grants, cooperative agreements, and special grants. The McIntire-Stennis program remains an important part of their "portfolio" of funding. Without the base funding provided by the program, forestry research would suffer at most of the institutions.

Impacts of the Program

Measuring impacts or outcomes of a program is difficult since other programs may be addressing the same problem. The institutional stakeholders chose the case study method as one approach for measuring McIntire-Stennis impacts.

The case studies provide further evidence of the impacts that the program has made. While they address state or regional problems, the results have positive spillovers to other states and regions. The Iowa State research on riparian buffer systems, for example, provided guidelines for a national conservation program. The Connecticut Agricultural Experiment Station's work on the biology of hemlock woolly adelgid and its predators was used by forestry organizations in most of the eastern states. The McIntire-Stennis program is well suited to the long periods required for forestry research results. The research in the program is usually coordinated with other research programs.

The Mississippi State University LIDAR study involves both NASA and the USDA Forest Service and is tied to similar research in Washington and Idaho. The newly created Mississippi Institute for Forest Inventory will apply the new technology developed from the successful pilot study at Mississippi State University. The data provided from the LIDAR system can provide additional information to the

USDA Forest Service's Forest Inventory and Analysis system.

The goal of increasing forest resource productivity includes non-timber forest products as well. In the Appalachian region, McIntire-Stennis supported research at Virginia Tech enhanced the region's economy and at the same time demonstrated sustainability of the non-timber resource. The case studies show that McIntire-Stennis research provides a holistic view of the nation's forests.

Oregon State University's investigations of the insect and disease problems affecting Douglas-fir considered more than the value of the timber resource by determining the species' place in the ecosystem. The integrated pest management strategies encompassed wildlife and fisheries management and habitat improvement, use of fire, ecological implications of control practices, and timber production. Like the Connecticut research, environmentally friendly pest controls were investigated.

The five selected case studies are a small part of the approximately 700 projects carried out annually with at least partial support from the McIntire-Stennis program. As with any type of research, some of the projects may not produce the impacts that the selected case studies illustrate. However, the benefits of the successful ones may easily outweigh the costs of the program, as illustrated by the high benefit cost ratios of the Iowa State case study. As McIntire-Stennis research considers the sustainability of the forest resource, many non-market benefits, such as improved water quality or carbon sequestration are enhanced. Since non-market benefits are often hard to quantify, calculating their benefit cost ratios would be difficult. As evidenced by the positive impacts of the selected case studies, the benefits of the program compared to its cost of slightly over $400 million through FY 2001 provides significant evidence of the program's efficiency.

Those noting Congress as an impediment to the program suggested increases in the annual appropriation as a remedy. The mandated obligation to increase the appropriation to the authorized one-half of the USDA Forest Service research budget was also made. When total funding for institutional research is considered, the financial resources of the institutions approximate that of the USDA Forest Service. One of the original concerns of the program was to encourage state and private contributions to forestry research by requiring matching funds. The originators wanted the McIntire-Stennis program funding to equal one-half of the USDA Forest Service research budget, while the state and private sector provided the other half. With this match, forestry research in the USDA Forest Service and the institutions would receive equal funding. The initial concerns over non-federal support are allayed as current state and private funds provide about 66 percent of the total institutional forestry research budget. When funds from all sources are considered the program leverages approximately five times its annual appropriation (Table 19). Closer coordination between the USDA Forest Service and McIntire-Stennis researchers would give Congress additional evidence that research was not duplicated.

As mentioned by some of the questionnaire respondents and several studies (NRC 1990, 2000), all of the agencies supplying research funds should meet to determine the goals they are attempting to achieve. Currently the Forestry Research Advisory Council (FRAC) is charged with advising the Secretary of Agriculture on forestry research needs. This council should request that all of the proposed projects and funding levels for forestry research be reported to them in order to determine the current level of forestry research. As more of the research funds come from agencies other than USDA and the USDA Forest Service, a method of tracking the new research using CRIS should be developed.

This evaluation provides evidence that the McIntire-Stennis program provides research to address the many challenges of sustaining the

nation's forests. As a base, the program leverages funds from private, state, and other federal sources. The continuity provided by the base allows for long-term research, but at the same time maintains the flexibility to change research directions based on stakeholder input. USDA should acknowledge the contributions of the program and recommend to OMB that the funding level be increased with the ultimate goal of reaching the authorized level of one-half of the USDA Forest Service research budget.

Congress made a positive move by increasing RREA appropriations in FY 2002, so that more funds are available to transfer new technologies resulting from forestry research to those who can benefit from the developments. Those public institutions receiving McIntire-Stennis funds but who are not eligible for RREA funds should be included in Extension's technology transfer program. As a non-land grant institution, the Connecticut Agricultural Experiment Station case study provides an excellent example of technology transfer in an institution ineligible for RREA funding. However, the questionnaire respondents reported that coordination is lacking in both land grant and non-land grant institutions. Since the land grant institutions have a technology transfer program in place through the Extension Service, they can provide the vehicle for outreach for the non land grant institutions. Adequate funding and a mandate by Congress for coordination could establish a better information sharing arrangement. This cooperation could range from using World Wide Web (www) linkages to present research results and recommendations, to providing forestry extension specialists at all of the institutions receiving McIntire-Stennis funds.

Program Support Changes

NAPFSC replaced ASCUFRO in 1982 as the organization providing support of the McIntire-Stennis program. NAPFSC provides testimony at congressional hearings to let Congress know of the program's status and needs. In 1999 NAPFSC, in cooperation with CSREES, published *The Role of Research, Education and Extension in Sustaining America's Forest Resources: Why You Should Care*. Several case studies were presented giving the McIntire-Stennis program credit for these research accomplishments.

Individual institutions may also be able to encourage program support by reporting their research results to constituents through their technology transfer functions. Stakeholder input is required by the 2002 Farm Bill, and many institutions currently have stakeholder input for their research projects. The McIntire-Stennis program should be recognized as a source of funding in research publications and graduate degrees. Without advertising the McIntire-Stennis program's contributions to research projects, very few outside of the institutional forestry research community will ever know of the program and its accomplishments. Many graduate students are unaware that the research conducted for their degrees received support from the McIntire-Stennis program.

Implications for Future Studies

By determining program goals and goal measurements, this evaluation provides a benchmark for future evaluations of the program. This evaluation sought input from the administrative stakeholders in the McIntire-Stennis program. Input was received from program administrators at CSREES, from the forestry representatives at the eligible institutions, and from the program's advisory group, FRAC. Future evaluations should address additional stakeholders, and include researchers, graduate students, landowners, industry representatives, and eventually the public who is the ultimate beneficiary of tax supported research. Suggestions made to provide information to decision makers and other stakeholders, if taken, should make future evaluations easier.

SUMMARY

With sub par funding for institutional forestry research in the 1950's, forestry school leaders sought additional federal appropriations. After several unsuccessful attempts, the leaders found support in Washington from Congressman Clifford G. McIntire of Maine and Senator John C. Stennis from Mississippi. Under the guidance of V.L. Harper, Research Chief in the USDA Forest Service, and support from the forestry community, PL 87-788, known as the McIntire-Stennis Cooperative Forestry Research Program was signed on October 10, 1962 by President John F. Kennedy. Since that time, a total of over $400 million has been appropriated to accomplish the program's goals presented by Senator Stennis to: (1) increase research in forest protection, production, and utilization; (2) involve other disciplines in forestry research; and (3) train future scientists.

At the institutions, the increases in forestry research, forestry faculty additions, and new facilities showed that the program was properly implemented. In addition, the program placed forestry research at the colleges and universities on the same level as USDA Forest Service research, and an equal to agricultural research on land-grant campuses.

The forestry leaders responsible for passage and implementation of the McIntire-Stennis program formed ASCUFRO to support the program. In their annual testimony before congressional hearings they pleaded for increased program funding to the authorized level of one-half of the USDA Forest Service budget. The increases in funding were difficult to obtain. Even the co-sponsor and "Champion of Forestry" Senator John Stennis could only obtain substantial increases in appropriations after 10th and 25th year commemorations of the program.

The proportion of total forestry research funding sponsored by the McIntire-Stennis program fell from over 20 percent in 1975 to less than 10 percent in 2001. This decrease in proportional research funding was the basis for this evaluation, which provides evidence that the program goals are being met with positive impacts.

The Forestry Representatives at the institutions who administer the McIntire-Stennis program were surveyed to obtain their current views of the 40-year-old program. In addition, a focus group and interviews with forestry leaders were held to provide additional stakeholder input. For the evaluation, both qualitative and quantitative data were combined in a mixed method evaluation.

The first step in the evaluation was to obtain a consensus from the current stakeholders on the goals of the program. The initial goals provided by Senator Stennis were still considered the current goals along with research to ensure forest sustainability. After determining the goals, the next evaluative step was to develop methods to measure how well the program is meeting its goals and objectives.

Program outputs and outcomes are indicators of program effectiveness and efficiency. Outputs are the products produced by the program while outcomes indicate the impact of the program as it addresses the problems that prompted its passage. Publications were ranked as the preferred method to measure program outputs. For program outcomes, survey respondents recommended case studies to provide the necessary qualitative and quantitative information to show program impacts. The leveraging of funds from other sources was another preferred measure of the program's outcome.

Providing research scientists was one of the goals of the McIntire-Stennis program. An estimated 2,000 doctoral degrees and 8,600 M.S. degrees have been awarded to students

whose research was fully or partially funded by the program (Thompson 2003, p. 109, 112). Survey respondents reported that in the period FY 1997 through FY 2001, one-third of the graduate degrees awarded at their institutions were linked to the McIntire-Stennis program. Considering that McIntire-Stennis funds account for less than 10 percent (Table 7) of the research budget at most institutions, having over one-third of the graduate degrees fully or partially funded by McIntire-Stennis funds indicates that the program is successful in achieving the goal of providing future scientists.

The current publication ratio of USDA Forest Service to McIntire-Stennis is about the same as it was when the program was implemented (2.8:1 vs. 2.3:1). However, the USDA Forest Service has improved considerably in publications per scientist, and cost per publication (Table 19).

Currently CSREES submits a budget to OMB suggesting the level of funding necessary for the programs they administer. Over the past three years, CSREES has proposed increases for their competitive grants program, National Research Initiative, while proposing less funding for the McIntire-Stennis program. Since stakeholders indicate that the McIntire-Stennis program is the base on which they support other research activities, failure to increase this base allows it to be eroded by inflation. Decision makers should recognize this erosion and provide additional funds. At the same time, decision makers might consider the disadvantages of competitive grants. Using research reported by others (McKenney 1993; NRC 2000) the net return to research for competitive grants indicates that the opportunity costs for time required for proposal writing for competitive funding is considerable. Often the quality of proposals does not match the quality of research performed (Huffman and Just 1994). Institutions may seek special grants in lieu of formula and competitive grant programs.

For special grants, political influences may replace scientific reasoning and justification. Questions about the fairness of competitive grants processes provide the rationale for institutional administrators to seek special grants. The pursuit of special grants can be stymied only if other funding programs are deemed fair. Since special grants usually represent a movement of funds from competitive grants or formula funds, rather than additional appropriations, all of the forestry research community should be concerned with increased reliance on special grants.

This evaluation of the McIntire-Stennis program obtains an empirical consensus of the program goals used by institutional stakeholders who are administratively responsible for research project selection. The outputs and outcomes of the program that stakeholders consider valid for goal accomplishments indicate that the program is meeting its goals. If the program is fulfilling its goals and objectives, "internal" justification exists for continuation of the program. With the program functioning positively internally, the proportional reductions in the amount of research funded by the program and the reduction in real funding suggest that "external" support problems exist.

Stakeholders identify Congress, CSREES, OMB, and state governments as possible impediments to the program. The failure of Congress to increase funding for the program is a major problem. Congress' reluctance to increase program appropriations has been attributed to the failure of CSREES to educate Congress and OMB on successes of the program. In defense of CSREES, information is not readily available on successes associated directly and indirectly with this program. Publications and graduate degrees have been identified by stakeholders as output measures of the program. However, this information is not currently summarized by CRIS's accounting and reporting system. Planned changes in CRIS should include reports on these outputs. Institutions are not crediting the McIntire-

Stennis program for its support of research projects.

With over 40 percent of McIntire-Stennis funds used for scientists' salaries, the program provides forestry institutions with a core of scientists. Without increases in program funding, however, the cadre of scientists needed for future research may not be adequate to provide the new technologies needed to meet the demands of society from our natural resources. Education in resource management might then regress by becoming based more on trial and error methods rather than science (Clapp 1926). At that point, the institutions would be back at the 1950 instructional and research level when the early forestry leaders recognized the need for a federal program such as McIntire-Stennis.

The following recommendations have the potential to enhance the McIntire-Stennis program's ability to meet its goals:

- CRIS should provide degree and publication information so that the publication titles can be summarized by year, author, institution, and research problem area. Similar information should be available for both masters and doctoral degrees. All public forestry research including that of the USDA Forest Service should be reported to and summarized by CRIS.
- NAPFSC should cooperate with CSREES to produce annual or periodic reports showing the research contributions the program provides to each state.
- CSREES should continue its support in administering the program and provide information to policy makers in USDA about the critical research base provided by this program.
- All information on forestry research grants should be channeled through FRAC and CRIS to prevent duplication of research and provide current information to researchers. Better cooperation with USDA Forest Service researchers should be encouraged with FRAC advising the Secretary of Agriculture on the needs of the forestry research community. The USDA Forest Service, McIntire-Stennis researchers, and extension specialists should participate in regional research forums.
- Institutions should give more recognition in publications and presentations about the contributions of the McIntire-Stennis program. The program should be recognized in general research information that many institutions now provide via periodic newsletters and other publications. Adequate technology transfer is essential to insure program equity. Funds should be provided to all McIntire-Stennis recipients for technology transfer. To demonstrate responsible use of program funds, all universities should adopt a peer review system for project selections with stakeholder input.
- This evaluation indicates that the McIntire-Stennis program is meeting it goals by being effective and efficient. The program is addressing all of the research areas investigated by the USDA Forest Service. As a base program for the institutions, the McIntire-Stennis program leverages funding equal to one-half of the USDA Forest Service research budget or five times its annual appropriation. For these reasons, the program should be funded at its authorized level of one-half of the USDA Forest Service research budget.

By obtaining a consensus from current stakeholders about the goals of the McIntire-Stennis program, along with the preferred

methods to measure both the outputs and outcomes of the program, this research provides a basis for future evaluations. Adoption of the recommendations by CRIS to summarize output data will improve the validity of future evaluations.

The five case studies presented in this evaluation represent a very small percentage of the projects conducted annually through the McIntire-Stennis program. The impacts of the case studies demonstrate that McIntire-Stennis supported research provides benefits that far exceed the program's costs. Currently, for example, the McIntire-Stennis program annually provides approximately $22 million for university research nationwide. When the research benefits from the Oregon State University project alone are estimated, the annual value of the trees saved from insect attack is in the millions of dollars. When these benefits are combined with other research conducted in the remainder of the McIntire-Stennis institutions, taxpayers can rest assured that the program continues to help insure the protection, utilization, production, and sustainability of the nation's forests.

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APPENDIX A

Public Law 87-788
87th Congress, H. R. 12688
October 10, 1962

An Act 76 Stat. 806.

To authorize the Secretary of Agriculture to encourage and assist the several States in carrying on a program of forestry research, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That it is hereby recognized that research in forestry is the driving force behind progress in developing and utilizing the resources of the Nation's forest and related rangelands. The production, protection, and utilization of the forest resources depend on the strong technological advances and continuing development of the knowledge necessary to increase the efficiency of forestry practices and to extend the benefits that flow from forest and related rangelands. It is recognized that the total forestry research efforts of the several State colleges and universities and of the Federal Government are more fully effective if there is close coordination between such programs, and it is further recognized that forestry schools are especially vital in the training of research workers in forestry.

Sec. 2. In order to promote research in forestry, the Secretary of Agriculture is hereby authorized to cooperate with the several States for the purpose of encouraging and assisting them in carrying out programs of forestry research.

Such assistance shall be in accordance with plans to be agreed upon in advance by the Secretary and (a) land-grant colleges or agricultural experiment stations established under the Morrill Act of July 2, 1862 (12 Stat. 503), as amended, and the Hatch Act of March 2, 1887 (24 Stat. 440), as amended, and (b) other State-supported colleges and universities offering graduate training in the sciences basic to forestry and having a forestry school; however, an appropriate State representative designated by the State's Governor shall in any agreement drawn up with the Secretary of Agriculture for the purposes of this Act, certify those eligible institutions of the State which will qualify for assistance and shall determine the proportionate amounts of assistance to be extended these certified institutions.

Sec. 3. To enable the Secretary to carry out the provisions of this Act there are hereby authorized to be appropriated such sums as the Congress may from time to time determine to be necessary but not exceeding in any one fiscal year one-half the amount appropriated for Federal forestry research conducted directly by the Department of Agriculture for the fiscal year preceding the year in which the budget is presented for such appropriation. Funds appropriated and made available to the states under this Act shall be in addition to allotments or grants that may be made under other authorizations.

Sec. 4. The amount paid by the Federal Government to any State-certified institution eligible for assistance under this Act shall not exceed during any fiscal year the amount available to and

budgeted for expenditure by such college or university during the same fiscal year for forestry research from non-Federal sources. The Secretary is authorized to make such expenditures on the certificate of the appropriate official of the college or university having charge of the forestry research for which the expenditures as herein provided are to be made. If any or all of the colleges or universities certified under this Act fails to make available and budget for expenditure for forestry research in any fiscal year sums at least as much as the amount for which it would be eligible for such year under this Act, the difference between the Federal funds available and the funds made available and budgeted for expenditure by the college or university shall be reapportioned by the Secretary to other eligible colleges or universities of the same State if there be any which qualify therefore and, if there be none, the Secretary shall reapportion such differences to the qualifying colleges and universities of other States participating in the forestry research program.

Sec 5. Apportionments among participating States and administrative expenses in connection with the program shall be determined by the Secretary after consultation with a national advisory board of not less than seven officials of the forestry schools of the State-certified eligible colleges and universities chosen by a majority of such schools. In making such apportionments consideration shall be given to pertinent factors including, but not limited to, areas of non-Federal commercial forest land and volume of timber cut annually from growing stock.

Sec. 6. The Secretary is authorized and directed to prescribe such rules and regulations as may be necessary to carry out the provisions of this Act and to furnish such advice and assistance through a cooperative State forestry research unit in the Department of Agriculture as will best promote the purposes of this Act. The Secretary is further authorized and directed to appoint an advisory committee which shall be constituted to give equal representation to Federal-State agencies concerned with developing and utilizing the Nation's forest resources and to the forest industries. The Secretary and the national advisory board shall seek at least once each year the counsel and advice of the advisory committee to accomplish effectively the purposes of this Act.

Sec. 7. The term "forestry research" as used in this Act shall include investigations relating to: (1) Reforestation and management of land for the production of crops of timber and other related products of the forest; (2) management of forest and related watershed lands to improve conditions of waterflow and to protect resources against floods and erosion; (3) management of forest and related rangeland for production of forage for domestic livestock and game and improvement of food and habitat for wildlife; (4) management of forest lands for outdoor recreation; (5) protection of forest land and resources against fire, insects, diseases, or other destructive agents; (6) utilizations of wood and other forest products; (7) development of sound policies for the management of forest lands and the harvesting and marketing of forest products; and (8) such other studies as may be necessary to obtain the fullest and most effective use of forest resources.

Sec. 8. The term "State" as used in the Act shall include Puerto Rico.

APPENDIX B

Table B. 1 CSREES Calculations for FY 1999 Distribution of McIntire-Stennis Funds[1]

A	B	C	D	E	F	G	H	I
State	Non-Federal Land (M Acres)	Timber Harvest (M Ft3.)	Non-Federal Funding	M/S Funds Without $25M Base Funds	M/S Funds With $25M Base Funds	M/S Funds Less SBA & Bio Deductions	M/S Funding FY 1999 Funds	Rank
Alabama	21,077	1,072,506	$2,444,198	$697,519	$722,519	$18,373	$704,146	50
Alaska	10,827	240,141	$725,837	$446,412	$471,412	$11,987	$459,425	32
Arizona	1,274	67,264	$2,309,551	$292,958	$317,958	$8,085	$309,873	21
Arkansas	14,697	758,417	$1,033,829	$599,866	$624,866	$15,889	$608,977	43
California	7,522	908,025	$6,506,152	$641,717	$666,717	$16,954	$649,764	46
Colorado	3,597	33,857	$1,224,987	$279,008	$304,008	$7,731	$296,277	20
Connecticut	1,754	21,059	$946,331	$209,256	$234,256	$5,957	$228,299	15
Delaware	376	3,204	$19,891	$41,851	$66,851	$1,670	$65,151	3
Florida	13,422	615,910	$1,598,276	$544,065	$569,065	$14,471	$554,594	39
Georgia	22,260	1,325,665	$5,394,966	$739,370	$764,370	$19,437	$744,933	53
Guam	0	0	$0	$13,950	$38,950	$990	$37,960	1
Hawaii	700	0	$767,139	$153,454	$178,454	$4,538	$173,916	11
Idaho	4,218	333,015	$3,677,880	$460,362	$485,362	$12,342	$473,020	33
Illinois	3,738	68,123	$1,144,169	$334,809	$359,809	$9,149	$350,660	24
Indiana	3,967	92,730	$2,322,605	$362,710	$387,710	$9,859	$377,851	26
Iowa	1,900	26,157	$1,674,290	$251,107	$276,107	$7,021	$269,086	18
Kansas	1,171	8,327	$306,577	$139,504	$164,504	$4,183	$160,321	10
Kentucky	11,476	100,145	$1,057,224	$404,561	$429,561	$10,923	$418,638	29
Louisiana	13,053	814,141	$1,867,798	$613,817	$638,817	$16,244	$622,572	44
Maine	16,928	459,378	$2,822,045	$571,965	$596,965	$15,180	$581,785	41
Maryland	2,399	39,272	$281,637	$223,206	$248,206	$6,312	$241,894	16
Massachusetts	2,942	36,809	$905,699	$265,057	$290,057	$7,358	$282,681	19
Michigan	15,003	382,930	$7,676,746	$627,767	$652,767	$16,599	$636,168	45
Minnesota	12,755	287,979	$4,330,633	$516,164	$541,164	$12,761	$527,403	37
Mississippi	15,499	961,515	$5,590,202	$669,618	$694,618	$17,663	$676,955	48
Missouri	11,804	135,928	$1,061,043	$432,462	$457,462	$11,633	$445,829	31
Montana	6,679	258,529	$2,414,457	$418,511	$443,511	$12,278	$432,233	30
Nebraska	507	5,383	$579,305	$111,603	$136,603	$3,474	$133,129	8
Nevada	115	615	$613,141	$97,653	$122,653	$3,119	$119,534	7
New Hampshire	4,225	85,670	$537,330	$306,908	$331,908	$8,440	$323,468	22
New Jersey	1,845	17,646	$425,309	$181,355	$206,355	$5,247	$201,108	13
New Mexico	2,055	29,523	$1,274,559	$237,156	$262,156	$6,666	$255,490	17
New York	15,648	222,831	$16,797,107	$655,658	$680,658	$17,308	$663,359	47
North Carolina	17,191	958,001	$6,121,772	$683,568	$708,568	$18,018	$690,551	49
North Dakota	327	1,687	$248,116	$69,751	$94,751	$2,409	$92,342	5
Ohio	7,380	113,139	$621,256	$376,660	$401,660	$10,213	$391,447	27
Oklahoma	5,654	84,103	$974,003	$348,759	$373,759	$9,504	$364,255	25
Oregon	9,485	1,365,806	$10,817,934	$725,416	$750,416	$19,082	$731,337	52
Pennsylvania	15,333	284,046	$2,602,411	$502,214	$527,214	$13,406	$513,807	36
Puerto Rico	589	2,079	$100,607	$83,703	$108,703	$2,764	$105,938	6
Rhode Island	371	2,587	$36,741	$55,802	$80,802	$2,055	$78,747	4
South Carolina	11,266	713,065	$995,424	$530,114	$555,114	$14,116	$540,999	38
South Dakota	531	35,533	$163,544	$125,553	$150,553	$3,828	$146,725	9
Tennessee	12,238	368,794	$2,346,758	$488,263	$513,263	$13,051	$500,212	35
Texas	11,844	621,291	$4,240,002	$585,916	$610,916	$15,535	$595,381	42
Utah	765	11,494	$535,144	$153,454	$178,454	$4,538	$173,916	11
Vermont	4,197	75,081	$724,343	$320,859	$345,859	$8,795	$337,064	23
Virgin Islands	20	400	$45,161	$27,901	$52,901	$1,345	$51,556	2
Virginia	13,624	558,716	$3,327,313	$558,015	$583,015	$14,825	$568,190	40
Washington	11,207	1,228,048	$8,523,262	$711,469	$736,469	$18,727	$717,742	51
West Virginia	10,920	71,060	$965,535	$390,611	$415,611	$10,568	$405,042	28
Wisconsin	13,492	360,685	$1,659,762	$474,313	$499,313	$12,697	$486,616	34
Wyoming	1,647	41,312	$264,018	$195,305	$220,305	$5,603	$214,703	14
TOTALS	393,514	16,309,621	$125,644,019	$19,949,024	$21,274,024	$540,920	$20,733,069	1430

[1] Post, Boyd, per. comm. May 10, 1999, CSREES

APPENDIX C

The Procedure for Determining McIntire-Stennis Fund Distributions

I. Administration

USDA receives three percent of the appropriation for administration of the Act.
In FY 1999, 3% of the $21,932,000 appropriation was $657,960, leaving $21,274,040.

II. Base funding

All states plus Puerto Rico, Guam, and the Virgin Islands are eligible to receive funds. Currently each receives a base allotment of $25,000. This total amount of 53 X $25,000 or $1,325,000,00 is subtracted from the appropriation. In FY 1999, $19,949,040 ($21,274,040-$1,325,000) remained after this subtraction. The base amount will be added back after the rankings are made.

III. Ranking

The states are ranked by the following factors:
Acres of private forestland (40%) from latest USDA Forest Service Forest Inventory and Analysis (FIA) data.
Volume of timber removed from growing stock (40%) from latest FIA data.
Amount of non-federal funding (20%) from Current Research Information System (CRIS) reports. (Form CSRS-OD-1233)

Using the following formula the state values are determined:

State value = State acres of private forestland X .40 /total acres of private forestland + State volume of timber removed from growing stock in cubic feet X .40/ total removal from growing stock + State amount of non-federal funding X .20/ total non-federal funds.

For Mississippi in FY 1999, for example, the following numbers were used to determine the state's funding level:

15499 acres X.40 + 961,515 cu. ft. X .40 + $5,590,202 X .20 = .048234
393,514 acres 16,309,621 ft3 $125,644,019

When ranked with the other states in FY 1999, Mississippi's ranking was 48.

IV. Distribution by Ranks

The sum of the ranks of all eligible states and territories is 1431 (the sum of 1,2,3,4,….53). The state with the highest value is given the rank of 53. If a state does not participate, the sum of the ranks of 1431 is reduced. In FY 1999 the sum of the ranks was 1430.

The appropriation is then multiplied by the ranking divided by the sum of the ranks. For Mississippi in FY 1999, 48/1430 X $19,949,040 = $669,618.13

V. Base Fund Addition

The base fund of $25,000 is now added to the amount allocated by the rank distribution. For Mississippi, after the $25,000 is added to the rank distribution of $669,618.13 the total is $694,618.13.

VI. Congressional Mandates

For FY 1999, Congress mandated a 2.54% Small Business Set-Aside and Biotechnology risk assessment.

After this deduction, the McIntire Stennis funds available to Mississippi in FY 1999 were $676,954.

VII. States with More than One Eligible Institution

The governor's representative determines the fund distributions in those states with more than one eligible institution as shown in Table C.1.

Table C.1 McIntire-Stennis Fund Distributions to States with Multiple Eligible Institutions.

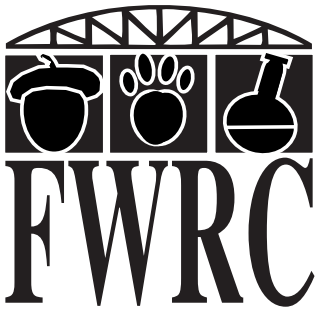
State	Institution	Percentage
Arizona	Northern Arizona University	50%
Arizona	University of Arizona	50%
California	University of California, Berkley	80%
California	California State University, Humbolt	15%
California	California Polytechnic State University	5%
Connecticut	University of Connecticut, Storrs AES	25%
Connecticut	Connecticut Ag Experiment Station	75%
Illinois	University of Illinois	50%
Illinois	Southern Illinois University	50%
Louisiana	Louisiana State University	70%
Louisiana	Louisiana Tech University	30%
Michigan	Michigan State University	33%
Michigan	Michigan Technological University	33%
Michigan	University of Michigan	33%
New York	Cornell University	25%
New York	State University of New York at Syracuse	75%
Texas	Texas A & M Ag Experiment Station	50%
Texas	Stephen F. Austin State University	50%
Washington	Washington State University	45%
Washington	University of Washington	55%

Source: B. Post per. comm. July 6, 2000 CSREES.

Table D.1 FY 2004 McIntire-Stennis Cooperative Forestry Research Program Fund Distributions to Eligible Institutions [1]

College	State	Amount	College	State	Amount
Auburn University	Alabama	$724,021	Mississippi State University	Mississippi	$710,566
University of Alaska, Fairbanks	Alaska	$495,283	University of Missouri	Missouri	$441,463
American Samoa Community College	American Samoa	$24,353	University of Montana	Montana	$401,097
Northern Arizona University	Arizona	$180,366	University of Nebraska	Nebraska	$172,359
University of Arizona	Arizona	$180,366	University of Nevada	Nevada	$131,994
University of Arkansas	Arkansas	$602,924	University of New Hampshire	New Hampshire	$320,366
Humbolt State University	California	$98,512	Cook College, Rutgers University	New Jersey	$172,359
University of California, Berkley	California	$459,721	New Mexico State University	New Mexico	$280,001
California Polytechnic State University	California	$98,512	Cornell University	New York	$157,459
Colorado State University	Colorado	$347,276	State University of New York	New York	$472,376
Connecticut Agricultural Exp. Station	Connecticut	$169,635	North Carolina State University	North Carolina	$683,655
University of Connecticut	Connecticut	$56,545	North Dakota University	North Dakota	$91,629
University of Delaware	Delaware	$78,173	Ohio State University	Ohio	$374,187
University of Florida	Florida	$549,104	Oklahoma State University	Oklahoma	$387,642
University of Georgia	Georgia	$737,476	Oregon State University	Oregon	$697,111
University of Guam	Guam	$37,808	Pennsylvania State University	Pennsylvania	$495,283
University of Hawaii at Manoa	Hawaii	$185,815	University of Puerto Rico-Mayaguez	Puerto Rico	$105,084
University of Idaho	Idaho	$428,007	University of Rhode Island	Rhode Island	$64,718
Southern Illinois University	Illinois	$153,456	Clemson University	South Carolina	$535,649
University of Illinois	Illinois	$153,455	South Dakota State University	South Dakota	$118,539
Purdue University	Indiana	$333,821	University of Tennessee	Tennessee	$522,193
Iowa State University	Iowa	$266,546	Texas A & M University	Texas	$335,100
Kansas State University	Kansas	$145,449	Stephen F. Austin State University	Texas	$335,100
University of Kentucky	Kentucky	$454,918	Utah State University	Utah	$199,270
Louisiana State University	Louisiana	$431,466	University of Vermont	Vermont	$280,001
Louisiana Tech University	Louisiana	$184,914	University of the Virgin Islands	Virgin Islands	$51,263
University of Maine	Maine	$562,559	Virginia Tech	Virginia	$589,469
University of Maryland	Maryland	$239,635	Washington State University	Washington	$295,535
University of Massachusetts	Massachusetts	$253,090	University of Washington	Washington	$361,210
University of Michigan	Michigan	$192,005	West Virginia University	West Virginia	$414,552
Michigan State University	Michigan	$192,004	University of Wisconsin	Wisconsin	$481,828
Michigan Tech University	Michigan	$192,005	University of Wyoming	Wyoming	$199,270
University of Minnesota	Minnesota	$468,373			

[1] Blanche, Catalino. per.comm. May 2004, CSREES



Forest and Wildlife Research Center
Mississippi State University

Mississippi State
UNIVERSITY