Report of the Annual General Meeting of the Western Forest and Conservation Nursery Association—Boise, Idaho August 19-21, 1997

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This excellent meeting was organized by Dr. Tom Landis, USDA-FS, Portland, OR; and Kay Beall, Nursery Culturalist, Lucky Peak Nursery, Boise, ID. The theme of the meeting was "Propagating native plants for fire rehabilitation, forest health, and streambank revegetation". The attached agenda and technical summaries provide only a brief synopsis of the papers presented at the meeting.

There were a number of recurring themes relating to forest nurseries, technology transfer, and government and community involvement in forestry, which are summarized below. For me, the "take-home message" was the number of parallels (and differences) between what is happening in the American and the Canadian forest community today, plus the glimpses of what we might expect in the near future and beyond. (Numbers in parentheses refer to the technical summaries).

Forest Nurseries
Less US federal government support for nurseries (1,2) Increased involvement of the private sector (1)

Propagation of native species for conservation and restoration
A wide range of trees, shrubs, forbs, and grasses are being grown and (5,7,8,12,13) used for fire rehabilitation, streambank stabilization, wildlife forage, improving water quality (3,8). Seeds of native species are often in short supply (3,12). Lack of knowledge on how to propagate native species (4,5,6,9,10,11).

Technology Co-operatives
USA: Nursery Technol. Coop., Oregon State Univ. (14,15,22) Canada: LUSTR Cooperative, Thunder Bay, Ontario (16)

Community involvement in restoration activities
Coalition of federal, state, and citizen groups in rehabilitation projects (3) Volunteers growing and planting trees for city streets and parks (20)

Environmental Protection
Tighter water quality standards for nursery effluents (21) Phasing out of methyl bromide (damage to human health and ozone layer) and other potentially hazardous substances (15,18).

I compliment both Tom Landis and Kay Beall (and all the behind-the-scenes helpers) on a very successful meeting. Everything ran seamlessly, primarily due to the attention paid to the small details. Tom attends a LOT of meetings as an extension officer for the USDA-FS, so he has some definite ideas about how meetings should be run (he's a pretty big guy, too, so usually no one argues with him). Tom's meeting tips were field-tested at Boise, and I can verify that they are 100% effective!

Meeting tip #1.
Use the "Yaker-Saker" to ensure your speakers finish on time. No meeting should be without one! The Yaker Saker is constructed from a lawn watering timer and has three lights. The green light is lit for about 20 minutes, and the yellow light is on for about 10 minutes. When the red light comes up, you're done! The enforcer is the session moderator, who sits in the front row equipped with a water canon.

Meeting tip #2.
Have trouble getting the audience back from the breaks? Offer them door prizes such baseball caps, gift certificates, etc. When attendees register for the meeting, print their registration numbers on the back of their name tag. At the meeting, 4 to 5 winning numbers are drawn promptly at the end of each break. You must be present in the meeting room to win.

Meeting tip #3.
Have plenty of variety. Present technical sessions in the morning, and plan stimulating field trips for the afternoon. This helps keep audience attention and interest up for the technical sessions. Good food and BBQs don't hurt either.

SUMMARIES OF TECHNICAL PRESENTATIONS
Meeting theme: "Propagating native plants for fire rehabilitation, forest health, and streambank revegetation"

Technical sessions Day One: August 19, 1997

(1) Jack Troyer, Deputy—Regional Forester, USDA-FS (Region 4, Ogden, UT)—New Demands on Forest & Conservation Nurseries in the West. Present forestry trends in the U.S. show an increased investment in small private woodlots, mostly driven by increased lumber prices. The establishment of private seedling nurseries is also increasing, but this is primarily due to reduced commitment by the USDA-FS to federal forest nurseries. Future projections by the Federal government show only one major nursery per Region (the USDA-FS currently has 8 regions in the continental US and Pacific Islands). These two trends are not acting independently; rising timber prices may once again increase the demand for seedling nurseries, but probably not in the near future.

(2) Frank Burch, National Co-ordinator, Forest Nursery Operations—Nursery trends in USDA-FS nurseries in the West. Frank briefly reviewed the history of Forest Service nurseries, then explained why the USDA-FS is closing many of them. The operation of seedling nurseries depends on National Forest timber sales, which have been steadily

decreasing during the last decade. In 1987, 12 billion board ft. were sold, compared to only 3.8 billion board-ft. in 1995.

Another factor is the reduction in reforestation backlog. In 1980, 180 million seedlings nation-wide were produced in FS nurseries; in 1995, this was reduced to 60 million. 1995 was also the first year that the number of seedlings from natural regeneration exceeded the number of seedlings planted. Another important trend in FS is the shift away from an exclusive focus on fast-growing seedling stock (with heavy emphasis on growth and yield) to prescriptions based on long-term suitability of planted seedlings, e.g., adaptability to climate change, greater disease resistance, etc. The responsibility for making such prescriptions depends upon the judgement of certified silviculturists.

(3) John Thorton, Boise National Firefighters—Boise NF Fire Rehabilitation. Fire is a major problem in the dry interior climate of Boise. Major fires in the grasscovered mountains surrounding Boise in the late 50's and in 1995 were followed by sudden, heavy rainfall. This resulted in major mud and debris slides into the center of Boise. In an effort to prevent such reoccurrences, a major coalition of government agencies and citizen groups organized to rehabilitate the grasslands and institute other measures to prevent erosion. The afternoon field trip visited an area of rehabilitation and erosion control efforts.

In the Boise area, fire rehabilitation depends primarily on the re-establishment of grasses and forbs. A major constraint is the availability of seeds of native species. Seeds are either in short supply, or not available at all. In such cases, non-native seed mixes must be used until supplies of native species are obtainable. Other researchers in restoration biology are attempting to meet this demand.

(4) Carole Leadem, B.C. Ministry of Forests, Victoria, BC—Overview of seed dormancy and treatments. It is difficult, if not impossible, to know a priori what type of treatment is needed to break seed dormancy. However, the reason(s) that seeds are dormant may offer clues regarding the treatment required to release seeds from the dormant state. Dormancy may be due to: unfavourable climatic conditions, immaturity, a light requirement, genetic variation, or protection against predation. Depending upon the type of dormancy, stratification, light, leaching, scarification, growth regulators, or high O_2 concentrations may be used to promote germination. Treatments such as stratification may have to be modified to meet the particular physiological requirements of different species. Five different types of stratification are presently used to release dormancy of forest trees. An evaluation of the habitat in which a particular species is found also may point to the most effective dormancy treatment if the requirements for a particular species are unknown.

(5) Bob Karrfalt, National Tree Seed Laboratory, Macon, GA—Considerations for processing native plants. Little is known about reproductive cycles of native plants. Extraction and storage protocols are also largely unknown. (With some plant material, it sometimes difficult to determine which parts are the seeds.) It is often necessary to rely on knowledge gained from other species that possess similar seed characteristics. Fortunately, many extraction and processing techniques used for agricultural seeds can be applied to the seeds of native plants. The National Tree Seed Laboratory has a continuing Quality Assurance

Program, which is subject to third-party review. One issue currently under consideration is how to name local varieties of native species, since protocols have not been established (e.g., should it be Ada County bitterbrush or Ada County germplasm of bitterbrush?)

(6)Victor Vankus, National Tree Seed Laboratory, Macon, GA—Tetrazolium (TZ) testing of native plant seeds. Victor explained the use of the TZ test, an useful assay technique when used in combination with germination tests. It may also been employed when species germination requirements are unknown. Technical Sessions Day Two: August 20, 1997

(7) David Steinfeld, J.H. Stone Nursery—Oregon Propagating diverse species at Forest Service nurseries. Forest nurseries don't look the same as they used to. Today you are as likely to see fields of grasses and shrubs as you are to see rows of conifer seedlings. In 1997, 24 species of grasses were sown from 24,000 lbs. of seeds. Blue wildrye (*Elymus glaucas*), Idaho and California fescue (*Festuca* spp.) are among the variety of species sown. 45 acres were in production in 1997, and 58 acres are planned for 1998. Hydroseeding or hand seeding are used to sow seeds into bareroot beds or containers. Seeds are covered with netting after sowing.

A number of shrubs are grown for restoration and wildlife forage, such as bitterbrush, Oregon grape, Ribes spp. (gooseberry, currant, etc.), and manzanita. Forbs include penstemon, aster and *Brendilla*. Deciduous trees such as willows and poplars are grown for riparian areas. Some sites have special stock requirements, e.g., pines grown for the Dunes Recreation Area, Oregon, must be grown in large containers for the plants to establish successfully. Considering the large number of species about which little is known, propagation of native plants in the nursery can be a real challenge!

(8) Scott Lambert, USDA-National Resource Conservation Service, Pullman, WA—Native Plants in the Pacific Northwest. The National Resource Conservation Service consists of 26 plant materials centers across the U.S. which produce plants for riparian zones in public lands and national parks. In the past, introduced species were used for rangelands, many of which came from Europe, Central Asia, and Russia. Today at Pullman, they are growing native wheat grasses, bluegrass, needle-and-thread grass, fescue, junegrass, and wild rye. Such large quantities of grass seeds are grown that agricultural harvesting equipment such as combines are required.

A variety of shrubs and trees are grown for forage, cover, ornamental use, streambanks: chokecherry, mock orange, w. serviceberry, vine maple, oceanspray, w. hazelnut (for disease resistant rootstock), red osier dogwood, blue elderberry, snowberry, and Sitka alder (soil erosion control). They grow a variety of forbs such as balsamroot, pine lupine, elkshorn, as well as mosses, ferns, and fungi. The propagation of some native species can be very difficult. Manzanita seeds, for example, are very dormant, and even cuttings are hard to grow.

(9) Kas Dumroese, University of Idaho, Forest Research Nursery, Moscow, ID—Propagation of woody riparian plants for streamside restoration projects. Plants are propagated from root cuttings (trembling aspen), softwood cuttings, and hardwood cuttings. Propagation from seeds is problematic because seed supplies are often unavailable, seed

quality is poor, proper seed treatments are unknown, and seed responses are quite variable.

Culturally, seedlings are usually grown in 10 to 20 cu.in. containers in a 1:1 peat:vermiculite mix. Nitrogen fertilization varies from 22 to 100 ppm. Shrubs generally must be top pruned. Stock of most species is sown in larger container sizes because seedlings with larger calliper have much better survival in the field.

(10) Dave Dreesen, Los Lunas PMC—Propagation of native plants for restoration projects in the Southwest. A variety of dormancy-release treatments are required for breaking the seed dormancy of south-western species. Tumbler scarification (60 rpm with carborundum for 1 to 30 days) and metal brushes are often used for mechanical scarification of seedcoats. Steeping seeds in hot water (90 °C) for 4 hours is also effective for seedcoat dormancy.

Plant growth regulators have been used for some species. A soak in 1% bleach solution followed by gibberellin (250 mg/l GA) treatment can stimulate the germination of Rubus (salmonberry, blackberry, etc.) seeds. Germination of Alnus is enhanced by treatment by 60-125 mg/l GA3, followed by stratification at 2-5°C.

(11) Scott Zeidler, Lone Peak Conservation Center, Draper, UT—Propagation of wetland plants in the Intermountain Area. A number of wetland plants have been successfully propagated from seeds e.g., sedges (*Carex* spp.), rushes (*Juncus* spp.), and bulrush (*Scirpus*). Propagation is very labour intensive so they are glad of the access to inmate labour. Propagation techniques used for wetland species can differ substantially from familiar tree nursery practice. *Juncus* seeds become very gelatinous in water and must be planted by pipette. Germination regimes are 110°F, with light and high humidity. The seeds do not require mulching as long as humidity is high. To control the growth of weeds, paper matting soaked in copper hydroxide solution is placed under containers on greenhouse benches.

Carex seeds are soaked in 33% bleach solution to reduce the microbial growth on seeds. The seeds are imbibed at 20 to 25°C for 24 h, and then stratified. The seeds are so buoyant they must be kept submerged by covering the seeds with a disk. Hydrogen peroxide treatment is sometimes substituted for stratification (1 day H_202 can substitute for 1 wk stratification at 2-5°C).

(12) Tom Jones, USDA-ARS, Logan, UT—The expanding potential for native grass seed production in W. North America. Native grasses can be separated into two general groups: C3 cold season grasses and C4 warm season grasses (biochemically, C3 and C4 refers to the first products of photosynthesis being a 3-carbon or 4-carbon compound, respectively). For breeding purposes, it is important to understand the physiological adaptations of the two types. The C3 cold season grasses require vernalization (cold conditions) and long-day conditions to flower; C4 warm season grasses requires short days for flowering.

Tom is studying the natural distribution of the two types, and what occurs when grasses are moved either north or south. In general:

C3 grasses	moved N flower earlier	moved S flower later
C4 grasses	moved N flower later	moved S flower earlier

C4 grasses	moved N flower later	moved S flower earlier

He is also studying other environmental effects such as soil texture, snow accumulation, and rainfall, and has found that the timing of precipitation is more important than the amount of precipitation. There is now enough data to separate the natural occurrence of C3 and C4 grasses into seed zones; the maximum movement of seed sources is 300 mi. north or 200 mi. south. Seed sources moved beyond these ranges are likely to suffer from winter kill and reproductive failure.

(13) Betsy Carroll, USDA-FS, Nat. For. Genet. Electrophoresis Lab., Placerville, CA— Application of genetic analyses to native plant propagation. Betsy outlined the techniques that are being used to characterize the genetic makeup of native plant species. These include isozyme analysis, RFLP (Restriction Fragment Length Polymorphic DNA), RAPD (Random Amplified Polymorphic DNA), and PCR (Polymerase Chain Reaction). The techniques are used in support of both tree improvement activities and conservation studies. Some of the practical applications of these methods are: in species that form mats, to distinguish one individual from another; to determine whether closely related species should be considered a distinct species; to assess the degree of diversity existing in natural communities; and to re-identify various clones in a southern pine seed orchard that was heavily damaged by a hurricane.

(14) Ben Lowman, USDA-FS, MTDC, Missoula, MT— Nursery equipment project at the Missoula Technology and Development Center. An impressive array of nursery equipment is being developed at the center. Just a partial list of the projects are: ultrasonic detection of seedling heights in nursery beds; using machine vision to automatically measure morphological characteristics of seedlings (at the rate of 10 seedlings/minute); improved devices for pollen collection and wet or dry pollen application; use of a reciprocating beater for cone collection; development of a granular applicator for herbicides; improved mesh for protecting planted seedlings; a safer Hawk Power Scalper (modified chainsaw attachment mfg. in Canada); new methods for girdling trees; use of garlic and other substances as game repellents.

(15) Dick Karrsky, USDA-FS, MTDC, Missoula, MT— Steam pasteurization of soil. Under the Clean Air Act, the US must halt production and importation of methyl bromide by the year 2001. This has prompted the development of alternate methods such as steam pasteurization for the fumigation of nursery soils. Pasteurization of soil with steam is not a new technique. It was first used in Germany and the U.S. around 1890, but was discontinued when nurseries started using methyl bromide in the 1950s. The unit currently being tested in nurseries (the Steam Plow) uses a portable diesel boiler which can generate one million BTU per hour; an undercutter blade helps to inject the steam into the soil. Some difficulties are the slow travel speed, and uneven temperature distribution. They are trying to rectify this by dragging a tarp behind the tractor to retain the heat longer in the soil. Another approach being tested at the University of California, Davis is soil fumigation with microwaves.

Technical Sessions Day Three: August 21, 1997

(16) Irwin Smith, LUSTR Co-op, Inc., Thunder Bay, ON—The nursery situation in Canada and the LUSTR Nursery Cooperative. The mission of the LUSTR Co-op, Inc. is to determine and execute research priorities and provide technical guidance, scientific liaison and support services for those involved in container seedling production and plantation establishment. This research and extension cooperative was originally funded by the Ontario government in late 1980's to provide technical services to Ontario seedling growers. By 1992, funding was no longer available, and with government downsizing, seedling research and technology was eliminated. The closure of the Angus seed plant closed left eastern Canada with no seed processing and storage facilities. To fill these continuing needs, the LUSTR Co-op Inc. was founded in 1993 as a registered, non-profit, self-funded organization to provide research and extension services to its members. LUSTR Co-op is Canada-wide and has 19 members, consisting of seedling growers, timber companies, tree planting contractors, and allied supply companies.

The co-op acts as a distribution center for information. A bi-monthly newsletter summarizes research results, co-op business, conference proceedings and upcoming meetings. A January conference and summer workshop are held annually. They have also published a greenhouse safety manual, and have given workshops on growing media, seeds, and other topics. [See recent article published in USDA-FS Forest Nursery Notes, July 1997.]

(17) Steve Grossnickle, BC Research, Vancouver, BC—Application of stock quality testing within an operational forest regeneration program. Steve described how BC Research applied stock quality testing in an actual operational field season. At the beginning of the planting season, seedlings underwent a series of intensive morphological and physiological tests to determine "fitness for purpose" for a variety of outplanting sites in B.C. Based on the results from "command central" seedlings were shipped to the most suitable sites for planting. The size of the workload and immediacy of the operation was a scheduling and transportation challenge. However, it was satisfying to demonstrate that that stock quality testing could work in an operational forestry regeneration program. Lessons from conducting a stock quality program: more automation and training are needed.

(18) Mark Crawford, Griffin Corp., Valdosta, GA—Update on chemical root pruning SpinOut is an improved user-applied copper (Cu) compound which was registered in 1993 for chemical root pruning. It has been successfully used for oak, coffee, flowering plants (e.g., *Lantana, Evolvulus*), *Acer, Pistacia*, and strawberry. When sprayed on pots its "Teflon effect" allows for clean, easy removal of bedding plants such as *Impatiens* from containers. Cu-imprinted paper is used in Japan to line the bottoms of trays for root pruning of greenhouse stock. Nonwoven fabric impregnated with Cu and covering the soil effectively controls weeds in containers, and doesn't leach out.

Other applications are for lining large containers sunk into the ground, which prevents root egress into the soil. The fabric is used on sandbeds in England and Oregon; it prevents tree growth into culverts or houses, and acts as weed barrier around street trees. Cu controls algal and fungal growth, and is avoided by slugs. The control of microbial growth provided by SpinOut preserves paper pots up to a year. Different formulations are available—user applied, spray, or fibre pots.

(19) Virginia Bruce, Team Web, Portland OR—The Internet and World Wide Web-basics and nursery applications. Using a computer with a projection screen, Virginia demonstrated how to access the Internet with a browser and how to use a Search Engine (Yahoo) to explore the Word Wide Web (WWW). The internet is a network of networked computers. The backbone of the WWW is maintained by a consortium of telecommunications corporations. When someone requests a web page, the information is broken up into addressed packets which find a path along the network, and get back to the client.

A modem and an account with an internet service provider (ISP) are needed to get online. Web pages are accessed by entering the Web page address. Web page files are in HTTP (Hyper Text Transfer Protocol), and usually have the form:

http://host name/Unix path/filename.htm

The USFS Seedling, Nursery, and Tree Improvement program has a website with a variety of useful information. To access, enter the path name:

HTTP://willow.ncfes.umn.edu/snti/snti.htm

(20) Jerry Stallsmith, Boise City Forester, Boise, ID—Boise: The City of Trees. Boise is known as The City of Trees, and the city is responsible for planting and maintaining all the trees in Boise. They have a central facility where they grow the trees until they are large enough to be planted along streets and in parks. Street trees must be 1 " to 1 1/2" caliper and park trees must be a minimum of 4" calliper. Species used for street trees must be able to withstand mechanical and drought stress; the usual life of a street tree is about 20 years, after which it must be replaced. A catalogue of species and their most appropriate use is available.

The nursery budget is only $6,000 per year, so volunteer help is essential to grow, plant and maintain the trees. Volunteers vary from private citizens to youth groups and service clubs.

(21) Chris Hoag, Aberdeen Plant Materials Center, ID—Use of constructed wetlands for water treatment. To help meet the stricter environmental standards in the U.S., constructed wetlands are used to enhance the quality of irrigation waste water. In addition to their role as purification sites, constructed wetlands create habitat essential for many wildlife species, add to food chain production, shield adjacent land, and create storage ponds. The field trip to the Lucky Peak Nursery outside Boise included a tour of a constructed wetland. 5-Step Plan for Constructed Wetlands (USDA public patent).

1. Heavy sediment basin removes most of phosphorus-containing compounds
2a. Sheet flow over rocks removes nitrogen and phosphorus
2b. Primary filter using plants (grass, sedges, rushes)
3. Shallow wetland with 12-15" water (cattails, bulrushes)
4. Deep pond 8-10 ft. (water lily and *Lemna*)
5. Natural wetland with willows (free of nitrates and phosphorus).

Constructed wetlands need a minimum linear run to work properly. Once that requirement is satisfied, you can adjust the various components according to nitrogen and phosphorus concentrations flowing into the system. It generally takes about 4 to 5 years for all components to become established and work effectively. Note, however, it is essential to have complete control of all components moving IN and OUT of the system.

An important aspect of creating a constructed wetland is the procurement of the plants needed for the system. Rush (*Juncus* spp.), bulrush (*Scirpus* spp.), and sedge (*Carex* spp.) are very effective in absorbing metals and other compounds from the wetland system. Rush seeds are relatively easy to germinate and require no stratification. Bulrush seeds are collected using a weed eater with special collection device (mfg. in Canada). They need light, heat, and plenty of water for establishment. For sedge, you must remove the husk and stratify the seeds. At least a 5" root system is needed before transplanting. A variety of species may be planted at different water levels. One system for establishing wetland species is to plant the seedlings in fibrelogs made of coconut When the plants are well established the entire log is transferred to the site. With the larger econolog system, it is possible to transplant an entire plant community. Bioengineering manual on this topic will be published soon.

(22) Robin Rose, OSU, Nursery Cooperative, Corvallis, OR—Nurseries and reforestation in Thailand. Robin described the planning and operation of a very successful two-year project to improve nursery and reforestation practices. They recognized that materials and equipment would be difficult to obtain once they left North America, so packed *everything* for a nursery operation, including greenhouse, automatic irrigation system, fertilizers, styroblocks, etc. into a sealed shipping container and sent it to Thailand. One of the elements contributing to the success of the project was the blessing of the Queen, who had proclaimed the reforestation project to celebrate the 50th year of the King's reign. In addition to the improvements made in production and planting of nursery stock, the project provided training in physiological assessment such as use of pressure bomb (a very popular technique!). Unfortunately, despite its success, the project ended abruptly when U.S. governmental support was withdrawn by declaring that Thailand did not qualify for assistance because it is no longer a developing country.

(23) Rich Phillips, and Raul Moreno, CEFORA, New Mexico State University—How nurseries fit into sustainable forestry in the Trillium Project, Tierra del Fuego, Chile This was a forestry aid project to demonstrate the feasibility of utilizing Nothofagus as a source of timber production in southern Chile. In this instance, very little was known about the seed production cycle, the processing, storage, and treatment of Nothofagus seeds. However, the team members were able to successfully establish greenhouse facilities and grow seedlings. Knowing the tendency for local governments to politicize such projects, the team purposely chose to remain apolitical. In spite of these efforts, however, the project has been delayed as a result of political interference.