RNGR: A National Resource for Reforestation, Restoration, and Nursery Professionals

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Members of the National RNGR Team (see table 1 for titles and locations)

Abstract

The Forest Service developed the national Reforestation, Nurseries, and Genetics Resources (RNGR) program to provide expert support to State, industrial, and private forest and conservation nurseries throughout the country. The RNGR program includes technical assistance to nurseries, research projects (to address seedling and field issues), and Internet sites. RNGR personnel publish periodicals, handbooks, and scientific articles and host annual nursery conferences and workshops. The National Seed Laboratory (NSL) and a Tribal Nursery Emphasis are also integral components of RNGR's mission.

The RNGR Program

The success of reforestation and restoration projects can greatly hinge on the use of high-quality and appropriate plant materials produced in nurseries. When implemented successfully, these projects contribute to air and water quality, wildlife habitat, biodiversity and ecosystem sustainability, timber production, healthy forests, and reduced soil erosion. Collectively, about 1,200 nurseries nationwide currently satisfy the need for plant materials used in restoration, reforestation, and conservation efforts. Although demand for commercial timber species declined during the past decade, demand for other native plant species, each having its own cultural and site requirements, has risen dramatically. Consequently, requests for information about how to propagate, store, ship, and plant specific native plant species have grown faster than the information is being developed. In addition, information associated with the use of native plants to address climate change, invasive species, and ecosystem services is lacking. Concurrently, relevant expertise and research resources within Federal and State agencies, universities, and other organizations have declined to levels outpaced by the need. To address this disparate trend in native plant knowledge and to continue supporting information needs for conventional forest species, a small team of specialists within the USDA Forest Service provides regional and national coordination of technical assistance to nursery, reforestation, restoration, and seed professionals.

The Forest Service is responsible for assisting States with producing, distributing, and planting seedlings on private land. In 2001, the agency created the RNGR Program. A national group of technical specialists located across the country is referred to as the "RiNGeR Team" (table 1). The RNGR Team assists Federal, State, territorial, tribal, and private nurseries by providing technical assistance aimed toward production of adequate supplies of reasonably priced, high-quality, genetically well-adapted seedlings for reforestation, conservation, and restoration. The team provides technical expertise on cost-effective propagation and planting methods that improve seedling survival and growth. The Forest Service NSL is also a key component of the RNGR Program, particularly with emerging needs for germplasm conservation. Geographically dispersed RNGR Team members are attuned to regional needs, but act nationally to bring significantly more expertise to solve localized problems through information sharing.

Table 1. The national RNGR Team and its affiliates.

The team		
R. Kasten Dumroese	Research Plant Physiologist and Editor, *Native Plants Journal*	Moscow, ID
Diane L. Haase	Western Nursery Specialist and Editor, *Tree Planters' Notes*	Portland, OR
George Hernandez	Southern Nursery Specialist	Atlanta, GA
Robert Karrfalt	National Seed Laboratory Director	Dry Branch, GA
Ronald Overton	Northeastern Nursery Specialist	West Lafayette, IN
Jeremiah R. Pinto	Tribal Nursery Coordinator and Research Plant Physiologist	Moscow, ID
RNGR affiliates		
Matt Howell	Information Technology Manager	Athens, GA
Tom Landis	Nursery Specialist Emeritus and Editor, *Forest Nursery Notes*	Medford, OR

The RNGR Program has several components, including Technical Assistance, a Research Program, a Tribal Nursery Emphasis, the NSL, and Collaborative Agreements and Cooperative Efforts. Each component is described below.

Technical Assistance

The team provides expert support to forest and conservation nurseries throughout the country. This support entails advising nursery managers and other plant professionals on a variety of issues and opportunities pertaining to seedling production, native plant restoration, and forest regeneration. The team assists nurseries with problem solving and provides guidance in developing strategies to address seedling quality issues. Through reports, publications, presentations, conferences, workshops, and onsite visits, RNGR personnel provide key information to aid in the understanding and implementation of effective technology for bareroot and container nursery operations.

Periodicals—Members of the RNGR Team are directly responsible for producing the *Native Plants Journal*, *Tree Planters' Notes,* and *Forest Nursery Notes*. Each of these publications delivers information and research results to the worldwide nursery, restoration, and reforestation communities. These periodicals feature easy-to-understand, hands-on information that can be readily applied in the field.

USDA Agriculture Handbooks—These publications summarize current knowledge on specific subjects, providing a source of information and reference for field professionals. *The Container Tree Nursery Manual* (seven volumes) (Landis and others 1989-2010, figure 1) is the standard for the industry and is the most downloaded publication from the RNGR Internet site (see next section). The final volume, *Seedling Processing, Storage, and Outplanting,* was published in 2010 (Landis and others 2010). Other handbooks published by RNGR are *The Woody Plant Seed Manual* (Bonner and Karrfalt 2008) and the two-volume *Nursery Manual for Native Plants: A Guide for Tribal Nurseries* (Dumroese and others 2009c). Two additional handbooks being written are the *Tropical Nursery Manual* and the *Hardwood Nursery Manual*. Full citations for recent RNGR publications are listed at the end of this article.

Internet Sites—The RNGR site (http://rngr.net) has the largest online collection of articles on producing native plants for reforestation, conservation, or restoration (approximately 7,000 articles and growing). All articles are searchable and are free to download. The publication database includes all issues of *Forest Nursery Notes* (1993–present), *Tree Planters' Notes* (1950–present), and the National Nursery Proceedings (1949–present) and many other articles. The RNGR site is used extensively by nursery and regeneration professionals around the world. During the past 2 years, the site had 100,782 visits and 92,251 content downloads by visitors from 199 countries—averaging one visit and one download every 10 to 12 minutes. In addition, the RNGR site contains a national nursery and seed directory, a calendar of events, a list of relevant links, and information about the RNGR Program and personnel (figure 2). RNGR personnel also created the Native Plants Network site (http://www.nativeplantnetwork.org). This one-of-a-kind searchable database contains approximately 3,000 propagation protocols for native plants. New protocols can be added by anyone willing to upload and share his or her techniques.

Conferences—RNGR assists with organization and management of the western, southern, and northeastern regional nursery conferences and the annual Intertribal Nursery Council meeting. These events provide the venue for sharing technical information, networking, and discussing emerging issues that

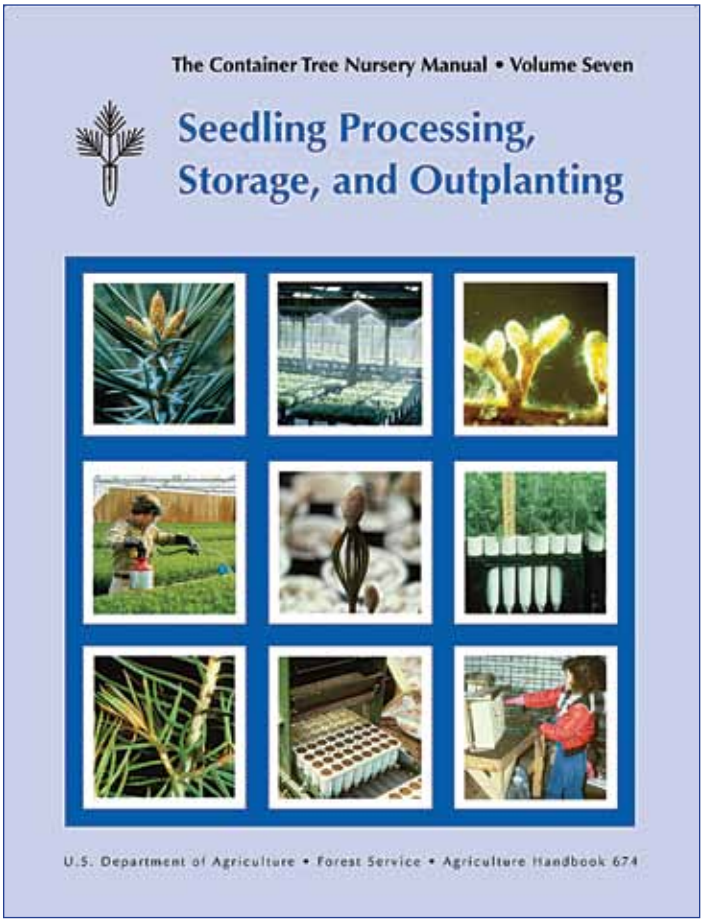

Figure 1. *The Container Tree Nursery Manual* (seven volumes) serves as the industry standard for production of container seedlings for reforestation and restoration.

confront nursery managers. Papers presented at these conferences are published by RNGR in the annual *National Nursery Proceedings* (available at the RNGR Web site).

Training—RNGR has organized or conducted training in tropical nursery management, seed collection, seed conditioning, native plant propagation, tree planting, longleaf ecosystem restoration, and hardwood nursery management (figure 3). In addition, RNGR Team members regularly give presentations at various forestry and conservation events.

Figure 2. The popular RNGR Web site has more than 7,000 downloadable articles and a national nursery directory, calendar of events, description of the RNGR program, and other resources.

Figure 3. Members of the RNGR Team regularly organize or participate in conferences and workshops to provide technical support to nurseries.

Research Program

The RNGR Team facilitates, coordinates, and conducts administrative studies and research projects among a variety of partners within government agencies, universities, and nongovernmental organizations. This work assesses and responds to specific nursery and field questions and problems, and the results are shared with managers through technology transfer presentations and publications and with peer scientists through refereed science articles (figure 4). Recent and current studies include developing protocols for assessing hardwood seedling quality and cold hardiness in the Central, Eastern, and Southern United States (Apostol and others 2007, 2009; Haase 2008; Islam and others 2008b; Jacobs and others 2008); examining acorn viability (Goodman and others 2005); identifying stock types and site preparation methods for restoration of native hardwoods in Hawaii (Dumroese and others 2009b, 2011); using fall fertilization to improve seedling growth and reduce nutrient leaching in nurseries in the Midwest (Islam and others 2008a, 2009); developing subirrigation methods for container seedlings to reduce water use and potential pollution nationwide (Dumroese and others 2006, 2007, 2011; Pinto and others 2008; Davis and others 2008); enhancing techniques for growing longleaf pine seedlings in the Southern United States (Dumroese and others 2005, 2009a; Barnett and Dumroese 2006; Jackson and others 2010); investigating the use of biochar as a media substrate in containers; and tracking isotope signatures and their relationship to seedling physiology during production.

Tribal Nursery Emphasis

American Indian tribes are working hard to preserve their traditional ecological knowledge and to develop and enhance production of native plants for spiritual, medicinal, cultural, land restoration, reforestation, and educational uses. Since 2001, the RNGR Team has emphasized outreach to tribes to foster long-term collaborations focusing on native plants, nurseries, and educational activities. In 2003, a *Tribal Nursery Needs Assessment* (Luna and others 2003) was published; it was the first survey of American Indian native plant needs and the first national directory of tribal nurseries.

The RNGR Tribal Nursery Emphasis currently has three components: (1) ongoing technical assistance to tribes about collection, propagation, and deployment of native plants; (2) organization of the Intertribal Nursery Council, an annual forum for tribal members to gather and discuss important topics relevant to native plants (figure 5); and (3) production of a comprehensive guide detailing nursery development and

Figure 4. Research projects are designed to solve problems, answer questions, and generate new technical information for field and nursery personnel to apply. **On left:** research focuses on a variety of species, such as blue spruce, big sage, and longleaf pine. **On right:** various measurements are conducted to evaluate plant quality in response to treatments. This study examined the effects of different irrigation and fertilization levels on photosynthesis.

native plant propagation as it relates to tribes. The guide, *Nursery Manual for Native Plants: A Guide for Tribal Nurseries, Volume 1, Nursery Management* (Dumroese and others 2009c, figure 6), includes information on nursery start-up, development and management, growing plants, and problem solving. Volume 2, Plant Propagation Protocols, is in preparation and contains nearly 300 protocols of plants identified in the *Tribal Nursery Needs Assessment*.

Figure 5. The Intertribal Nursery Council meets annually to promote networking among tribal members and to discuss technology and programs for plant production.

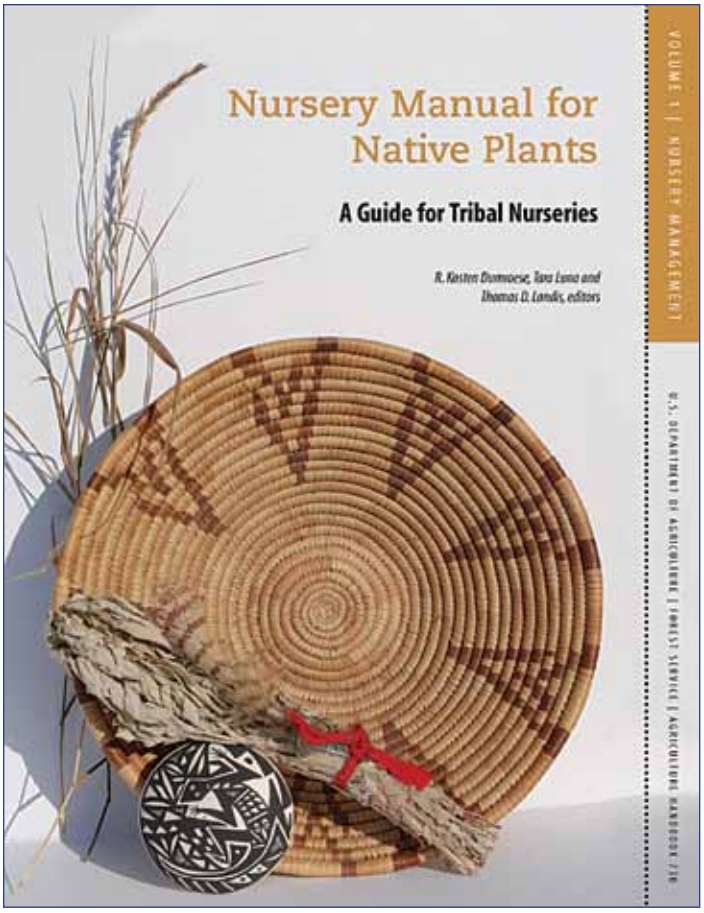

Figure 6. The first volume of the *Nursery Manual for Native Plants: A Guide for Tribal Nurseries* focuses on nursery management and covers all aspects of managing a native plant nursery, from initial planning through crop production to establishing trials and improving nursery productivity into the future.

To date, the program has assisted nearly 80 tribes across the United States and Canada and has worked one on one with more than 500 professionals within those tribes. This assistance has included conducting various nursery training workshops, organizing information-sharing meetings, and technical assistance. In addition, RNGR helped construct a Cultural Plant Propagation Center, a greenhouse that was developed in partnership with the Moencopi School near Tuba City, AZ, to enhance conservation education, promote restoration, and provide opportunities for Hopi and Navajo elders to interact with children and share traditional ecological knowledge. The Tribal Nursery Emphasis program will continue to foster technology transfer through the annual Intertribal Nursery Council meeting, identify funding opportunities and seek innovative partnerships to enable tribes to develop their own nurseries, provide organizational structure and expertise for Forest Service support of tribal nursery and ecosystem efforts, and continue to build and maintain collaborative and trusting government-to-government relationships.

National Seed Laboratory

Sufficient quantities of seeds are needed to restore and sustain native plant communities that are increasingly affected by invasive species, pest infestations, wildfire, overuse by humans, inherent biology, and climate change. Supplying these seeds is complex as each species has its own unique seed production and germination protocols. As well, it has become increasingly evident that successful seed production and storage is important for preserving the genetic integrity of endangered species and other plants being lost in large numbers in the wild. The National Seed Laboratory (NSL) serves as the primary national strategic resource for forest ecosystem seed science and technology; it directly addresses the complex challenges associated with the use of seed for conservation and restoration. Located in Macon, GA, the NSL originated in the 1950s to support southern pine restoration work but has undergone several evolutions since then, thereby diversifying its purpose. The latest change occurred in 2005, when the Chief of the Forest Service expanded the NSL's mission to include all native plants, with an emphasis on gene conservation through long-term seed storage.

The NSL is diverse in its seed service offerings. It develops protocols for seed cleaning, germination, and storage of a variety of native forest plant seeds, ranging from commercial timber species to herbaceous understory plants. It provides onsite seed storage for many conservation species and in security backup vaults maintained in Fort Collins, CO. The NSL provides training materials, workshops, and customized individual training programs to U.S. and international seed workers. It also collaborates with research and production facilities worldwide and participates in several national and international conferences every year. NSL staff members are authors and co-editors of *The Woody Plant Seed Manual* (Bonner and Karrfalt 2008, figure 7).

The NSL performs seed tests for private industry, State governments, and Federal agencies. Results are used in forest and conservation nurseries to make efficient use of seeds, to evaluate seed quality in processing plants, and as the basis for seed price determination. The NSL is the only U.S. facility accredited by the International Seed Testing Association (ISTA) to test forest seeds.

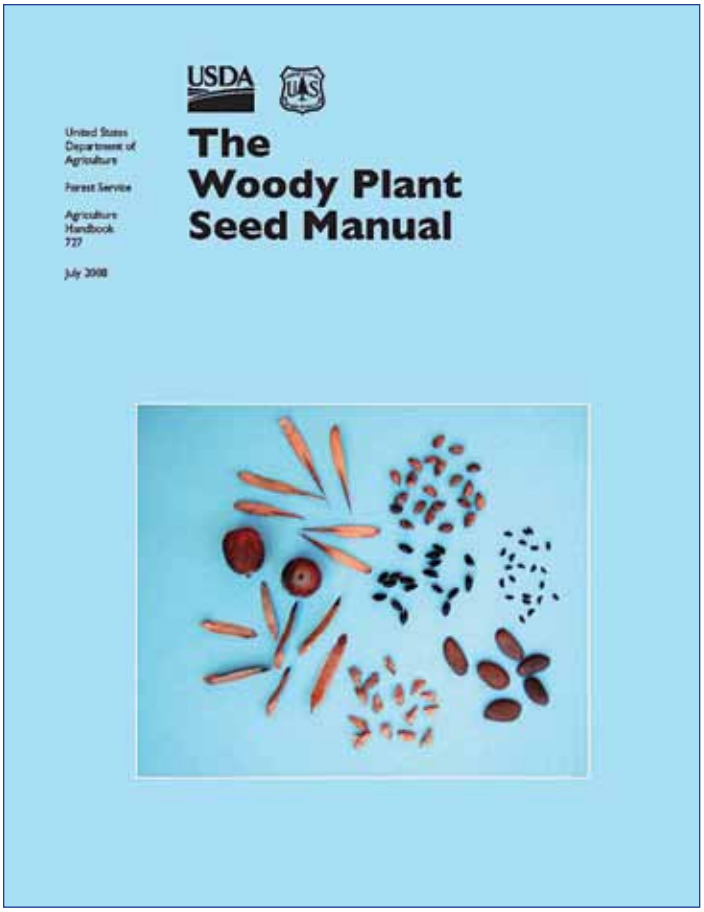

Figure 7. *The Woody Plant Seed Manual* includes seven chapters on general principles such as seed biology, harvesting, storage, testing, and nursery practices and detailed information on 236 genera of native and introduced woody plants.

Collaborative Agreements and Cooperative Efforts

To leverage scarce resources, RNGR partners with universities, Federal agencies, and State agencies to provide training, technical assistance, and research to nursery and reforestation programs. In addition, RNGR works with International Forestry, the Institute for Pacific Island Forestry, and the International Institute for Tropical Forestry to provide assistance to programs in the Caribbean and Pacific. RNGR collaborates with the USDA Foreign Agricultural Service (FAS), the U.S. Agency for International Development, U.S. Fish and Wildlife Service, and the Food and Agriculture Organization of the United Nations to provide nursery and reforestation assistance internationally (e.g., RNGR provided FAS with a nursery manual and training tools for use in Afghanistan). RNGR has collaborated to translate (and print) the *Container Tree Nursery Manual* into Spanish and Chinese languages.

Clearly, the national RNGR Program provides significant support to forest and conservation nurseries nationally and internationally and is continually striving to meet the growing needs of these nurseries as well. To learn more about RNGR, its programs, its members or affiliates, or to request assistance, please visit the RNGR Web site (http://rngr.net).

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