The Reproductive Ecology of Broadleaved Trees and Shrubs: An Innovative Educational Approach

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Abstract

Articles on the reproduction and ecology of broadleaved trees and shrubs are common in the scientific literature. However, discussion and informal surveys reveal that information published in scientific journals is often slow in reaching on-the-ground resource professionals—those who can apply it directly. As a result, several scientists and educators from Oregon State University (OSU) and the USDA Forest Service teamed-up to develop an innovative educational program that helps bridge this gap. The program's purpose is to help resource managers (and others) understand how broadleaved trees and shrubs reproduce, and how this knowledge can be used to help manage those species. The program consists of a set of audio-visual and printed components that can be used individually or together to form a comprehensive training package. It focuses on species that occur in the Pacific Northwest, but describes principles that are true regardless of geographic region.

Keywords

technology transfer, sexual reproduction, vegetative reproduction, multimedia education

Introduction

How woody plants reproduce is key to their survival. It is also key to our understanding of how best to manage them, regardless of whether management activities are intended to increase or decrease their influence on a site. Therefore, it is important that those charged with managing forested lands understand how these species grow and reproduce in order to manage them effectively.

Much information about the reproductive ecology of broadleaved trees and shrubs is published in the scientific literature (e.g. Haeussler and Tappeiner 1993, Hibbs, DeBell, and Tarrant 1994, O'Dea et al. 1995, Tappeiner et al. 1986, Tappeiner and Zasada 1993) and perhaps even more lies in unpublished theses and dissertations (e.g. Ahrens 1990, Allen 1969, Anderson 1967, Barber 1976, Carlton 1988, Russell 1974). However, conversations with a variety of land managers and resource specialists in the early 1990's made us aware of how slowly this information finds its way to personnel working on-the-ground.

To help speed the flow of information to potential audiences, we formed a small team of educators and scientists who were committed to trying a different educational approach, specifically targeting audiences for whom this information on the ecology of broadleaved trees and shrubs was being developed.

Analysis and Design

Many of the ideas that led to this project arose during the late 1980's and early 1990's from our association with a variety of continuing education programs conducted at OSU . We were repeatedly surprised that many of the well- educated, highly motivated, widely experienced foresters, wildlife biologists, ecologists, and other resource professionals who attended these programs were only vaguely aware of the reproductive strategies of broadleaved trees and shrubs that they were managing. And they weren't alone; this finding was repeatedly confirmed in other settings with other groups. In keeping with their professional nature, it was clear that these resource specialists wanted to learn more, and that they would like to be able to share what they learned with others. Through conversations and informal surveys we determined what they already knew, what else they'd like to know, and how they'd like to receive additional information. The results of this informal needs assessment were incorporated into a set of educational goals for our proposed effort and a multifaceted approach for accomplishing those goals.

Specific instructional goals were to help current and future resource specialists:

- Understand the principal reproductive processes of broadleaved trees and shrubs (sexual and vegetative)
- Predict how broadleaved trees and shrubs are likely to respond to specific land management activities (with special emphasis on reproduction)
- Identify broadleaved trees and shrubs common in the Pacific Northwest.

In addition, we wanted to produce a set of educational products that would enable members of the audience to:

- learn from scientists who were actively developing new knowledge about the ecology and management of broadleaved trees and shrubs
- visit sites and view changes in plants over time that they might not ordinarily be able to experience
- Continue to learn about the ecology of broadleaved trees and shrubs over time, learn either individually or in groups
- Share their knowledge with others (e.g. co-workers or members of the public)

The program that resulted from this analysis includes five distinct educational components, each serving a different, but related, purpose: 1) a 60-minute videotape, 2) a three-part slide-tape series, 3) an overview paper, 4) a series of species-specific leaflets, and 5) an illustrated glossary of terms. The videotape is the centerpiece of the educational program, supported by the other components (see Figure 1); however, components can be used independently or collectively. All written documents are designed to fit into a loose-leaf, 3- ring binder so they can

Figure1. Components of educational program on the reproductive ecology of broadleaved trees and shrubs.

be easily modified as new information is discovered and expanded as new leaflets are developed.

Following are details about the purpose and design of each of the components that comprise this program.

Videotape

A one-hour videotape (divided into two parts) forms the core of this educational program. Its purpose is to stimulate the interest of viewers about the reproduction of woody plants and to provide a foundation for additional information. Specifically, it describes: a) the roles of broadleaved trees and shrubs in managed and unmanaged environments, b) the reproductive ecology of broadleaved species, and c) how the abundance and distribution of various species are likely to change throughout the successional sequence. It uses a case study approach, centered around five prominent Northwest species. Species were chosen to illustrate important and different strategies of reproduction. For example, vine maple (*Acer circinatum*) exemplifies species that produce new above ground stems via layering; salmonberry (*Rubus spectabilis*) exemplifies species that produce new above ground stems via rhizomes and basal sprouting; red alder (*Alnus rubra*) exemplifies species that reproduce primarily via seeds without delayed germination; snowbrush (*Ceanothus velutinus*) exemplifies species that reproduce primarily via seeds that exhibit delayed germination; and tanoak (*Lithocarpus densiflorus*) exemplifies species that produce above ground shoots from buds arising from underground burls. Case studies average 9 minutes in length and are presented in the field by scientists actively involved in studying these species. Multiple sites are visited for each species to illustrate changes that are likely to occur over time and with advancing seral status. In all, five scientists participated in the production, adding credibility and variety to the video. A narrator presents a general overview of sexual and vegetative reproduction, and makes transitions between case studies. The video is intended to be of interest to the entire spectrum of potential users and can be viewed equally well by individuals or groups.

Slide-Tape Series

The purpose of this three-part slide-tape series is to assist users in identifying thirty common Pacific Northwest shrubs. Each program is about forty minutes long and contains eighty color slides illustrating common and scientific names, key identifying characteristics, geographic ranges, and important ecological characteristics. This series is intended for anyone who wants to improve his or her ability to identify native shrubs. It can be used equally well by individuals or groups. It is now also available in video format, and is currently being converted to CD-ROM.

Overview Paper

The purpose of this document is to present an overview of sexual and vegetative reproduction in broadleaved trees and shrubs. It highlights some important contributions of broadleaved trees and shrubs to managed and unmanaged environments, discusses sexual and vegetative reproduction, and summarizes why broadleaved species are important components of forest ecosystems. It is intended to serve as a primer for users who are unfamiliar with the principal terms and concepts associated with sexual and vegetative reproduction of woody plants.

Species Leaflets

The purpose of these leaflets is to provide detailed information on the reproductive ecology of selected species. Species featured in the videotape are described in more detail here; in addition, it provides an opportunity to describe species not covered in the video. Each leaflet focuses on a single species of broadleaved tree or shrub and includes information on identifying characteristics, habitat and range, methods of reproduction, role in succession, importance to fish and wildlife, cultural and historical uses, and management opportunities. Leaflets are brief (5-6 pages each), readable, and unbound so the series can increase

over time. Leaflets can be used individually, if the user is interested in a single species, or in conjunction with the videotape and other educational products, if a more complete picture is desired. Current leaflets feature four of the five species illustrated in the videotape, but two more are underway, and many more are planned.

Glossary of Terms

The purpose of the illustrated glossary is to define terms used throughout other components of the program. It includes approximately 70 terms frequently used in discussing the ecology and management of trees and shrubs. Examples include: achene, adventitious, germination, ramet, tolerance, and vegetative reproduction.

Distribution

It's not sufficient to produce a good educational package. You must also make potential users aware of it, and then be able get it to them. All too often good programs sit on the shelves of those who produce them, or are distributed until a fixed number are gone, at which time they become unavailable. We wanted to be able to use this package within our own programs (undergraduate, graduate, and extended education), but also make it available to others through the mail—and because the information within it is not likely to go out of date soon, we wanted it to continue to be available over a long period time.

As a result, this educational program is packaged and distributed in several ways, enabling users to select the components that best meet their needs. The printed publications alone are distributed through OSU's Forest Research Lab at no charge to the user. The audio-visual based packages (including either the videotape or slide-tapes combined with printed publications) are available for sale or rent through OSU's Forestry Media Center. Advertising occurs via catalogs produced by the Forestry Media Center and Forest Research Lab, and through association and agency newsletters. This dual system of distribution allows users access to just the parts of the program they want, and ensures that the program will continue to be available over time. Fees generated from the rental and purchase of the programs are used to help offset the considerable costs of production and re-production.

Of course, parts of this program are also used directly, in undergraduate, graduate, and extended education classes at OSU. The audio-visual components are often shown to groups, but are also available for individual use in the College of Forestry's Self-Learning Center at no cost.

Results

With multifaceted programs like this one, results can be measured in many ways. Perhaps the most important questions are: who is using it, how often is it used, and with what results?

In our case, we are most certain about results that have occurred within our own programs—undergraduate classes like dendrology, forest ecology, and silviculture, and extended education programs like the Silviculture Institute and the Natural Resources Institute. We have watched those audiences respond in very positive ways.

Outside of our own institution, we know who has ordered the programs, but we're unsure of how many times they've used them, with whom, and with what results— one of the real challenges with distributed learning materials. For example, we know that the Forestry Research Lab has mailed out approximately 500 sets of the printed publications since their release in May 1995. We also know that the Forestry Media Center has sold and rented approximately 30 sets of the video and associated publications. Not huge numbers, but not unreasonable, given the size of the "market."

Unfortunately, we have no good way of assessing the total number of users, nor the impact of the programs on them. The feedback that we've received has been favorable, but minimal.

Final Thoughts

We're not done with this project; it's in a continuous state of development. We're currently working on species leaflets for snowbrush (*Ceanothus velutinus*) and big huckleberry (*Vaccinium membranaceum*), with others planned. We're currently working on conversion of the shrub identification slide-tapes to CD- ROM. And there's always room for a second video or a web site—perhaps sharing some of the innovative uses of native plants described in this symposium.

We believe that this multifaceted, multimedia approach to education can serve as a model for producing programs on a variety of subjects. The use of multiple forms of media helps ensure that a wide range of learners can be reached, increasing the effectiveness of the program. The user-friendly formats of the printed publications make them easy to read, update, and store, increasing the chance that they will be used. And the dual distribution system helps ensure that the program will be available well into the future.

What's it take to make this approach work? Mostly teamwork and initiative— scientists, educators, and communication specialists dedicated to developing and delivering innovative, effective education. A little bit of money doesn't hurt either.

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