U.S. FOREST SERVICE RESEARCH AT NACOGDOCHES, TEXAS

by Ronald E. Thill

The U.S. Forest Service is the largest agency within the Department of Agriculture. With more than 30,000 employees, it is composed of three primary operational branches: the National Forest System, State and Private Forestry, and Forest Service Research and Development. The National Forest System, by far the largest of the three, is responsible for protecting and managing the 191 million acres that comprise the 155 national forests and twenty national grasslands of the United States. State and Private Forestry provides technical and financial assistance to state, private, and tribal forestland owners. Forest Service Research, the largest forest research organization in the world, is comprised of six stations as well as the Forest Products Laboratory in Madison, Wisconsin. Most stations consist of an administrative headquarters, various research work units distributed among the states that comprise the station, and experimental forests where station scientists conduct much of their research. Many research work units are located on university campuses to facilitate collaborative research and share equipment and facilities.

From its headquarters in Asheville, North Carolina, the Southern Research Station (SRS) oversees state-of-the-art research in thirteen states, including Texas. Each of the twenty-five research work units that comprise the SRS focuses on one or more specific forest research topics that include extensive and intensive forest management of pines, hardwoods, and mixed forest types; forest hydrology; forest law and taxation; forest economics; forest genetics; wildlife; fisheries; forest products; fire; forest engineering; and forest insects and diseases. Although the SRS has research wildlife biologists located at several forestry-oriented units to foster multidisciplinary research, its primary wildlife research unit is located on the campus of Stephen F. Austin State University (SFASU) in Nacogdoches, Texas, within the Wildlife Habitat & Silviculture Lab (WHSL); this unit was formerly known as the East Texas Branch (ETB). When established in 1945, research at the ETB dealt primarily with forest management. In 1961, the focus shifted to combine wildlife and forestry research. Early wildlife research dealt almost entirely with the impacts of forest management practices on game species such as deer and squirrels. During the late 1970s, research at Nacogdoches began to shift to nongame research – especially forest birds. Today, research at the Nacogdoches Lab focuses only on nongame species, including birds, butterflies, bats and other small mammals, reptiles, and amphibians, and is designed to determine how forest management practices affect wildlife.

This paper briefly chronicles more than fifty-six years of Forest Service research in Nacogdoches. Additional information regarding current research and Lab personnel, publications, the Stephen F. Austin Experimental Forest (SFAEF), and the SFA Interpretive Trail System can be found on the Unit's

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web page: www.srs.fs.fed.us/wildlife. A more detailed version of this paper is on file at the WHSL.

The Nacogdoches Lab's earliest history is poorly documented. This article is based on a number of sources, including newspaper archives, research planning documents, Dr. Robert Baker's *Timbered Again, The Story of the National Forests in Texas*,[1] work unit publications, discussions with current and retired lab scientists, and the author's personal experience at the Nacogdoches Lab since 1986.

Much of the earliest Forest Service research in Texas was conducted on three experimental forests. In 1939, Acting Chief C. Granger established the San Jacinto Experimental Forest, although the first research there – a cutting methods study involving thirty-two plots – actually began 1938.[2] This 2,150-acre experimental forest was located near Huntsville, Texas, on the Sam Houston National Forest in Walker County. Another study comparing selection cutting with the "D+ thinning method" was initiated there in 1949. Together, these two studies occupied less than 100 acres.[3] Except for a thinning operation in the mid-1940s and minor salvage removals, very little management or additional research was conducted there during the 1950s and 1960s.[4] Thus, the San Jacinto Experimental Forest was decommissioned in 1969.[5]

Paul Boynton, President of the Stephen F. Austin Teachers College (SFATC), now Stephen F. Austin State University, was one of the first to recognize the importance of forestry and forestry research to the future of East Texas.[6] Working with the Texas Forestry Association, a Nacogdoches lumberman named Lacy Hunt, and other influential individuals, Boynton was instrumental in establishing a forestry department at the college as well as the Stephen F. Austin Experimental Forest. On December 14, 1944, the 78th Congress enacted Public Law 539, which directed the Chief of the U.S. Forest Service to work cooperatively with the SFATC to establish this experimental forest; the SFAEF was officially established on September 19, 1945. Currently the only experimental forest in Texas, the SFAEF is technically part of the Angelina National Forest but is administered by the WHSL. This 2,560-acre forest is located in Nacogdoches County about seven miles southwest of Nacogdoches adjacent to the Angelina River. Although Lab scientists still have several active studies on the experimental forest, most of their research is now conducted on other U.S. Forest Service and forest industry holdings in Texas, Louisiana, Arkansas, and eastern Oklahoma.

The ETB leased the third experimental forest (the Kurth Tract) from E. L. Kurth, president of the Angelina Lumber Company.[7] This 1,200-acre forest, located adjacent to State Highway 59 just south of the Piney Woods Country Club, had been under a continuous yield selective harvest silvicultural system since it was acquired in 1906.[8] Studies there compared timber growth and yield under this management system with those produced under seed-tree, shelterwood, clear-cutting and planting, and group-selection regeneration systems.

When the ETB was established, its scientists and clerical staff were housed in the basement of the SFASU Science Building.[9] Back then most of

the technicians had their offices at the SFAEF. In 1957, the research staff moved to the old SFASU Music Building at the corner of Raguet and East College Street, which had been remodeled to accommodate their needs. To make way for construction of the new School of Forestry building, the staff moved to the Forest Science Laboratory in 1969, a site that formerly had been the university's maintenance building. In 1971, they moved into the new 10,000-square-foot Wildlife Habitat & Silviculture Lab. SFASU President Ralph W. Steen, Laurence C. Walker (Dean of the SFASU College of Forestry), and Lacy Hunt were instrumental in helping the Station secure funding for this lab. Located at 506 Hayter Street on land owned by the University and leased to the Forest Service under a 99-year agreement, the new lab was officially dedicated on October 22, 1971.[10] U.S. Senator John G. Tower and W. Caleb Glazener (Assistant Director of the Welder Wildlife Foundation) were principal speakers at the dedication ceremony.

The Forest Service has provided office space for a number of cooperators over the years. Phil Goodrum (a biologists with the U.S. Fish and Wildlife Service) and Daniel W. Lay (a Texas Parks and Wildlife Commission biologist) moved into the new lab in 1971. In the mid 1980s, nine employees of the Soil Conservation Service (now the Natural Resources Conservation Service) had offices in the lab for about five years. James A. Neal (a biologist with the U.S. Fish and Wildlife Service) arrived in 1985. In addition to Neal, current lab occupants include three Texas Parks and Wildlife Department employees and a biologist with The Nature Conservancy. The presence of all these individuals has fostered interagency cooperation and has helped Lab scientists extend their resources and expand their research.

Paul Boynton and others who lobbied to establish the SFAEF in 1945 also helped the Southern Forest Experiment Station secure operating funds for the ETB. Established in 1945 under the leadership of Hubert L. Person (Forester in Charge),[11] the ETB was the first U.S. Forest Service research office in Texas. In 1945, much of the forests of East Texas (like those throughout much of the South) had been clear-cut or "high graded" (where the best trees were removed, leaving only inferior or younger trees). Such lands were essentially abandoned from a forestry standpoint, as few foresters or forestry researchers knew much about reforestation or managing these lands for pine production. Natural regeneration of the cutover forests was hampered by frequent burning (from both natural and arson origins) and excessive livestock grazing, often under an open range (unfenced) system involving multiple livestock species.

With six professional foresters in 1948, the ETB was one of the largest of the nine work centers within the Southern Forest Experiment Station. Most of the earliest research at Nacogdoches focused on the daunting task of providing landowners with methods for reestablishing pine trees on cut-over sites and protecting and managing these young new forests. Early studies focused on a number of key issues that were to define forestry in the South for years to come: (1) improvement of depleted pine-hardwood stands (including hardwood control); (2) methods, costs, and returns from intensively managed farm

woodlands; (3) marketing timber products; (4) effects of log quality and size on economic returns; (5) improved techniques for cruising, mapping, and protecting forests; (6) alternative silvicultural systems for shortleaf (*Pinus echinata*) and loblolly pine (*P. taeda*) management; (7) management of bottomland hardwoods; (8) utilization of inferior hardwoods; (9) use of fire as a forest management tool; and (10) woodland grazing.[11] The grazing studies sought to increase livestock production without reducing pine reproduction and growth.[12]

George K. Stephenson assumed leadership of the ETB in July 1953. Research progress reports from the early 1950s through the early 1960s cover a diversity of projects including studies on pine regeneration and survival, control of hardwoods using herbicides and fire, utilization of so-called inferior hardwoods, forest product market surveys, economics of natural regeneration systems, pine seed depredation by rodents and birds, and damage to longleaf pine (*P. palustris*) seedlings by cotton rats (*Sigmodon hispidus*). Carter B. Gibbs developed guidelines for managing small "farm forests,"[13] deriving many of his findings from five small (approximately thirteen-acre) experimental stands within what is now designated as the "Jack Creek Loop" of the Stephen F. Austin Interpretive Trail System. Gibbs also conducted a number of studies on the effectiveness of various herbicides for hardwood control. Edwin R. Ferguson studied loblolly pine seedling establishment, survival, and growth. He also cooperated with W. Calvin Royall, Jr., a biologist with the U.S. Fish and Wildlife Service, to evaluate the effectiveness of several repellents in reducing pine seed consumption by birds and rodents. Thad Harrington's research included herbicide and method of cutting studies.

The first newspaper clipping in the WHSL files that mentions wildlife research is dated April 30, 1955.[14] The journalist wrote that the Southern Forest Experiment Station would gradually incorporate research on the impacts of forest management practices on game animals at its Texas, Arkansas, Louisiana, Mississippi, and Alabama research labs. Following a 1961 Station reorganization, Nacogdoches was designated as the headquarters for all the Station's wildlife habitat research. In December 1961, Lowell K. Halls was transferred to Nacogdoches to become project leader of the Station's new wildlife research unit; George Stephenson accepted an Assistant Director position in New Orleans, then headquarters of the Southern Forest Experiment Station. Following this change in the unit's research mission, most of the foresters at the Nacogdoches Lab either retired or moved to new assignments. John Stransky oversaw timber management research from 1963 through 1973. By the 1970s, most of his research dealt with the impacts of various forest site preparation practices on wildlife forage composition and yield. Stransky also studied the effects of site preparation practices on soil properties and pine seedling growth, and the impacts of fire on fruit production from woody plants before retiring in 1985.

Lowell Halls' research dealt primarily with determining the potential of southern forests to produce and support game species – primarily white-tailed

deer (*Odocoileus virginianus*). To improve pine production, foresters used a variety of methods to reduce hardwood competition. However, from a wildlife standpoint, hardwoods are extremely important. Thus, one of Halls' primary studies evaluated the impacts of hardwood removal (and the accompanying loss of acorns) on white-tailed deer and other wildlife. In a long-term, cooperative study (involving Halls, Dan Lay, Charlie Segelquist, and Phil Goodrum) two large (167-172 acre) deer enclosures were erected at the SFAEF by prisoners from Huntsville in 1964. Hardwoods were removed from one enclosure but retained in the other.[15] Each pen was then stocked with deer and their numbers, reproduction, food habits, and general health were monitored over time.[16] Phil Goodrum monitored squirrel (*Sciurus* spp.) populations within these two enclosures. Similar studies were conducted at the Sylamore Experimental Forest, part of the Ozark-St. Francis National Forest in Arkansas, and on the Kisatchie National Forest near Winnfield, Louisiana.[17] Together, these studies provided valuable information on the number of deer that different forest types could support over time, with and without various types of management.

Halls and Sim Oefinger published a number of woody plant booklets that were very popular with wildlife biologists, foresters, and the public – especially hunters.[18] Halls is perhaps best known for compiling and editing the 870-page book titled *White-tailed Deer: Ecology and Management*.[19]

Halls hired James G. Dickson as a research wildlife biologist during the summer of 1976. Dickson's initial research documented bird communities in various forest types. For example, he, Dick Conner (see below), and Howard Williamson (a Lab forestry technician) surveyed birds annually during winter and spring in a pine plantation from stand age two through about seventeen years. Likewise, Dickson and Charles Segelquist studied winter bird communities in pine and pine-hardwood stands having different canopy heights. In 1979, Dickson, Dick Conner, and others co-edited a book on the role of insectivorous birds in forest ecosystems.[20] Following Halls' retirement in January 1981, Dickson was appointed project leader of the WHSL.

In the mid 1980s Dickson initiated a study to determine the importance of streamside management zones (SMZ) to wildlife. SMZ are remnants of older forests that are often retained along streams for watershed protection when adjacent stands are harvested. With their older forest habitat features (large snags and coarse woody debris; mature mast-producing hardwoods; structurally-diverse canopies; etc.) many biologists assumed that SMZ provided valuable habitat for many wildlife species – especially those whose habitat requirements are not met within adjacent plantations. As concerns over impacts of shorter-rotation forestry and the growing loss of mature hardwoods grew across the South, SMZ were a logical research topic. Dickson's study addressed the effect that different widths of SMZ had on wildlife abundance and diversity. Co-investigators in this study included Dick Conner and Brent Ortego (a Texas Parks and Wildlife Department biologist) for bird surveys, Jimmy C. Huntley (a WHSL research wildlife biologist) for squirrel and small mammal surveys, and Craig Rudolph for amphibian and reptile surveys.

Among Dickson's primary accomplishments were compiling and editing *The Wild Turkey: Biology and Management*, published in 1992, and *Wildlife of Southern Forests: Habitat and Management*, which was published in 2001.[21] Following his retirement in January 1999, Dickson moved to Ruston, Louisiana, where he currently serves as Merritt Professor and coordinator of wildlife programs in the School of Forestry at Louisiana Tech University.

Richard (Dick) N. Conner was hired by Lowell Halls as a research wildlife biologist during the summer of 1977. Conner's research interests centered on forest birds, especially woodpeckers. Woodpeckers play key ecological roles in forest ecosystems by creating cavities and consuming insects – including many forest pests. When woodpeckers abandon their nest and roost cavities, these sites often are used by a host of other species. Consequently, woodpeckers have a major impact on forest wildlife diversity and forest health.

Much of Conner's early research at Nacogdoches focused on interrelationships between woodpeckers, their nest trees, and the fungi that decay pines and hardwoods, softening heartwood and thereby facilitating cavity excavation by woodpeckers. With a gradual shift toward pine plantation management and toward shorter timber rotations, many biologists and conservationists were concerned over the future availability of older trees – those most likely to contain sufficient fungal decay for cavity excavation – for woodpecker utilization. Conner was the first scientist to isolate different species of heart and sapwood fungi, grow these in wooden dowels, and then insert them in trees so that he could monitor their development over time; he also monitored use of these trees by woodpeckers. His fungal inoculation work was expanded to include groups of pines that had been selected as future recruitment stands for the endangered red-cockaded woodpecker (RCW, *Picoides borealis*).

Conner also monitored populations of standing dead trees (snags) over time to determine natural gains and losses of these important nesting and foraging sites for primary cavity nesters (woodpeckers) and secondary cavity nesters (birds that cannot excavate cavities but nest in abandoned woodpecker cavities). From this work he provided management recommendations on densities of snags needed for enhanced bird diversity and forest health. Conner also studied characteristics of living trees and snags (e.g., size, species, and bark rugosity) selected by woodpeckers for nesting and foraging.

In May 1985, Conner and David L. Kulhavy (a SFASU School of Forestry faculty member and a cooperator on pine resin studies) organized and hosted a symposium in Nacogdoches titled *Wilderness and Natural Areas in the Eastern United States: A Management Challenge*. In 1986, the School of Forestry published a proceedings of symposium presentations.[22] The papers in this volume have aided in management of recently established wilderness and natural areas of the eastern United States.

Dan Lay was one of the first to suspect that RCW populations were declining in Texas. Conner's surveys, beginning in the late 1970s, verified his concerns. Since then, most of Conner's research efforts have been devoted to

identifying the causes for declining RCW populations and to recommending management practices to increase the species' populations. These studies involved nearly all facets of RCW biology, pine resin production (and more recently resin chemistry), and interactions between RCWs and southern pine beetles (*Dendroctonus frontalis*). The presence of suitable cavity trees largely determines the presence and extent of RCW populations. Cavity tree destruction by southern pine beetles is the primary cause for cavity tree losses, and pine resin is the tree's first defense against bark beetle attack. The wealth of information brought to light by these studies is published in the book *The Red-Cockaded Woodpecker: Surviving in a Fire-Maintained Ecosystem*, which Conner co-authored with Craig Rudolph and Jeffrey R. Walters.[23] With his extensive knowledge of RCW biology and management, Conner has served as an advisor and expert witness in several federal litigation cases in Texas and helped formulate the latest RCW recovery plan, which should be released in 2002. Conner and his team's efforts in RCW conservation have had a major impact on the management of southern forests – especially those in public ownership.

Conner's avian research was not restricted to woodpeckers and snags. He worked on avian censuring, marking, and habitat measurement techniques, and contributed significantly to the understanding of avian vocal behavior. He was one of the first ornithologists to apply multivariate statistical procedures to study interrelationships between bird song, habitat quality, and nesting success; vegetation structure and bird song acoustical properties; and vegetation structure and fledgling success. He also wrote extensively on the ways various forest management practices affect forest birds. In recent years, Conner has worked with Craig Rudolph on a number of reptile studies and as a collaborator on many of Dan Saenz's anuran (frog) research projects.

In June 1986, Ronald E. Thill was assigned to the Nacogdoches Lab as a research wildlife biologist. Dickson's research on SMZ had considered a number of wildlife species and taxonomic groups, but it did not adequately address deer. Because deer were the primary game species throughout the South and generated considerable income for landowners willing to lease their land for deer hunting, it was imperative to expand this work to examine seasonal use of SMZ by white-tailed deer. When Jim Dickson stepped down as project leader of the Nacogdoches Lab in August 1987 to concentrate on his wild turkey book, Thill was appointed "Acting Project Leader"; in October 1988, he became project leader on a permanent basis and is still serving in this capacity.

In 1988, Thill initiated a deer telemetry study in cooperation with R. Lee Rayburn, R. Montague Whiting, Jr., of the SFASU College of Forestry, and graduate student Micah L. Poteet. Results of this study indicated that deer exhibit seasonal preferences for SMZ when they are imbedded within a landscape composed primarily of pine plantations.[24] In 1989, Thill began a six-year cooperative study with M. Anthony Melchiors, Weyerhaeuser Company's wildlife biologist for the southeastern U.S., and T. Bently Wigley from the University of Arkansas at Monticello (UAM). They sought to evaluate forest

bird and small mammal responses to SMZ of different widths within pine plantations of three age classes in the Ouachita Mountains of Arkansas.

During the 1980s and early 1990s, environmentalists were pressuring the Forest Service to consider uneven-aged management as an alternative to clear-cutting and planting of pine on the national forests of the South. During a periodic examination of the Nacogdoches Lab's mission in 1989, Thill proposed new research to evaluate the impacts of alternative pine regeneration systems on wildlife communities. He located a number of selectively logged, privately owned stands in East Texas that had excellent uneven-age stand structure, and in 1990 began a study using these stands and even-aged stands of six age/successional stages to compare relative abundance and diversity of bird, small mammal, and herpetofaunal (amphibians and reptiles, collectively) communities.

During the 1980s, the Ouachita National Forest (ONF, the largest national forest within the southern region) came under increasing environmental pressure because of its clear-cutting and hardwood control practices. In an attempt to resolve these issues, the Southern Forest Experiment Station began a major research initiative on the ONF to evaluate the suitability and economics of alternative forest regeneration systems, and the impacts of these systems on other forest resources – including wildlife.

Since 1990, Thill has served as group leader for all of the wildlife research conducted under the Ouachita Mountains Ecosystem Management Research initiative. As part of this project, scientists have been monitoring birds, small mammals, and various habitat features in twenty differently managed stands located in Arkansas and Oklahoma.[25] Under another component of this initiative, Thill and cooperating scientists have been developing models to predict presence/absence and relative abundance of birds, amphibians, and reptiles under a variety of forest management scenarios. These models are currently under development and a study to validate their utility will be initiated in 2002. Thill also initiated a radio telemetry study in 2000 to determine roosting behavior of "tree bats" in the Ouachita Mountains and the impacts of alternative forest management practices on these bats. Roger W. Perry, a professional support biologist hired by Thill in 1993, (assisted by forestry technicians Howard Williamson and Rodney Buford and many temporary employees) has been overseeing the Arkansas and Oklahoma studies.

Early in the 1990s, the Ouachita National Forest initiated a large-scale effort to restore about 150,000 acres of shortleaf pine-bluestem ecosystem, once common in the Interior Highlands. A primary goal is to expand RCW populations on the Forest. Restoration of this ecosystem is being accomplished by thinning the pine overstory, reducing abundance of midstory hardwoods, and burning these stands approximately every three years. Thill and Craig Rudolph initiated a study in 2000 to evaluate the impacts of this restoration program on amphibians and reptiles, as well as butterflies and their nectar plants. With financial assistance from the Poteau District, this work was expanded to include moth surveys during 2001 and 2002. Charles Ely, a retired university biologist and temporary Nacogdoches Lab employee, is handling

the daunting task of identifying the numerous moths that are being collected.

Although D. Craig Rudolph was hired by Ron Thill as a research ecologist in August 1991, he had worked under contract and as a temporary employee with the WHSL since 1984. Nearly all of Rudolph's research from 1986 through the early 1990s dealt with various aspects of the RCW research. Although his research gradually shifted to reptiles in the early 1990s, his RCW responsibilities have continued through the present. Rudolph led studies involving foraging behavior and reintroduction of RCWs into vacant habitat using simultaneous releases of juvenile males and females, which proved very successful. He also aided in the development of the U.S. Forest Service's 1995 RCW Environmental Impact Statement, which established management guidelines and goals for this species, and provided considerable technical assistance to the National Forests and Grasslands in Texas on litigation involving RCWs and southern pine beetles.

Beginning early in the 1990s, Rudolph initiated reptile studies involving a number of species of conservation concern. In 1993 he (assisted by Dick Conner and others) initiated radio telemetry studies on the timber rattlesnake (*Crotalus horridus*) and the Louisiana pine snake (*Pituophis ruthveni*) that revealed basic life history information (including the impacts of road mortality). Research on the Louisiana pine snake eventually involved habitat selection, seasonal movement patterns, prey handling behavior, food habitats, sources of mortality, and surveys of known historical habitat and potential habitat to document current status of this species. This work has verified the perceived rarity of the Louisiana pine snake and is providing management guidelines needed to ensure the survival of this species. Other reptile studies focused on western diamondback rattlesnakes (*Crotalus atrox*), black pine snakes (*Pituophis melanoleucus*), and alligator snapping turtles (*Macroclemys temminckii*).

In 1995, Rudolph and Chuck Ely began surveys to quantify the effects of prescribed burning on adult butterfly and nectar plant populations in eastern Texas. This work eventually led to the butterfly and moth studies in Arkansas. One important early finding from the Arkansas work is the positive impact that prescribed burning is having on adult butterfly populations, including the rare Diana fritillary (*Speyeria diana*).

In October 1999, Kathleen (Kay) E. Franzreb was assigned to the WHSL and stationed in Knoxville, Tennessee, where she became the Station's representative to the Southern Appalachians Cooperative Ecosystems Studies Unit, a new research cooperative that was established at the University of Tennessee. Her current research involves completing RCW research that she initiated or inherited at a previous post, and research on impacts of land management practices on Neotropical migratory birds of the Southern Appalachian Mountains. In 2000, at the request of (and with full project funding from) the National Forests in Florida, Franzreb also initiated a four-to-five year study on the threatened Florida scrub jay (*Aphelocoma coerulescens*) on the Ocala National Forest.

The recently released draft Southern Forest Resource Assessment (www.srs.fs.fed.us/ sustain) identified a number of critical gaps in our knowledge of wildlife in the South that will require new or expanded research efforts. Logical topics that the WHSL could address include continued research on the growing list of threatened, endangered, and sensitive species, of research on basic ecology of amphibians and the impacts on forest management practices on these species; impacts of intensified forest management practices (involving shorter rotations and greater reliance on genetic improvements, herbicides, fertilizers, and even irrigation) on wildlife; and the effects of expanding human populations and urbanization on wildlife. This latter topic should at least address the impacts of increasing road densities, higher traffic volumes, and the expansion of off-road vehicle use on private and public lands.

The need for amphibian research is especially critical. While the South supports the highest diversity of amphibians in North America, there are growing concerns (regionally and internationally) over declining amphibian populations. Fifty-four amphibian species are currently classified as species of conservation concern in the South, and nineteen are critically imperiled.

While the focus of its research has evolved over time, the Nacogdoches Lab continues to occupy an important niche within the forest research community of the South. With a growing list of threatened, endangered, and sensitive species requiring research for their management and protection and an infusion of new scientists like Kay Franzreb, the future of the WHSL research program seems secure.

NOTES

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