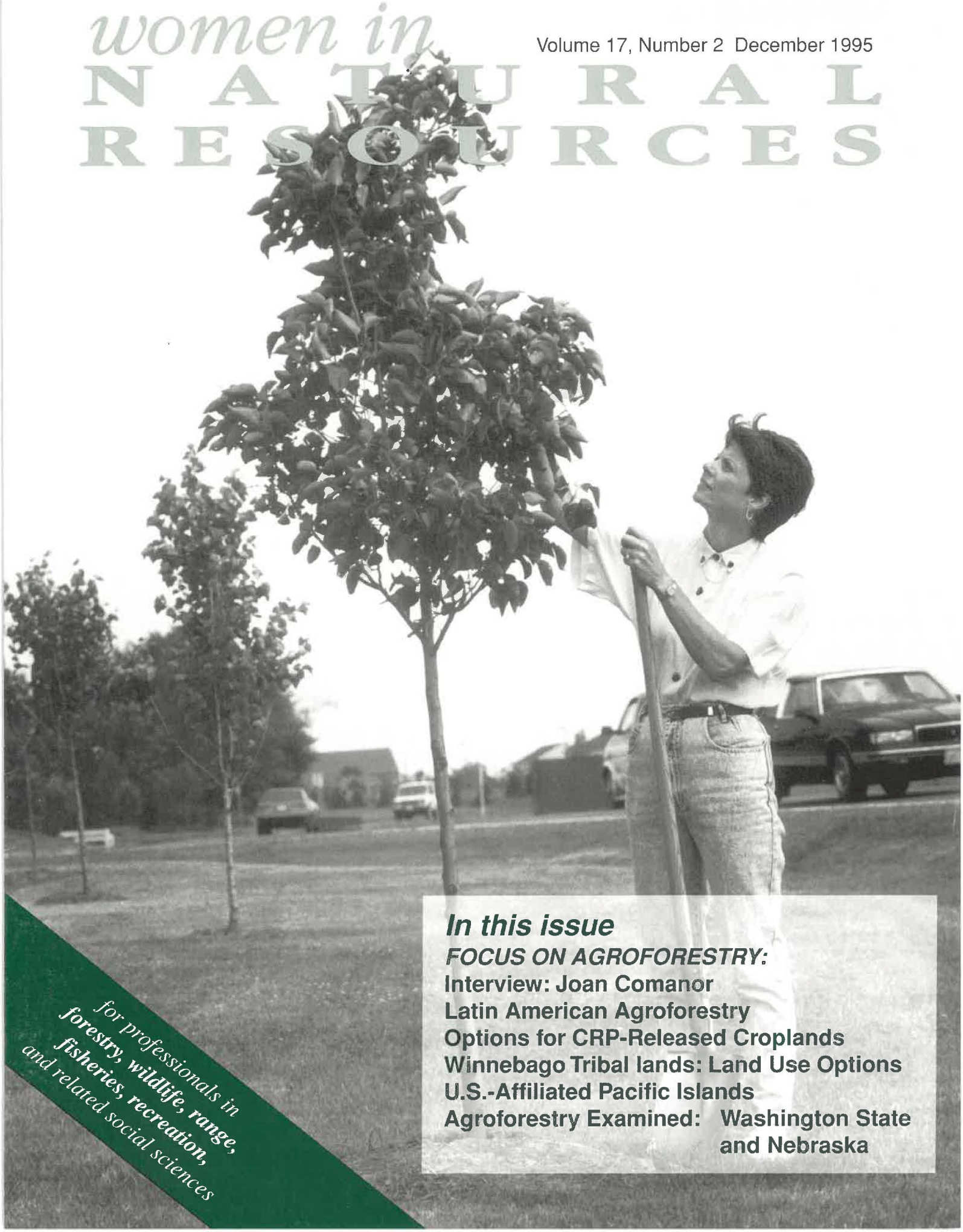
women in NATURAL RESOURCES

Volume 17, Number 2 December 1995



for professionals in **forestry, wildlife, range, fisheries, recreation,** and related social sciences

In this issue

FOCUS ON AGROFORESTRY:

Guest Editorial by *Michael Gold*

This issue, *Women in Natural Resources focuses* on Agroforestry. As an alternative to conventional agriculture, agroforestry is unique because it simultaneously addresses critical economic, environmental, and social needs within agroecosystems. Discussions of the merits and potentials of agroforestry land use practices invariably "turn on a light" in the minds of many of the participants. Once introduced, agroforestry is often perceived as a compelling and viable alternative land use system. A common first question is: if agroforestry has so much to contribute to both land use protection and production, why isn't it a widespread and common land use practice?

The response is that agroforestry consists of a group of integrated land use management practices that have heretofore differed from the way most of us view land use and our perception of the landscape. Up to the present time, a different tradition has existed in our government research and extension agencies, U.S. university research and extension systems, traditional commodity production organizations and in the minds of those who make their living from the land. This tradition manifests itself as a distinct separation of land use practices and has lead to our current landscape of feedlots, woodlots, and crop monocultures. These current traditions do not encompass the potential production and conservation benefits of agroforestry and have constrained its development and implementation.

It is necessary to look at a landscape without a predetermined decision as to what land use is most appropriate; once analyzed, decisions can be made as to what land use practices are needed where, without assuming that agroforestry must be a part of the solution. Trees and shrubs should be incorporated where needed or desired on the landscape to achieve a landowners economic and environmental objectives.

At present, agroforestry for temperate, industrialized countries, falls outside of existing land use management institutional structures. Agroforestry's greatest potential, the ability to capture the synergism of combined land use production systems for simultaneous economic and ecologic benefit, also presents its greatest challenge. Our research, education and extension systems are organized by discipline (e.g., forestry, crops, livestock) and commodity, and research funding is targeted toward specialization within discipline. At present, no major political, commodity, or academic lobby groups exist to pressure state or federal legislators to focus on agroforestry research, education or extension. In contrast to the fields of agriculture and forestry, agroforestry currently lacks a research, development, and application infrastructure. These infrastructures provide researchers, teachers, extension agents, and farm and forest landowner practitioners with an interconnected feedback system promoting the development, optimization and implementation of new ideas and practices. There is also uncertainty associated with temperate agroforestry as untried and unproven land use systems. The bottom line result of these constraints is that the entire spectrum of knowledge, including information about joint species/crop responses, site characteristics, management practices for yield enhancement, and economics and marketing, is both impeded and limited.

The Association for Temperate Agroforestry (AFTA) was established in 1991 to help create the local, regional, and national support needed to begin to broaden our current land use traditions and assist in promoting the broader use of integrated land use practices in which trees play an integral role. AFTA exists to help organize, catalyze, develop, promote and network agroforestry for our collective benefit. And it has been involved in national activities over the past two years to further the awareness and develop the support base to increase the use of agroforestry throughout the U.S.

Three major documents have been developed including: 1) Agroforestry: An integrated land-use management system for production and farmland conservation (February 1994). The report details the value of a broad application of agroforestry practices; 2) Agroforestry for sustainable development: A national strategy to develop and implement agroforestry is a workshop (June 1994) "white paper" outlining a framework for a coordinated national agroforestry program; 3) Agroforestry: Blending agriculture and forestry production and conservation practices is a policy paper outlining national needs to be addressed. This document reflects the combined efforts of a group of individuals representing forestry, agronomy, range, agroforestry, conservation, and sustainable agriculture organizations.

Numerous efforts are underway to increase use at state, regional, and national levels. At the state level, efforts range from very advanced to new initiatives. The USDA Forest Service National Agroforestry Center (NAC) and Natural Resources Conservation Service (NRCS) have sponsored 10 regional agroforestry assessments. By mid-1996, under a cooperative agreement with NAC and NRCS, AFTA will develop reports on national agroforestry needs and priorities and propose an overall framework for regional agroforestry working groups.

AFTA is cooperating with the forestry profession through its Society of American Foresters Working Group. There is discussion of a special issue of the *Journal of Forestry* dedicated to it. With the American Society of Agronomy, AFTA will convene an agroforestry poster session and is planning a symposium in 1996 at the national meeting. It is hoped that a textbook on temperate agroforestry will be written and available concurrent to that meeting. Temperate agroforestry has a likely partner with the sustainable agriculture movement. In early 1995, the Wallace Institute for Alternative Agriculture sponsored a "primer" on agroforestry to introduce it to a broad array of key individuals in Washington D.C.

All of these linkages with traditional disciplines indicate a dynamic period of growth and development ahead. U.S. agroforestry has come a long way in a short time.

Michael A. Gold is Assistant Professor, Department of Forestry, Michigan State University. He is Immediate Past President, AFTA.

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WOMEN IN NATURAL RESOURCES

December 1995

Volume 17, Number 2

FEATURES

DEPARTMENTS

Cover photo is of
Joan Comanor
Deputy Chief, State and Private Forestry, USDA Forest Service
Planting and maintaining trees in America's 52,000 communities is an important component of Urban and Community Forestry, one of Comanor's program areas.

FEATURES

LETTERS & OPINIONS

Your publication is always received here with much interest and discussion. But your September edition arrived at the Conway School of Landscape Design with much fanfare. With an alum in print [Amy Klippenstein who wrote New England Landscape: A Developmental History] as well as one of the instructors, we had reason to take a moment and pat ourselves on the back. I am the author of the poem La Mer Bleue...The original poem was not aligned in the way it appears in the magazine. For all poets, line length, justification, and position on the page are chosen as carefully as the words themselves. The last choice I would have made for this poem would be to center each line [as you did]. Taking license with a poem undermines the compliment you mean to give... Again, you have my thanks for appreciating and taking the risk to publish my work.

Maureen Buchanan Jones, Conway, Massachusetts

Editor's note: We did appreciate the poem and did not realize that fitting it to our space constraints and presentation would cause problems—we offer an apology. We would like to publish more poetry, however, and challenge poets to accept that in our journal, it will be formatted in a left-aligned or centered format with three columns on the page.

The job announcement flyers that you offer with the price of the journal is a great deal. As downsizing continues to blow its hot breath on our backs, I find them a good resource for me and my colleagues. Keep up the good work; you don't know how important it is that the journal endures.

Alicia Kohls, Milwaukee, Wisconsin

I know that many readers work for the federal government agencies. I just want them to know that it bugs the #%&* out of me that not enough sympathy was shown to them during the shutdown of the government. Losing that huge percentage of a work-year has got to mean that workloads will become even more unbearable as they try to catchup or compensate. Everyone is trying to suck it up and not whine too much, but how much hardship can one sector take?

Al Wang, San Francisco, California

The Center for Alaskan Coastal Studies is a non profit, grass roots, environmental education organization located in Homer, Alaska. In 1996 the Center will have two Bio-Tech/Caretaker positions to fill with a stipend of $1,500. Interested applicants could call for the description at 907-235-6667.

Penny Hodges, Homer Alaska

In the September 1995 issue, the interview by Elaine Zieroth of BLMs Oregon/Washington Director Elaine Zielinski was very good. Learned a lot about the organization. In the box on page 29 there were some statistics about the agency. Included in the budget figures was ten million plus dollars for the Jobs in the Woods program. What is the status of that program and exactly what does the agency provide? Incidentally, it was good to see a married woman raising a kid who combines her work on $150,000,000 budgets with family life. She gives me hope.

Clarisa Newton, Macon, Georgia

I liked the point that Amy Klippenstein was making about the relationship between humans and their landscape in WiNR (Vol.17:2). What bothers me is that many New Englanders think theirs is a higher and better form of both humanity and landscape than others in this country.

Winton Blind, Pueblo, Colorado

MISSOURI DEPARTMENT OF CONSERVATION

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Responsibilities for both: Coordinating and overseeing educational programming, providing direction, ensuring coordination within the region with all Divisions; reviews budgets; coordinates on statewide interpretive events; represents Education/Interpretation on the Urban Coordination Team; markets and promotes interpretive and educational events; develops partnerships; coordinates curriculum development.

Qualifications for both: Bachelor's in Conservation Education, Interpretation, Natural Sciences, Ecological Studies, Biological Sciences, Botany, Forestry, Wildlife or Fisheries Management, Envionmental Studies or closely-related subjects and five years of progressively responsible professional experience in one or more of the above areas; or an equivalent combination of education and experience.

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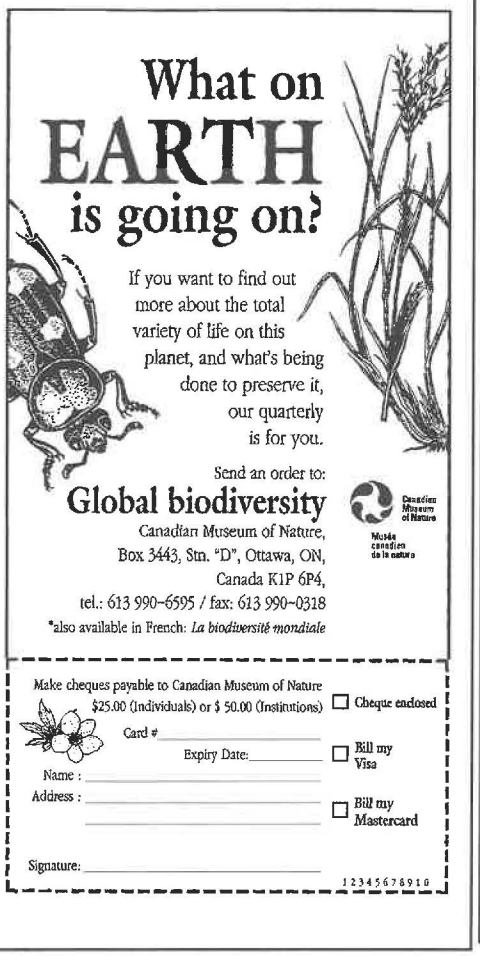


Environmental Policy & Government

SUNY——Tenure track, Assistant Professor position to begin August 1996. This is an academic year position with undergraduate and graduate teaching emphasis with scholarly research responsibilities. Interdisciplinary involvement is required with the College's science, natural resource, and professional programs, the Pack Environmental Institute, and affiliated units at Syracuse University.

The ideal candidate is required to have completed a Ph.D. in an applied social science by appointment, have a demonstrated emphasis in environmental policy; and have professional teaching experience. Preferred that candidates have an interdisciplinary orientation with an emphasis in U.S. Federalism. Publications and potential for funded research are desirable.

Persons meeting these qualifications are invited to submit application, resume, official academic graduate transcripts, dissertation abstract, and three letters of reference to: Chair, Search Committee, Faculty of Environmental Studies, SUNY College of Environmental Science and Forestry, 107 Marshall Hall, Syracuse NY 13210-2778. *Application deadline is March 4, 1996.* Phone 315-470-6636; fax 315-470-6915. *AA/EOE*

Trees on the Great Plains: Agro-Ecosystem Diversity

Laurie Hodges, Mary Ellen Dix
James R. Brandle, Mark O. Harrell
Robert J. Wright, Ron J. Johnson
Ronald M. Case, Kenneth G. Hubbard
Linda J. Young, Rebecca L. Fitzmaurice
Nathalie J. Sunderman, Michele M. Schoeneberger

L. Hodges presenting research results on impacts of tree shelterbelts on growth and yield of cabbage to visiting international agronomists.

The University of Nebraska and the Forest Service collaborate in an eight-discipline, twelve-person project. They look at "life on the edges."

Agriculture in the Great Plains faces increasing pressure for environmental stewardship and for more economical farming and pest management practices. The concept of sustainable agriculture was developed to address these needs. A sustainable agricultural system is one that consistently enhances environmental quality and the resource bases, provides basic human food and fiber needs, is economically viable, and enhances the quality of life for farmers and society. In the Great Plains, we define agroforestry as the use of trees to help make agricultural production systems more sustainable. The trees function to conserve soil, water, wildlife, and other natural resources. They also improve water quality while maintaining natural resources and crop and livestock productivity and profitability.

The use of trees in agroecosystems impacts the microclimate and biological environment of the systems. Agroforestry ecosystems are composed of crops, trees, soils, invertebrate and vertebrate wildlife, and many other components. The roles of each component and how the components interact within the system must be better understood before effective guidelines can be developed for managing the agroecosystem.

In the Great Plains, farmers and urban dwellers rely extensively on synthetic pesticides to control insect pests and help produce more crops. This has created problems such as pest resistance to pesticides, unintentional pesticide damage to nontarget organisms, and contamination of the ecosystems. New methods are needed to control pests. Native natural enemies can provide long-term protection from most forest defoliators and be used to control pests of crops in the Great Plains. However, farming, urban development, and other practices have destroyed most ecosystems that provided long-term habitat for natural enemies of crop pests. Crops now cover extensive areas of the Great Plains. Farming, urban development, and other practices have destabilized most of the ecosystems in the Great Plains that provided long-term habitat for natural enemies of insect pests. Because tree plantings are the most stable component of this otherwise unstable human-modified ecosystem, they can be used to enhance and conserve populations of natural enemies. Tree plantings can affect natural enemy abundance by altering the microclimate in adjacent areas, by providing food, protection and reproduction sites, and by providing the vertical and horizontal diversity needed by many vertebrate and invertebrate natural enemies.

Trees in agricultural ecosystems increase farm outputs and enhance the human and natural environment. Research in Nebraska and throughout the world has demonstrated that tree windbreaks (shelterbelts) modify wind profiles, temperatures, available moisture and other microclimate factors. Trees also provide food and shelter for many kinds of wildlife, including arthropods and birds. Many of these arthropods and birds are important natural enemies of tree and crop pests and have the ability to reduce destructive insect infestations. Insecticides, fertilizers, and cultural practices impact pest insects as well as their natural enemies. Furthermore, inputs of insecticides and fertilizers have replaced the interactions among pests and their natural enemies.

In agroecosystems, plant and animal diversity is particularly high along edges where crops and trees are in close proximity. These edges could serve as refuges for both beneficial and pest species during periods of unfavorable conditions within the crops. The use of tree windbreaks to enhance natural enemy populations is an attractive alternative to pesticides in the rural landscape. Little is known about the insect populations or the diversity of insect species found in tree windbreaks common in the Great Plains. Insect diversity in the edge zones where crop and trees meet is also largely unexamined. Most available information on the influences of tree windbreaks on arthropod natural enemies is scattered, was obtained in forest ecosystems, and does not pertain to agroecosystems of the Great Plains. In addition, information on how tree and crop management practices influence abundance of wildlife, such as resident and migratory birds, is extremely limited.

In 1991, scientists representing eight disciplines from two agencies (the USDA Forest Service and the University of Nebraska) and five university departments (Forestry, Fisheries and Wildlife; Horticulture; Agricultural Meteorology; Entomology; and Biometrics) met to form an Agroforestry Team. The purpose of the team is to explore the nature of agroforestry ecosystems, to understand the differences between sheltered and exposed systems, and to develop ways to optimize aspects of these systems most appropriate for sustainable management. Funding to date for the various projects has been through the U. S. Forest Service, Hatch funds, McIntire-Stennis funds, and an Agriculture in Concert with the Environment (ACE) USDA grant. Two of the projects led by women researchers will be described; a third project features the research of two women graduate students on the diversity and numbers of birds using riparian woody and herbaceous edges and windbreaks and herbaceous edges and adjacent crop fields.

Quality, Quantity, and Pests of Vegetable Crops

Project Leader: Laurie Hodges Although several studies show that windbreaks increase dryland yields of corn, wheat, and other field crops, and that the yield lost by ground occupied by windbreaks is more than compensated for by increases in the quality and quantity of the harvest, the precise effects of shelterbelts on vegetable production are not well understood. The direct effect of shelter on vegetable yield is only part of the story. The time of harvest and quality of the harvested product also have a major effect on the economic viability of an enterprise. Vegetable quality is as important as yield and has a direct impact on net profitability of the crop.

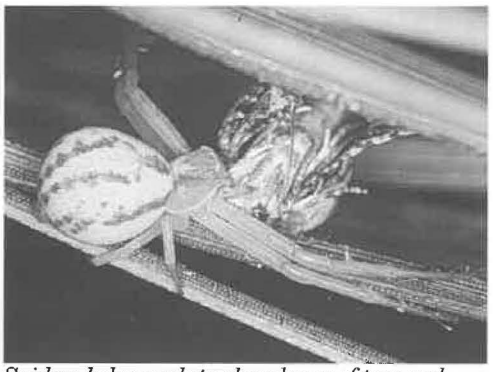
Muskmelon grown in sheltered and exposed sites, for example, are being compared for earliness, percent culls, average weight per head, head shape, cavity size, color, sugar and sugar components, and levels of damage from insects and diseases. Cabbage cultivars grown in sheltered and exposed sites are being compared for head density or solidity, color, pungency, levels of vitamin C and folic acid, percent culls, marketability, average weight per head, pest damage, and earliness. Sequentially planting snapbeans within the protected zone provided by tree windbreaks takes advantage of the microclimate changes in the protected zone, especially warmer air and soil temperatures, effectively extending the growing season by 7 to 10 days, thus providing a marketable crop when economic returns generally are highest. This information will be used to develop recommendations for growing vegetables near tree windbreaks, management guidelines for sequencing the vegetable crops, and harvest scheduling and labor needs.

Incorporating vegetable crop production with traditional grain production systems characteristic of the Great Plains provides diversification of the farm's economic base. It also provides additional food and habitat for the insect pests of the various crops and the natural enemies of these pests. Little research has been conducted toward understanding the extremely complex dynamics of predator and prey in relation to high value horticultural crop production in the lee of tree windbreaks. The landscape scale or systems approach to pest management within this agroecosystem will be necessary to develop sustainable production systems incorporating crops with very low tolerance for insect damage and where the damage has a direct economic impact on market quality. This aspect is being studied under the next set of projects.

Native Arthropod Enemies of Crop Pests

Project Leader: Mary Ellen Dix

In 1990, studies were initiated to determine the impact of trees on the distribution and abundance of invertebrate natural enemies of crop pests. These studies were initially conducted in windbreak systems at the Agricultural Research and Development Center (ARDC), University of Nebraska, near Mead, Nebraska and were expanded to private farms in 1993. Ground and foliage-inhabiting arthropods in the shelterbelts and crops were sampled periodically throughout the year with pitfall traps, foliage sweeps, and branch samples. Distribution of these generalist arthropod predators in the woody edge and other components of the ecosystem were compared, and the most common and effective predators will be targeted for furture studies to enhance their abundance. Preliminary results are encourageing because greater numbers of predators, especially ants and spiders usually were found in crop fields near shelterbelts than in similar fields away from shelterbelts. The tree species and tree species diversity within the shelterbelts influenced predator abundance and arthropod predator:prey ratios within the shelterbelt and neighboring crops. Crop management practices, such as harvesting wheat and alfalfa in adjacent fields, also affected the predator:prey ratios. In addition, predator:prey ratios were found in litter under the trees. Low ratios were found within grass edges, alfalfa, and muskmelon.



Spiders help regulate abundance of tree and crop pests in agroforestry systems.

Integrated Pest Management (IPM) commonly is targeted toward control of a specific pest problem, and frequently has not been integrated into the long-term management of crops, trees, or surrounding landscape. Future research will focus on habitat enhancement through manipulation of tree species components of windbreaks, their edges, and crop management to favorably affect the balance of natural predators to prey. The information we are gathering on insect abundance and diversity can be used to develop environmentally sound practices for managing the landscape instead of a single crop or crop pest.

M.E. Dix is installing a pitfall trap near a tree row. These traps are used to determine influences of trees on abundance of ground dwelling arthopods in agroforestry and tree/turf ecosystems. She is digging a hole for a pitfall trap.

M.E. Dix is collecting arthropods caught in a pitfall trap located on the perimeter of a corn field and next to a juniper shelterbelt.

Avian Use of Shelterbelts and Adjacent Crop Fields

Project Leader: Ron Johnson

Graduate Students: Rebecca Fitzmaurice and Nathalie Sunderman

Additional studies are assessing wildlife use of trees and other vegetation in windbreaks and along riparian corridors through agricultural ecosystems. Species diversity and abundance of the birds and mammals in these ecosystems are being evaluated during the winter, breeding season, and spring and fall migrations. During the breeding season, many birds are insectivorous and also feed insects to their young. Common resident species as well as neotropical mi-

Indonesian graduate student planting muskmelons in a plot sheltered by trees.

grants were observed using the shelterbelts and riparian corridors. More birds and bird species used shelterbelts than edges without trees, i.e. herbaceous edges where cropland adjoins grassy edges. These birds may be consuming insect pests that spend a portion of their life cycle in the litter under trees or in the grass at edges. In fields, the variety of species was greater in those with woody edges (tree windbreaks or where trees formed borders to riparian areas), but the generally abundance (number) of birds in fields was similar regardless of edge type. However, more insectivorous species were found in fields next to windbreaks, especially within the first 150 feet from the windbreak.

Our preliminary data indicate that field edges, particularly woody edges, provide habitat for bird species in agricultural areas and potential benefits for sustainable agricultural systems. Some unique bird species prefer herbaceous edges without woody cover, and the requirements of these species need to be considered in landscape managment practices.

As we develop more comprehensive data bases, the information will be correlated with information on pest abundance. Future studies will evaluate prey preferences, feeding behavior, and other information needed to develop methods for enhancing the abundance of targeted species and increasing their impact on pests.

Laurie Hodges, University of Nebraska-Lincoln (UNL), Department of Horticulture, is a Vegetable Specialist and Plant Physiologist. She received her Ph. D. from Auburn University in Plant Pathology. She received her other degrees from the University of Arkansas (Agronomy) and the University of New Hampshire (Botany).

Mary Ellen Dix, USDA Forest Service, National Agroforestry Center, Lincoln, Nebraska (Agroforestry Center) is a Research Entomologist with the U. S. Forest Service. She received degrees from George Washington University, Mount Holyoke, and the University of Georgia

James R. Brandle is a Forest Physiologist in the Department of Forestry, Fisheries and Wildlife(FFW) at UNL. He received his Ph. D. from Missouri State and M. S. and B. S. degrees from the University of Tennessee.

Mark O. Harrell, also in FFW, is a Forest Entomologist. He received his Ph. D. and M. S. from the University of Wisconsin and his B. S. from the College of William and Mary.

Robert J. Wright, of UNL's Department of Entomology, is a Crop Entomologist. He received his Ph. D. from the North Carolina State University, the M. S. degree from the University of Arizona, and his B. S. from the University of California-Santa Barbara.

Ron J. Johnson, Department of FFW, is a Wildlife Biologist with research interest in sustainability in agricultural landscapes and the ecology of edge habitats and corridors. He received his Ph. D. from Cornell and the M. S. and B. S. degree from The Ohio State University.

Ronald M. Case, also FFW, is a Wildlife Biologist. He received his Ph. D. from Kansas State, his M. S. from the University of Illinois, and the A.B. from Ripon College.

Kenneth G. Hubbard, Department of Agricultural Meteorology, is an Agricultural Meteorologist and Director of the High Plains Climate Center. He received his Ph. D. from Utah State, M.S. from the South Dakota School of Mines and Technology, and the B. S. from Chadron State (Nebraska).

Linda J. Young, Department of Biometrics, UNL, is a Biometrician. She received her Ph. D. from Oklahoma State University, and the M.S. and B. S. degree from West Texas State University.

Rebecca L. Fitzmaurice, is currently a communications specialist in wildlife and natural resource conservation, employed with D. J. Case & Associates in Mishawaka, Indiana. She will received her M. S. degree from the University of Nebraska in Wildlife Biology. Her B. S. is from the University of Evansville (Indiana).

Nathalie J. Sunderman, FFW, received her M. S. degree from the University of Nebraska in Wildlife Biology and her B. S. in Biology from Concordia College (Nebraska).

Michele M. Schoeneberger, Agroforestry Center, is a Soil Scientist, U. S. Forest Service and received degrees from Wisconsin, Oregon State, and North Carolina State.

PEOPLE & PUBLICATIONS

The Forest History Society awarded **Susan Rhodes Neel**, Montana State University, the $125 **Ralph W. Hidy** Award for her article Newton Drury and the Eco Park Dam Controversy. The article appeared in the Society's April 1994 issue of *Forest & Conservation History*. **Nancy Bazilchuk** won the **John M. Collier** Award for Forest History Journalism. Her Hardwoods, Hard Choices, a three-part series, was published in January 1994 in the Burlington *Free Press*. When the Society recently elected officers, **Patricia M. Bedient** a Boise, Idaho Partner in the firm Arthur Andersen, was elected Treasurer.

•**Bruce Babbitt**, Secretary of the U.S. Department of Interior, recently noted in a speech given to the Garden Club of America, that he was raised in Flagstaff Arizona in the 1940s where a **Mrs. Seacrest** was the founder and leader of Flagstaff's Garden Club. She transformed the town by planting native blue spruce and quaking aspens. He talked also of **Kay Boggs** of Indianapolis, working in the 1950s to save Darby Creek. **Helen Fenske** who turned the Great Swamp in New Jersey into a national wildlife refuge was joined in Babbitt's speech to **Rachel Carson**, who wrote from Springdale Pennsylvania about what we now call environmentalism. All of these women seemed to Babbitt to be visionary, committed women, upon whom the environment depends for the sparks to ignite a new outpouring of public concern.

•**Christine M. Moffitt**, adjunct associate professor and research scientist in fisheries at the College of Forestry, Wildlife and Range Sciences at the University of Idaho was recently awarded the Meritorious Service Award from the American Fisheries Society. There have only been 10 such awards. Her work on the biology, health, and management of anadromous fish, and on fish chemotherapeutants has won her very large federal grants over the years to study the use of the antibiotic erythromycin to control bacterial kidney disease in chinook salmon. Moffitt edits the *Journal of Aquatic Animal Health*.

•President **Clara Lovett** of Northern Arizona University will be recognized by the American Association of University Women-Yuma Crossing Branch with the Leading Educator of the Year of 1995 Award. The International Federation of University Women and the Transcultural Border Alliance of Women will also honor her as an outstanding leader. She is the first to win awards by all three organizations.

•**Cecile Jackson**, of the School of Development Studies, University of East Anglia, Norwich UK, has been awarded a two-year Research Fellowship under the the ESRC's Global Environmental Change Research Initiative for a project entitled Gender Analysis of Environmental Change in Developing Countries. She will look at linkages between poverty, environmental degradation, and gender. She notes that whether women should be seen as an especially important resource in averting degradation or in conservation and regenerative environmental management is questionable. Such views can lead to environmental interventions which deepen gender inequalities, as can gender-blind sustainable development interventions. We need to develop more critical application of gender analysis to environmental ideologies and the rhetoric of sustainability, she believes.

Each year the Center for Disease Control publishes a *Summary of Health Information for International Travel*, a book containing important medical facts for travellers planning a trip overseas. The information can be found at their world wide web sit at http://www.cdc.gov/ or call them at 404-322-4565 for a hard copy.

Ann Zwinger wrote a new book titled *Downcanyon: A Naturalist Explores the Colorado River Through the Grand Canyon* (University of Arizona Press, 1995). She was part of a team exploring the canyon by boat and on foot. She describes the flora, fauna, and the natural and human history. The book won the 1995 Western States Book Award.

Another book published by the University of Arizona Press (1995) is Helen Kreider Henderson and Ellen Hansen's book *Gender and Agricultural Development: Surveying the Field*. The book is a synthesis of the major issues related to women in agricultural development and provides an extensive bibliography of relevant literature covering 30 years of research in Africa, Latin America, the Caribbean, Asia, and Oceania.

Globalizing the College of Agriculture Curricula Workshop Proceedings (1995) was published by Louisiana State University. The volume contains results of six workshops held at LSU from 1991 to 1995 as part of a USDA Challenge grant to improve the undergraduate curriculum in the agricultural sciences. It features globalization of education, measures of global competence, and an annotated bibliography.

Gender Analysis and Forestry Training is a package for forestry professionals involved in sustainable forestry projects around the world. There are management frameworks, fieldwork guides, gender analysis specifically applied to forestry, and case studies. There are video and slide sets, plus guides and brochures. Write FAO Distribution and Sales Section, Vialle delle Terme di Caracalla, 00100 Rome Italy or inquiries to e-mail Helen.Gillman@fao.org.

Earth Work has published *The New Complete Guide to Environmental Careers* produced by the Environmental Careers Organization (ECO). Write them at PO Box 550, Charlestown NH 03603 for a copy.

LATERAL THINKING }}}}}}}>>>

Barb Springer Beck

Lateral thinking calls for creativity. Now before you say to yourself "But I'm not creative," the fact is, everyone has the ability to think creatively...and solve problems. According to Eduard deBono, the originator of the concept of lateral thinking, creativity is a skill, and can be learned along with lateral thinking, through discipline and practice. In his book *Serious Creativity* he says;

In my view, learning creative thinking is no different from learning methematics or any sport. We do not sit back and say that natural talent is sufficient and nothing can be done. We know that we can train people to a useful level of competence.

What is Lateral Thinking?

Lateral thinking is concerned with the arrangement of information, and how that information is used. DeBono explains that "lateral refers to moving sideways across the patterns instead of moving along them as in normal thinking." Lateral thinking is used to restructure patterns by putting things together in a different way.

Lateral thinking can best be understood by constrasting it with vertical thinking. Vertical and lateral thinking are very different. Vertical thinking is the approach typically used by the western world to solve problems. In vertical thinking, the object is to progress through a series of logical steps. Each step is dependent on the foundation of the previous step, and consistent with it. Only relevant information is sought out and considered. Vertical thinking is linear in nature. The NEPA process which is initiated by developing a proposed action, then scoping for issues, generating alternatives, evaluating the alternatives, and finally, making the decision, is a good example of vertical thinking. Natural resource managing agencies have highly developed, and effective systems of vertical thinking and problem-solving.

Lateral thinking by contrast is generative, as opposed to analytical. Information is used for its own sake. Information—such as a random word not directly relevant to the situation—is sought out as a stimulus to expose and restructure existing patterns. Lateral thinking is concerned with new ideas, new ways of thinking and breaking out of old patterns of the mind. Lateral thinking is both an *attitude* and a *way of using information*. Lateral thinking techniques have been under-utilized in resource management, and I believe could offer significant benefits.

Both hemispheres of the brain are utilized in creative effort. Although the right brain is believed to perform more holistically, the left brain is where concepts and perceptions are formed. Since creative effort is achieved through both systematic application of thinking tools and holistic thinking, both the right and left brain are involved.

Lateral Thinking Techniques—The Creative Pause

The simplest of the thinking techniques, and a good place to start your creative effort, is the pause. The creative pause is the result of your intention to *interrupt* the routine. You pause because you want to make a creative effort. A creative pause is the brief period of time during which you stop, and focus deliberately on a situation or process. The pause is an end in itself. While there may be a tangible result, that's not the object of the pause. This is a simple technique, but not necessarily easy to do. Try it by simply stopping yourself for no reason except to think and reflect on what has become routine. If you want to practice and develop your creative thinking skills, set a goal to make this one of your habits.

Simple Focus

Have you ever heard the remark, "If it ain't broke, don't fix it"? Simple focus is another creative thinking technique in which you focus on something, which contrary to the warning, is not a problem. Your purpose is to find alternative ideas. The idea behind simple focus is embodied in Robert Kreigel's antithetical statement from his book of the same name, "If it ain't broke, break it." What's worked in the past, may not be working effectively now, and probably will not work in the future. Use simple focus to scrutinize traditional approaches and assumptions.

Creative Challenge

Creative thinkers refuse to automatically accept that the current way of doing something is the best or only one. The creative challenge is based on the belief that the current way of doing something is only one of many possibilities. One approach to the creative challenge is the block technique. Ask yourself, "If I was blocked from doing something the way I am

ON THE GROW

A Management Column

doing it now, how would I accomplish it?" Managers have been confronted with just this situation since passsage of the Wilderness Act in 1964. Because motorized and mechanized equipment is not allowed in designated wilderness, they are blocked from accomplishing work by routine methods. Wilderness managers have demonstrated time and again their ability to accomplish the creation and repair of a myriad of trails, facilities, and other tasks in wilderness by other-than-motorized methods. Try applying the block technique to a process you believe can be improved.

Provocation—Applying Lateral Thinking to a Water Quality Problem

Let's look at the application of vertical and lateral thinking techniques to controlling water pollution from a hypothetical industrial plant. As a regulating agency, we are concerned with chemical pollution of the Runs-Through-It River. The plant takes in water from the river for the purpose of cooling, then discharges it back into the river after use. We know from past data collection, the chemical composition of water above the plant. To ensure that discharge does not exceed standards, we set up a monitoring station below the plant, and collect data at prescribed intervals. If a problem occurs it will be detected during subsequent monitoring.

Now let's look at what results we might obtain by using a creative thinking technique called the provocation or "po." With a provocation, we *deliberately* produce what appears to be an impossibility or madness as a stimulus for new ideas. There are a number of ways to set up a provocation; we'll use the escape method.

The first step in using the escape method is to spell out something we take for granted. In this case, we assume that the intake from the river is above the plant and that water is returned to the river below the plant. The second step is to "escape" from that assumption by reversing it. This would mean that the discharge of the plant occurs above the intake. Our provocation is the statement "Po, the plant is downstream of itself." By using the word po at the beginning of a statement, it is identified as a deliberate attempt to break the established pattern of thinking.

How can this be? If this seems utter nonsense to you, you're getting the picture! With this provocation we have just broken a pattern, and created a situation where the plant would discharge into the river upstream from its intake. The third step in using an escape provocation is movement. At this point we ask ourselves, what does this mean, is there any value, are there any possibilities to this? The obvious result of this reversal is that if the discharge was upstream of the plant, the plant would be the first to use what it had discharged. The plant would be *highly* concerned with the quality of water it discharged into the river. Indeed, the plant's operations are dependent upon excellent water quality at the intake.

Requiring the plant to discharge above intake has the effect of truly shifting responsibility to the plant for maintaining high water quality. This arrangement could preclude the need for a costly taxpayer sponsored downstream monitoring program. Siting for industrial facilities in some countries now require this as a form of pollution control.

As we've seen in the preceeding example, the purpose of a provocation is to get us out of the rut of our patterned thinking. We create the provocation without logic ("Po, the plant is downstream of itself.") and then in retrospect create the pattern or link which gives it meaning, the hindsight justification. Provocations are experiments of the mind which as you've seen above can be used in real life problem-solving.

Benefits of Lateral Thinking

So, you're wondering, is lateral thinking THE answer? Simply put, lateral thinking is an approach that with some skill and practice can help you generate breakthrough ideas. Lateral thinking can be practiced and used by anyone. Whether you realize it or not, you are constantly practicing your vertical thinking abilities. Now you can add lateral thinking to your repertoire. Vertical thinking and lateral thinking are both valuable, the two methods complement each other. So, next time you believe that something could be done better, or you run up against a tough issue, try a creative pause or a provocation—you might generate a really terrific idea!

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THE CONSERVATION RESERVE PROGRAM (CRP) WAS INITIATED IN THE 1985 FARM BILL TO ENABLE FARMERS TO RETIRE HIGHLY ERODIBLE CROPLAND FOR A 10 YEAR PERIOD. BUT 10 YEARS OF FALLOW HAS NOT SIGNIFICANTLY CHANGED THE ERODIBILITY CLASSIFICATION OF THESE LANDS.

AGROFORESTRY OPTIONS FOR CONSERVATION RESERVE PROGRAM-RELEASED LANDS

DEBORAH B. HILL

The Conservation Reserve Program, (CRP) was initiated in the 1985 Farm Bill to enable farmers to retire highly erodible cropland into grass or legume cover and/or into forest timber-producing trees for a ten-year period. Now, ten years of fallow has not significantly changed the erodibility classification of these lands. Release of these lands provides an ideal opportunity for introducing agroforestry techniques to the farming public as alternatives to traditional agronomic crop production. In our Kentucky study, high value hardwoods were planted as a windbreak—and fast-growing Paulownia for timber on CRP-released farmland.

Introduction

When Congress put the Conservation Reserve Program (CRP) into the Food Securities Act of the 1985 Farm Bill (P.L. 99-198), they hoped to be able to set aside about 45 million acres of highly erodible land for ten years and to recompense the farmers who took these lands out of production. This program was intended to accomplish several things:

* reduce soil erosion
* improve water quality by reducing soil erosion
* curb production of surplus commodities
* enhance fish and wildlife habitat
* reduce sediments in streams and along roadsides
* provide income support to farmers (Glaser 1986)

Strict federal and state guidelines dictated what species of trees, grasses, and legumes were appropriate and eligible for cost share. Interested farmers applied for these monies to convert their land from active agronomic production to the new cover crops and to supplement their income by idling some of their productive land. The land was to be left undisturbed for ten years, during which time the farmers could not make a profit on whatever was growing on the land. Now, ten years later as these CRP lands are beginning to be released from restrictions, agroforestry options such as silvopastoral techniques, alley cropping, commercial tree/specialty crop/agronomic crop intercropping, windbreaks and riparian buffer systems may be more appropriate for future crop use of these lands than reversion to agronomic crops alone.

Sign-ups for farmers began in the spring of 1986, and continued over an eight-year period until 1993, with usually two sign-ups per year. The two major options were for permanent ground cover (grass, legume, or a mixture), and/or for timber-producing forest trees. Farmers could bid a per acre price to the then ASCS (*A*gricultural *S*tabilization and *C*onservation *S*ervice, now CFSA - *C*onsolidated *F*arm *S*ervices *A*dministration), but the actual per acre rental rate ranged from a low of $36.62 (Alaska) to a high of $82.31 (Iowa) with the average around $50. The ASCS was to provide up to 50% of the costs of establishing the ground cover or trees, and those cost shares averaged $75 per acre for all practices. Farmers could not harvest a crop from these set aside lands. For this reason, both orchard trees and Christmas trees were specifically disallowed as tree crops because they a) required much annual maintenance work, and b) would produce one or more crops within the ten year time frame. The only cultural practice allowed in tree crops was pruning black walnut trees, as pruning in the first ten years of walnut growth is essential for maximum timber value many decades later.

Results of the Conservation Reserve Program

CRP-appropriate lands qualified because the soils were highly erodible. Over 69,500,000 acres were determined to be eligible for this program across the nation. By 1993 when the sign-ups ended, more than 35,000,000 acres had been successfully contracted, but on only a small percentage, 6.8%, of those acres were trees planted. This varied greatly in different parts of the country. For example, in Georgia almost 95% of the CRP land was planted to trees (Dangerfield et al., 1995); that pattern was consistent across much of the deep South. Since timber production is a major component of the state economies of most of the Southern states and is probably the best land use for many of their soil types, this high percentage of CRP land in tree crops is understandable. The North Central states, the "breadbasket of America," had the largest total number of CRP acres, but only a small percent

Table 1. CONSERVATION RESERVE PROGRAM (1985-1993)

REGION	ELIGIBLE ACRES	ACRES CONTRACTED	% ACRES IN TREES
SOUTHERN	21,959,100	9,441,458	23.3
NORTH CENTRAL	29,961,300	18,275,782	1.3
NORTHEASTERN	2,539,300	227,029	4.6
WESTERN	15,070,000	8,452,612	0.13
TOTAL	69,529,700	36,422,772	6.8

Table 2. ANTICIPATED POST-CONTRACT USES OF CRP LAND

PLANT to A CROP	43%
LEAVE IN GRASS for HAY CROP OR PASTURE	23%
RENT/LEASE LAND to OTHER FARMERS	13%
IDLE LAND to MEET SET-ASIDE REQUIREMENTS	4%
LEAVE TREES for TIMBER PRODUCTION	4%
ENROLL IN 0/92 OR 50/92 PROGRAMS	3%
SELL LAND	3%
LEAVE in GRASS/TREES with NO SPECIFIC PLAN	3%
LEAVE in GRASS/TREES for WILDLIFE/RECREATION	2%
OTHER	2%
TOTAL	100%

(USDA-ERS 1994)

(1.3%) of those acres in trees. The Northeastern states had the second highest percentage of CRP land in trees, largely due to plantings in Maine, New York and Pennsylvania (Table 1) (USDA-ASCS 1993). Like the deep South, Maine is a major timber state, and both Pennsylvania and New York have large timber economies, also.

The results of the CRP program were both negative and positive. Only about 52% of the lands eligible for the Conservation Reserve Program actually were contracted and planted. The total number of acres fell almost ten million short of the Congressional goal of 45 million acres. On the positive side, one recent USDA report (USDA-ERS, 1994) indicates that the United States has experienced a 22% reduction in soil erosion from 1985 to 1993, while CRP was in effect. There have also been significant wildlife habitat improvements with the sowing of more warm season and other native prairie grasses in the Central states (Huegel, 1986; Huegel and Hill, 1986; Infanger, 1995). These latter results would imply that the program was overall a success.

Within the CRP program itself, several agroforestry practices were allowed for cost-share. Over 60,000 acres were cost-shared for field windbreaks, filter strips, shelterbelts, living snow fences and alley cropping (Table 3). Though this was a very small portion of the total CRP acreage, it is significant that these soil-protective measures were considered viable by the ASCS and worthy of financial support.

In 1995, many of the acres initially enrolled in the Conservation Program are ready to be released and farmers are looking for options for post-CRP land use. As the CRP contract release time approaches, there have been studies about the probable post-contract uses of these lands (USDA-ERS, 1994). Surveys indicated the likelihood of various options being selected (Table 2). Almost 30% of the farmers surveyed want to leave the land in grass or trees, nearly 15% of respondents want to forgo or give up responsibility for the use of their land by selling it or leasing it to others, and more than a third are interested in regaining the production from the land that they have foregone for the past ten years. However, agronomic crop production by traditional methods was a major part of the initial problem with these highly erodible soils. Agroforestry practices such as riparian buffer systems, tree/pasture systems, commercial tree/specialty crop systems, windbreaks and alley cropping are all options that may allow farmers to grow crops such as grain or hay crops in addition to tree crops.

The Kentucky Experience

The Commonwealth of Kentucky had about a million and a half acres of land eligible for the Conservation Reserve Program. Over the 12 sign-up periods, 451,317 acres, or a little over 30% of the potential acres, were successfully bid for CRP, 3,877 acres (0.86 %) of which were planted to trees. In 1994, a western Kentucky farmer asked Cooperative Extension personnel in the University of Kentucky's College of Agriculture to collaborate with him in demonstrating options for land use after CRP lands were released. He received special permission to release some of his 262 acres of CRP land early so that these demonstrations could be put in place. Along with traditional and no-till crops such as corn and soybeans, as well as forage grasses and wildlife plantings, we decided to plant some typical high value Kentucky hardwoods as a long term investment, as well as to plant some fast-growing Paulownia as an experiment. We established two block plantations of high value native hardwood seedlings: (black walnut (*Juglans nigra*), Northern red oak

(*Quercus rubra*), and white ash (*Fraxinus americana*))(Figure 1). In addition, we established a planting of three Paulownia species (*Paulownia tomentosa, P. elongata,* and *P. fortunei*) along the contour of a slope near an existing woodlot on the property, to experiment with a fast-growing high value non-native hardwood.

Ash, oak and walnut seedlings from the Kentucky Division of Forestry were planted in March in two blocks on the windward side of the agronomic crops and were staggered in the rows within the blocks to provide some windbreak effect for the other crops. In one block, the hardwoods were planted in single species rows, with the walnuts in the lowest slope position, in case there were any allelopathic effects between the walnuts and the other two species. The second block was completely randomized in placement of species. The Paulownia seedlings, donated by a private grower, were planted on a slope following the contour along the edge of an existing woodlot. Under some fairly unusual weather conditions (very wet spring followed by drought in May and wet early summer followed by more drought and very high heat and humidity) at least fifty percent of each of the hardwood species managed to survive (ash - 72%, oak - 51%, walnut - 82%). Although planted two months later than the hardwoods to avoid a late frost, the flip-flop of wet/dry and cold/hot hurt the Paulownia, and they had less than thirty percent survival.

On a humid July day when the temperature hit the century mark, over 400 people, from 36 counties, 6 states and one foreign country braved the elements to tour the various exhibits in the demonstration field day. Most of the farmers were interested in the agronomic crops, but many also came by to inquire about growing trees.

One forest economist at the University of Kentucky calculated what the future value of these trees would be. We assumed:

* average site quality - soil nutrients, water, soil depth
* 10 x 20 foot spacing (about 200 trees per acre)
* average site index (60)
* 50% survival of the planted trees over the 50- to 80-year rotation.

Looking at economic possibilities - each species alone or mixed species - 50 year, per acre values ranged from a low of $2,000 (oak alone - a slow grower) to $3,300 (black walnut alone - the highest value species of the three). Thirty years later at 80 years, the per acre values ranged from a low of $22,600 (ash alone - the least valuable of the three) to a high of $36,000 (oak alone - higher volume than walnut at this age). Further calculations indicated that the present value of the land with the trees planted in it ranged

Table 3. CONSERVATION RESERVE PROGRAM AGROFORESTRY PRACTICES

PRACTICE	# ACRES%	TOTAL CRP ACRES
FIELD WINDBREAKS	7,501	.0206
FILTER STRIPS	52,931	.1453
SHELTERBELTS	299	.0008
LIVING SNOW FENCES	26	.00007
ALLEY CROPPING	53	.00014
TOTAL	60,810	.1669

(USDA-ASCS 1993)

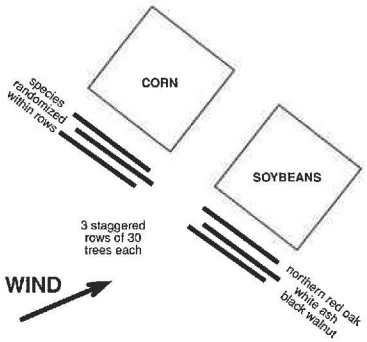

Figure 1. Layout of high value hardwoods on CRP-released farmland in western Kentucky

Table 4. POST-CRP LAND USE ECONOMICS (KENTUCKY)

LAND USE	RETURN PER ACRE/YEAR	50 YR RETURN	80 YR RETURN
CORN (TRADITIONAL OR NO-TILL)	$110	$5,500	$8,800
SOYBEANS (TRADITIONAL)	90	4,500	7,200
SOYBEANS (NO-TILL)	84	4,200	6,920
COW/CALF OPERATION	61	3,050	4,880
STOCKER CALVES	10	500	800

	PRESENT VALUE/ACRE	50 YR VOLUME	50 YR VALUE	80 YR VOLUME	80 YR VALUE
MIXED HIGH VALUE HARDWOODS	$370	6.3 MBF	$2,600	19.8 MBF	$29,300
ASH ONLY	350	7.8	2,500	23.2	22,600
OAK ONLY	280	6.2	2,000	21.1	36,000
WALNUT ONLY	460	4.9	3,300	15.1	29,400

(M. PELKKI, personal communication 1995, TRIMBLE, R. 1995)

from $280 to $460 per acre. We had calculated that the establishment costs for the tree planting, including plant material, mulch, herbicide for planting spots, and labor to herbicide, plant, and mulch equalled about $350. The economic calculations therefore indicated that the present value of any one of the tree species individually, or of the three species combined equalled or exceeded the costs of establishment.

After establishment, a farmer might want to replace any lost seedlings, and the walnut seedlings need pruning in their early years, but otherwise the plantation is essentially maintenance free. The wide spacing of the trees allows the use of equipment to harvest an agronomic crop under the trees.

The point we were trying to make with this demonstration is that farmers do not necessarily have to give up the idea of annual crops or to set aside this highly erodible land forever, but rather to consider putting in a hay or grain crop with trees as a component, spaced so that the harvesting equipment for the ground crop can maneuver between the trees. Given the growth rate of many of our native trees, a farmer could have at least one decade of crop productivity before the tree crowns dominate the site.

Part of the purpose of the Kentucky demonstration field day was to show farmers what kinds of returns they could expect from different options. Aside from the fact that all the non-tree agronomic options would produce an income on an annual basis, the per acre value information is interesting (Table 4). Over a fifty year period, assuming that the agronomic crops can produce consistently at the level measured this year and that market values are stable, they would produce more economic value than the trees, which are just beginning to reach merchantable size at the age of fifty. However, if the trees are allowed to mature to eighty years, the value of the land with trees exceeds that with crops by three to four times. It does involve planning for another generation, though - few of us would be around to see a tree from planting age through to maturity.

Summary

As the highly erodible lands protected under the Conservation Reserve Program come to the end of their ten year contracts, there is an excellent window of opportunity for farmers to adopt one or more agroforestry techniques to produce an agronomic crop while having the long term soil protection provided by trees. Both high value hardwoods and Christmas trees are options for both long and short term tree crops that may be compatible with various agronomic crops.

According to a white paper produced by AFTA in 1994, agroforestry systems have the following potentials:

* increase crop production
* control erosion and sedimentation
* provide multiple crops including wood products
* sequester and biodegrade excess nutrients and pesticides
* moderate microclimates
* diversify habitats for wildlife and humans
* sequester carbon
* serve as renewable energy source

If Congress's intentions for the Conservation Reserve Program are recalled, there is a very high degree of correlation. We are in a position to effect some major changes in the way farming is done on fragile soils if we can convince farmers that agroforestry practices are both ecologically and economically sound ways of doing business.

Lands eligible for CRP were marginal for agronomic production to begin with. Ten years of fallow have not significantly changed the erodibility classification of these lands. "Business as usual" is not appropriate for crop production following CRP. Release of CRP lands provides an ideal opportunity for introducing agroforestry techniques, as alternatives to traditional agronomic crop production, to the farming public.

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Deborah B. Hill, pictured below on a demonstration plot, is Extension Professor, Department of Forestry, University of Kentucky, Lexington.

Comparing Forest Landowners' and Land Management Advisors' Perceptions of Agroforestry in Washington State

Linda H. Hardesty and J. H. Lawrence

The good news is that agroforestry is in common use in Washington State and there is strong interest in agroforestry practices, even among those who do not use it or advocate it at this time.

Introduction

In 1990, two separate but related surveys were conducted to assess attitudes towards agroforestry as a land management strategy in Washington State. Land management advisors were surveyed in order to define issues to be evaluated in a subsequent survey of landowners. It was thought that land management advisers would be able to distill experience with a broad range of landowners and management objectives, and that their responses would define the boundaries of profitable inquiry among landowners.

Respondents consisted of 47 percent Natural Resource Conservation Service (NRCS) employees, 25 percent Cooperative Extension employees and 27 percent others. Just over half (55 percent) of this group either practiced or advised others in the practice of agroforestry, although almost all (94 percent) reported that they were familiar with agroforestry (Lawrence and Hardesty, 1992).

Information from the survey of land management advisors was used to design a more comprehensive survey of non-industrial private forest landowners. The objectives of this study were to assess landowners' use of agroforestry as well as their motivation to use or not use agroforestry. Two hundred ninety six landowners returned usable surveys, a 64 percent response rate. Some form of agroforestry was practiced by 57 percent of the respondents (Lawrence et al., 1992).

Because the survey of landowners was based partially upon the input from advisors, it would be expected that the results of the landowner survey would be biased toward agreement with the advisors, but this was not always the case. Advisors are not necessarily aware of, or in agreement with landowners and may unintentionally represent their own professional position rather than that of their clients (Dove, 1992). Results of the two surveys are compared to evaluate the reliability of one group to represent the needs of the other, and to derive information that might improve the effectiveness of agroforestry technical assistance.

Objectives

1. Determine the ability of land management advisors to anticipate the interests, needs and perceptions of private non-industrial forest land owners towards agroforestry.

2. Identify conflicting, or unique perceptions of agroforestry among the two groups that might limit the effectiveness of agroforestry assistance.

3. Provide information that might assist land management advisors in providing more effective agroforestry assistance to this group of landowners.

Methods

Both mail surveys were designed using Dillman's *Total Design Method* (1979) . For the advisors, a single mailing of a two page open-ended questionnaire was sent to 168 Natural Resource Conservation Service, Cooperative Extension, Department of Natural Resources, and county government employees as well as other persons known to be involved in agroforestry. Advisors were asked in what situations agroforestry would be most useful. The landowners to be surveyed were selected from a list of those using the fourth ranked land management practice (non-industrial private forest landowners). Advisors in all 39 of the State's counties were surveyed while landowners were clustered into three groups of four counties each where agriculture and forestry are important land uses. Results of both surveys were analyzed using the Chi square equality of means test at alpha = 0.05. Frequency of response between the two surveys cannot be compared statistically because the advisors had open ended questions while the landowners were offered a number of specified choices as well as the opportunity for open ended response. However, the ranking of responses is informative.

Results and discussion

Practices advocated or used

Both advisors and landowners identified forestland grazing as the most common agroforestry practice in the region. Windbreaks and shelterbelts and relatively minor attention to orchard agroforestry was second for both groups (Table 1). However the two groups diverged in third place, with advisors emphasizing wildlife/CRP, while landowners chose harvest of special forest products, a practice not mentioned by advisors.

The Conservation Reserve Program (CRP) is a federal land retirement and resource conservation program (including wildlife habitat) implemented by the NRCS. Special forest products are non-timber resources such as mushrooms and floral greens that are produced in forest stands. Harvest of special forest products has been, until recently, a local tradition that received little attention from land management advisors (Hardesty and Lyon, 1994). The other major difference between the two groups was the advisor's choice of riparian enhancement. Agencies such as NRCS, with responsibility for water quality, may be more aware of the need for riparian enhancement than landowners. Although this choice was not offered to landowners, none of them volunteered it either. Matthews et al. (1994) noted little landowner interest in riparian plantings in Eastern Canada, even when landowners were asked directly about the practice.

Differences between land management advisors and forest landowners are a factor in the reliability of comparisons between the two groups' perceptions. We can assume that more of the advisors had formal ties to agriculture (47 percent were Department of Agriculture [NRCS] employees), while only 21 percent of the landowners named themselves as ranchers or farmers, although some of the retired respondents (33 percent of landowner respondents) may have retired from an agricultural career. There is probably a stronger agricultural affiliation among advisors than among this particular group of landowners. This may explain the emphasis advisors placed on wildlife and CRP plantings when these options were not selected by landowners. CRP was a new, high priority agricultural program at the time of the survey. It should be noted that in many cases, advisors' responsibilities may be broader than just advising private landowners, sometimes embracing commercial, municipal or government managed lands as well.

Practice	Advisors n = 75		Landowners n = 287	
	percent	rank	percent	rank
Forestland grazing	34	1	39	1
Windbreaks & enrichment plantings	30	2	+	+
(Windbreaks)	-	-	34	2
(Shelter planting)	-	-	6	5
(Forage planting)	-	-	1	6
Wildlife/CRP[1]	16	3	+	+
Special forest products[2]	-	-	12	3
Orchard grazing or intercropping	10	4	7	4
Riparian enhancement	10	4	+	+

- not suggested by land management advisors
+ not offered to, nor volunteered by landowners
[1] CRP stands for the Conservation Reserve Program, a resource conservation and production limiting incentive program offered by the US Department of Agriculture. Wildlife habitat enhancement is also a component of the program.
[2] Non-timber forest resources, e.g. mushrooms or floral greens grown in forest stands.

Table 1. Practices advocated by land management advisors compared to practices used by Washington State agroforesters.

Opportunities and advantages of agroforestry

Both advisors and landowners identified similar advantages but they were chosen in differing order of frequency (Table 2). Landowners most often selected aesthetics while advisors most often selected diversifying land use. The second most frequent choice for both groups was enhancing productivity. Some choices shared the same frequency of selection, thus income related factors were also among the three most frequently selected advantages or opportunities (#2 for landowners, #3 for advisors). Landowners had two choices related to income: increase income was chosen more often than diversify income, while advisors indicated that diversity would be the major income related opportunity.

It is interesting that the landowner's emphases on water conservation and microclimate improvement were not anticipated by land management advisors. Yet only 48 percent of the landowners responding were from eastern Washington counties where water availability may limit production. Riparian enhancement, amelioration of marginal lands and pest control were of more interest to advisors than landowners. Landowners gave more attention to reducing fuel, fertilizer, and pesticide inputs than did advisors even though this was the focus of major new government programs at the time of the survey. Landowners gave equal attention to increasing biodiversity and soil erosion control while advisors saw increasing biodiversity as a greater opportunity than soil conservation. This is interesting because many of the advisors are responsible for controlling soil erosion while biodiversity is a relatively recent concern for which none of the groups had any official responsibility.

It should be noted that among the landowners, responses of agroforesters (57 percent of respondents) and non-agroforesters (43 percent) are pooled. The only statistical differences between these two groups' responses concerning potential advantages of agroforestry were that agroforesters selected aesthetics, increase income, water conservation, and diversify productive and economic base more frequently than did non-agroforesters (Lawrence at al., 1992) .

Obstacles and disadvantages of agroforestry

Advisors were asked to identify obstacles to agroforestry while landowners were asked two different questions probing this topic. First, landowners were asked why *other* landowners might choose not to use agroforestry, and second, what disadvantages they perceived to agroforestry. In this manner, landowners could account for differences between their own situations and what they perceived the situations of their peers to be. There may also be cases in which the first question, being less personal, might elicit responses that would otherwise be omitted (e.g. relating to personal finances).

Lack of information was the greatest disincentive identified by advisors and landowners when referring to others. Landowners did not select lack of information when referring to their personal situation, perhaps viewing themselves as better informed than others. Less frequent selection of lack of research by landowners and omission of this by advisors implies that it is believed that more information exists about agroforestry than is generally available.

Establishment costs and lack of financial assistance were the most frequent, and third most frequent disadvantages selected by landowners, while advisors cited establishment costs as the third most frequent obstacle and did not mention lack of financial assistance. Landowner's assessment that others might not view agroforestry as commercially viable again reinforces the importance of financial criteria in making decisions about land uses. In contrast, the advisor's second most frequently cited obstacle, lack of technical assistance, was not mentioned by landowners. This difference between providers and potential consumers of technical assistance is intriguing. Perhaps landowners view advisors as a source of information and do not see sources as lacking, only relevant information. Both NRCS and extension personnel reported that lack of money, time and materials constrain agroforestry technical assistance (Lawrence and Hardesty, 1992) .

Agroforestry not being an established practice was seen as an obstacle by both advisors and landowners when referring to others. Landowner respondents apparently view themselves as more independent or innovative than they expect their peers to be. Both advisors and land-

Table 2. Comparison of advisor's perceptions of opportunities and landowner's perceptions of advantages of agroforestry in Washington State.

Opportunity or advantage	Advisors n = 75 percent	rank	Landowners n = 287 percent	rank
Diversify land use	25	1	+	+
(Diversify productive & income base)	-	-	68	5
(Integrate conservation and production)	-	-	72	3
Enhance productivity	18	2	+	+
(Improve soil productivity)	-	-	75	2
Aesthetics	13	3	78	1
Income diversity	13	3	+	+
(Diversify productive & income base)	-	-	68	5
Increase income	-	-	75	2
Increase biodiversity	10	4	66	6
Riparian enhancement	7	5	+	+
Ameliorate marginal lands	6	6	+	+
(Microclimate improvement)	-	-	54	8
Pest control	5	7	+	+
(Decrease fuel, fertilizer, pesticides)	-	-	58	7
Soil erosion control	5	7	66	6
Water conservation	-	-	70	4

\- not suggested by land management advisors
\+ not offered to, not volunteered by, landowners

owners selected management related concerns with comparable frequency, perhaps reflecting the lack of information cited earlier.

Lack of access to plant and animal stocks was cited surprisingly often when landowners anticipated others' difficulties. It is not clear if this lack of access is financial, or just that animals or trees are not currently components of others' production systems; however, landowners saw this as a disincentive much more often than advisors did (Table 3). A major disadvantage identified by landowners was livestock damage to trees and crops (and less often, soil compaction). The extent of this concern was not anticipated by land management advisors, who may not have envisioned livestock being as integral a part of agroforestry systems as they are to landowners. Likewise, it appears that landowners experienced or anticipated more difficulties with trees as obstacles, and more hazard from pests than did advisors.

Interestingly, advisors were concerned about markets for agroforestry products but landowners did not mention this. We do not know if the same products are envisioned by both groups, but apparently, landowners do not plan to invest in products they cannot market. The non-commodity values of agroforestry (such as aesthetics) may compensate for lack of marketability, or sales of new products may not be the objective of using agroforestry. Matthews et al.(1994) found that many landowners did not find agroforestry profitable, but participated for the stewardship value. Landowner respondents in Washington also consider non-commodity values. The most frequent reasons for owning land among agroforesters and non-agroforesters alike were: to pass on to children (80 percent of respondents), to keep it natural (75 percent), a place to retire (73 percent), income from timber (72 percent), and current or future home site (72 percent) (Lawrence et al., 1992). It is encouraging that these motivations are compatible with many current definitions of sustainability.

There were no statistically significant differences between agroforesters' and non-agroforesters' responses to the question about why others would not use agroforestry. The only statistically significant differences between these two groups relating to disadvantages were that non-agroforesters expressed more frequent concern about financial assistance and pests than did agroforesters. These differences are explored in detail by Lawrence et al. (1992).

Egan and Jones (1993) remind us of an important caveat to all survey research, respondent's behavior does not always match their own reports or predictions. As with all survey results, these must be interpreted with caution, and in the context of other knowledge.

Conclusions

We have few data by which to determine who is "right" when advisors' and landowners' views differ, or even if both are "right" when they concur: we cannot know exactly the situations or definitions each group envisioned as the questionnaires were completed. But where common visions exist, and are consistent with what is known about the performance of various agroforestry systems in the region (Hardesty and Lyon, 1994), then a situation exists in which the two groups can work together to implement land management practices that maximize the advantages that both see as desirable.

There are several key areas where land management advisors and landowners agree. Both groups acknowledge that lack of technical information and support is constraining use of agroforestry. Thirty-nine percent of the landowners expressed interest in specific types of agroforestry information, most often management of trees (100 percent), special forest products (91 percent) and livestock (76 percent) in agroforestry systems. In addition, 76 percent of the land management advisors were interested in participating further in this project and 94 percent wanted to learn more about agroforestry.

Concurrence on this topic suggests that agroforestry use could be successfully increased through informational programs directed at either group. Snyder and Broderick (1992) emphasize the importance of opinion leaders in the adoption process and demonstrate that peers as well as "authorities" can influence others' voluntary behavior.

Another area of general agreement was the degree of interest in livestock in agroforestry systems. Not only was forest grazing the most common agroforestry practice, but several of the less common practices—enrichment planting and orchard grazing, also involved livestock. Overall, at least 55 percent of the agroforestry practices reported by landowners included an identifiable livestock component. Landowner's

concerns about livestock damage and identification of lack of livestock, or access to livestock facilities, as an obstacle to agroforestry adoption also suggest that the degree to which livestock are a desired component of agroforestry systems may be underestimated by advisors. Matthews et al. (1994) found that farmers with livestock were more likely to make riparian plantings than farmers with no livestock. Problems associated with livestock need greater attention if the use of agroforestry is to be optimized. This suggests not only a need for research on animal agroforestry, but also that range managers and agricultural extension agents may be an appropriate audience for agroforestry training and materials.

The good news is that agroforestry is in common use in Washington State and there is strong interest in agroforestry practices, even among those who do not use it or advocate it at this time. Those advocating agroforestry should give particular attention to its financial implications, conservation value, and aesthetic benefits. Concerns about costs, livestock damage, and logistical aspects such as interference with operation of machinery should also be anticipated and addressed.

Programs designed to reach landowners through advisors might be enhanced by additional direct contact with landowners, or perhaps through the use of landowner advisory groups. Snyder and Broderick (1992) describe a landowner to landowner educational program designed to enhance adoption of wildlife habitat management practices. A comparable model for agroforestry might alleviate some of the time constraints on advisors and allow more effective communication on topics such as livestock damage and finances that concern landowners more than advisors. Both of the original surveys and this comparison highlight the potential of agroforestry to satisfy a variety of production and conservation objectives of non-industrial private forest landowners and the public.

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Table 3. Constraints to agroforestry identified by land management advisors compared to landowner's perceptions of why others would not choose to practice agroforestry and their own perceived disadvantages of agroforestry.

	Advisors n = 75 Constraints		Landowners n = 287 Why others..			
					Disadvantages	
	%	rank	%	rank	%	rank
Lack of information	28	1	+	+	+	+
(Lack research)	-	-	54	4	+	+
(Lack technical assistance/educational support)	-	-	69	1	+	+
Lack technical assistance	18	2	+	+	+	+
Establishment costs	15	3	+	+	66	1
(Lack $ assistance)	-	-	+	+	61	3
Not established practice	15	3	+	+	+	+
(Not commercially viable)	-	-	58	2	+	+
(Bias against combining livestock & trees)	-	-	38	5	+	+
(Bias of peers)	-	-	36	6	+	+
Lack of management experience	10	4	+	+	+	+
(Complicated to manage)	-	-	+	+	47	4
Livestock damage to trees or crops	7	5	+	+	64	2
(Livestock compact soil)	-	-	+	+	39	7
No market for products	3	6	+	+	+	+
Lack access to plant/animal stock	2	7	58	2	+	+

NEWS & NOTES

Have you ever wanted a wilderness experience?

For over 50 years, Outward Bound has provided the opportunity for wilderness experience. Founded in Aberdovey, Wales, Outward Bound was originally designed to help young men defeat their depression caused by the lack of opportunities in Britain. The program spread to the United States in 1951. Today there are over forty Outward Bound in twenty-nine countries.

A traditional Outward Bound program consists of five core elements. They include a training phase, an expedition phase, solo, final phase, and concluding phase. Each phase is designed to build self-esteem, encourage camaraderie, instill leadership skills, encourage an environmental ethic and develop physical conditioning. A standard course lasts 23-26 days. However, there are courses designed that vary from 4-80 days. Outward Bound normally caters to youth between the ages of 16-24 but also serves other populations.

Outward Bound has an ongoing partnership with the U.S. Forest Service. The symbiotic relationship allows Outward Bound programs to utilize Forest Service lands. The Outward Bound students, in turn, work alongside Forest Service personnel in maintaining trails and campsites and educating wilderness users.

Outward Bound has made great efforts to promote diversity. Specifically, they have reached out to people having different socioeconomic and physical conditions, gender, and race. Outward Bound is also making efforts to include urban environments in their programs. As the 21st century approaches, Outward Bound hopes to instill a stewardship ethic in the global environment.

Katrina S. Abbott, *Journal of Wilderness,* Vol. 1, Number 1

After you have downshifted, then what?

The hardest thing for many fast-track women to give up is not the material rewards of the job, but the sense of identity it provides. When Susan Wittig Albert, author of *Work of Her Own: A Woman's Guide to Success Off the Career Track,* stepped down from a draining position as a college vice president, she felt at first that "my life had no meaning. Without the work that filled up my days, I was empty, I was not real." Another friend, the erstwhile executive editor, spent her first few months of freedom "piddling," as she put it—"setting up my office, taking all morning to answer my mail, getting depressed." Success, for most of us, has meant being in the loop, having more phone messages and faxes than we can answer, scurrying into meetings 10 minutes late. Measuring success in a new way—as calm and deliberate achievement instead of frenetic busyness—takes some getting used to.

Work, after all, is much more than a means to an end. In standard American usage, "hardworking" is synonymous with "decent," "reliable" and possibly "saved." Professionals especially tend to confuse work with self, and even to see mere busyness as a mark of status. I can remember my embarrassment in a gathering of high-powered women when the time came to schedule the next meeting and I opened my appointment book to reveal a vast, weeklong empty expanse. According to Benjamin Hunnicutt, a professor of leisure studies at the University of Iowa, Americans have come to see work as a kind of religion. It is in work, he argues, rather than in traditional religion, that "we look for the answers to the cosmic questions, such as "Who am I? Where am I going?"'

For today's downshifters, the solution is to discover what radical priest and voluntary-simplicity guru Mathew Fox terms their "soul work." Susan Wittig Albert now fills her days writing, volunteering, gardening and woodworking... My friend the former editor applies her administrative skills at a shelter for homeless children. To an extent, they all still measure their worth by their work. The difference is that they no longer measure the worth of their work in dollars.

Barbara Ehrenreich, *Working Woman,* December 1995

Painful and plain truth not faced easily

It could be said that in the 50 years since the German field marshal Wilhelm Keitel laid down his staff and his hat on a Berlin table, and the war in Europe ended, Germans have been trying to talk their way out of an unutterable past and back into what they like to call History. They have been talking mainly to one another. History is a German obsession and a German metier. There are people who claim that, with Hegel and the great 19th Century historiographers, Germans actually invented history, and it is certainly true that the country now produces historians the way Italy produces lawyers, or Argentina psychoanalysts—in aggressive, even defiant, disproportion. By History, Germans mean German history. They call it a Wissenschaft, a science, but it is arguably more alchemy than science, since it has always had to do with turning the myths, memories, and language of "Germanness" into a kind of collective destiny known as the German nation. It may be history's revenge that today, 50 years after the surrender, Germans are still arguing about what to do with the destiny that they invented.

For practical, political purposes--purposes of state--the negotiation of a new German past began six years ago, when the Wall came down, though some Germans have put it much later, somewhere around the time Schindler's List opened in Berlin and the prospect of what could be called "the past of the good Germans" was suddenly so evident and so exhilarating. Some say that it was Helmut Kohl's project all along—this new and revised Germany, settled into its history, comfortable, even in its history. Call it--this is the past of choice--Victim Germany. It is the Germany that Hitler "seized" in 1933 and "occupied" for 12 dark years; the Germany that was "liberated" in 1945, as if it were Holland, or a concentration camp. And it may have been the inevitable Germany, because once the Wall fell, in November of 1989, this Germany turned out to be the only version of themselves that East Germans and West Germans could be brought to hold in common.

The two Germanys do not much like each other now that they are one Germany, or agree on anything beyond a taste in cars, but they share this: they are determined to settle their crimes into "history." They want to resolve a duty to remember and a longing to forget, as if duty and desire were the thesis and antithesis of a dialectic of destiny. They have a stubborn, almost innocent German faith that their past is like their prime rate or their GNP--something that with a good plan and a lot of attention can be adjusted, refreshed, pressed into the service of the new German nation. After 50 years, they have lost patience with the painful plain truths of recapitulation. They prefer the symbolic simplicities of objectification--the monuments, memorials, and "commemorative sites" that take memory and deposit it, so to speak, in the landscape, where it can be visited at appropriate ceremonial moments, but where it does not interfere unduly with the business of life at hand.

Jane Kramer, *The New Yorker,* August 14, 1995

University of Wisconsin scores high in fighting sexual harassment

Sexual harassment complaints have dropped by half within the 150,000-student system over the last two years. The number of complaints went from 170 to 85 in 1994. University officials attribute the drop to greater awareness and a desire on the part of complainants to resolve matters informally. Sylvia Banuelos, a complaint investigator with the office of affirmative action and compliance at UW-Madison, explains

that women are now better equipped to handle potential sexual harassment situations, thereby heading off more egregious behavior or formal complaint procedures. "The women on campus are more assertive and able to speak up when they reach a certain discomfort level," Banuelos explains. "I've consulted with many women who choose to confront the person who is allegedly harassing them through a letter or a private discussion with a department representative who acts as a facilitator." About one third of the calls she gets through their office are regarding alleged sexual harassment situations.

There are many different options to work with. At the Madison campus each department has a designated "sexual harassment contact person" trained in the issue and relevant laws. An education trainer also works with those individuals identified by their department as in need of awareness training.

However, problems persist. "The message that not only is this inappropriate, but potentially illegal, has not permeated" traditionally male-dominated departments, Banuelos explains. Because deans and chairs usually try to take care of these incidents internally, the AAO has no way of tracking the less extreme cases. In at least two cases filed since 1993, professors resigned soon after they were confronted with the charges made against them.

The Monthly Forum on Women in Higher Education, December 1995

Armed bargain

Because Idaho Department of Fish and Game (IDFG) conservation officers spend most of their time enforcing fish and game laws, the broader role they play in law enforcement is often overlooked. As bonafide peace officers, conservation officers are charged with enforcing all Idaho laws and protecting the public. Thanks to these dedicated professionals, Idahoans have 116 more law-enforcement personnel in the field to protect them. And this additional protection costs the Idaho taxpayer nothing. "Hunters and anglers pay our salaries by purchasing licenses and tags, but all Idahoans benefit from our presence," conservation officer Tom Pokalski points out. "In many places, we're the only 'law' for miles."

Nationwide, the cry for increased law enforcement protection is unrelenting. Yet, at a time when Idaho's conservation officers are more valuable than ever, some people want these officers disarmed. Why? Conservation officer Al Nicholson suggests lack of knowledge is one reason. "More than once I've heard 'You don't need a gun to check a deer tag or a fishing license.' That's right, 99 percent of the time—the average hunter or angler accepts our wildlife law enforcement authority. But a few bad apples don't, and carrying a weapon can make a difference with them." Pokalski agrees. "Some people see us simply as outdoor referees, not realizing that our responsibilities have grown. When I explain what we do, most people develop a whole new appreciation for the demands on us." Moose, elk, and even deer can be formidable foes in the wrong set of circumstances. Large predators—mountain lions, bears, and dogs—can also endanger an officer. A policy change allowed officers to carry oleoresin capsicum, a red pepper spray and gives conservation officers another weapon.

Confrontations that force a conservation officer to draw a weapon against a human in self-defense are increasing at an alarming rate. In 1989, Idaho had the fourth-highest assault rate at 3.26 percent, which jumped to 4.1 in 1994, just slightly less than assault rates against Idaho State Police (4.1 percent). Far from complaining, the people of Idaho and their elected representatives clearly and decisively approve of conservation officers and the job they are doing. Findings from a 1994 independent review of the IDFG dramatically illustrate just how supportive Idahoans are of their conservation officers.

Evin Oneale, *Idaho Wildlife,* Hunting 1995

Practicing what they preach

By the end of the decade, the word "green" may have a whole new meaning when applied to the environmental world. This green refers to money and economic growth, and environmentalists are out to prove that it is not as incompatible with its agenda as the business press, right-wing think tanks, and anti-green movements would make you think. The clearest example of this is the Bronx Community Paper Company, a $200 million de-inking mill that, if it's built, will be owned by a nonprofit housing group and two paper manufacturers. The entire operation was spearheaded by the Natural Resources Defense Council (NRDC), whose senior scientist, Allen Hershkowitz, calls the project the "next phase of environmentalism," in which groups like NRDC would promote, rather than fight, economic development. For the mainstream greens, it is their version of Nixon going to China.

James Bradley, *E, the Environment Magazine*, December 1995

Still haven't written your holiday thank yous?

A couple of years ago, I tried to ease the burden on my children for writing thank you notes by teaching them to write them the way Daddy does: on a computer, with lots of boilerplate text that can be cut and pasted. They caught on immediately, and made refinements of their own, such as the discovery that the liberal use of clip art can make a short letter seem long without arousing the suspicions of a pre-digital grandmother. Still, the minimal effort involved in composing even a single all-purpose paragraph seems excessive to them. Why not abandon the exercise entirely?

This year, I have been working on another idea. With the help of an off-the-shelf computer program, I have created a new legal document, called a Power of Beneficiary. I am going to send one to every person who normally gives me presents, and it will permanently relieve me of the obligation to thank them. In effect, it will authorize my relatives and friends to be grateful to themselves, in my stead, for their kindness to me. Similarly, I plan to extend to others the right not to thank me for anything I might give them—perhaps through another legal document, an Irrevocable Waiver of Gratitude.

Despite the foregoing, I am not opposed to all forms of overt appreciation. There are even times when I myself enjoy being thanked, as in "Thank you for setting me straight on that," or "Thanks for pointing out the logical flaws in my attempted

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Jessie A. Micales

Research In Progress

Focus on: Restoration Ecology

Monitoring the effects of stream diversion in the Sierra Nevada

Edith Read
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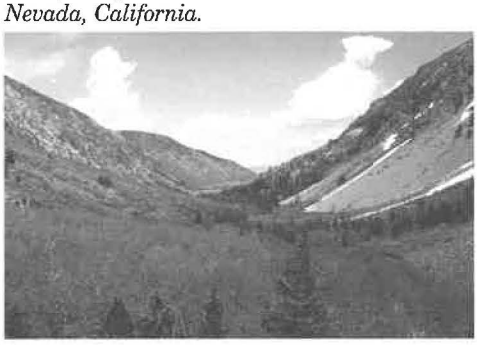
When most people think of habitat restoration, they think of the end product—a self-sustaining ecosystem or natural community that can function independently of humans once it is established. While the essential elements of ecosystem functions are understood, the details of these systems vary by every imaginable parameter: latitude, soil features, geologic history, proximity to groundwater, proximity to urban centers, fire history, and so on. These details are perhaps manageable, or at least predictable, when one is dealing with a few acres of habitat and a decent database on site conditions. Larger systems like watersheds are much more complex, but this is the scale at which many human impacts occur. Dealing with these impacts while meeting human needs is the realistic problem.

I am presently monitoring the effects of hydropower projects and stream diversion on natural resources as part of a contract with a major utility company. The project involves riparian (streamside) vegetation and trout habitat in the eastern Sierra Nevada of California. The goal of the U.S. Forest Service, which is acting as the regulating agency, is to restore the vegetation and trout habitats back to at least 80 percent of their original state, primarily by requiring increases in stream flow releases from dams. Unfortunately, the hydropower project has been in place for almost 100 years, so there is no database of habitat conditions on the watershed before the hydroelectric project. No one knows what 80 percent of the original habitat means! There are also no places to establish control sites, or sites that have been unaffected by stream diversions, since there is too much diversity in geological and hydrological conditions.

Below: Riparian habitat in Lundy Canyon, eastern Sierra Nevada, California.



As a result, what we are doing is monitoring sites over many years to see how the habitats on these sites change, if at all, in relation to changes in streamflow. We already know that plants and fish cannot survive without water. The key question that the utility company wants answered is how they can continue to operate profitably, provide a reliable source of electricity to the public, and not significantly impact the habitat. A wide range of parameters is measured to find the answers to these questions, ranging from groundwater levels to plant species diversity and tree cover. We have also studied tree growth, as measured by tree rings visible on small core samples, in comparison to historical stream flow records.

We are a long way from completing the project, but we have data that support at least three major themes:

•We have learned that the groundwater table on which many riparian plant species depend, especially cottonwoods, cannot rise indefinitely with increasing stream flow. There is a point at which additional stream flow below the dams will have no measurable effect on depth to groundwater. This finding places an upper limit on how much riparian vegetation can be supported on any given site. Thus, it is not enough to simply say that we want to restore "X" amount of vegetation by increasing stream flow to "Y" amount. We need to look at the groundwater to see what the relationship between X and Y will really be.

•Our observations also support the importance of sand and gravel deposition within the streambed for the recruitment of willows and cottonwoods. Seedlings of these species establish best where they are free from competition and have adequate moisture levels that can be sustained during their first few growing seasons. These ideal sites are typically along the stream edge or on sand and gravel bars that are elevated above stream level. The hydropower dams trap this sediment, disrupting the natural processes of sediment deposition. In the bouldered, glacially-deposited terrain of our study sites, sediment input into the stream is already limited. We will be working with the power company to find ways of reducing this type of impact on the stream system.

•Tree ring data from the oldest trees in the watershed, which pre-date the hydropower diversions, indicate that hydrological conditions on the watershed were starting to change before the dams were built. We also have soil profile data that show a history of long-term changes in the climate of this area that coincided with the construction of the dams.

Future work will be focused on analyzing data collected over the past few years. These data will be used to develop empirical models of the stream systems that can be used by the power company to provide realistic predictions of their operation's effects on habitats. Such models are potentially adaptable to other stream systems. Having these data available is especially desirable for natural resource managers who cannot wait decades for answers to complex watershed questions.

Edith Read received her B.S. in Biology from the University of California, Irvine in 1977. After working in the nursery industry for four years, she received an M.A. in Biology from California State University, Fullerton and a Ph.D. from UC Irvine in 1989. She is currently working for Psomas and Associates, a multi-discipline company with projects that include surveying, civil engineering, hydrology, habitat restoration, endangered species management, and geographical information systems.

Restoration of the Upper Ocklawaha River: The Emeralda Marsh Conservation Area

Joy E. Marburger
St. Johns River Water Management District, Palatka, Forida

The Ocklawaha River, approximately 96 miles long, was once one of Florida's great rivers with dense cypress and bottomland hardwood forests extending along its banks. Just above its headwaters near Lake Apopka in central Florida, vast sawgrass prairies extended beyond the forested swamps. Since the early 1900s, the river has undergone human-induced changes such as channelization to improve navigation and to increase access for development. Levees and canals were built during the 1920s to drain the marshes of the extensive floodplains for crop production.

Large-scale agricultural projects were initiated in the 1950s. Much of the sawgrass prairie was lost and the cypress trees logged for lumber. Many of the lakes and streams became eutrophic due to drainage of excess nutrients from the farmland. Large-scale farm development of the 1950s and 1960s resulted in draining of the highly organic peat soils and burning of the sawgrass marshes.

During the late 1980s and early 1990s, the St. Johns River Water Management District (SJRWMD) began purchasing many of the agricultural properties to help restore the Upper Ocklawaha River Basin. One such project, the Emeralda Marsh Conservation Area (EMCA), includes about 7,000 acres of former cattle ranches and muck farms that border the eastern side of Lake Griffin. The SJRWMD manages public ownership of these land acquisitions. Funding for restoration and management is provided mainly through the Surface Water Improvement and Management Act (SWIM).

Restoration of the EMCA is limited by the hydrological conditions that currently exist. Water control structures determine the flow of water to Lake Griffin from other lakes through artificial canals and a channeled stream. Seasonal water fluctuations have been dampened to reduce the possibility of residential flooding and to provide water storage for navigation and recreation. Thus the periodic fluctuations required to maintain sawgrass prairies in the majority of the former peatlands no longer occur.

Intensive agricultural use has resulted in soil compaction and oxidation of the organic peat where the sawgrass prairies once existed; thus large areas of the EMCA will be permanently inundated. The size of the area and the high costs of active water level management to restore sawgrass prairie haveresulted in an alternative management approach. Water levels will fluctuate with Lake Griffin according to a modified lake stage schedule that allows some increase in water level fluctuations on the acquired properties.

The primary restoration goals are

(1) long-term water quality improvement by reducing nutrient inputs from former farmland adjacent to Lake Griffin, and

(2) establishment of fish and wildlife habitat by managing the developing wetlands and aquatic areas.

Control of exotic plant species such as water hyacinth (Eichhornia crassipes) and hydrilla (Hydrilla verticellata) is required to promote establishment of native plant species. District personnel are currently developing a monitoring program to determine the success in achieving restoration goals. Restoration activities during the past two years have attracted large populations of migratory waterfowl and wading birds and provided large recreational fishing areas.

Several agencies have been involved in restoration activities at the EMCA. Other District staff and I are currently monitoring hydrology, water quality, sediments, vegetation changes, and avian populations in the EMCA. The Florida Game and Fresh Water Fish Commission is conducting surveys of fish and alligator populations. We have involved the Audubon Society in conducting monthly bird counts. Ducks Unlimited is interested in enhancing wood duck habitat at the site. Researchers from the University of Florida are evaluating the nutrient flux from the recently flooded agricultural soils.

Information from these studies will help us understand why Lake Griffin has become hypereutrophic and no longer supports large-mouth bass. The intent of monitoring the changes occurring at the site is to establish management strategies for system-wide water quality improvement and wildlife habitat creation, as well as provide recreational usage.

Working the wetlands of Florida is a totally different experience than my earlier one of working in the sedge meadows of Illinois. One month after moving here in 1993, I was walking transects in a 60-acre floating marsh when I noticed that my other companions in the marsh were water moccasins and alligators. Since that time I have encountered only one water moccasin. The alligators, however, are very numerous but stay within a safe distance to observe human activities in their habitat.

Joy Marburger has a B.S. in Biology from Allegheny College (Pennsylvania), a M.S. in Biology from Bowling Green State University (Ohio), and a Ph.D. in Plant Genetics from the University of Maryland.

Below: Joy Marburger and Dave Douglas (Florida Game and Fresh Water Fish Commission) installing wetland plants in saturated soils of a flooded farm in the EMCA.

JOAN COMANOR

AN INTERVIEW BY DAINA DRAVNIEKS APPLE

INTERVIEW

WiNR: As the first female to become Deputy Chief in the Forest Service, did you find it difficult to become accepted by the management team?

Comanor: I would like to think that being female was not an issue, that I was just another new person coming into a job because I did not find it difficult to feel accepted. What may have helped is that many of the other members of the top management team were also in transition. There are only two, the Deputy Chief-Research, and Deputy Chief-Programs and Legislation, who have been in their current positions for any length of time at all. Most of us came on as a peer group of new or relatively new people into those positions but many of us had worked together prior to these particular roles. If this were even 10 years earlier, I might have answered that differently.

We have a number of women who are members of the National Leadership Team (NLT). I can sense how the dynamic is different from earlier years as a consequence of that. Every now and again I think about it in those terms—that this is being discussed in this way—or the concerns we are expressing in this way are being expressed more openly because there are more women on the leadership team. I think we all focus more on *effects* of decisions on people and that influences how we address issues—revealing more humanness.

WiNR: Especially when discussing downsizing, for example?

Comanor: Yes. I think all of us, men and women, are more open in expressing ourselves in human terms as opposed to, "Well, we've got this program result done, so many numbers placed."

WiNR: I think that the Forest Service has tried to be a more humanistic organization, rather than stay in the command/control system, in the managing of employees. Very consciously, it's tried to train people, especially as they move up, to be facilitative.

Comanor: Dave Unger, particularly, in his daily leadership role in the agency, has made it clear that we should all, as individuals, feel open to speak. It's been made clear that it is OK to express differences constructively. We very, very rarely shoot the messengers.

WiNR: I'd like to hear about your previous career prior to coming to the Forest Service.

Comanor: I sampled several different things. I worked in the private sector. And I worked overseas with the State Department building on a lifelong interest in France and things French. I had minored in French, and lo and behold, got an opportunity to work in the ambassador's office in Paris. I was working there when the environmental movement in the early seventies was really booming. I returned to the States and finished my degree in natural resources.

Because I had grown up in the South, the most visible, known agency to me was the Park Service, so I thought I would like to work for them—but then I discovered there was a Bureau of Land Management, and there was an agency called the Forest Service. After finishing my degree, I got a job with the Bureau of Land Management, worked in Nevada for six years, and then transferred to the Washington office of BLM.

WiNR: What positions did you hold in BLM?

Comanor: When I first started looking, the only job they had open in Nevada, was in public affairs. They really had wanted a journalism major, because this was the first public affairs person they'd had on the District (equivalent to our Forest level). I convinced them that I could write well and speak comfortably, knew resources, and talked my way into getting that job.

I transitioned from public affairs into an environmental coordinator position and also became involved in land management planning. During the mid-1970s, BLM saw rapid development in the Wild Horse and Burro program, especially in Nevada. I got involved in that and subsequently transferred to the Washington office of BLM on their brand new Wild Horse and Burro staff. In the mid-eighties, I worked in the Eastern Regional Office of BLM as Branch Chief of Renewable Resources.

WiNR: When did you go to the Forest Service?

Comanor: In 1986. I think I happened to be in the right place at the right time for an opening that gave me an opportunity to cotinue building on my past experiences. Another reason that was motivating me was curiosity about how the much larger sister agency operated. BLM and the Forest Service are very much alike in many respects. I was hired in the Range Management staff of

the Forest Service as the budget coordinator. I helped in an effort to strengthen the range program, taking an ecological approach to range issues. We got that up and running, we added more staff, and it became known as Change on the Range. In the late 1980s, USDA committed to opening up the Senior Exec levels to include women and minorities. I was encouraged to apply for the Senior Executive development program and was selected as the first woman from the Forest Service to participate in that.

WiNR: How long were you on the Range staff?

Comanor: About three years.

WiNR: I met you in 1988-89 when I was on detail as Al West's, (State and Private Forestry Deputy Chief) staff assistant.

Comanor: At that time I would have been on the Cooperative Forestry staff. I was the Assistant Director for Rural Forest Resource Programs. I learned about delivering natural resources programs on the non-federal forests in the country—about the different partnerships and different relationships that we have, and how, through voluntary methods, we can influence improved management of private forest lands.

WiNR: To backtrack just a bit, did you have a lot of professional adjustment to make from BLM when you came to the Forest Service?

Comanor: It was an easy transition in very many ways. Many of the public land programs are very similar. The laws are in many cases the same, and where they are different, there are minor differences. Having worked with some of the people, it was more comfortable than I thought it might be. But it's always intimidating to leave an agency that you've worked with for 11 years, where you knew a lot of the people, to come into a much larger agency.

WiNR: Was the management style very different?

Comanor: I think the Forest Service is more systematic because the Forest Service has far more employees We have stronger budgets so we were often able to get more done. There were more opportunities for training and opportunities for details. The agency prides itself on its professionalism and in some ways that was very nurturing for me. BLM has those same kinds of qualities, but it doesn't have the depth in terms of number of employees, size of budget, or 100 years of history and tradition to build upon. At that time there were major concerns about workforce diversification in both agencies. Even with the similarities, I felt the trepidations one always feels before a big change: "I don't know anybody," "will I be accepted?"—but overall, the Forest Service offered a very welcoming, supportive, positive climate.

WiNR: Back to the chronology—where did you go next?

Comanor: From Assistant Director of Cooperative Forestry, my first Senior Executive Service position was Director of Land Management Planning. At that point I got to tie back to some of my early career experiences with the BLM and the planning we were doing there. I recall a faculty member in college jokingly saying that when you start working in your career field, you'll find that you'll do very many different things from what you're studying. One of the areas of concentration that I pursued was wild land planning. So it took about 20 years to cycle back into that full time. It was also a good time to be in planning. We were trying to overhaul, simplify, and streamline the planning process. I spent about three years doing that, and we're about to see the results five years later. From that position, I became the Deputy Chief of State and Private Forestry.

WiNR: So you went straight to Deputy Chief without being the Associate which is more typical?

Comanor: Yes. When I mentor people, I always advise that there are three elements to focus on in terms of helping your own career development. Always maintain a strong grounding in your area of expertise, the "what you know." You also have to invest in the "who you know" and make sure you have a good network, not only in your area of expertise, but in related ones. The third element in realizing career aspirations is timing—a "wild card" which a person can do very little to influence. I can trace very specific times I got to do something new to being in the right place at the right time with the right kinds of credentials. All three elements had to align or the opportunity simply would not have happened.

Joan Comanor is Deputy Chief, State and Private Forests, for the USDA Forest Service. Her programs are among the most flexible and partnership-intensive in the agency, crossing jurisdictional and administrative boundaries routinely.

WiNR: Tell us what you do as Deputy Chief of State and Private Forestry.

Comanor: One of the program areas that I'm responsible for is Cooperative Forestry. Those include an array of technical and financial assistance programs targeted (1) toward rural forest landowners, (2) toward communities for community forestry, and (3) toward natural resource rural communities for economic assistance when they're in transition.

I'm also responsible for Forest Insect and Disease Management. Those programs provide direct management on the National Forest System lands, and assist other federal land managing agencies to deal with their insect and disease problems, as well as to state and local governments and private landowners. That

program area crosses all the agency boundaries. The third set of programs is Fire and Aviation Management which deals with fire protection and management on the National Forests, and assistance off the national forest lands on wild land fire issues. With states we provide technical assistance and training and we benefit from having reciprocal agreements for help in fire fighting. In a similar way, we oversee and coordinate use of aircraft in natural resource applications ranging from inventory or remote sensing operations to firefighting. Finally, I am also assigned oversight of Tribal Government relationships for the agency—another important element for the Forest Service.

WiNR: Is there some commonality among the programs?

Comanor: Yes. The element that I would characterize in common is a crossing of the administrative or jurisdictional boundaries. Forest insects and disease don't make distinctions when they go from one ownership to the other, and they can't be addressed unless you're working at multiple scales and ownership; same with the wild land fires which will burn as long as they have fuel. The nonfederal owners of forest land in the country who are interested in good healthy forests for wildlife habitat, for clean water and clean air, all need to be working together. That's the reason the mission area is called State and Private Forestry—which can be somewhat mysterious in terms of what that really means—but the concept is addressing resource issues in an across-the-boundaries mode. In addition to the specific programs, it's part of the agency mission in terms of maintaining good relationships with others who are key players in bringing a conservation ethic to people and to having our natural resources managed on a sustainable basis. We forge the linkages to others who help shape America's forest resources.

WiNR: Describe the role of each state's foresters in all this.

Comanor: They are key partners. By law they are our field troops for delivering certain specific programs, and as such, they are an extension of our own employees. They are delivering federal partnership programs, just as our field employees deliver wildlife management or whatever on the National Forest System. They have a mandate to deliver, on our behalf, the Forest Stewardship Program or the Urban Forestry Program, for example, to nonfederal customers. So they are part family as well as partners. An original part of the agency's mission in State and Private, was to build capacity to work with states to build strong state forestry organizations. I like to think that that mission has long since been accomplished.

WiNR: So the Forest Service helped develop the state forestry capacity. How do you interact now with the state foresters?

Comanor: As I said, we work as full, equal partners in some specific programs. We also work together on public policy issues relating to forestry. We share information, technology, and training to more effectively deliver programs to stay current on issues. Because the benefits accrue not only to the federal government or to the national interests, but also to local interests, there is a matching requirement. In other words, if we put X federal dollars on the table to help improve privately-owned forest land, there is a matching requirement that states must make to help deliver that program since both the federal and state governments achieve shared objectives.

Smokey, fire prevention, and wildland fire management fall under Comanor's responsibility.

WiNR: Do we monitor that to make sure that the results are accomplished?

Comanor: Of course. It's really very comparable in many ways to how we would hold our Regions accountable or the Region would hold the individual National Forests accountable for accomplishing assigned work.

WiNR: In terms of proportions of time, since you span such an array of interests, what percent of your time do you think is spent on internal matters versus external to the Forest Service business?

Comanor: On this staff we focus toward blurring the lines. We even try not to think about internal/external, because our mission is across the boundaries. But in terms of the day-to-day administrivia that occurs, probably a third of the time it is internal Forest Service, like going to leadership team meetings and activities like that. And two-thirds on relationships, programs, problem solving, looking ahead, trying to position ourselves, responding to the Hill, proposals.

WiNR: Getting back to when you were director of Land Management Planning, as I recall, that's about the time that ecosystem management as a concept and as a way of doing business was just getting started. There was a lot of controversy about whether we should be doing it, but it did get institutionalized. Reflecting back on your role, is there anything that the Forest Service should have been doing differently to help itself?

Comanor: I'm not sure it's with 20/20 hindsight, but in hindsight, I think we perhaps missed being fully sensitive to the emotional loading of the term "ecosystem management." Concern about private property rights were coming along at about the same time, and in my view, the label and what it was feared to mean put off a number of people. There is the dislike that people attached to the name; since they didn't know what it meant, they worried—is the federal government going to take over everything? The application of laws on wetlands and other issues already had people highly wary.

WiNR: There is even the fear of surveying. The National Biological Service is finding that people fear those who want to look for what's out there.

Comanor: Perfect example. A year ago when I gave a talk at the Society of American Forester's annual meeting on ecosystem management and private landowners, I fully expected to have some strong reaction such as "better stay off the private lands," or something along those lines. In my talk, I told them I believe in the principles of what's really intended by the term ecosystem management. It's very pragmatic to me—using all the sciences and principles of different science specialties, looking at conditions and trends on multiple scales, involving the public, recognizing that if you don't look at solving problems over time and perhaps ahead of time, maybe all you are doing is a quick patch job or actually creating other problems. The first statement I got after the presentation by one of the people in the audience was, "After some reflection, I've decided I've been practicing ecosystem management for 30 years." I took that as a

positive signal that we're over the hump of, "Huh, whatever that means" to "maybe actually I do some of those things." At that point, the debate is on a different plane and more constructive. While we still do have some people at the "whatever that means" or "it's not going to be practiced here" stage, I hope we can pursue how we can more effectively apply the principles of ecosystem management. There is still that concern about federal government taking over, but we've not experienced that in the voluntary programs we do with private landowners.

WiNR: In some of the most recent issues of *Women in Natural Resources*, there were several articles about the development of micro enterprises with Forest Service seed money. Is this an effective means of sustaining large-scale economic change in rural areas impacted by reduced cuts on the National Forests?

Comanor: I think it's definitely one of the tools in the toolkit for several different reasons. It demonstrates that here are some things that can be done and it emphasizes the human dimension. In so many areas, people are struggling with "How can we possibly do anything to alter this outcome?" With this money and technical assisance, people say, "Well, I can't solve all the world's problems, but maybe I can get this little effort going."

WiNR: Do you think there is enough of an infusion of capital to make a real difference, or is it a palliative?

Comanor: There are plenty of things that are capital-dependent. No question about that. We're going to have some false starts and failures. It's helpful, even so, to think not only in terms of financial capital, but also to appeal to the human spirit and ingenuity, and realize you can't control everything that happens to you, but you can perhaps shape the outcome and buffer the rough times. You can either sit back and be tossed and turned, or you can get out there and try. This assistance encourages those mindsets. But if you're asking if there are any miracles, that suddenly there are going to be magnets that draw in large capital to these resource dependent rural communities, I don't think so.

WiNR: So the purpose is to effect some stabilizing?

Comanor: Yes. We can't presume that the change is a temporary condition, so we are building toward weathering through, if not benefiting from, whatever the future might bring.

I think in the whole country we're seeing that play out, not just in natural resources, but in many areas—look at our whole industrial infrastructure. After World War II, the U.S. economy was based on economies of scale—the larger the better—build the big behemoths. And we're now in a shake-out period. In the automobile industry, for example, worldwide, there are many brands of cars; some are fairly small manufacturers, but they've got models out there competing. So it's an economic balancing act communities face as well, and it's not an either one or the other paradigm choice, as though big is always right and small is wrong. We're saying there are different scale and product line approaches that can be very competitive and can create jobs.

WiNR: I was in California when logging cutbacks started. There was violence and predictions of dire social consequences.

Comanor: And we have had some in some places.

WiNR: People just did not want to give up logging, and would rather die than change jobs or do other things.

Comanor: In some places we're not saying you have to give up logging forever, but they may have to reposition in terms of the big mill and a processing capacity based only on old growth timber. For example, we're now suggesting smaller mills that have some flexibility and resiliency. There are other sizes and species of timber still available, and there are niche markets for wood products. I was at a conference with western county commissioners a few weeks ago, and one pointed out to me that a Forest Service economic assistance grant in a very depressed county had enabled a small mill to start up and run when the traditional big operation had closed and left the county. The new mill started out employing 18 people, but she said that after two or three years, there's been increasing demand and the mill now employs 54 people. She felt these were positive results; she also said it hasn't offset the 200 lost jobs in the traditional mill, but her constituents are seeing other opportunities to further diversify and are recognizing the vulnerability of having only one large employment base.

WiNR: This particular issue of *Women in Natural Resources* focuses on agroforestry. You attended the 4th Agroforestry Conference in Boise this summer. I'd like you to share your observations of how agroforestry fits into State and Private Forestry. I think most people don't really know that that's a part of it.

Comanor: In this country people are aware of forestry or forest management—or farming. Not too many people put the two together in practice. Agroforestry is much better known and understood in developing countries, but it's now just finding its niche and establishing a foothold in this country. Still, if we went out on the street and asked the first 10 people we ran into, "What do you think of agroforestry?" it wouldn't surprise me at all if we got a blank look. Many universities are training professionals in agroforestry but to some who don't understand what they're talking about it's as mysterious as any other in-house jargon. We may want to think about how better to characterize it. But it is clear that Americans are using the tools that are represented by agroforestry; the timing is right to begin applying the science. If I'm a farmer, I discover that I can lessen the impact on my fields of summer's hot breath or winter's snow-laden winds if I have rows of windbreaks and shelterbelts. With trees and shrubs strategically planted I can shelter some of my own crops, perhaps shade my house or protect pastured animals, add some nutrients, and I also have "crops" from nuts and later from timber. I can perhaps mitigate soil erosion into my creek and benefit wildlife, too, if I plant certain species in prescribed ways.

WiNR: What would State and Private Forestry do in agroforestry?

Comanor: We actually have a partnership operation with Forest Service Research and with other USDA agencies and and universities. There is an Agroforestry Center in Lincoln, Nebraska, led by Bill Reitveldt, who has a number of people stationed there. A key partner is the Natural Resources Conservation Service (formerly Soil Conservation Service) in agroforestry applications. We have an interest in developing more knowledge and more applications and techniques to be applied throughout the U.S. . We also rely on partnerships with other research institutions, such as the Agriculture Research Service within USDA, as well as a number of universities. At the Boise conference you noted, attendees heard about the use of trees in non-forest, non-traditional applications. Some I've mentioned: use of trees for diversifying a farm, to have walnut tree and nut production along with annual crop production, for example; crops of fast-growing trees for fuel or pulpwood; use of trees as tools to mitigate erosion or add nutrients; to integrate wildlife habitat on crop lands; shelter homes for energy conservation; use trees as living snow fences to facilitate rural highway management; trees for pest control, dust abatement, and cleaner air.

WiNR: Do you think the country is receptive to it?

Comanor: We have a lot to learn from what developing countries have had to do in order to expand their capacity. Usually we in the States think of ourselves as exporters of knowledge and know-how; in this case, we have some things that we can learn from others. Part of day-to-day survival in some countries is knowing how to use every resource they've got in as many ways as possible. We also could perhaps learn some lessons in how to approach private landowners here. They've been conditioned from previous massive efforts of the federal government to respond warily: "Oh, no, here they come again!" We need to use what we learned from the experience of the National Biological Survey and make sure our terms are very well understood and that we are truly helping landowners meet their needs and objectives.

With Forest Service Chief Jack Thomas (center in white cap) on a tour of the northeast to show him the partnership programs that are State and Private Forestry's core and to meet with many of the partners. Here the group is discussing the Chesapeake Bay water quality concerns and the role forestry is playing in improving water quality.

WiNR: Do you see S&PF as having extension forestry roles, like the extension people in agriculture? And if so, is that acceptable to the public these days?

Comanor: I think so. We do work very closely with the extension service and with local extension agents. I think the reason why our programs worked well in this era of concern about private property rights is that we have already been working with private landowners. We have more than 100,000 private forest landowners who have put management plans on their private forest land—and our programs are voluntary. We make private owners aware of the programs and the services, but it's their call; they can stop at any time.

WiNR: It must benefit them.

Comanor: We stress that our objective is to help them meet their management goals in the most environmentally sound and economically efficient way. That's why in this era that implies just the opposite, we continue to have more demand than we can quickly meet. This is part of that partnership with the state foresters—or with community foresters in the case of community forestry programs—where the program is delivered by someone at the local level instead of a "federal person." So that's the beauty of our somewhat unique set of delivery tools.

WiNR: Does it take a special kind of person to work in S&PF because of the cooperative mode you are in?

Comanor: Yes, it takes a different mind set. It's one of "I am not in control." It's where your first thoughts have to be, "Oh, here's the issue. Who else do we need to bring to the table?" It takes people who enjoy working in a consensus mode. Most people we bring in who have had experience within the agency or are from other agencies, after they've worked for a short time, enjoy the stimulation of working with multiple partners and working across boundaries to get things done.

WiNR: How is the funding looking for S&PF these days?

Comanor: I think everyone is nervous: all one has to do is read the headlines or hear the latest ideas coming from the Hill on how to cut the budget. I think we're all on edge. We have a number of satisfied customers, however, who are coming forward to say "We think this is highly effective, and we'd like to think the government is willing to work in partnership instead of telling us *you must do this*." If you try to find out where the dissatisfaction with the Forest Service is that some people are expressing, State & Private Forestry has many of the elements that pass that dissatisfaction filter: we are voluntary, working in partnerships. We try very hard not to be redundant. We are very cost effective: when we invest a federal dollar, we are usually leveraging at least equal and in many cases, multiple additional dollars, so there is already an instant return on the investment. For example, I met a person who is involved at the local level in Minnesota community forestry activities. She said she uses the Forest Service—our seed money as well as our name. She said, "I take it as a personal challenge to leverage, within a week, every Forest Service dollar into another four dollars from other private local sources. Her goal is to leverage $13 for every one. She approaches private foundations and others and says, "Here's this local goal we're trying to accomplish. We've got some partners already saying, Yes, we think it's worthwhile and she then invokes the Forest Service name as one who is willing to invest. She said that for the first time recently they were able to get participation from the Kellogg Foundation in a project. She was told by Kellogg that if we were for it to count them in. In Washington we hear about all the things that aren't working well. Unfortunately we don't often see this side of the coin, where we are viewed as respected, well known, and valued as a partner who helps others meet their goals.

WiNR: Does the western states rights/county supremacy feeling carry over into S&PF? Do you personally get some hostility when you go out or when your people go out?

Comanor: We're mindful of it. But quite often, once they find out how these programs operate and what they're trying to do, it's usually not an issue. At another recent conference, one of our employees from New Mexico, which has had some very strained and high-profile concerns about federal government, said he had gotten some better working relationships as a result of having some of the programs we offer. These are some wonderful programs, and we have flexibility many federal programs do not have. We use that so that we can work across the boundaries when it's to everybody's benefit.

WiNR: As the potential grows in Congress for handing back huge chunks of federal land to the states to manage, many people are very worried that they are ill equipped to manage them. In Idaho, the state controller, J.D. Williams, has said that transferring public lands to Idaho would be a disaster. He concluded that the state would lose more than $90 million per year. And others worry that such a move would allow such states as Idaho to sell the lands off to private interests. What do you think about these persisting movements?

Authors Graciela Verzino and Peter Williams inspect *Prosopis* seedlings growing in the nursery at IPEA #3 at Cruz del Eje.

were designed to assess six species for their potential for forest rehabilitation in the Bosque Serrano. Forest rehabilitation includes species enhancement of depleted forests and replanting of highly degraded forests. While coco is an important species, it was not included in the outplanting because the collected seed did not germinate. Using a randomized-complete experimental design, five replications of the six species were planted in four-tree experimental units on each aspect (Table 6) (a total of 120 seedlings of each species). The seedlings were planted by students of the Facultad de Cs. Agropecuarias (UNC).

The seedlings were measured at planting time. Survival will be measured in October 1995 and second year growth and survival will be evaluated in 1996.

Results and conclusions

The project has resulted in a number of achievements at this preliminary stage.

•From the social point of view the project has resulted in:

(1) An increasing consciousness of some producers about the importance of natural resources conservation and rational management,

(2) A raising interest of community groups regarding forest protection and reforestation, and

(3)Strengthened ties between the University of Guelph, the Universidad Nacional de Córdoba, local NGO's, and agencies, resulting in better communication within the "conservation" community.

•Specific achievements in the social arena have been:

(1) The involvement of high school students in nursery practices and plantations has helped the development of a regional skilled workforce to implement forestry activities, and

(2) a planting team has been organized with the direct participation of young people from the local communities.

•From the ecological point of view:

(1) Seed trees of multipurpose native species were located and the harvest time, storage and germination of fruits were assessed. Cultural practices for nursery production and outplanting were also assessed.

(2) Ten plantations were established in different sites in the Valle de Punilla. The species used for the trials were: *Prosopis alba, P. alba* var *panta, P. affinis, P. caldenia, P. chilensis, P. hassleri, P. ferox, P. flexuosa, P. kuntzei, P. nigra, Schinus molle, Schinopsis haenkeana, Celtis tala* and *Lithraea ternifolia.*

The experience of working with native species has pointed to a number of critical issues that warrant more attention or research, including:

.planting time (time of year and relative to moisture conditions),

. protection from rodents/rodent habitat management,

. livestock impacts,

. impact of/protection from fire, and

. competition from grasses and shrubs.

While poor survival in some cases was disappointing, it should be apparent that we are in a learning phase. As more experience is gained working with these «new species» and their particular needs, better survival and growth can be expected. These plantations have demonstrated the potential of working with these species and highlighted important considerations for seedling production and establishment. Future successes, will help maintain genetic resources of *Prosopis* and help to maintain all of these species in the landscape.

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ABOUT 60 PERCENT OF CURRENT DEFORESTATION IS CARRIED OUT BY SMALL-SCALE FARMERS PRACTICING SHIFTING AGRICULTURE. AT LEAST 80 PERCENT OF THE TREE SPECIES IN FALLOW VEGETATION CAN BE USED FOR MEDICINE, FODDER, TIMBER, OR CONSTRUCTION.

FALLOW VEGETATION IN THE TROPICS: OPPORTUNITIES FOR SUSTAINABLE MANAGEMENT THROUGH AGROFORESTRY

Patricia Negreros-Castillo
Marcelino Avila
Manuel Esteban Magafa-Monforte

Introduction

Tropical deforestation and non-sustainable life styles of developed countries are having very negative effects on global climate, biodiversity, and soil and water conservation. Global climatic changes are presently worldwide concern (Sánchez, 1994; Zerbe, et al 1980). This paper focus in one of the many activities that contribute to tropical deforestation.

Shifting cultivation

About 60% of current tropical deforestation is carried out by small-scale farmers for agricultural settlement (World Bank, 1991). This deforested rain forest, which totals about 10 million hectares per year, is cleared by slash-and burn methods. The cleared land is converted into pasture land, agricultural fields or housing space. When converted into agricultural fields, the land is used only two to three years and then abandoned. After the site is abandoned, natural succession begins which allows the soil to recuperate its fertily. This type of agriculture is known as shifting or slash-and-burn agriculture (SBA). SBA is really a dynamic system that has three phases. Phase one involves cutting of forests and burning the residue. In phase two the site is cropped for a few years (two to three), and in phase three the site is abandoned. The last phase is known as the fallow phase and usually lasts from 5 to 12 years depending of land availability, among other factors. Farmers extract a wide array of products from fallow vegetation in all age stages. The amount of material extracted has not been quantified but does not seem to be very large. What is definitely large is the abundance of fallow vegetation. There is more fallow forest than mature forest. Because of its abundance and apparent richness in useful species, fallow vegetation can very well represent an opportunity for developing sustainable agroforestry systems (AFS).

To help develop useful AFS in Quintana Roo, Mexico, a research study plan was prepared. The plan has four basic steps: 1) study of the composition and current uses of the species present in the fallow vegetation of this region, 2) design with farmers AF systems for fallow vegetation, 3) establishment of designed AF systems on farmer's land, and 4) research results and guidelines and recommendations. This papers deals with the partial results of step one.

Study area

The study was carried out in the central region of state of Quintana Roo Mexico (Fig.1) known locally as the Mayan Zone of Quintana Roo. Quintana Roo is located along the eastern portion of the Yucatan peninsula (southeastern part of Mexico) (Fig. 1). The peninsula projects northward into the gulf of Mexico as a great limestone platform joined at its base to the Sierras of northern Central America. The predominant types of soil present are Rendolls which are, in general, shallow with high organic matter and a pH close to neutral (Bridges, 1970). The Mayans have developed their own soil classification that help them to identify suitable sites for agriculture practices (Table 1) . The annual rainfall is between 1.0 m and 1.2 m, distributed unevenly (August-April) with a dry period of 3 to 4 months. The annual mean temperature is 26°C with a minimum of 8°C (Tamayo,1981). The state of Quintana Roo occupies an area of 50,500 km^2. Originally it was approximately 90% forested, but now approximately 30% is old or mature forest. The composition of the forest is the result of the precipitation regime and soil types as well as hurricanes, fires, and agriculture activities since remote times (Gómez-Pompa, 1987; Gómez-Pompa et al, 1987). Thus the vegetation of Quintana Roo is a mosaic of sites that range from early succession stages to very advanced ones. The vegetation in this region is classified as the tropical dry forest formation (Holdridge, 1947) and the most abundant tall trees are white ramon (*Brosimum alicastrum)* and chicozapote (*Manilkara zapota*) (Pennington, T.D. and J. Sarukhán., 1968).

Table 1. Soil classification. FAO and Maya classification approximation (Duch, 1988)

Mayan classification	FAO-UNESCO
Tsek'el	Litosol
Box-lum, Pus-lu'um, Ka-cab	Rendzina
Chac-lu'um, Ek-lu'um	Cambisol
Kancab, Ya'axhom	Luvisol
Ya'axhom, Ak'alche	Vertisol
Kancab	Nitosol
Ak'alche	Gleysol

Table 2. Plot size by age of fallow vegetation

Age of Fallow vegetation (Yr.)	Plot size (m^2)
2	16
5	24
8	32
12	64

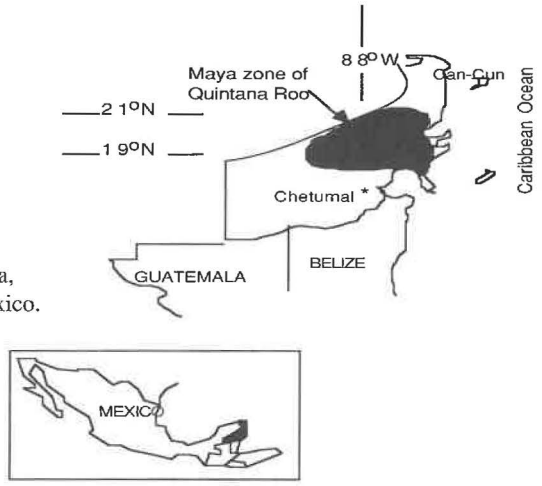

Figure 1. Study area, Quintana Roo state, Mexico.

Methodology

To carry out the characterization of the fallow vegetation, five communities representative of the Mayan Zone were selected (X-Maben, X-Pichil , Laguna Kana, Naranjal Poniente and Cafetal-Limones). In these communities, areas with fallow vegetation that were 2, 5, 8 and 12 years old and located on three types of soil (Kankab, Tsek'el, and Chac-lu'um) were sampled. Each soil-vegetation combination was sampled in three different sites resulting in a total of 36 sample plots for all combinations. The size of the sample plot depended upon the age of the vegetation. Plot size was determined by using the minimum area method (Table 2).

To calculate frequency of occurrence of each species, each plot was divided into $1m^2$ subplots. Every plant was identified by species and its diameter and height measured. The uses of the species encountered in the plots were obtained from direct communication with farmers during field work.

Results

The data have only been partially analyzed. Only the results for plots found on litosol (Tsek'el) soils will be presented here.

The total number of species found in each age did not vary much, except for age 12 which had about 40 percent more species than the other three ages (Table 3). The number of strata and the height of the tallest stratum increased as the age of the vegetation increased. There were species that were found only on each stage (Table 3), although 23 species were common to all four ages (Table 4).

The farmers' uses of the species is very diverse; however, the most common uses were for timber, medicine, rural construction and fodder. Table 5 shows the percentage of $1m^2$ sections that had species used for these common uses.

Conclusions

A necessary component of agroforestry systems (AFS) is trees. However, depending on the species, trees require a considerable number of years before they can provide their benefits to the system

Table 3. Number of species found on each fallow vegetation stage.

Age of Fallow vegetation (Yr)	Total number of species found	Number of species only found by stage	Number of strata	Height of tallest stratum (m)
2	60	9	1	1.5
5	65	13	1	5
8	60	9	2	10
12	86	24	3	15

Table 4. Species found in all four fallow vegetation ages.

	Scientific Name	Local Name	Uses
1	*Croton reeflexiofolius*	Perez Cutz	None
2	*Pluchea comphorata*	Bob che'	Rural construction, timber
3	*Cydista potosina*	Eek' ki' ix	Rural construction
4	*Colubrina reclinata*	Chak nich	Rural construction
5	*Sabal yapa*	Guano	House roofing
6	*Zuelania guidonia*	Tamay	Rural construction
7	*Lasiacis ruscifolia*	Si' it	House roofing
8	*Cydista diversifolia*	Bilin kok	Medicinal
9	*Bursera simaruba*	Chacá	Fodder
10	*Malmea depressa*	Elemuy	Rural construction
11	*Guettarda elliptica*	Tas ta'ab	Rural construction
12	*Swartzia cubensis*	Katalox	Timber
13	*Macroptilium artropurpureum*	Bu'ul cho'o	None
14	*Vitex gaumeri*	Ya'ax niik	Rural construction
15	*Petrea volubilis*	Yo Yoox Pzimin	Medicinal
16	*Cesakounua vesicaria*	Yaax k'anab	Medicinal, fodder
17	*Lonchocarpus rufosus*	K'anasin	Rural construction
18	Not identified	Silil	Rural construction
19	Not identified	Sibche	None
20	Not identified	Chich booch	Medicinal
21	Not identified	Cho choch	None
22	Not identified	Zurintok	Rural construction
23	Not identified	Ganjoul	Medicinal

Naronjal, 1995

Table 5. Percentage of $1m^2$ sections where species with specific uses were found.

Age of Fallow vegetation (Yr.)	Timber	Medicine	Rural Construction	Fodder
2	-	39	39	40
5	10	30	47	21
8	31	35	39	9
12	18	23	28	18

The proposed agroforestry demonstration is an intercropping system with both temporal and spatial components. Black walnut will be planted at a 11' x 66' spacing and intercropped with sweet clover, Indian corn, and soybeans. For the first year, the 55 acres will be planted into sweet clover as a cover crop and then plowed under for green manure. In subsequent years, until year 15 when crown closure begins, the land will be divided into three sections. There will be intercropping of the three agronomic crops in-between rows of black walnut. Black walnut will be grown for nut production, veneer, and wildlife habitat. Nut production will begin in year 15 and continue until year 76 with selective harvest for veneer beginning in year 40. Areas classified as wet alluvials will be planted with diamond willows. Wild raspberries currently growing along the drainage ditch will be cultivated to increase yields and may offer economic possibilities for the Tribe, such as for home use or for marketing. Additionally, milkweed, which is consumed within the community and is currently growing uncultivated in the project area, will be encouraged to grow in a selected area within the 55 acres. Emphasis will be placed on the importance of soil rejuvenation and land restoration and maintenance while avoiding the use of agro-chemicals. All aerial spraying has been banned on the BBH area. Starting 1995, no agro-chemicals will be applied to the 55-acre demonstration area .

Economic Analysis of the Proposed Agroforestry Demonstration

An *ex-ante* economic analysis was conducted for the agroforestry demonstration based on the proposed intercropping system using a real alternative rate of return (ARR) of four percent. The system was evaluated using constant cost and prices in a before-tax type analysis for 76 years, and considered only a 44-acre area (10 acres were taken out for willow plantings). This is referred to as Alternative 1. The demonstration system was then separated into its various components (Alternatives 2, 3, and 4) which were also analyzed separately. Various activities in the different phases of the system were identified and their associated costs and benefits determined. Because of concern for costs incurred in black walnut maintenance, two alternatives (3 and 4) were considered differing only in the type of weed control practice used. The four alternatives were then compared with two other systems: the traditional corn/soybean rotation currently practiced, and cash rent. The decision criteria used to evaluate the project and its various components were net present value and benefit-to-cost ratio. Evaluation results (Table 4) showed that best alternatives were the rotation of agronomic crops (Alternative 2) and the proposed agroforestry system (Alternative 1) which ranked first and second, respectively. The earlier and higher cost of planting black walnut was offset with the early income obtained from the agronomic crops. A sensitivity analysis performed with low, medium, and high revenues for Alternatives 1 and 2 revealed that, even with low expected revenues, both of these alternatives would produce sufficient returns.

Summary / Conclusions

The seven land use alternatives developed for BBH were arrived at using various decision criteria and schemes of weighting priorities. Agroforestry alternatives were found to be best regardless of which weighting scheme was used. The subsequent agroforestry demonstration that has been proposed will allow agroforestry-type options to be examined on a smaller scale, and the Tribe to make choices considering alternative land uses.

Some plantings have already been implemented while other parts of the project are undergoing review by the Tribe. There is a need to identify tribal and local community members who are interested in the maintenance of and involvement with agronomic alternatives of the project.

The economic analysis to date has only examined market values. The objectives generated a number of non-market values, some conflicting and some complementary, that must be addressed to determine real tradeoffs existing in the project. These tradeoffs are important to determine how they contribute to the fulfillment of the Tribe's land stewardship philosophy.

Using agroforestry as a development tool is an iterative process that allows the integration of the Tribe's goals, resources, and the environmental constraints into their land stewardship philosophy.

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BOOKS

Reviewed by Jonne Hower

Saving Nature's Legacy: Protecting and Restoring Biodiversity
Reed F. Noss
Allen Y. Cooperrider
Island Press, Washington, D.C. 1994.

In 10 large and technical chapters, the authors set out to convince the reader of the importance of biodiversity. In the preface they state:

Our intended audience ... includes managers and staff of land-managing agencies, elected officials and their staffs, other policy-makers, private landowners and land managers, environmentalists, and everyone else who care about how land is managed and conserved.

Well, doesn't that include most everybody?

Technical information is presented technically. And, I'm willing to believe it is compelling. However, there isn't any interpretation. No, "what this really means" or "the implications of this are ..." So, any of the above-listed audience who won't wade through technical information is rather left out. But, if you do wade through (and understand) the technical stuff, I have a sneaking suspicion that you'll agree with the authors.

If you needed to prepare a presentation on biodiversity, this would be a great resource tool. There are chapters on the value of biodiversity as well as its creation and destruction. The authors discuss conservation strategies past and present. And discuss emerging conservation movements. There are chapters addressing forests, rangeland, and aquatic systems as well as one on designing reserve networks.

However, the authors don't approach the *reality* of management today: if you want to manage for biodiversity, what processes or steps do you take to create the social/political climate in which to manage? And, how do you bridge the gap between the on-the-ground staff and the policy-making folks? It is in building those bridges that we'll "save nature's legacy."

Ecopsychology: Restoring the Earth, Healing the Mind
Edited by Theodore Roszak
Mary E. Gomes
Allen D. Kanner
Sierra Club Books, San Francisco. 1995.

From this book, my understanding of the term *ecopsychology* is that it is an emerging field that recognizes you cannot have sanity without sane relationships with your environment. It is easy to use: the table of contents contains brief summary statements of the collected essays and each of the three main divisions of the book sports a one-page summary.

There is much to ponder in this wide-ranging and thought-provoking book. Which was not, interestingly enough, my first impression. After spending some time with it, however, I realized that for natural resource managers, the collection helps to put in perspective some of today's changing public sentiment.

In part one, Theoretical Perspectives, the editors have collected a series of essays which lays the groundwork for exploration of personal psychology and the environment. Essays explore the relationship of madness (or the opposite of a healthy person) and the changing of our global ecosystem. There are essays dealing with therapeutic experiences based on wilderness (this discussion reminds me of my previously-reviewed *Retreat: Time Apart for Silence and Solitude*). And, there are essays exploring the psychology (or ecology) of grief for "magnificent trees, the lovely animals, and the beautiful places that we are losing."

Part Two explores ecopsychology in practice. Terrance O'Connor relates an experience while presenting a talk at a workshop in which a woman asked why we should bother ourselves with wanting a healthy, mature relationship with our environment. His reply (in Therapy for a Dying Planet):

Let me say something about the status quo.... The hole in the ozone layer is as big as the United States...[and] some scientists are predicting that by the middle of the next century global warming will result in most of the coast cities...being below sea level .... Why should we bother? Because healthy relationships are not an esoteric goal. It is a matter of our very survival and the survival of most of the life upon this earth.

The author goes on to describe how the workshop changed focus.

As we began to look at all of our personal concerns from a global perspective, we could see that the patterns of control, denial, and projection that sabotage intimate relationships are the very patterns that endanger the world. To change these patterns is to change not just our social lives but our relationship to the planet.

How does all this relate to resource management? Just as we can't manage one part of the natural environment (or so the new thinking on ecosystem management says), we cannot manage natural resources out of context with people and their (our) culture. I believe this book is important for resource managers in order to develop a larger context for the changing demands our society places on its natural resources and, consequently, its resource managers.

The final section, Cultural Diversity and Political Engagement, doesn't seem to fit so well with rest of the essays and their major themes.

Forest Dreams, Forest Nightmares: The Paradox of Old Growth in the Inland West
Nancy Langston
University of Washington Press, 1995.

I've chosen to live in northeastern Oregon's Blue Mountains for the last several years and am intrigued by this book—

continued on page 35

Overview:

Agroforestry in the U.S. -Affiliated Pacific Islands

Kathleen S. Friday
Robert W. Wescom

There is tremendous diversity in the technical systems used and their cultural and economic contexts

Geography. The over 2,000 U.S.-affiliated islands of the Pacific include most of Micronesia, Hawaii, and the eastern Samoan islands. The total land area is less than 19,000 sq. km., of which 16,654 sq. km. are in Hawaii. However, the region extends across much of the Pacific ocean.

Hawaii is the only tropical state of the United States. Guam and American Samoa are unincorporated territories of the U.S., and the Northern Marianas Islands are a Commonwealth. The Republic of Palau, the Federated States of Micronesia and the Republic of the Marshall Islands were formerly part of the U.N. Trust Territory of the Pacific Islands; they are now independent countries with "Compacts of Free Association" with the United States.

Climate. The climate of Samoa and Micronesia is tropical and is characterized by heavy rainfall, high temperatures, and high humidity. Hawaii, located further to the north, is also tropical, but cooler than the other islands; its mountains reach elevations over 3900 m and are sometimes snowcapped. Precipitation in Samoa and Micronesia ranges from 2000 mm per year in the Northern Marianas, with a pronounced dry season (Falanruw et al, 1989), to over 7000 mm/year on the peaks of the high volcanic islands. Hawaii, with its larger islands and taller mountains, receives as much as 10,000 mm/year on Waialeale Peak (Kauai) and 500 mm/year in leeward (rain shadow) coastal areas (Armstrong, 1983). Measurable precipitation is recorded each month but most islands experience a period of dryness.

Soils. The surfaces of these islands are either formed through volcanic action above the surface of the ocean, or through coral reef formation over a core of volcanic origin. Highly weathered Oxisols and deeply leached Ultisols are most widespread, but all soil orders are represented (Foote et al 1972). Many tropical volcanic soils can support considerable biomass, but their inherent fertility may be largely dependent on maintaining vegetative cover and natural nutrient cycles to ameliorate their low pH (3.5-6.0) and rapid leaching of soluble nutrients, and to prevent erosion from sloping lands. Coralline soils may be formed on uplifted limestone plateaus or loose coral rubble and sand. Many coralline soils are shallow and therefore have limited water holding capacity. Atolls have coralline soils that are generally excessively drained, with high pH values (6.6-8.4), low organic matter, and rapid leaching of soluble nutrients. With proper management and large inputs of organic matter, coralline soils can be productive (Laird, 1986).

Land Use. Table 1 presents data for the high islands from the 1970s and 1980s, the most recent available (see references under table). Coconut (*Cocos nucifera*) plantations were listed in Forest Service vegetation surveys under "agroforests"; to make this table consistent, fruit, nut, and coffee (*Coffea arabica*) plantations in Hawaii are likewise listed under agroforests. Windbreak-protected fields and pastures in Hawaii are listed under "cropland" and "grasslands."

In the Carolines and American Samoa, vegetation surveys showed an average of 22 percent of the land area in agroforests and 61 percent under other forest cover. Since that time, there has been progressive conversion of forest to various types and stages of agroforestry; conversion of agroforestry to agriculture; and, in Samoa, conversion of agroforests to secondary vegetation because of hurricanes.

In the Mariana Islands, 38 percent of the land was described as "forest" but most of that was shrubby, non-native *Leucaena leucocephala.* Though not much agroforest (2 percent) existed, it was more extensive than cropland (1 percent). Since the 1980s, much grassland and forest has been converted to urban uses.

In Hawaii, at least 30,000 ha of sugarcane (*Saccharum officianarum*) and pineapple (*Ananas cosmosus*) are being taken out of production in the mid-1990s and converted to tree plantations, pasture, and diversified crops (Newell and Friday, 1993).

Each Pacific Island developed its own complex agroforestry system

An extensive description has been compiled by Clarke and Thaman (1993). "Modern" agroforestry systems have also been introduced, many of which are more fully described by Vergara and Nair (1985). For the purposes of this paper, "agroforestry" is management to optimize benefits from biological interactions between woody species and crops and/or livestock. These interactions may take place from mixing species in space or time. Trees have many roles within farming systems and landscape management that do not meet the above definition of agroforestry. Accordingly, this paper does not include farm woodlots, riparian restoration, or Christmas tree plantations (unless combined with crop or livestock species); nor does it address recreation, non-timber forest products, wildlife, or other forest values except within managed agroforests. Plantations of fruit and nut trees or coffee are not considered agroforestry unless managed with a second species (tree, crop or livestock); however, they are often discussed in this paper because of their potential for use in agroforestry systems.

Shifting cultivation. Shifting cultivation or "swidden" is an agricultural system used since the earliest settlers. Small plots of forest land are cleared manually, with the use of fire in some areas. Crops such as bananas (*Musa* spp.) or yams (*Dioscorea* spp.) are grown for two or three harvests, until crop yields decline as a result of decreased soil fertility or increased weeds and pests. At that point, the field is abandoned. Secondary vegetation recolonizes the site, with succession from herbaceous plants to woody shrubs and trees. After a fallow period the vegetation is cleared again and another cropping sequence begun.

Where the fallow period is long enough (for example, 15-25 years), the system is quite sustainable. The tree fallow serves to restore soil organic matter and fertility, and may eradicate crop pests and weeds. Shifting cultivation may be considered an agroforestry system if managed to realize the benefits of the (temporal) tree component. For example, new swiddens might be opened in secondary forest of a certain age or with species indicating suitability. Swiddens might be abandoned with timing or treatments calculated to result in a favorable pattern of succession

in the fallow. We are not aware of detailed studies of such management techniques in Micronesia or American Samoa, although Clarke and Thaman (1993) have collected anecdotal examples from elsewhere in the Pacific.

Multilayer Tree Gardens or Agroforests. This common Pacific Island agroforestry system typically has an extensive, permanent overstory of breadfruit (*Artocarpus altilis*), coconut and forest trees; a lower canopy of various fruit and multipurpose trees; and an understory of shrubs, root crops, and herbaceous plants. The agroforest may be initiated or rejuvenated with a period of annual crops in a manner similar to shifting cultivation, but the forest fallow is managed by planting and weeding to favor certain species, and is extended for many decades.

The mixture of plant species provides a variety of products including food, medicines, and building materials. The taller vegetation is also used as support for climbing crops such as yams. Mulching and composting techniques are used. The harvest of breadfruit is complementary to that of yams (Falanruw, 1983, 1986; Raynor & Fownes, 1991a), and the culture of numerous species and cultivars both broadens the range of products and provides for harvest throughout much of the year. Pohnpei's agroforest provides an example of species richness with an average of 26 species of trees, shrubs and crops per farm, not counting various cultivars and numerous herbaceous non-crop plants with medicinal, food, ornamental, other uses. Many of these species were introduced after Western contact but were incorporated into the traditional multi-story system (Raynor and Fownes, 1991a & 1991b).

Atoll agroforests have constraints of salt spray, occasional inundation, and limited land area. As traditionally developed, they are more intensive and reliant on tree species but less species-rich than high island systems. They provide a steady supply of organic matter to the sandy soil, including materials which are relatively slow to break down.

Home gardens. On Pohnpei, the agroforest increases in species richness with proximity to dwellings, apparently because access allows more intensive management and frequent harvesting of "convenience foods" (Raynor & Fownes, 1991b). Even in urban Honolulu, homes are often surrounded by trees providing fruit, nuts and foliage; shade, cooling, beauty, and ambience for the home's inhabitants; and occasional shade and support for annual crops or food for animals. The "home garden" may be a microcosm of either agroforestry or non-agroforestry (orchard) systems. It is important because of its relationship with the human environment, its role in family nutrition, and its persistence through cultural and economic changes.

Contour hedgerows. Contour hedgerows (alley cropping on sloping land) are being demonstrated in the Pacific Islands; only a few private landowners are trying them. Agricultural crops are planted between parallel hedgerows of fast-growing woody species, usually nitrogen-fixers. The hedgerows are on contours about 1.5 vertical m apart, and stems are densely planted within the hedgerow (stems 15 cm apart); combined with crop residues, they thus form a barrier to surface flow of water and soil. The hedges may be trimmed to provide mulch and allow light to reach annual crops. Trimmings and leaf drop provide green manure continuously, thus allowing for longer cropping periods between fallows. The hedges may also be allowed to grow tall as fallow vegetation. Contour hedgerows are suitable only where manual labor is used, due to the narrow and curving cropping strips (Gonsalves & Ronquillo, 1990).

Windbreaks. The Marianas and Hawaii experience several months of persistent trade winds which can increase water use as well as cause mechanical plant damage. These winds often persist for six to nine months each year. Windbreaks are commonly used in Hawaii; 13,645 meters of windbreak were planted in 1994 under USDA Natural Resources Conservation Service plans (USDA NRCS, 1994) to protect orchards, pastures and crops. Windbreaks have been introduced to the Marianas and Pohnpei by the USDA NRCS as well. Windbreak planting in the Marianas averages about 8,900 m/yr. Farmers and NRCS extensionists in the Marianas have developed effective windbreak systems using mango (*Mangifera indica*), lemon (*Citrus* sp.), and multiple rows of a deep-rooted Palauan variety of banana as the windbreak (USDA NRCS, 1995).

Simple intercropping and multilayer systems. Erythrina variegata, a nitrogen-fixing legume, is often interplanted in gardens and banana plots in Samoa. Coffee plantations on Kauai are often established with an intercrop of sorghum as a windbreak for the young plants, plus *Erythrina* spp. windbreaks. Coffee in Kona (Big Island of Hawaii) has been grown with bananas and shade trees. Monocrop plantations (such as coconuts) in Samoa and Micronesia have often had shrub or ground crops added by local people.

Livestock-tree systems. Plantations and agroforests in Micronesia have been used by local people to pasture or let forage domestic livestock. In Hawaii, Smith (1989) has tested the use of cattle, sheep and goats under macademia nut (*Macadamia integrifolia*), banana, and guava (*Psidium guajava*) plantations. Factors examined included nutrient value of the forage, effectiveness at reducing weed competition to the crop trees, and detrimental impacts of the animals (debarking of trees, damage to irrigation systems). Sheep and macademia nuts have been used in at least one large operation.

Live trellises and fenceposts. Hibiscus tiliaceus is used as a live trellis for yams in Pohnpei as well as a live fence post (planted from cuttings). Black pepper (*Piper nigrum*) is often trained to climb on coconut and breadfruit trees. (Raynor, 1991).

Problem solving with agroforestry

Soil Erosion and Degradation. Many of the high volcanic Pacific islands receive abundant rain on steep to very steep slopes. The cultivation of root crop staples requires that soil be disturbed twice during each crop rotation. Agricultural systems such as mono-cropping and the use of mechanical tillage expose the soils to the full impact of rain. In Hawaii, sugarcane and pineapple plantations have long been major sources of sediments. Erosion and soil degradation can also result from extensive use of fire and clearing in agroforestry, either modern or traditional.

Multilayer agroforests, with their herb and shrub strata, protect the soils from the impacts of rain, and also provide a steady supply of organic matter. Shifting cultivation likewise may conserve soils through mulching, limited clearing size, and a mosaic of areas in fallow or secondary forest. Contour hedgerows can mitigate soil erosion from otherwise monocropped systems. These types of agroforestry can prevent soil erosion only if they are economically and culturally competitive land-use options.

It must be recognized that refining agriculture and agroforestry to minimize soil erosion can not protect the marine resources of islands that are currently engaged in construction of roads, buildings, golf courses, and quarries with poor environmental controls resulting in overwhelming sedimentation.

Water Use and Salt Water Intrusion. Coralline atoll islands depend on capturing and storing precipitation and the presence of a shallow fresh water lens for domestic and agriculture uses. Lowering of the water lens for domestic or agriculture use can result in salt water intrusion. Even islands comprised of uplifted limestone plateaus are subject to degradation of water quality as a result of salt

water intrusion if excessive water is pumped. Several commercial agriculture operations on Majuro have pump and irrigation systems tapping the groundwater. In traditional agroforestry, water needs are moderated by species choice, shading, mulching, and the management of soil water by ditching to drain or maintain moisture (Falanruw, 1994).

Fertilizers and pesticides. The water lenses on coralline atolls and many limestone islands, because they are shallow and soils are porous, are especially susceptible to rapid and serious contamination by fertilizer and pesticide application. In many cases the groundwater is the sole source of fresh water for the island. Vegetable cropping introduced to Majuro and Rota, among other places, uses considerable chemical inputs. Certain characteristics of agroforestry lend themselves to the minimization of chemical use. Agroforestry systems are inherently more complex in structure and species diversity than mono-cropping systems, which may provide habitat for beneficial insects and birds, and create barriers for pest movement in fields (Schreiner, 1991). The dispersal of susceptible species in a mixed stand may also minimize pest problems and reduce the need for pesticides. On the other hand, intercropping may provide alternate hosts for pests and mulching may provide habitat for pests. Each system and technique requires specific evaluation. Traditional agroforestry was an extensive but productive land use for centuries; if such traditional systems are retained or modified to meet changing needs without requiring too many chemical inputs, the problem of groundwater contamination can be largely avoided.

Health Issues. Exposure to Western culture and the availability of imported foods has contributed to dietary changes due to the convenience of preparing imported foods, and the resultant changing of dietary preferences of younger generations raised on a higher proportion of imported foods. The proportion of fresh vegetables, root crops and fruits (agroforest products) in islanders' diets has declined (in Hawaii and Majuro) and is still declining (on other islands), while consumption of imported rice, canned meats, and beer is increasing. Consequently, health problems such as diabetes and heart disease have increased dramatically. A return to traditional diets would help prevent these problems, but this would require changes in attitudes and integration of agroforestry with evolving cultures.

Cash economy issues. The FSM and Palau are in a period of rapid transition from subsistence farming and fishing to a cash economy dependent upon imports of food, construction materials and other goods. However, the major source of foreign exchange is "compact payments" from the U.S., slated to decline; other sources are from industries (tourism, fish processing and others) for which long-term revenues and impacts are uncertain. On a national level, it would be desirable to minimize dependency on imports via production and consumption of agroforestry products.

On a local level, the expanding urban cash economy is driving rapid socio-cultural changes (such as migration to urban areas and a breaking down of the extended family into nuclear units around a few wage-earners). If agroforestry systems and markets can be developed to meet the desire for cash income, the rural economy would be strengthened and some cultural changes might be mitigated. An example of a rather desperate attempt to achieve this is found in the Marshallese government's support of copra prices to keep cash flowing to distant atolls even after world copra prices dropped; the purpose is to avoid having those atolls' economies collapse and their inhabitants move en masse to the capital.

Loss of Rare and Endangered Ecosystems, Species, and Populations. Isolation is a major factor affecting biotic diversity on islands. In comparison to most continents, total species richness of a Pacific island is low, but the proportion of endemic species to the total number of native species is high (up to 90 percent endemicity for native plant taxa in Hawaii). The small,

Table 1--Area of U.S.-affiliated high islands, in hectares, by land class and type

Land class and type	Carolines (FSM & Palau)	American Samoa	Marianas (Guam & CNMI)	Hawaii
Dates of raw data	(1986)	(1984)	(1976-80)	1970-87)
Secondary Vegetation:	4,647	246	10,111	
Forest:	62,674	11,609	32,526	688,000
Agroforest:				
Agroforest	5,403	58	7	
Agroforest/coconuts	14,177	5,241	48	
Nut/fruit/coffee				14,000
Coconut plantation	1,097	978	1,755	
Total agroforest	20,677	6,277	1,810	14,000
Nonforest:				
Grasslands	10,624	163	26,026	373,000
Cropland	362	37	909	127,000
Urban	1,441	945	12,198	63,000
Marsh	1,243	34	164	
Strand	16	89	1,217	
Barren	197	4	293	394,000
Water	574	25	99	17,000
Total nonforest	14,250	1,298	40,906	974,000
Total area	102,248	19,430	85,353	1,676,000

Table 1 Sources: American Samoa: Cole et al (1988); Chuuk: Falanruw et al (1987a); CNMI: Falanruw et al (1989); Guam: Perry (1983); Hawaii: Dept. Business (1994); Kosrae: Whitesell et al (1986); Palau: Cole et al (1987); Pohnpei: MacLean et al (1986); Yap: Falanruw et al (1987b).

diverse and fragmented land area of the islands makes rare ecosystems, species, and populations especially vulnerable to habitat destruction (Stone & Stone, 1989). Conversion of native forest to agroforestry poses grave dangers to biodiversity, but agroforestry on lands otherwise occupied by monocrop agriculture or urban land uses can provide otherwise unavailable habitat for native species (Walker, 1989).

Sustainability and viability concerns

Traditional systems

•Changing interests in work and consumption. Local consumer preferences in diet, housing, medicine and clothing have shifted away from traditional agroforest products in general. Young people seek work in occupations they consider more attractive, especially high-paying, high-status white-collar jobs; even when they are unable to get those, they may spurn agricultural work. As a result, some agroforests are unharvested and unmanaged, or are managed in a different way by paid, immigrant labor.

•Loss of indigenous knowledge. Much knowledge is being lost as elderly people die, though much information is also being recorded by Falanruw, Raynor and others: local species and varieties and their cultural characteristics and uses, techniques, seasons, systems for managing particular microsites, etc.

•Technical simplification. Due to increasing populations and changes in land tenure systems, agroforestry is often being implemented with shortened fallow periods and simultaneous opening of large areas. Where cropping periods are long or fallow periods are short, chemical fertilizers and pesticides are increasingly used. Lengthy cropping periods may end with site occupation by grasses or Chromolaena (*Eupatorium odoratum*) which impede succession into woody species. Bulldozers and fire are more often used in clearing, compacting the soil and reducing organic matter and nitrogen. The focus on short-term cash gains has sometimes resulted in use of fewer species.

An example is the widespread cultivation of sakau (*Piper methysticum*) on Pohnpei (Raynor & Anson, 1995). Because of sharp local price increases in sakau, large areas of the interior are now being planted to the crop. Streambanks are conducive to sakau growth and are being cleared, with probable effects on stream temperature and turbidity. Whereas sakau has usually been grown under partial shade in the lowlands as part of a multi-story agroforest, it is now additionally grown in the cloudier uplands, with full rather than partial removal of the overstory to maximize production.

Modern systems

•Marginal Economics of Rural Resource Management. Due to the small island sizes and isolation from markets, the Pacific islands are generally classified as rural economies. With a few exceptions, their economies are based on small domestic markets with people having modest levels of income and scattered over large distances. Poverty is a serious problem. Income from agriculture is insufficient to support investment in conservation practices such as windbreaks and contour hedgerows.

•Shipping. Inter-island shipping is not scheduled for perishable produce. Freight space on flights is limited and expensive; farmers must predict harvest times and quantities and deliver as contracted. National quarantines pose barriers and phytosanitary standards must be met.

•Marketing. Accurate assessment of markets and tight quality control are required. For example, "sugar spots" on sweet Kosraen bananas may not be appreciated by tourists on Guam used to bananas bred for shipping.

•Theft. Some families are hesitant to invest time and money into intensive agroforestry management because of potential crop theft. Landowners may reside in towns rather than on their land; because of the high cash value of certain crops; and/or because of the breakdown of cultural mechanisms which prevented, redefined or mitigated "theft."

•Labor and land costs. Opportunity costs are high for agroforestry in Hawaii, Guam and the CNMI, where land sale and lease prices are often high for tourism development. Labor and workers' compensation costs are very high in Hawaii, which along with diseconomies of scale make it difficult to compete with developing countries in the production of tropical tree crops.

•Weediness. Many nitrogen-fixing trees and shrubs that might be introduced as components of agroforestry systems could become naturalized weeds posing a threat to native ecosystems.

Needs, opportunities, and recommendations

Economic needs. Assessment of potential markets and development of markets is an area rarely addressed adequately in agroforestry (Raynor, 1991). Market-based approaches should consider the following:

(1) developing markets for existing agroforestry products;

(2) adding marketable cash crop components to a traditional agroforestry structure (seeking to retain its environmental benefits);

(3) developing high value, lightweight, nonperishable products for export.

Most Pacific islands aspire to significant tourism industries. Whether this is mass tourism, as established in Hawaii, Guam and CNMI, or planned ecotourism, as suggested for Kosrae and Palau, the industry is related to its natural and cultural environment. Agroforestry can contribute to and benefit from this in several ways (Wylie, 1994).

First, as a land use, it is attractive and (as traditionally practiced) protective of the marine resources that attract tourists. Second, a few agroforest farms can be visitor attractions, providing income to their owners and visitor-days to the island economies. Existing models include the "Maui Tropical Plantation," California vineyards, and New England apple orchards and strawberry farms. Third, agroforestry products can be marketed to tourists. Increased availability of local fruits (rather than New Zealand apples and Philippine imports) would enhance the visitor experience on Guam and CNMI. Existing souvenirs include products woven from *Pandanus* spp., carvings from local woods, oils and soaps from coconut, and Pohnpeian black pepper. Regional as well as national marketing of these products would not only increase their sales but would contribute to the regional collaboration that is needed to establish a viable tourism image of "Micronesia."

Specific technical opportunities. One promising form of agroforestry for Hawaii is the deliberate management of cattle and *Acacia koa*, a high-value native hardwood (Grace, 1995). For over a century, cattle have grazed under koa, to koa's detriment as regeneration has been browsed and old growth gradually cut. The increased price of koa has led to interest in agroforestry management. Biologically, cattle and koa can be integrated if new koa plantations (or natural stands stimulated by scarification) are established in cattle exclosures. Cattle can be grazed in older plantations where they can help control a vine, banana poka (*Passiflora mollissima*), which tends to grow over the koa canopy. Economically, the inclusion of cattle provides early cash flow and reduces property taxes significantly. Should such cattle-koa agroforestry become widespread on existing pasture lands, pressure could be diverted from cutting koa in other native forests, and the new koa might provide some habitat for native birds. Should the cattle subsequently be removed (because of reduced beef prices or reduced property taxes on commercial forests), a forest understory and habitat for native birds and plants might be established.

Also in Hawaii, there is a loose network of people experimenting with agricultural techniques emphasizing soil and water conservation and organic methods (generally in-

spired by but not formally affiliated with the "Permaculture" movement). Conferences and consultants working with this group look to Pacific and Asian agroforestry as a source of ideas (Dalla Rosa, 1995). Two management plans recently approved by the Forest Stewardship Committee in Hawaii envision the establishment of mixed plantations with timber, timber/fruit and nut trees, grazed by livestock and protected by windbreaks and contour hedgerows (Elevitch, 1995a&b).

Delivery system. The Pacific has the advantage of potentially good integration between forestry and agriculture institutions, if only because many forestry programs are small and contained within agriculture institutions. Appreciation of agroforestry has significantly increased over the last 10 years. However, especially outside Hawaii, local extension programs suffer from understaffing, under-educated staff, lack of funds for operations, lack of extension materials, and often a lack of a definition of what to deliver.

USDA Forest Service grants provide a large part of operations budgets for agroforestry nurseries, training, demonstration, and extension in Samoa and Micronesia. The recently formed Pacific Islands Committee of the Western Council of State Foresters will advocate stability of this grant funding, its efficient use, and appropriate guidelines for Federal programs.

In Palau and Yap, farming is traditionally a women's activity yet forestry and agriculture extensionists are male. Educating existing staff and hiring more women may help improve service to farmers.

Certain key positions in the region would help delivery of agroforestry extension. A University of Hawaii faculty extension specialist in forestry (none now exists) would disseminate information generated by research. A well-educated forester or agroforester working at the national level of the Federated States of Micronesia would play a valuable role in guiding local forestry and agriculture technicians, coordinating external assistance, and identifying needs and opportunities for applied research.

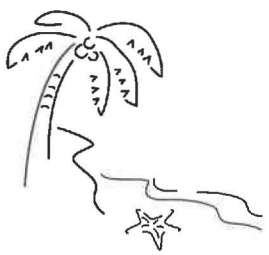
Education. There is a critical need to create a new generation of college-educated foresters in Samoa and Micronesia; most forestry programs there are now led by agriculturists, technicians, or expatriates. The Forest Service is trying to encourage islanders to attend Philippine and South Pacific schools (see Byron et al, 1992), favored for their tropical curricula and the tendency of graduates to return to their homes (rather than staying in the U.S. after U.S. schooling). The Forest Service has also begun to link Micronesian college students at the University of Hawaii (studying agriculture or geography) with forestry internships on their home islands.

Public education for the appreciation and understanding of agroforestry is important. A fairly specific definition of "agroforestry" should be used and objective explanations of the benefits of specific systems presented. There has been a tendency for enthusiasts to make broad claims for the benefits of agroforestry in general over agriculture in general, which may undermine the credibility of extension to farmers. In Hawaii, the term "agroforestry" has been used for plantation silviculture and unmanaged grazing under koa, drawing public perception of agroforestry into controversies over those practices.

Planting materials. Farmers need access to high-quality planting materials of desired species, modern varieties, and traditional cultivars of timber and fiber, fruit and nut, and vegetable and root crop planting materials. Systematic methods of needs assessment and farm planning will help tailor nursery production to demand. Care must be taken that new varieties not displace valuable traditional varieties simply because of their attractiveness due to novelty.

Research needs. Research in tropical Pacific agriculture and agroforestry has followed two somewhat disjointed approaches: Clarke and Thaman (1983) characterized it as "modern, institutional; and the traditional, or indigenous... The approach that focuses on traditional or indigenous agroforestry arises from cultural geography and ecological anthropology; it seeks to record the attributes of traditional or non-institutionalized agroforestry systems that are in use now." The separation of the two approaches risks confining practical, applied, market-based research to modern, introduced systems of agroforestry and agriculture. Opportunity lies in using existing agroforestry systems as a prototype for development, and testing interventions which would meet farmers' current needs (for cash, etc.).

Examples of applied research, a few of which are already being pursued, include the documentation and validation of traditional cultural techniques; documentation and validation of medicinal uses of various species; documentation and collection of local cultivars; trials of commercial crops under conditions (shade, etc.) found in multistory agroforests; trials of indigenous nitrogen-fixing species for intercropping and alley cropping systems; control strategies for introduced weeds; long-term trials of stand development and yield of trees in timber/grazing and mixed timber/fruit systems; studies of wind and dessication in windbreak systems; and studies of nutrient contributions and cycling in alleycropping and interplanting systems.



Policy. National policies need to emphasize sustainability in decisions regarding land uses and agricultural development projects. Environmental impact statement (EIS) procedures need to be established (on some islands) and followed; island governments can be supported with training and technical assistance in preparing EISs. The economic values of agroforests also need to be better understood and factored in. These values are often higher than assumed, especially when import substitution is considered (Clarke and Thaman, 1983).

Several islands would benefit from an evaluation and appropriate action regarding land tenure and its impacts on agroforestry and forests. In Hawaii, property tax rates on sugarcane and grazing are much lower than on forestry and horticulture (Myles, 1990). The concentration of private land ownership in relatively few hands has limited access of smallholders to land for long-term investment in horticulture. A morass of factors has hindered development and distribution of Hawaiian Homelands agricultural parcels to Hawaiian lessees. In American Samoa and Micronesia, transitions from chiefly to nuclear-family land ownership patterns have encouraged land clearing to demonstrate occupancy (Newell, 1992) or a shift from agroforestry to agriculture to adapt to confined parcel boundaries (Raynor, 1991).

Health, economic and agricultural policy could come together in campaigns to encourage consumption of traditional agroforest foods. A model exists in the "Waianae diet" in Hawaii, which is based on Polynesian foods (excluding pork) with the optional addition of various fruits and vegetables. It has proven effective in controlling obesity and related diseases among Polynesians; the diet is coupled with a renaissance in Hawaiian cultural pride (Shintani & Hughes, 1991). It would be important to meet consumer needs for convenience via processing, packaging and/or distribution.

Summary

Pacific agroforestry shares some regional characteristics, but there is tremendous diversity in technical systems used and their economic and cultural contexts. In addition, the nature of an archipelago hinders a free flow of supplies and products,

information, extension services, and research collaboration. An ideal model for development would coordinate work in research, marketing, technical trials, extension, and policy to meet landowner needs, but it is difficult to bring all these resources to bear on any one small island. Well-educated and dedicated island agroforesters can play a key role in integrating and filtering outside assistance to their home island. Federal agencies and other outside entities can help by ensuring that skills and information transfer to islanders, tailored to island and regional needs, takes place in all programs. The most sound development will come with islands depending primarily on their own people and sustainable management of their own resources. Government policies must recognize and emphasize this need for sustainability.

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THIS STUDY WAS DESIGNED TO EXAMINE PINE PLANTATIONS FOR COMBINED WOOD AND HERBAGE PRODUCTION. SILVOPASTORAL PRODUCTION UNDER VARIOUS DENSITIES.

PINUS RADIATA IN THE ANDEAN HIGHLANDS

MARIANN GARRISON
DAVID ADAMS

Introduction

This paper covers the basic methodology and findings of a research project carried out in the Andean highlands of Ecuador to study the effects of overstory tree density on timber and herbage production. We selected *Pinus radiata* for this study due to its extensive use as a plantation tree in the Ecuadorian highlands. We chose to examine herbage production as well as timber production due to the widespread need of local agriculturalists for pasture areas for livestock.

Ecuador is located on the Pacific coast of South America between Colombia and Peru. Ecuador's population is composed principally of two ethnic groups, the indigenous and the *mestizo*, or mixed indigenous and Spanish (U.S. State Department, 1991). Generally, the rural areas are populated by communities of indigenous persons whose lifestyle is based on subsistence agriculture. Daily needs of these agriculturalists include firewood, feed for livestock, and occasional housing materials such as posts or thatch. The availability of these supplies is decreasing as the expanding population places increasing pressures on local natural resources.

Approximately 17,000 hectares of Monterey pine (*Pinus radiata*) have been established in the Ecuadorian highlands since the late 1950's (DINAF 1987). Many plantations are located on lands adjacent to or belonging to campesino communities, and are accessed by these communities for gathering fuelwood (Garrison and Pita, 1992, Carlson and Ronceros, 1987). Entire trees are occasionally removed, and the understory herbage is commonly utilized either through cutting or through direct grazing.

The pine plantations were initially established with economic return on commercial timber as the primary objective (Galloway, 1987). Studies of *Pinus radiata* in other areas of the world indicate that stands must be thinned and pruned in order to improve marketability and tree health (MacLaren, 1987; Scott, 1960). Some thinning operations did take place in Ecuador's plantations during the 1980's and early 1990's (Garrison and Pita, 1992; Carlson and Añazco, 1990; Galloway, 1987). For the most part, these activities were not widely practiced and did not have a strong technical basis or well-defined objectives. As a result of the overall lack of management, many plantations have grown dense and are showing signs of disease and reduced growth.

Silvopastoral systems are a type of land use system in which trees and herbage are jointly produced on one piece of land (Thomas, 1990; Barker, 1990). Silvopastoral systems utilizing *Pinus radiata* have been studied in various regions of the world. Researchers in Australia and New Zealand found that variations in tree densities were likely to modify root production and influence the ability of trees and pasture to compete for nutrients and water (Eastham and Rose, 1990; Eastham et al., 1990). A study in New Zealand showed that only 100 trees per hectare can reduce wind velocity, providing a measure of protection for grazing animals (Peñaloza and Hervé, 1984). Chilean researchers found that heating and cooling processes are modified by tree cover, which may contribute to decreased lamb mortality, better protection of recently sheared sheep, and improved yield of meat and milk (Hawke and Percival, 1984).

In comparison to other countries, research on *Pinus radiata* is relatively new to the Ecuadorian highlands. The environment, growing season and understory plant associations in Ecuador are unlike those for other countries where *Pinus radiata* is grown. Furthermore, the social situation in Ecuador promotes intensive use of pine plantations. While the original production goal of these plantations was timber, other human needs are taking precedence, including the need for grazing animals and fuelwood. Managed pine plantations could have indirect effects on the local community, in addition, such as the provision of employment for local community members.

For the above reasons and to help further the Ecuadorian knowledge base regarding this resource, the research project was designed to investigate Ecuador's *Pinus radiata* plantations for utilization as silvopastoral systems. Specifically, the objective of this study was to measure the effects of stand density on tree size and understory production, and thereby evaluate the potential for management of the pine plantations as silvopastoral systems.

Methodology

For this study, we selected two 12-year-old *Pinus radiata* stands within the intermountain region of Ecuador's central Andes, in the provinces of Chimborazo and Cotopaxi. The Cotopaxi site was located at an elevation of 3100 meters above sea level, with an average annual precipitation of 385 mm per year (INEMHI, 1993). The Chimborazo site was located at 3600 meters, and had an average rainfall of 296 mm. Both sites had a mean annual mid-day temperature of 10.5°C, and ranged from a low of 1.5°C to a high of 20°C. Both sites wereselected based on landowner interest and on history of management activities which provided a range of tree densities for study.

One installation of five .02 ha treatments was located in each stand in July 1992, for a total of 10 experimental units. The five treatments at each site included a control (unthinned) treatment, and four thinned treatments representing 800 trees per hectare (tpha), 600 tpha, 400 tpha, and 200 tpha. Thinning had occurred at least two years prior to the study. In order to exclude grazing animals, we fenced each unit with four strands of barbed wire.

For examination of tree growth and yield, we collected total height, diameter at breast height (dbh) of 1.3 m, and form and

vigor information for each tree during July and August of 1992, and again in 1993. We used this information to calculate various measures of site productivity and stand density for use as independent variables during analyses. Site productivity measures included mean top height, site class (Zeaser et al., 1989), and yield class (Jadán, 1982). Stand density measures included number of trees per hectare, stand density index (Reineke, 1933), relative density indices (Drew and Flewelling, 1977), and relative spacing indices (Beekhuis, 1966).

We examined herbage as the current year's peak standing crop, which we measured by randomly locating 10-50 cm x 50 cm microplots in each fenced unit at the conclusion of the annual rainy season in June 1993. These microplots were clipped to the soil level, and the vegetation dried and weighed using standard procedures (Reppert et al., 1963). For analysis of herbage production, we used the same site productivity and stand density measures mentioned above, and added shade percentage to the stand density variables as a measure of incoming light.

Incoming light is thought to be a critical factor in determination of herbage production in silvopastoral systems (Sequeira and Gholz, 1991; Eastham and Rose, 1990; Eastham et al., 1990). We measured shade percentages using a modification of a simple procedure developed by Wellner (1979) for determining light intensity. Our procedure involved drawing a ten-square grid on a large card, and placing the card on the ground 50 times throughout each unit, between 10 am and 2 pm on days of full sunlight. We averaged the number of squares covered by shade to obtain the shade percentage.

Analyses were performed using the SAS statistical analysis system (SAS Institute, Inc.). We used analysis of variance (ANOVA), regression procedures, and pairwise comparison of means using Fischer's protected least significant difference (lsd) for both tree volume and peak herbage data ($p>.05$). We selected the "best" regression models for both tree production and herbage production for discussion, then combined results to discuss silvopastoral management implications.

Results and discussion

The results of our study essentially fell into three categories: tree growth, herbage production, and combined silvopastoral production.

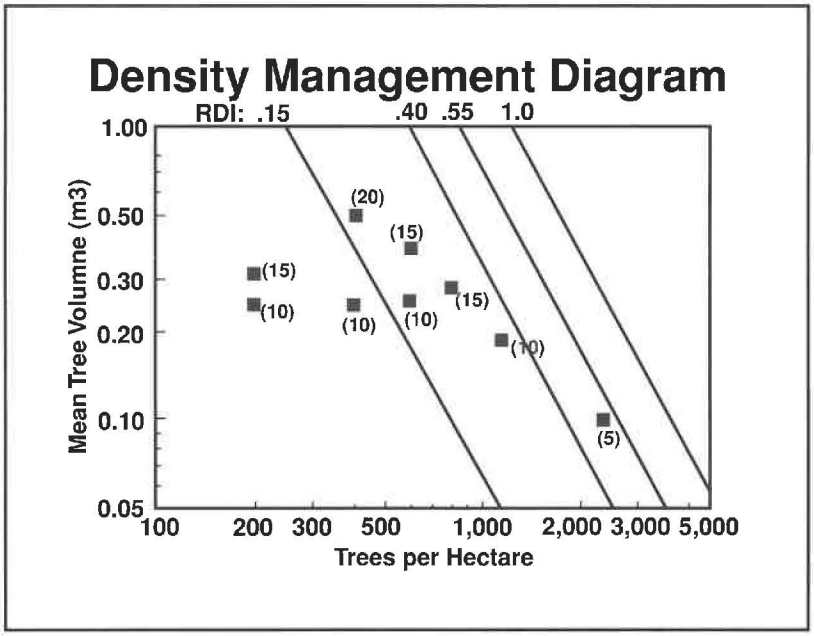
Tree growth

For tree growth, we expected that as number of trees increased, mean tree size would decrease and total fiber production would increase. We based these expectations on assumptions of equal site productivity and competition across all units. However, the occurrence of treatment by location interactions during ANOVA analysis indicated that these assumptions may have been incorrect. Therefore, we used regression analysis to try to identify factors other than number of trees per hectare which may affect tree volume production. Simple linear regression indicated that site productivity, represented as yield class, was most important ($r=.86$) to tree volume production. By employing the natural logarithm transformation of the mean tree volume data, we found that a model using yield class in combination with relative density index gave best overall prediction ($r=.93$) of mean tree volume. In other words, bigger trees were produced on better sites, and the number of trees was less important.

We followed a similar procedure for examination of total wood fiber production, and found that a combination of yield class and basal area per hectare gave best prediction ($r=.98$) of total wood fiber production per hectare. Again, this indicated that site quality was most important to total fiber production, followed by stand density.

Herbage production

For herbage production, we followed a similar procedure to that used for analysis of tree production. Based on the same assumptions as mentioned above, we expected peak standing crop to decrease as stand density increased. Again, treatment by location interactions occurred during ANOVA, indicating that some factor other than number of trees per hectare was having an effect. We performed regression analysis using the same site productivity and stand density variables used during tree volume analyses, and added shade percentage as a stand density indicator. Simple linear regression indicated that shade percentage was the best single indicator ($r=.82$) of peak standing crop herbage production. Using the natural logarithm transformation of herbage data, we found that either shade percentage or relative density index, in combination with mean top height, gave best prediction ($r=.90$ for both models) of peak standing crop. In other words, herbage production depended more heavily upon stand density than upon site quality. We selected the model using relative density for further discussion in order to relate herbage production to timber production.



Density management diagram (Drew and Flewelling 1979) displaying study sites and yield class designations for Ecuadorian study on tree and herbage production under various densities of *Pinus radiata* in the Andean highlands. Yield class designations are depicted in parenthesis. Three classifications for good, medium and poor silvopastoral production are indicated by dotted lines and the letters a, b, and c respectively.

Combined production goals

In order to identify management options for combined tree and herbage production, we utilized their respective relationships to relative density. We relied heavily on Drew and Flewelling's (1979) stand density management concepts, which were developed in conjunction with relative density indices, to relate timber and herbage production. Figure 1 shows a density management diagram modeled on the work of Drew and Flewelling (1979 & 1977). This diagram depicts relative density indices, and helps illustrate the effects of stand density on mean tree volume. This graph may be conceptually broken down into four sections, indicated by the solid lines on the diagram, which represent relative densities of 0-.15, .15-.40, .40-.55, and greater than .55.

Theoretically, mean tree volume is maximized by managing a stand at or below a relative density of .15. This would be a desirable relative density if the production

goal is to grow the largest trees possible. A relative density of .15 indicates crown closure and the onset of competition. From relative densities of .15 to .40, stand volume growth increases as stand density increases, though individual tree growth slows. By sacrificing some mean tree volume growth, overall stand production in this range can be increased by increasing the number of trees. Silvicultural management for timber production ideally maintains stands around the .40 level, and this would also be a desirable relative density if the production goal is to maximize total wood fiber production. From the .40 level to the .55 level, stand growth remains constant regardless of stand density. In other words, if more trees are present, the same amount of stand volume is distributed among more trees, resulting in smaller individuals. Above the .55 zone stand growth is expected to decrease rapidly due to competition-caused mortality.

Our study sites and their yield class designations are also depicted on the density management diagram in Figure 1. Interpretation of this information indicates that for our study, three units had not yet reached crown closure, and six had reached a stage where competition caused decreased individual tree growth, although total stand growth was still increasing. Only one unit was in the .40-.55 zone where high density resulted in lower mean tree volume. These observations supported earlier indications that competition was secondary to site productivity in predicting mean tree volume. We included yield class in Figure 1 to help illustrate its effect on mean tree volume. This illustration indicates that for units of a given stand density, mean tree volume increased almost proportionately with increased yield class. However, as stands approached a relative density of .40, stand density seemed to play an stronger role than yield class as compared to units closer to the .15 line. The low mean tree volumes on the control treatments reflected their higher stand density and lower yield class ratings.

In order to draw herbage production into the discussion, we also grouped herbage production in terms of relative stand density. Mean separation of peak standing crop by treatment indicated that the 200 tpha and 400 tpha treatments had the greatest level of production, followed by the 600 tpha and 800 tpha treatments, followed by the control treatments. These roughly correspond to relative density ranges of .00-.16, .16-.30, and .30-.50, which are designated by the dotted lines on the graph as zones a, b and c, respectively. We combined this information with the previous discussion of stand development to infer that herbage production and mean tree volume were greatest at or before a relative density of approximately .15. From a relative density of .16 to .30, both individual tree size and herbage production decreased, though total wood fiber production still increased. At relative density greater than.30, herbage production was poorest, and wood fiber production eventually decreased due to mortality.

Silvopastoral management implications

A decision regarding the management of a particular stand within this range of relative densities should depend on production goals and site productivity. As discussed above, mean tree volume and total wood fiber production relied primarily upon site quality, followed by stand density. Herbage, on the other hand, relied primarily upon stand density and secondarily upon site quality. Therefore, if herbage production and/or individual tree size are of primary importance, management at a relative density of .15 would allow for maximized herbage and mean tree volume production. If an emphasis on wood fiber production is preferred, management closer to the .30 line would allow for this while still maintaining an intermediate level of herbage production.

Site productivity should also be considered in the selection of appropriate relative density. We found that yield class was a strong predictor of individual tree growth. Herbage production, however, was affected more by incoming light than by yield class. Therefore, on less productive sites, management at a relative density of .15 may be desirable in order to favor herbage production on sites where tree growth is inherently less favorable. On better quality sites, a shift toward .30 might take better advantage of tree-growing capacity while maintaining adequate herbage production.

Several other concerns should be addressed when considering management of *Pinus radiata* plantations as silvopastoral systems in Ecuador. Tree quality could be improved starting at regeneration, by securing certified seed appropriate to the conditions of central Ecuador. Regardless of biodegradability, containers should be removed at the time of planting to allow for root development, particularly on drier sites. Herbage currently on the sites should be evaluated for quality and response to utilization, and improved through the introduction of species selected for palatability, nutritional value, and resilience under grazing. In terms of stand management, thinning and pruning activities should be instituted in order to maintain a stand at a given relative density. These activities may also have important social implications in terms of intermediate products and local employment. Grazing management activities, including calculation of carrying capacity and selection of animal rotation or cut and carry systems of utilization, should be designed and implemented, as overutilization of herbage is a common problem.

Ecological implications should also be considered if silvopastoral systems are to be implemented in these regions. Erosion is a serious problem in the Ecuadorian highlands, which may be exacerbated by improper grazing practices, particularly on steep slopes. The microclimate of a given site changes following reforestation, hence some changes in moisture patterns and microbial activities may also be expected. Since much of the tree and herbage material is being removed from the sites for fuelwood or grazing use, long term site productivity is another concern, particularly if these areas continue to be intensively used for grazing and timber production.

Conclusions

During this study, we found that site productivity was a significant factor in prediction of volume production of *P. radiata*. This is important for Ecuador, because trees are often planted on degraded sites which no longer served for agricultural purposes. We also found herbage production to be more dependent upon stand density than on site quality. Although timber production was the original goal of most of the radiata pine plantations, the understory herbage is presently being heavily utilized for livestock production by local people. This indicates that silvopastoral production may be an important management option for these pine plantations.

The density management diagram proposed by Drew and Flewelling (1979) was a convenient tool to observe both tree and herbage production over a range of tree densities in Ecuador. Based on our results, it appears that density management might be a viable option for managing these stands as silvopastoral systems. Relative densities ranging from .15 to .30 allow for a balance between herbage production and tree production, and the selection of a specific level of relative density would depend on management objectives and site productivity. Other concerns which should be addressed when considering silvopastoral use of these sites include seedling stock, planting techniques, site selection, silvicultural activities, herbage quality and grazing management.

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refutation of your ideas." The key, I guess is unexpectedness: the gratitude of others is most pleasing when it does not seem to be a mere side effect of a brutally disciplined upbringing. The only way to cultivate this sense of spontaneity—fortunately—is to be stingy with one's gratefulness. If every kindness is promptly acknowledged, the impact is lost.

These are radical ideas, I realize. But they are sensible, and they are overdue. For your time and consideration, I thank you in advance.

David Owen, *New Yorker*, December 18, 1995

A view of women in natural resources from World War II and Colorado State University

In the winter of 1943, two college women, Jo Taylor and Helen Galley, decided to conduct a survey. They began by writing a letter: *We are two girls studying forestry at Colorado State College (now University) in spite of all warnings, discouragements and advice to the contrary. Since we are now Juniors, we have been advised to reach a complete understanding of our future professional opportunities soon.* The women sent copies of the letter to 19 university or college deans of forestry, 26 national forest and park supervisors, nine directors of range and forest experiment stations, and 14 regional foresters. They enclosed a questionnaire that asked for specific information about women who had either studied forestry or worked as forestry professionals.

The survey revealed that there were 41 women who had by then been enrolled in the 22 forestry schools in the United States, and 18 had received degrees. The women's graduation rate of 43.9 percent was comparable to that of the male forestry class of 1936-40 at Colorado State College which was 43.1 percent. Of the 18 who had received degrees, eight had at some time been employed in forestry. Interpretative positions, working in parks as naturalist-guides, were often held by women, but these were temporary and seasonal. Women were also employed as public relations and statistical specialists, fire watchers, and stenographers.

Survey results offered insights into the attitudes of the women themselves toward majoring in forestry or working as forestry professionals. When a woman who had studied forestry could be traced through college records, she was asked if she felt that her forestry training had been a worthwhile addition to her life? Without exception the answer was an emphatic "yes" both from women who had worked in the profession and women who had married and never used their training professionally. The most frequently mentioned reasons for this positive attitude were: 1) a better understanding of men's viewpoints, 2) stimulating contacts, 3) worthwhile friendships (4) a broadened horizon, 5) a sense of sportsmanship not stressed in typically women's fields... One woman who had worked for six summers as an "information clerk" at Yosemite National Park, always hoping to be upgraded to the position of naturalist, responded: *I wish I could assure you that you would find attractive opportunities in your chosen profession. But from my own experience I can not offer you much encouragement.... If you are willing to 'enter by the back door' —by that I mean in some clerical position or possibly by volunteer work of some kind, or by marrying a ranger—you might get a chance to do something interesting.*

Nearly all the men contacted replied similarly to this: The field is very limited to women because of prejudice, social customs, and physical strength. The advice they offered the college women was practical and often very frank: Not only does she require separate housing facilities and considerations, but she inhibits the natural freedom of the camp.... *Every forester must frequently supervise crews of rough and tough men, and even if a woman had good supervising ability, I believe many men of this type would resent having a lady boss.... I believe the membership of [service clubs, fish and game clubs, chambers of commerce] would rather deal and mingle (officially) with men executives.*

Having concluded their survey and compiled the results, the women had strong words for other women: *A women entering forestry training "for a lark" or because it happens to be "something different" is violating an ideal—sincerety of purpose. She must respect the ethics of the profession. She must realize, furthermore, that she is in a spotlight position and by her choice is forced to assume certain obligations....*

Susan Cockrell, Colorado State University College of Natural Resources *Newsletter*, Fall 1995

Fish tanks, gulf coast style

An innovative partnership with the US Army has resulted in a growing artificial reef system and improved sport fishing on Alabama's Gulf Coast. The project, aided by coastal conservation groups and saltwater fishing enthusiasts, recycles old army tanks into artificial reefs. Downsizing of the military caused necessary scrapping of many weapons including several thousands of obsolete tanks used in World War II, Korea, and Vietnam. Rather than for scrap, the tanks went to the REEF-EX program, the most comprehensive reef-building program in US history. Alabama was the first state to benefit because of the state's history of artificial reef building—700 square nautical miles of ocean bottom—in three general permit areas were already designated and approved. Fifty-eight obsolete M-60 tanks, stripped and cleaned by army reservists, were deployed at 30 locations in Alabama's offshore waters in summer 1994. By September, 100 tanks were sunk. The EPA inspected them before they were sunk in water depths of 75 to 110 feet. The tanks, constructed of heavy-gauge steel, will take an estimated 50 to 100 years to deteriorate in salt water. By then, buildup of encrusting organisms on the tanks will form a natural reef which will produce fish [snapper, grouper, and amberjack, and serve as ambush points to attack baitfish] indefinitely. Alabama's artificial reef program began more than 40 years ago in 1954, with the sinking of 250 car bodies off the coasts of Baldwin and Mobile Counties. Fishing improved within six months. Since then, the Marine Resources Division has placed bridge rubble, liberty ships, drydocks, oil platforms, and railroad boxcars in addition to the car bodies. People who own their own boats now can put out from Alabama's coast to fish over the well-mapped reefs, predominately located within the three Artificial Reef General Permit Areas. More additions to the reefs are planned.

Gaylon Gwin, *Outdoor Alabama*, Special 1995

Biodiversity patents: a new approach to resource extraction

Under a new "partnership model," no natural products are removed from their country of origin. Instead, biotechnology and technological knowhow—especially among the international pharmaceutical industries—are transferred directly to the developing world. According to Edgar Asebey, President and CEO of Andes Pharmaceuticals Inc, based in Bolivia, the search for new and better medical products has traditionally viewed environmental resources in other parts of the world as fair game. Multinational corporations have generated billions of dollars in revenue through removal of raw materials, scientific study, product development, and commercial exploitation. Traditionally, no economic, social, or health benefits have been realized among populations who reside in those locations from which raw materials were extracted. Seventy-percent of all plants known to have anti-tumor properties, for example, are located only in rainforests. Of an estimated 60,000 plant species in the Amazon, only about 500 have ever been chemically studied, and 90 percent have yet to undergo even rudimentary analysis. New patent laws are expected to not only increase the availability of plant materials to scientific analysis, but to transfer institutional mechanisms designed to undertake such analysis directly to areas where the natural resources are located. The new model will generate revenue, place renewed emphasis on the conservation of biological diversity among threatened resource bases, encourage cooperation between international governments and advance scientific exploration.

World Information Transfer, Inc., World Ecology Report, Fall 1995

Deep seawater is a natural resource

Deep seawater is found at ocean depths where sunlight, required for photosynthesis in phytoplankton, does not penetrate. Although the depth varies from region to region, generally water below 150 to 200 meters is regarded as deep seawater. Approximately 71 percent of the earth's surface is covered by oceans having an average depth of 3,800 meters, which means about 95 percent of the total volume of water in the seas is deep seawater. The huge quantities of deep seawater are tremendously valuable resources. Deep seawater far surpasses the surface water we are usually exposed to in terms of its richness in nutrients, purity, and low temperature stability. The concentration of such nutrient salts as phosphates, nitrates, and silicates—is several tens of times greater in deep seawater than in surface water. This phenomenon is caused by bacteria that decompose the remains of surface-inhabiting fish and plants into inorganic substances as the remains sink into the deep layer where the substances accumulate. Purity is much higher because a scarcity of organic matter, the nutrient source of microorganisms, prevents pathological germs from reproducing. The amount of organic matter and such pathological bacteria as vibrio and E.coli, the main causes of pollution is 1,000 to 10,000 times less in the deep layer. Deep waters do not normally mix with surface waters, but there are times when the natural forces of wind or sea currents cause them to swell up and mix with the surface waters in certain areas. The region where the waters meet is termed the upwelling sea area, and phytoplankton teems when the sun strikes the nutrient-rich deep seawaters. Zooplankton feed on the flourishing phytoplankton and are in turn eaten by sardines and mackerel, which are then consumed by schools of tuna and bonito, creating a highly productive fishing ground. Large upwelling sea areas can be found off the shores of California and Peru, and along the western coast of Africa. About half the total fish catch comes from such fishing grounds even though they occupy no more than 0.1 percent of the world's total ocean area.

In 1976, the Japan Marine Science and Technology Center (JAMSTEC) began research on deep seawater, and in 1989 the Kochi Artificial Upwelling Laboratory (KAUL), the first research center to focus on testing of deep seawaters, was completed. KAUL pumps every day 1,000 tons of deep seawater to the surface from a depth of 320 meters. The temperature is 13 degrees Celsius, the concentration of nitrates is about 23 micromoles, and the water contains an abundance of eutrophic substances.

Research on fish cultures requires clean water. The use of surface waters involves huge costs and much energy to filter the water mechanically and subject it to ultraviolet light to remove the pathological bacteria. Another major expense is cooling the water in the summer to prevent the retarded growth or death of the fish. Utilizing deep waters dispenses with the need for such treatments. Surrounded by seas, Japan, while poor in most natural resources, can collect water from great depths at distances not far from shore, certainly a blessing for utilizing deep-seawater resources.

Toshimitsu Nakashima, *Look Japan*, October 1995

Bering Glacier surges again

In mid-April 1995, after seven months of near-stagnation, Alaska's Bering Glacier resumed surging. A surge occurs when water becomes trapped underneath a glacier, breaking its contact with the ground. The resulting dislocation allows the glacier to slide rapidly. "The glacier

acts like a hydroplaning car on a rain-slick highway," says Bruce F. Molnia, leader of the U.S. Geological Survey's Bering Glacier Project. "During a surge, rates of ice motion may increase as much as 100 times. In August 1993, it was moving as fast as 330 feet per day, or 14 feet per hour. During the current surge, rates have been up to 70 feet a day. Bering, the largest surging glacier on earth, is located in coastal south-central Alaska, much of it on land administered by the Bureau of Land Management and the National Park Service. In the earlier surge, part of the terminus advanced nearly six miles, iceberg production increased substantially, and the size and water chemistry of Vitus Lake at the glacier's edge changed radically. The advancing ice covered islands in Vitus lake where many species of waterfowl nested, including a severely stressed population of dusky Canadian geese. USGS researchers will continue to monitor this new surge with aerial and field observations. Iceberg production will be closely watched, especially if the number of large icebergs that enter the Pacific Ocean through the Seal River, the primary outlet of Vitus Lake, begins to increase, threatening shipping. Seal River is located about 100 kilometers from the Pacific Ocean shipping lanes that exit and enter Prince William Sound.

Gordon P. Eaton and Kathleen Gohn, *People Land & Water*, October 1995

Researchers measure women's interest in sports

At the University of Wyoming (UW), researchers have developed an effective model to help colleges and universities meet federal Title IX sports equity requirements. In 1992, the university responded to the Office of Civil Rights (responsible for enforcing Title IX) by conducting a self-assessment of how well it addressed the sports interests and needs of both its male and female students. The most useful survey data indicated participation interest at all levels by women students. The five sports with the highest level of interest were skiing, volleyball, softball, basketball, and soccer. UW has club skiing, basketball, and volleyball, added soccer in 1995 as an NCAA Division I sport, tennis in 1996, and is considering adding softball in 1997. Part of the rationale behind Title IX was that girls in junior high and high school will have an incentive to stick with a sport if it can be carried on into college.

University of Wyoming *News*, September 26, 1995

From he to she and back again

A small goby fish found in Japan called *Trimma okinawa*e can change its sex repeatedly, based on social factors. Tomoki Sunobe of the Natural History Museum and Institute at Chiba Chuo-ku, Japan, and Matthew Grober, professor of zoology at the University of Idaho have collaborated since 1993 on studying the one and a half inch long fish that occupies cave ceilings and rocky slopes in the temperate reefs off the east coast of Japan. The largest male in a social group actively courts and controls multiple females. After mating, the male alone cares for the young during their early vulnerable days. If the dominant male is removed from the group, the largest female changes to a male and takes his place in the social group. However, this "new" male can revert back to the female sex if a larger-sized male is introduced into the social group. Although there is data that documents sex changes in a range of teleost fishes, they were one-time occurrences and considered irreversible. Research on the *Trimma okinawae*, however, indicates that a species can change sex numerous times in either direction—male to female or vice versa—and the process can be completed in as little as four days. The sex change is not limited to sexual organs: the process also includes a number of other physical changes, including changes in brain chemistry, behavior and morphology specific to a particular sex. Grober and Sunobe studied brain tissue from the fish to identify cells that produce hormones involved in the production of mating and parental behaviors. Microscopic imaging techniques were used to measure the size and number of these cells.

The research provides an ideal model for understanding, and eventually engineering, dramatic changes in brain and behavior. The next step is to look more closely at different points between the start and completion of sex change in the fish to establish what prompts specific physiological changes in the brain and gonads. Then they will look at other relevant brain chemicals and their role in sexual transformation. The project is being supported in part by a grant from the National Science Foundation.

Jeff Olson, University of Idaho *Register*, October 13, 1995

Western Universities learn there is more to forestry than chainsaws.

Unlike the liberal arts colleges of the East—indulgent places, where children of the establishment contemplate the ambiguities of the universe before going on to law or medical school—the land-grant colleges of forestry and agriculture were founded to teach the "industrial and mechanical arts." They were everything middle-class America was: youthful, optimistic, democratic, functional, and sure. They were made to abolish ambiguity and uncertainty, not embrace them. Less than a century later, certainty is in short supply on our forests and in our colleges of forestry. Our timberlands are in worse shape than they were before we started logging them—although scientists disagree over why. Our logging industry feels paralyzed by environmental litigation, and the Forest Service has confessed that its policies over the last century are partly to blame. Behind the snarl of lawsuits and legislation convulsing public lands forestry, there lies a larger truth: We don't understand our forests. And we never have. "Forestry's at the biggest transition it's ever been in and it's going to continue to be in it for the next five to 10 years," says Charles Grier, head of the Department of Forest Sciences at Colorado State University in Fort Collins. "We're going to go from Gifford Pinchot's view (of trees as crops) to Aldo Leopold's view of ecosystem management. There's no way this country's ever going to get away from its need for forest products. But it's going to change from forest management for commodities to management for forest health, and wood will be a by-product, rather than an end product." Change is painful, and uneven. Walk the corridors of any western forestry school and you will find bewildered academics who feel betrayed by the turn forestry has taken. Down the hall, in the same school, you will find people who welcome the change. Colleges of forestry do not stand alone. They are part of a complex system made up of state legislatures, the timber industry, the U.S. Forest Service, environmental groups, and alumni. Throw in the talent and drive of the individual faculty and the ability of the academic administration to deal with conflict, and inevitably there will be many different responses to the challenges now confronting forestry schools....

Progress in academic forestry is nothing if not choppy. The only certainty is that change will continue. One of the greatest changes is that women, minorities and philosophy majors are entering a field long dominated by white men with technical training. In 1990, wildlife biology overtook forest management as the most popular major among graduates from 10 of the West's forestry and natural resources schools. By 1993, its enrollment outstripped forest management's by 25 percent, and one in three of its majors was a woman. Meanwhile, more than one in four forest management majors were women. There is no guarantee that the newcomers will do a better job with our forests than today's managers. But outsiders bring with them a valuable trait: they already know something about being uncertain, about being off balance. In a field whose history has been characterized by doing the wrong thing well, they are likely to help.

Lisa Jones, *High Country News*, November 13, 1995

The Society for Range Management will meet in Wichita, Kansas February 11-15, 1996. In addition to the papers there is a Women's Luncheon scheduled, plus tours to the Flint Hills, Maxwell Game Refuge, and other activities. For information, contact SRM at PO Box 303, Manhattan KS 66505-0303 or fax them at 913-532-6315.

The National Women's History Project, 7738 Bell Road, Windsor CA 95492-8518 (707-838-6000) has videos, posters, displays for Women's History month. They also carry (for Black History month in February) a good selection of African American Women items: Black Americans of Achievement, Women of Hope, Amazing Grace, which depict contributions of artists and educators, civil rights workers, and athletes.

Beginning June 1996, the Institute of Public Service International at the University of Connecticut will be offering a month long training workshop for top and mid-level managers from developing countries who are responsible for design, implementation, and management of development projects in which women are active as participants and planners. Contact IPSI, Attn Andrea Luery, UCONN-IPSI, 1800 Asylum Ave, West Hartford, CT, 06117 (860-241-4924). Ask about the Gender in Development Planning and Management course.

The 5th International Conference on Desert Development will be held August 12-17, 1996 in Lubbock Texas. For information contact Idris Traylor, Office of International Affairs, Texas Tech University, Box 41036 Lubbock TX 79409 (806-742-2218).

The Summer Institute for Women in Higher Education Administration is holding its 21st intensive training for women administrators at Bryn Mawr College. For information contacts HERS, Mid-America, University of Denver, Park Hill Campus, 7150 Montview Blvd., Denver CO 80220 (303-871-6866).

The Symposium on Nonindustrial Private Forests will be held February 18-20 1996 in Washington DC. Contact Mel Baughman, University of Minnesota, Department of Forest Resources, 1530 N. Cleveland Ave, St. Paul MN 55108 (612-624-0734). Following that meeting, the American Forest Congress will convene until February 24th. Contact Office of the Congress, 205 Prospect St., New Haven CT 06511 (203-432-5117.

The World Forestry Center provides a listing of programs at their museum, memorial tree farm, training for volunteers or educators, and others. Contact Rick Zenn at WFC, 4033 SW Canyon Rd, Portland OR 97221 (503-228-1367).

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The Civil Liberties Act of 1988 provided for redress payments of $20,000 each to people, mostly Japanese Americans, who were interned, relocated, or evacuated during World War II and who were still alive on August 10, 1988, the effective date of the law. The Justice Department's Office of Redress Administration is seeking some 4,000 individuals who have not yet received their payments. Those who apply will need present full name, name used during internment, date of birth, address, telephone number, place of internment or relocation or evacuation. Contact the Justice Department at PO Box 66260, Washington DC 20035-6260 (202-219-6900).

Developing country researchers interested in finding solutions to specific conservation and development challenges related to biological diversity can apply for Conservation Impact Grants through the Biodiversity Support Program. Grants of up to $15,000 for up to two years, can be used for proposals in eligible countries. Collaboration with industrialized country scientists and NGOs is encouraged. Contact World Wildlife Fund, 1250 24th Street NW, Washington DC 20037 (202-293-4800).

The Society for Ecological Restoration will hold Paved to Protected: Restoration in the Urban/Rural Context Conference June 20-22, 1996 at Rutgers, The State University of New Jersey. For information, contact Jean Marie Hartman at 908-932-2917 or e-mail them at ser96@aesop.rutgers.edu.

For the June 1996 issue, *Women in Natural Resources* journal will focus on the 10th anniversary of the Dallas Symposium: Women in Natural Resources. We invite papers from attendees. To discuss topics, call or write Andrea Warner, 1515 4th St., Bellingham WA 98225 (206-734-9881) or the editor at 208-885-6754, e-mail dixie@uidaho.edu. Deadlines for manuscripts will be first week of April.

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TO SUBMIT A MANUSCRIPT to Women in Natural Resources journal, send to the editorial office a single spaced preliminary draft by FAX (208-885-5878) for consideration to Dr. Dixie L. Ehrenreich, Editor. To discuss a topic, please call 208-885-6754.

TO ADVERTISE A POSITION OR PRODUCT in a flyer or journal, send text by FAX (number above) for an estimate of cost. WiNR sends out twice-monthly job announcement flyers. The journal is quarterly. Price for a full page (8 1/2 x 11) in the journal or the flyer is $900; half page is $450; one-third page is $300; quarter page is $225; the smallest is one-eighth at $115. We format at no extra charge, or accept camera ready copy sent to our address (see below).

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