2801

Educator's Guide to Program Development in Natural Resources

Education as a Community Resource

An Interim Report of the **Northwest Center for Sustainable Resources** (NSF/ATE/DUE #9813445)

CHEMEKETA COMMUNITY COLLEGE

Educator's Guide to Program Development in Natural Resources

Education as a Community Resource

Northwest Center for Sustainable Resources

(NSF/ATE/DUE #9813445)

This project was supported in part by the
National Science Foundation
Opinions expressed are those of the authors and not necessarily those of the foundation

For more information about the NCSR, contact
Center Director Susie Kelly at Chemeketa Community College:
Phone: 503-315-4583 • Fax: 503-589-7622 • e-mail: kels@chemeketa.edu
www.ncsr.org

Designed and produced by Sharla Cassidy, sjcassidy@earthlink.net

Chemeketa Community College is an equal opportunity, affirmative action institution.

CHEMEKETA COMMUNITY COLLEGE SALEM, OREGON

Printed on recycled paper

© 2000 All Rights Reserved.

TABLE OF CONTENTS

Introduction i

Program Themes 1

Community-based Education 3

Community as a Context for Learning 7

Education for Sustainability 11

Ecosystem Management 13

Program (Community) Processes 19

Public Domain — Accessing the Community 23

Information Gathering — Inventory/Monitor/Research 27

Policy/Decision Making — Community Participation 29

Program Outline 33

Phase I — Ecosystems and Ecology 37

Phase II — Management of Ecosystems 39

Phase III — Natural Resource Applications 41

Case Studies 43

Program Development 47

Program versus Projects 50

Program Design 51

Program Sustainability 52

Hurdles versus Barriers 53

Next Steps 55

Model Community College Programs 56

Summary 59

Appendix 61

A- NCSR Background 62

B- Applications for Ecosystem-based Management 64

C- Checklist for Establishing a Field Study Site 69

D- Case Study 70

E- Overall Program Planning Outline 73

F- Project Planning Outline Form 74

G- Community Resource Reference Form 77

Acknowledgements

There are a number of people who need to be recognized for their contributions to this effort. First and foremost, is Neal Maine, the philosophical architect of this project. He has brought light to a new educational path that leads to more meaningful and authentic learning experiences for all those individuals and groups that make up a community. His thoughtfulness, patience and insight allowed me to expand and change my ideas on education.

Many Natural Resource Institute participants have contributed ideas, refinements, and evaluations that have focused and made this manual more useful for educational practitioners. A number of these educators have developed model programs that are wonderful examples of education as a community resource. Their energy and enthusiasm was always contagious and helped carry us through this project.

The Northwest Center for Sustainable Resources funded by NSF has funded and supported this effort. Susie Kelly, the director of NCSR, has been incredibly supportive financially. Most importantly however, has been her constant encouragement and pats on the back that has made difficult tasks so much easier and enjoyable.

Lastly, a special thanks goes to someone who has provided unending support and freedom for me to explore these new frontiers, understanding for my days away on travels, and patience with my hectic schedule. To my wife, Joyce, and children Mary, Nathan, and Leah, thank you.

Jon Yoder
Secondary Education Coordinator for NCSR

Thank you to the following educators who have helped edit and review this manual.

Mike Baird
Enterprise High School
Enterprise, OR

Michael Britton
Sheridan High School
Sheridan,OR

Miles Carroll
Idaho Falls High School
Idaho Falls, ID

Richard Cooper
Pacific High School
Port Orford, OR

Martin Cunningham
Silverton High School
Silverton,OR

Heather Fabbri
Thurston High School
Springfield, OR

Felicia Guest
North Salem High School
Salem, OR

Stan Iverson
Oak Ridge High School
El Dorado Hills, CA

Richard Kannely
Mount Vernon High School
Mount Vernon, WA

Becky Lippman
North Salem High School
Salem, OR

Terry Manning
Silverton Union High School
Silverton, OR

Yuki Monteith
Ph.D. candidate –
Portland State University
Portland, OR

Theressa Ann Sams
Horace Mann Middle School
Los Angeles, CA

Linda Tompkins
Mynderse Academy
Seneca Falls, NY

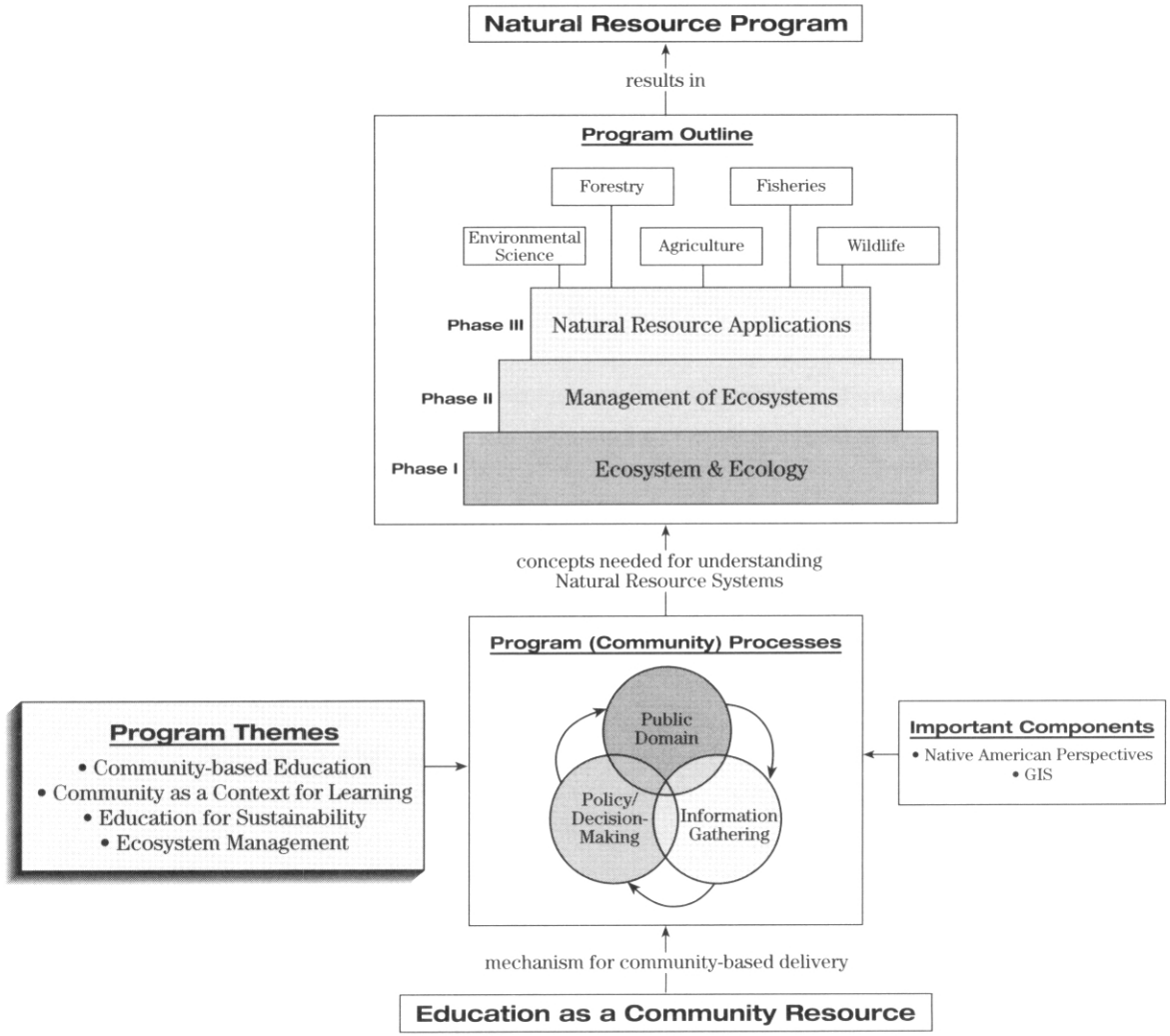
Introduction

The purpose of this manual is to assist educators in the development of natural resource programs that use ecosystem-based management principles and concepts to reach sustainable practices and are delivered through a community-based approach to education.

Through the use of this manual, educators will gain an understanding of community-based education and ecosystem-based management as an organizing framework, examine a program framework, observe case studies, and begin developing a program around natural resource systems. This document is a guidebook and not the final answer or step in program development. That will need to come from each school or district as they connect with their community. Educators will need to take on a leadership role in moving this type of school-community program forward. The hope is that this manual can generate ideas, provide support, and highlight an organizational template for educators that will allow that process to begin or continue.

The manual was developed and written by Jon Yoder and Neal Maine of the Northwest Center for Sustainable Resources (NCSR). Jon Yoder is the Secondary Education Coordinator for the NCSR and a science teacher at North Salem High School in Salem, Oregon. Neal Maine is the Secondary Education Consultant for NCSR and Director for Pacific Educational Resources in Seaside, Oregon. Further information regarding NCSR, can be found in appendix A (pp.62-63) of this manual and by accessing their web site at [www.ncsr.org].

Framework for a Community-based Natural Resource Program



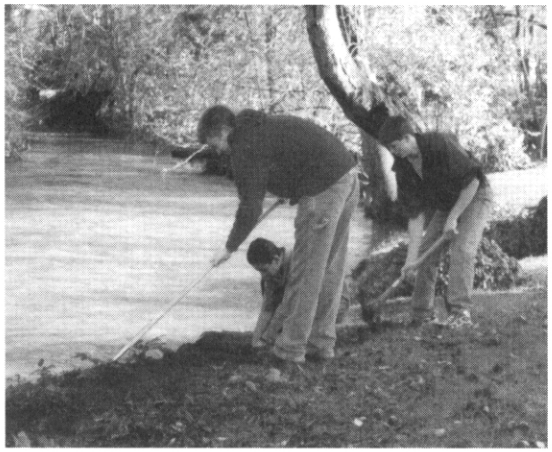
PROGRAM THEMES

— Community-based Education

— Community as a Context for Learning

— Education for Sustainability

— Ecosystem Management



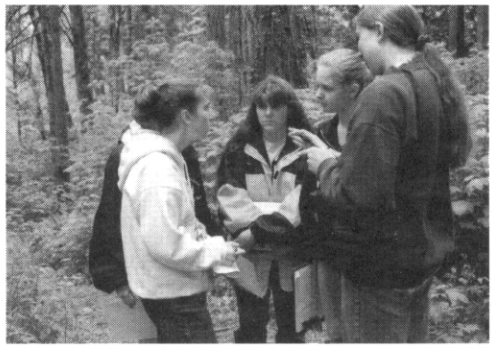
"The greatest gap students have to bridge is the horrendous expanse between the remote island of public education and the mainland of productive citizenship. Community-based education is essential for helping students make the transition."

— *Dustin Beck*
NCSR Institute Participant, 1999
Mohawk High School
Marcola, Oregon

COMMUNITY-BASED EDUCATION

The need for educational reform is on the agenda of nearly every group that is in any way connected to public welfare in America.

Although education historically has been called upon to lead the way in dealing with change in our society, clearly the pressures on our communities from international competition, current economic issues, lack of skilled workers, need for highly skilled and technology-literate citizens, and the incidence of serious social and environmental issues cannot be denied. Increasing day-to-day needs for citizens to be scientifically, technologically, ecologically, and socially literate underscores that there is reason to be concerned about the educational preparation of our student-citizen.



The task, instead, is one of separating us from the past and developing new ways of thinking about a citizen's education.

The Challenge

This background of concerns clearly illustrates that the task for reforming education is more than simply rearranging what is currently being offered in most schools throughout America. Changes cannot be achieved by attempts to simply revise, restructure, reorganize, or update the current school curricula. These courses and how they are currently taught are the very reasons for the demands for educational reform. The task, instead, is one of separating us from the past and developing new ways of thinking about a citizen's education. As educators, our responsibility is to provide leadership in creating programs that represents a system for student-citizens to engage in change that protects and enhances our natural and social worlds. Programs need to be more than single courses offered at the end of a students' high school experience, and instead should be comprehensive, coordinated series of experiences grades K-12.

Neal Maine, NCSR's Secondary Education Consultant, uses a baseball analogy where the young player-citizen's community-based educational program may need some participation tees, the bases may be set closer, and more attention given to safety. However, when young player-citizens see major league baseball played, it includes a bat and ball much like theirs, the rules are generally the same, and the concept of the game is understood. They have actually participated in and played the game. Schools need to provide a setting where our student-citizens have authentic opportunities to participate in the "games" played out in their communities so upon leaving the educational institution their entrance into the community is a known and practiced experience. These authentic opportunities are requested or asked for by the community and are therefore the same experiences that are currently taking place there. An example would be a city agency asking students to assist them in completing their mission, which could be anything from conducting a tree inventory to educating community members about water quality.

It is to the communities' advantage to assure that young citizens have played the game for years and not start when they graduate from high school. To have students become productive and participating members of the community, is the mission of education, without years of experiences actually doing this would seem to lower the capacity for reaching or maintaining sustainable and vibrant communities. The current approach of sitting in a classroom "learning" about math, English, science, and social studies, reading out of textbooks, and doing worksheets allows for little opportunity for the community engagement necessary for citizen participation. Connecting students to their own interests and lives is an important factor to consider in the education of the student-citizen.

The NCSR Approach

The Northwest Center for Sustainable Resources (NCSR) has developed a process for educators to use as they develop community-based programs. Although focused around natural resource program development, it is a process that can be used in many other arenas. This approach encourages teachers to develop programs that engage students in surveying, exploring, and studying how their communities are involved in using and managing natural resources.

Step One

— Examine documents that guide agencies and citizens in the use and management of resources to select out a developmentally appropriate entry point for participation.

Step Two

— Students learn the skills and knowledge necessary to monitor, inventory, and research areas that the community has said

are important and needed. Students form partnerships with agencies and members of the community to help them complete their work.

Step Three

— Student-citizens provide feedback to the agencies and general public on what they have found and learned from the participation. This then raises the capacity of the community to be involved in policy and decision-making by becoming aware of and understanding the use and management of the natural resources around them.

In this way, our students have numerous opportunities to experience and participate in the processes and workings of our community. They not only acquire the necessary skills and knowledge that the public is concerned about, but through meaningful and authentic ways act as a participating citizen of their community.

It is time for communities and educators to expand their current efforts and develop community-based programs that will build civic engagement in our community. A more concerted effort is needed to involve student-citizens of our community in whose hands we leave the future of our world.

The NCSR Goals

A graphic representation of the possible relationship between school programs and community may help highlight the NCSR program goals.

Figure 1

Figure 1 represents the typical relationship that exists between schools and communities. Students take a set of discrete courses in what often looks very little like the experiences taking place or needed in the community. Upon graduation students are assumed to know how to be a participating, contributing member of the community regardless of knowing what that means or having had previous experiences or opportunities within the community.

Figure 2

Figure 2 shows the relationship "school" taking place out in the community, but not interacting with the community processes. An example would be stream studies at a local site where there is no additional purpose other than to do stream studies. The school has not been asked to serve as a resource or participate by the community. In addition, guest speakers come in to school to talk about what may go on out in the community, but again students do not experience it first hand.

Figure 3

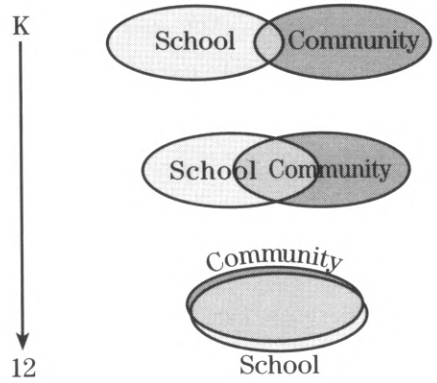


Figure 3 represents the relationship between schools and community that NCSR advocates for your natural resource program. In this model, schools are involved in serving as a resource for the community. The skills, knowledge, and attitudes are developed within the

A more concerted effort is needed to involve citizens of our community in whose hands we leave the future of our world.

Establishing a community-based program is the fulfillment of the mission we have been given.

authentic experiences of the community. Student-citizens are involved in the community processes and are considered a valuable resource by the community. From the diagrams above you see that the amount of overlap may vary as you move from K-12. Developmentally appropriate experiences in the community would likely occur less frequently in the primary years than as a 12th grader who may be in the community arena nearly full time. Elementary school students should have frequent exposure to ecosystem studies and can be powerful spokespeople when given the chance to be community participants.

It is important to note that this relationship between schools and communities is almost always mandated.

An example is the mission statement from the Salem-Keizer school district which reads:

> *In partnership with the community, we ensure that each student will have the essential knowledge, skills and attitudes to be a life long learner, a contributing citizen and a productive worker in a changing and increasingly diverse world.*

If we are to take this seriously, we need to design our programs in partnership with the community so the learning that takes place is within the context of the community. Most schools and districts across the country have similar mission statements, yet most learning that takes place is not within the community context but in isolated classrooms. Establishing a community-based program is the fulfillment of the mission we have been given. Important knowledge, skills, and attitudes are still taught and content standards are addressed, but now it is within the context of "In partnership with the community."

We realize that this is a major paradigm shift and cannot be achieved by a single individual in a short period of time. What we are proposing will be a long and somewhat difficult task to accomplish. However, this approach will be rewarding enough for students, teachers and community members that it will be difficult to go back to a more traditional mode of education. Discussions with colleagues, administrators, and community members are good places to start the change process. We hope this manual will provide ideas, a process and framework that will aid you in initiating change in your school and community.

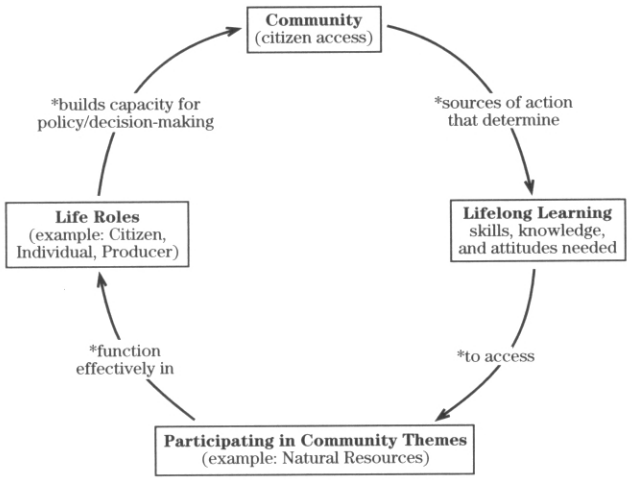
COMMUNITY AS A CONTEXT FOR LEARNING

Understanding the community around you is essential in development of a community-based program. There are three areas that will be used to describe a community: ***lifelong learning, community themes,*** *and* ***community life roles*** *of community members. All of these further support the notion that schools need to more closely interface with the community.*

This section of the manual may also be used to justify the appropriateness or need for the community-based approach in natural resource programs.

The three areas that describe a community—lifelong learning, community themes, and community life roles—are all connected. An example of the community process is shown below.

Figure 1



In Figure 1, citizens access and participate within a community in a variety of ways. Often this involvement serves as a source of action where lifelong learning (skills, knowledge, and attitudes) is needed. This participation occurs within community organizations that can be categorized into broad themes such as natural resources. The interaction of community members within these themes allows for functioning in a number of life roles such as citizen, producer, and consumer. The result in this community process is to build a capacity for policy and decision-making among all members of the community.

In the next section of this manual, we will revise this process to one you can use in developing your natural resource program. It is important to note that although we are focusing on natural resources, this process can be used for all community themes.

LIFELONG LEARNING

In order for citizens to be successful participants in the public process they must be able to acquire the basic public skills.

The first area of community deals with life-long learning and the skills, knowledge, and attitudes necessary to function effectively in a community.

In this rapidly changing world, new skills are needed by wide segments of the public to maintain pace with community development, careers and jobs. Keeping up with these constant changes can often exceed the capacity of the average citizen. A community-based educational program could help bridge the gap between citizens and active participation in their communities.

Each member of the community brings a wide range of personal skills and knowledge to the public process: educational experience, their own personal life experience, diverse attitudes, and their own unique personality. The question for full participation is not so much how old the citizens are, but what is their personal entry-level skill for participation in the public arena? Although somewhat unclear for some, it is clear to the educational reform effort that students are and must be considered full participating citizens in our communities. The proposed framework insures that developmentally appropriate access would be provided for the young citizens of our communities.

In order for citizens to be successful participants in the public process, they must be able to acquire the basic public skills, such as being an effective communicator and team player. They must have an opportunity to develop additional specialized skills and knowledge, such as application of specific technologies, if they are to contribute to the more specialized "themes" of the community.

If citizen skills and knowledge are not developed in the formal process during their schooling, then this opportunity should be available for development at any time. Although some will seek additional formal educational opportunities, most will go with what they have, often limiting their participation to "crisis" community issues where the motivation exceeds the concern about personal skills and knowledge; or that concern motivates the individuals to personally develop the skills and knowledge necessary to get through the crisis.

Skills (Examples)

- Effective communications – oral and written
- Use of electronic communications, email, web access, etc.
- Problem-solving approaches for community actions
- Techniques in being a "team player"
- Organizational skills

Knowledge (Examples)

- Knowledge of community processes
- Opportunity to build a sense of place
- Access to the community and regional history
- Relationship of community in state, national and global context
- Interactions of economic, social, and ecological elements of community
- Local geography

Attitudes (Examples)

- A spirit of cooperation
- Support for linkage between rights and responsibilities
- Building a sense of ownership of community
- Feeling for linkage between services and service
- Confidence in actions to identify, analyze, and select
- Actions to resolve issues

COMMUNITY THEMES

The actions of the community can be organized around community themes. The themes being proposed are useful organizers for our communities and can also be used to plan and focus asset inventories. These are the valued social, economic and ecological components of a community. The inventories would serve as the "common" resources of community members and be useful in planning and developing community action plans. None of these themes operates in isolation in the "real world"; thus, the community themes are only for the purpose of planning. The following is a list of proposed community organizing themes. Academic disciplines should be used to advance these themes.

Human Resources: A fundamental area of community study and participation that includes political and social systems. These may include, but need not be limited to, education, law and legal studies, law enforcement, public administration, child and family services, religion, and social services.

Health & Safety Services: A theme that is critical to groups and individuals in communities and fosters the promotion of health as well as the treatment of injuries, conditions, and disease. These may include, but need not be limited to, medicine, dentistry, nursing, therapy and rehabilitation, nutrition, fitness and hygiene.

Business and Management: The economic base of communities must be understood to insure participation, and includes areas of study related to business environment. These may include, but need not be limited to, entrepreneurship, sales, marketing, hospitality and tourism, computer/information systems, finance accounting, personnel, economy and management.

Arts & Communications: Often the base of community culture and community pride, this includes areas of study related to the humanities and to the performing, visual, literary and media arts. These may include, but need not be limited to, architecture, creative writing, film and cinema studies, fine arts, graphic design and production, journalism, foreign languages, radio and television broadcasting, advertising and public relations.

Infrastructure and Engineering Systems: Fundamental to current community infrastructure, this area of study is related to the necessity to design, develop, install, or maintain physical systems. These may include, but need not be limited to, engineering and related technologies, mechanics and repair, manufacturing technology, precision production and construction.

Natural Resource Systems: Often one of the limiting factors in community economics and development, this area of study is related to environment and natural resources systems. These may include, but need not be limited to, agriculture, earth sciences, environmental sciences, fisheries management, forestry, horticulture, and wildlife management. Ecosystem management is the standard for many public agencies and must include citizen participation. This theme also relates to citizens' stewardship and land use planning for communities and resource land.

These community themes are drawn from the Oregon's Certificate of Advanced Mastery (CAM) program and support the development of a program that includes natural resources as an organizing theme and connections to the community.

COMMUNITY LIFE ROLES

A third area of community description is community life roles. These life roles of the community are the front line of action and play a significant role in determining the breadth and depth of capacity being added to the community. Linking actions to the life roles can help focus the work, both within the formal educational community and the broader community institutions. All citizens, including young citizens-students, should have the opportunity to function effectively in the following life roles of the community:

"Citizen": to learn to act in a responsible manner; to learn of the rights and responsibilities of citizens of the community, state, nation, and world, and to learn to understand, respect, and interact with people of different cultures, generations, and races.

"Family Member": to learn of the rights and responsibilities of family members and to acquire the skills and knowledge to strengthen and enjoy family life.

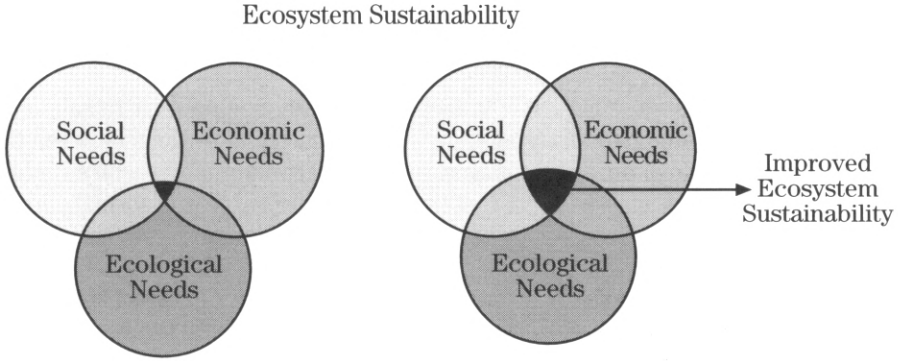
"Individual": to develop the skills necessary for achieving fulfillment as a self-directed person; to acquire the knowledge necessary for achieving and maintaining physical and mental health and to develop the capacity for coping with change through an understanding of the arts, humanities, scientific processes, and the principles involved in making moral and ethical choices.

"Lifelong Learner": to develop the skills of reading, writing, mathematics, spelling, speaking, listening, and reasoning and apply them in a context that creates a positive attitude toward learning.

"Consumer": to acquire knowledge and develop skills in the management of personal resources necessary for meeting obligations to self, family, and society.

"Producer": to learn of the variety of occupations; to learn to appreciate the dignity and value of work and the mutual responsibilities of employees and employers; and to learn to identify personal talents and interests, to make appropriate career choices, and develop career skills.

These life roles were taken from the Oregon State Education Goals whose goal is to assure that every student citizen shall have the opportunity to learn to "function" effectively in six life roles. Public school should provide developmentally appropriate participation "during" the school experience to accomplish this.



The physical and biological capabilities of ecosystems are limited in flexibility and therefore convergence requires shifts in social and economic needs to comply more with ecosystem capabilities.

Sustainability and Communities

The term *sustainability* generally refers to long-term economic, environmental, and community health. It was popularized by the 1992 "Earth Summit" and the World Commission on Environment and Development's 1987 report *Our Common Future*, which defined sustainability as meeting the needs of the present without jeopardizing the ability of future generations to meet their own needs.

Increasingly, Northwest communities are exploring what sustainability means for them in specific, local terms. It can be seen as an umbrella concept that can help them deal, in a comprehensive way, with the goals of promoting economic vitality, protecting the environment, managing growth, building healthy communities, and enhancing the well-being of their residents.

The diagram on the left shows the relationship between ecosystem capabilities and social and economic needs. The diagram on the right shows the relationship between ecosystem capabilities and social and economic needs with greater convergence resulting in improved ecosystem sustainability. The physical and biological capabilities of ecosystems are limited in flexibility and therefore convergence requires shifts in social and economic needs to comply more with ecosystem capabilities. It is important to keep this model in mind as a source for program goals.

"It is not about teaching science, math, art or natural resources, it is about teaching about life and the connections, dependencies and relationships every organism has with one another."

— *Bruce Carvalho*
NCSR Institute
Participant, 1996
Bend High School
Bend, Oregon

Education for sustainability is critical and must consider enlarging that area of intersection between the social, economic and ecological resources.

What is education for sustainability?

1. Education for sustainability is a lifelong learning process that leads to an informed and involved citizenry having the creative problem-solving skills, scientific and social literacy, and commitment to engage in responsible individual and cooperative actions. These actions will help ensure an environmentally sound and economically prosperous future.

2. Education for sustainability ensures that the interconnections between the environment, economy, and social structures become an integral part of formal education, starting with kindergarten and continuing through elementary and secondary school and on through education at the college, university, professional levels, and as citizens (lifelong learners).

Ecosystem management may be the opportunity that allows for greater interaction between the social, economic and ecological needs to occur. In our next section we will try to define and explain ecosystem management and its application to program development.

ECOSYSTEM MANAGEMENT

In a world where there is significant dependence on a natural resources-based economy, it is important that there is good stewardship of our natural resources. Ecosystem management is being adopted as a guiding philosophy for many natural resources-based agencies, where changes toward more sustainable methods of managing fisheries, wildlife, forest, and agricultural lands are being implemented.

To meet the challenges of increased resources use and reach the goal of sustainability, we need an ecosystems-based approach to natural resource education where educators use innovative methods, cutting-edge research and technology, and field experiences for their students that are imbedded within the operations of the surrounding community.

What is Ecosystem Management?

The following is an article by Wynn Cudmore, NCSR Principal Investigator, to help define ecosystem management and provide some applications for program development.

Ecosystem Management: An Overview

Wynn Cudmore, NCSR Principle Investigator

As we have consumed, exploited and manipulated natural resources for human use (food production, lumber production, mining, recreation, etc.), it has become obvious that the resources we value do not exist in isolation—rather, they are part of larger systems. In these systems, each component plays an important role. It may be argued that to maintain the integrity of these systems, the "best management is no management." However, given that we will continue to manipulate natural and artificial ecosystems, it is in our best long-term interest to do so in a manner that assures (or at least improves the likelihood of) the integrity of those systems. **Ecosystem Management (EM)** has been proposed as a mechanism that strives to achieve this goal and will be used as a recurring theme in this course.

The concept of EM is currently under development. It has been labeled everything from an oxymoron to a guiding principle that will "protect the environment, maintain healthy ecosystems, preserve biological diversity, and ensure sustainable development" (Lackey, 1995). The concept has led to antagonism from pro-development interests who see it as a smoke screen by environmentalists to preserve more acreage in its natural state. Nevertheless, the U.S. Forest Service and the Bureau of Land Management adopted EM as their guiding philosophy in 1992, and 16 additional federal agencies and departments in 1993 did the same. At the very least it appears that ecosystem management provides some options or insurance for the

Ecosystem management is being adopted as a guiding philosophy for many natural resources-based agencies, where changes toward more sustainable methods of managing fisheries, wildlife, forest, and agricultural lands are being implemented.

Since management will be based on ecological rather than political boundaries, EM will require unprecedented cooperation between various parties (public and private) responsible for stewardship of various land holdings.

future that may not be available under other management philosophies. Attempts to apply EM on a large scale include the President's (Northwest) Forest Plan (Option 9) in the Pacific Northwest and the Everglades Ecosystem Project in Florida. The concept has achieved a great degree of acceptance in scientific, socioeconomic and political circles and it appears, at least for now, that "ecosystem management represents our best opportunity to describe, understand and fit in with the natural world" (Grumbine 1994).

What is Ecosystem Management?

Ecosystem management emphasizes goals designed to:

— maintain existing biodiversity at genetic, species and ecosystems levels

— maintain evolutionary and ecological processes within ecosystems

— maintain or enhance long-term productivity of ecosystems

— manage over temporal and spatial scales that are appropriate for the ecosystem

— accommodate human uses within these constraints

A sampling of definitions of EM by various authors:

"Ecosystem management integrates scientific knowledge of ecological relationships within a complex sociopolitical and values framework toward the general goal of protecting native ecosystem integrity over the long term." Grumbine (1994)

"EM is an approach to the management of natural resources that strives to maintain or restore sustainability of ecosystems and to provide present and future generations a continuous flow of multiple benefits in a manner harmonious with ecosystem sustainability." Unger (1994) Associate Chief of U.S. Forest Service

"Protecting or restoring the function, structure and species composition of an ecosystem, recognizing that all components are interrelated." U.S. Fish and Wildlife Service

"EM is a process that considers the total environment. It requires the skillful use of ecological, economic, social, and managerial principles in managing ecosystems to produce, restore, or sustain ecosystem integrity and desired conditions, uses, productivity, values, and services over the long term.... EM recognizes that people and their social and economic needs are an integral part of ecological systems." U.S. Bureau of Land Management (1993)

Some Underlying Principles and Implications

Ecosystem management has ecosystem science at its core. This includes concepts such as interconnectedness of ecosystem components, biodiversity, nutrient cycling, energy flow, population growth, limiting factors, species interactions, competition, symbiosis, etc. Ecosystem management will require unprecedented cooperation between various parties (public and private) responsible for stewardship of various land holdings since management will be based on *ecological* rather than *political* boundaries.

Ecosystem management requires thorough understanding of the ecosystems we are managing. **Adaptive management** recognizes that our knowledge of ecosystems is incomplete and uses management as an ongoing process to gain further understanding of our impact on complex systems. A close working relationship between "managers" and "researchers" assures that management activities incorporate the latest scientific information and that management activities will be updated on an ongoing basis as our understanding of ecosystems improves. A close working relationship between researchers and managers is of mutual benefit. Managers gain access to state-of-the-art information on

the systems they are managing. Researchers gain feedback that fine tunes the focus of scientific studies and provides them with a better understanding of the practical difficulties faced by managers. The results of management activities are monitored continually, providing a feedback loop to managers. Management practices can, therefore, be adjusted as we learn of inadequacies or mistakes.

Ecosystem management goals are *socially* defined. People must be recognized as an integral component of ecosystems. Human values will play an important role in defining the goals of ecosystem management. This may be the most problematic component of EM, for even if we gain the *scientific* knowledge to manage ecosystems sustainably, conflicting societal goals and human values may prevent this from happening. There is evidence to suggest that some interests are using this aspect of EM to justify "business as usual"; e.g., short-term, single- commodity based management with minimal regard for ecosystem integrity.

Where is Ecosystem Management being Discussed, Implemented or Practiced?

- Ecosystem management has been a major theme at national and international conferences including the Seventh American Forest Congress (1996) and the Canadian Institute of Forestry Annual Meeting (1996).
- *Journal of Forestry* has published a number of major articles on ecosystem management and adaptive management in recent issues. Articles in the February and June 1996 issues address EM in non-industrial private forests.
- Boise Cascade Corporation is developing a plan for management of a 300,000 acre area in Minnesota that will be used as a demonstration project for ecosystem management. Another demonstration project is planned by Boise Cascade in Idaho.
- Implementation of ecosystem management in large rivers and floodplains is addressed in a series of articles in *BioScience: 45(3)*.
- Some examples of projects that are being presented as attempts to implement ecosystem management:
  - Clayoquot Sound, Vancouver, British Columbia
  - Eastside Ecosystem Management Project—Eastern Washington
  - Columbia Basin Ecosystem Management Project
  - President's Forest Plan—Option 9 (Northwest Forest Plan)
  - Greater Yellowstone Ecosystem
  - Everglades Restoration Project—Florida
  - Wildlands Project—North America

The U.S. Forest Service adopted EM as a major emphasis in 1993. Concepts of EM are being implemented on National Forests across the United Sates.

Sustainability, and Applications of Ecosystem Management

EM and **sustainability** are closely aligned. The term generally refers to longterm economic, environmental, and community health. It was popularized in the 1992 "Earth Summit," and sustainability was defined in the World Commission on Environmental and Development's 1987 report, "Our Common Future," as: *Meeting the needs of the present generation without jeopardizing the ability of future generations to meet their own needs.*

I have listed below some natural resource emphasis areas where EM is important. The term *sustainability* is a frequent component of these topics and the margins between EM and "sustainable development," "sustainable forestry," "sustainable agriculture," etc., often blur. This might provide a starting point for application components of EM.

FORESTRY. In forest ecosystem management, the products taken from the system are an important secondary objective. Integrity of the forest ecosystem comes first. Ecosystem management would identify forest sustainability as the foremost goal of national forest management, and use the conservation of biodiversity as the mechanism to that end.

AGRICULTURE. Sustainable agriculture is a systems-level approach to understanding complex interactions within agricultural ecosystems. It produces adequate amounts of high quality food while protecting other resources by using practices that are both environmentally safe and profitable. A sustainable farm relies as much as possible on beneficial natural processes and renewable resources drawn from the site itself. Integrated pest management and holistic agriculture are examples of its application.

FISH & WILDLIFE. Protecting wildlife and fish populations on forested and other terrestrial sites are major reasons to practice ecosystem management. Protecting the system protects species which depend on it. Applications and examples of incorporating systems-based management and conservation approaches include GAP analysis, application of island biogeography theory to wildlife management, establishing minimum critical size for ecosystem studies, providing wetland and riparian buffer protection and ecological preserve designs; i.e., core reserves, buffers and corridors.

In appendix B (pp. 64-68) is a list of topics that may be considered as elements of EM to engage students. In many of these topics, the different roles that the community, science, and government play in the management of natural resources can be highlighted. This provides the opportunity to develop a natural resource program that is community-based.

In addition a number of authors have published articles that define ecosystem management and describe attempts to implement it. The appendix briefly describes articles that are representative of some of these publications. Educators interested in incorporating ecosystem management into the curriculum should find these to be valuable resources.

Program Themes Summary

In developing programs in natural resources, an important theme to include throughout is sustainability through ecosystem-based management delivered through a community-based approach to education. We have defined and explained those themes that should be a central feature throughout a program of study. In designing a program, check to see if the educational opportunities and experiences contain these important themes.

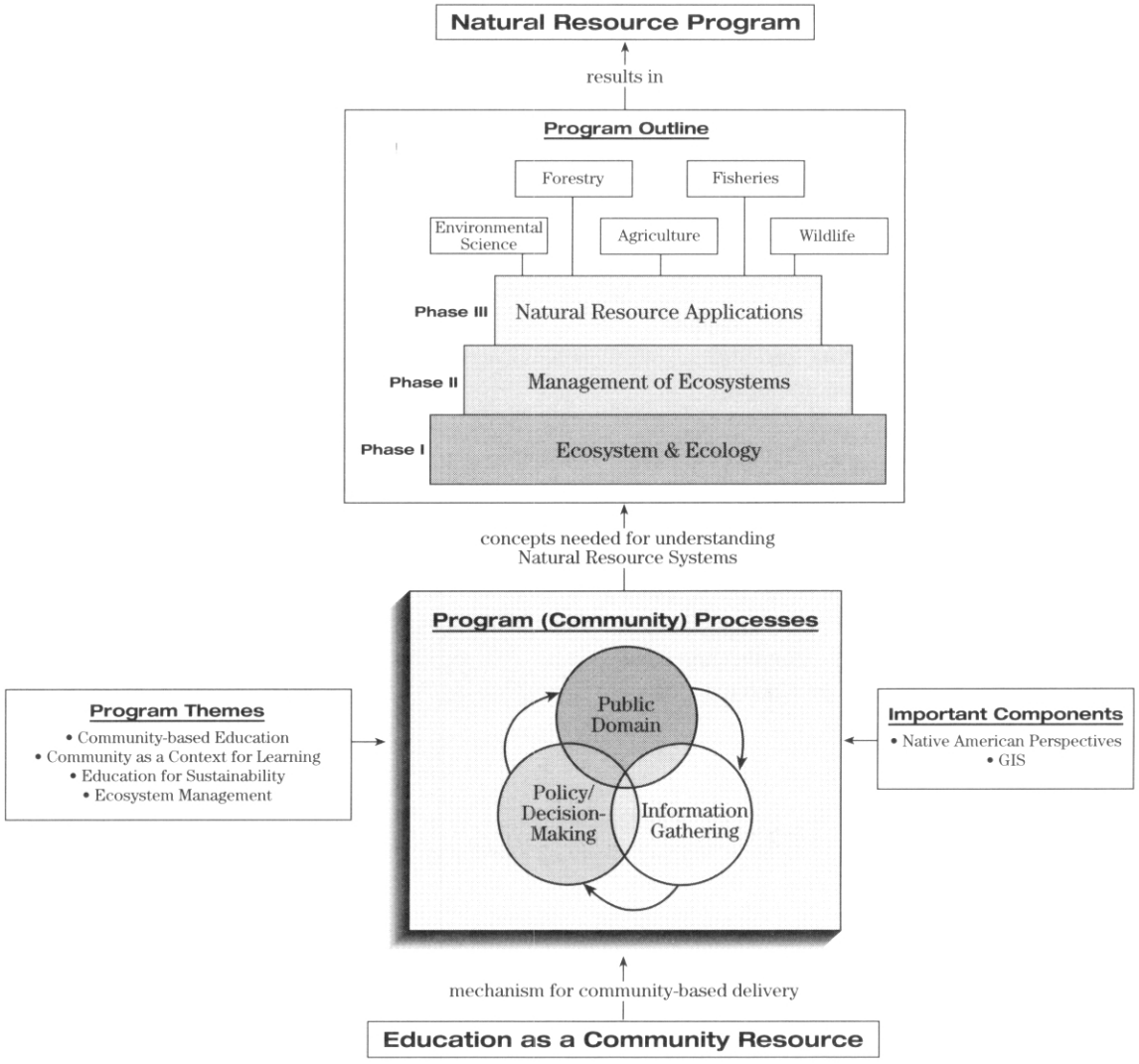
- Community-based education is the delivery model used, where the community is the classroom and the school is viewed as a community resource center. The natural resource program uses the community theme of natural resource systems to engage students in a variety of life roles to develop lifelong skills, knowledge, and attitudes.
- Ecosystem sustainability is our goal and considers the social, economic, and ecological needs of our community.
- Ecosystem management takes those needs into consideration and determines how we use and manage our resources to achieve sustainability.

In the upcoming sections of the manual, a more specific design framework and components will be laid out, along with examples and case studies to show how this approach may look in a variety of settings.

"The school science program must extend beyond the walls of the school to include the resources of the community."

— excerpted from the National Science Education Standards

Framework for a Community-based Natural Resource Program

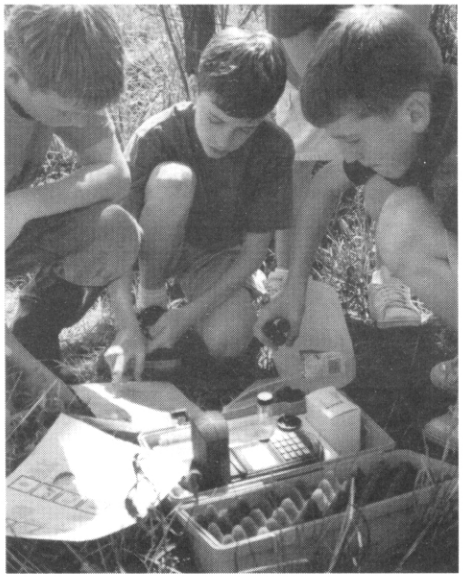


PROGRAM (COMMUNITY) PROCESSES

— Public Domain - Accessing the Community

— Information Gathering - Inventory/Monitor/Research

— Policy/Decision Making - Community Participation



PROGRAM (COMMUNITY) PROCESSES

This section of the manual will describe a process that can be used in selection of student experiences for your natural resources program.

The focus is once again on the authentic participation of the student-citizen in the community processes. The graphic below provides an overview of this program/ community process.

Each circle or arena will be explained and an example will be used to clarify and showcase what the program processes look like.

The exchange of productive communication across each of the arenas in this model is the most critical element in building and maintaining a viable program.

For effective program design, this model must support the development of skills and knowledge to insure access for participation by young citizens in each arena.

Figure 1

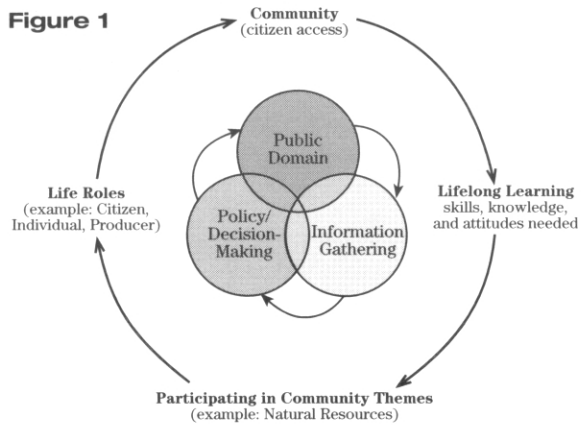
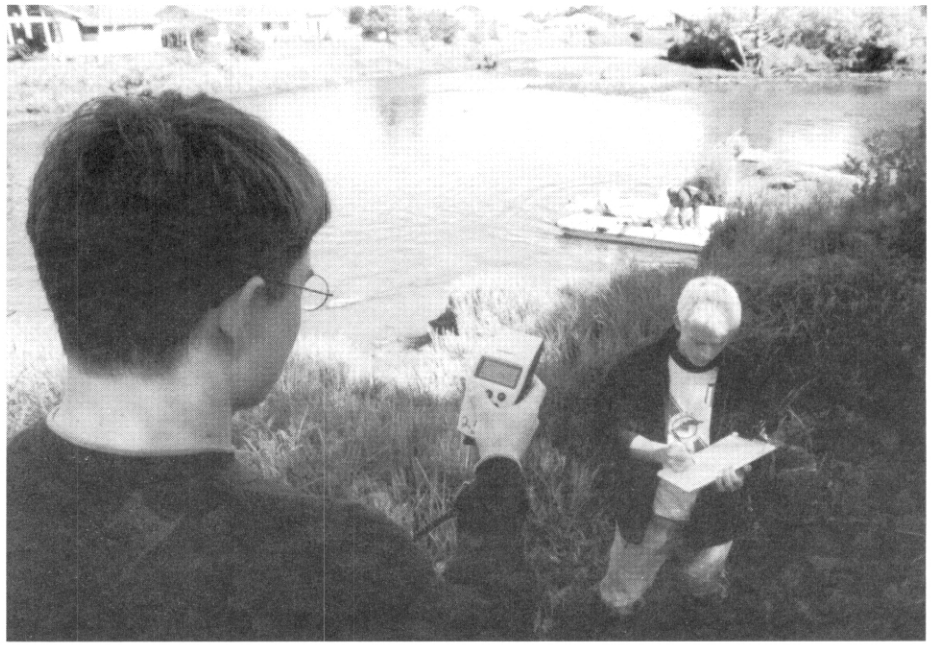


Figure 1 shows the community process on the outside of the diagram while the center circles are the instructional strategies used by educators that allow for student participation in those community processes.



PUBLIC DOMAIN

Accessing the Community

In this arena, the community uses and manages natural resources in a variety of ways. Numerous agencies—city, county, state and federal—are responsible to carry out mandates and laws regarding the use and management of natural resources. Businesses, industry, and other community groups are also interested and involved in the use and management of natural resources.

Possible Resources within your Community

Activities in the community that use natural resources are:

- Land-Conversion
- Water Diversion or Use
- Agriculture
- Mineral Extraction
- Forestry
- Fuel Consumption
- Fisheries
- Industrialization
- Urbanization
- Recreation

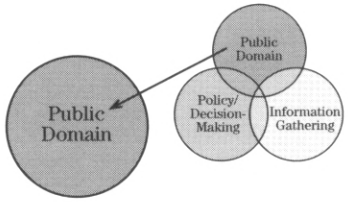
The management or uses of natural resources in these activities is guided by laws and regulations, found in a variety of documents and agency mandates. Some public agencies that are involved in managing the use of our natural resources are:

- City Planning, Public Works, and Parks and Recreation Depts.
- County Planning Dept.
- U.S. and State Dept. of Fish and Wildlife
- Soil & Water Conservation
- Natural Resources Conservation Service
- Bureau of Land Management
- U.S. and State Forest Service
- Environmental Protection Agency
- Water Resources Dept.

Examples of documents that guide the use of our natural resources are:

- City and County Comprehensive Plans
- Forest Practices Regulations
- State Planning Goals
- Water Resources Planning
- Public Agency Plans
- Land Use Goals
- EPA Standards
- Business and Industry Regulations
- Land Trusts

The goal is to maintain healthy, sustainable ecosystems that provide both "goods" and "services" to the community.



- Ecosystem "goods" include:
  - Food
  - Construction materials — Raw materials
  - Medicinal plants
  - Wild genes for domestic plants and animals
- Ecosystem "services" include:
  - Regulating climate
  - Generating and maintaining soils
  - Maintaining hydrological cycles
  - Providing sites for recreation and research
  - Storing and cycling essential nutrients

The goal is to find a task or project the students have been invited to participate in by the community.

Classroom Application

For the educator, here is the entry point for most people in developing experiences and opportunities for students. The goal is to find a task or project the students have been invited to participate in by the community. There are a number of ways to have students enter this arena.

One way to start is by having the students do an inventory of their community to discover how natural resources are being used, who is in charge of managing the resources, and what documents determine how the resources are used and managed. From these documents there are always "invitations" to the community to become involved in some way. This is an open invitation to the student citizen to participate. In addition there is usually an education component to the plan and this is again another opportunity for student involvement.

There are several examples of public domain documents that can be showcased. These include state, county and city goals and plans. The state of Oregon has a document titled *Oregon's Statewide Planning Goals and Guidelines*. Goal one is titled "Citizen Involvement," and states this priority: "to develop a citizen involvement program that insures the opportunity for citizens to be involved in all phases of the planning process." The document goes on to specify citizen involvement and influence. Data collection, inventorying, and mapping are specific tasks citizens are often called to be involved in.

Polk County includes citizen involvement as one of its primary goals in its comprehensive plan. The plan states that "a strong citizen involvement program is felt to be essential to the success of the Polk County planning process." This includes "the formation and development of plans, maps, surveys, inventories, or other elements of the planning process." This provides the perfect entry point for authentic and contextual learning experiences for the student-citizen.

The City of Salem has numerous documents requesting citizen involvement. The Public Works Department is an example of this with operating documents that call for public education and participation. Schools are involved in collecting data and providing education on behalf of the city through the Stormwater Permit requirements and as part of the city's obligations for the Endangered Species Act.

These examples of state, county, and city documents can be found in every community throughout the United States. These are invitations for you and your school to become a resource for the community and will encourage the development of educational experiences that will involve students as citizens.

Educators themselves may want to do the community inventory beforehand and can themselves, or with student input, decide where an appropriate participation point may be. There are numerous ways by which you and your students can carry out an effective community inventory or assessment. One way is to create a community resource map. Through

resource mapping you can identify community processes, needs, problems, and issues in your area. This process can help you identify possible project ideas and most importantly will help you make sure that you are doing what is actually needed by your community. Below are a series of questions that may help you start the community inventory or mapping. Ask these questions after you or your students have described in detail the area or site you are assessing. You may want to add or delete questions as you begin to discover more about your community.

— What natural resources exist at this site or in this area?
— Who lives, uses, or is affected by the area?
— Who manages the resources and by what laws, regulations, and rules?
— In what ways can citizens participate in the management of this site?

Often a survey or inventory of the community will reveal numerous opportunities for participation. A key feature in selection of an access point is that it is done in partnership with a group or agency that has invited your assistance in carrying out their mission. This "invitation" may come from the public documents that you have accessed or be a direct request from the agency or group. As your program becomes more established and well known in the community, numerous opportunities will be presented to you, and your school will become a valuable resource. Your class can be involved in helping those who use and manage natural resources reach their goals.

Contacting the resource users and managers involved and finding developmentally appropriate experiences that meet your program framework will engage students in the community process of natural resource use and management.

"The community-based projects that we have been involved in have been some of the most powerful and meaningful learning experiences our students have had during their high school careers."

— Scott Braly
NCSR Institute Participant
Granite Bay High School
Granite Bay, California

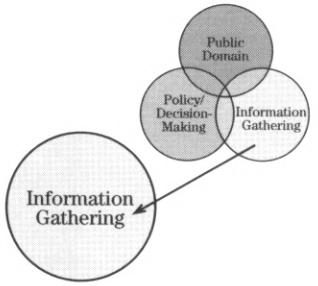
INFORMATION GATHERING

Inventory/Monitor/Research

The next step in the program process, after arranging authentic, developmentally appropriate student experiences in the community, is to conduct the research, survey or inventory, monitoring, or other tasks necessary to complete their work.

It is within this arena that the educator is most comfortable and familiar. This is where the necessary skills, knowledge, and attitudes are developed within the context of community participation. It is within this arena that the district, state, and national content standards are addressed. If these standards are important to our community, then schools should be able to find experiences in the community where these standards are needed or used. The selection of student experiences from the public domain needs to take these content standards into consideration. The content standards should be viewed as a means to an end and not the ends in themselves. Educators will need to use, modify, or create educational materials, activities, and labs that provide the information necessary to accomplish the task that has been selected. Traditional materials, texts, and labs may still be appropriate, but now are used in the context of solving a problem or completing a task in the community.

In addition, educators will need to access community resources and expertise. This often means that the educator is truly a facilitator—lining up and arranging resources, materials, and experiences from a variety of sources. Forming partnerships with the experts in the community will help both the educator and the students develop the necessary skills and knowledge.



In this arena, students may still study a chapter in a text on ecosystems or populations and do classroom activities and labs, but learning activities take place in the context of a real problem or project which they are working on in the public domain. In addition, content standards can be addressed in the selection of an appropriate project in the community. In a recent publication, *Closing the Achievement Gap* (Lieberman and Hoody, 1998; www.seer.org), research has shown that students actually perform better when the environment is used as the integrating context.

Examples of experiences that could fall within this arena are:

- Wetland inventories
- State & Federal Forest inventory
- City & State Park surveys
- Stream monitoring

- Estuary and beach monitoring
- Agricultural surveys
- Private land development monitoring
- Species diversity studies

Remember that these student opportunities are selected after the following has been done:

- Surveys of natural resource use and management in the community
- Examining documents regarding the use and management of natural resources for an invitation to participate
- Forming partnerships with agencies, businesses, and industries associated with natural resources
- Considerating what is developmentally appropriate and meets content standards for programs
- Students have been involved in decision

It is in this arena that the teacher can "show off" the educator skills they know so well. This is their area of real strength. However, as educators participate in the public domain and the policy decision-making arenas, they will need to form community partnerships since these are generally less familiar areas for them.

POLICY/DECISION MAKING

Community Participation

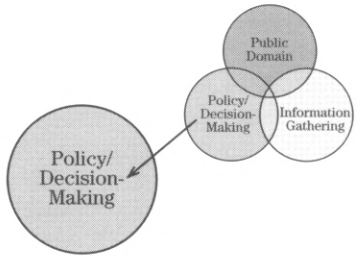
Upon completing monitoring and inventorying, the next step is to produce products useful at the community level. Participation by the student/citizen in the public domain is most often the piece missing from natural resource programs. If projects are selected from public domain documents, then the policy/decision-making bodies, agencies, businesses, industries and the rest of the community may want to know how things are going. The school, serving as a resource, can raise the awareness and capacity of the community by sharing their findings and information. This may take the form of presentations to policy/decision-making bodies as well as a variety of other community groups and educational institutions. Having students consider social, economic and ecological factors is an important part of this information dissemination and community renewal.

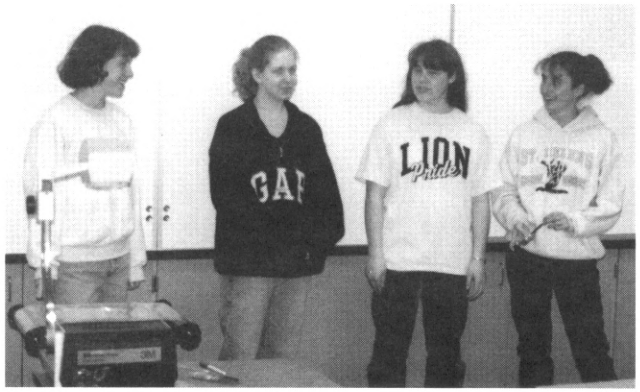
Providing public information through products such as signage and brochures can also be considered student products that impact policy and decision-making in the community. There may also be a variety of action items like tree planting or riparian restoration associated with the public products that allow students to develop a deeper and stronger connection to their community.

Some examples of participation and student products are:

- Presentations to various boards, agencies, organizations
- Interpretive information at study site (brochures, signage)
- Public information displays

By having students prepare materials for public use and participate in policy and decision-making processes, our educational institutions can better reach their mission of developing productive citizens.





Program (Community) Processes Summary

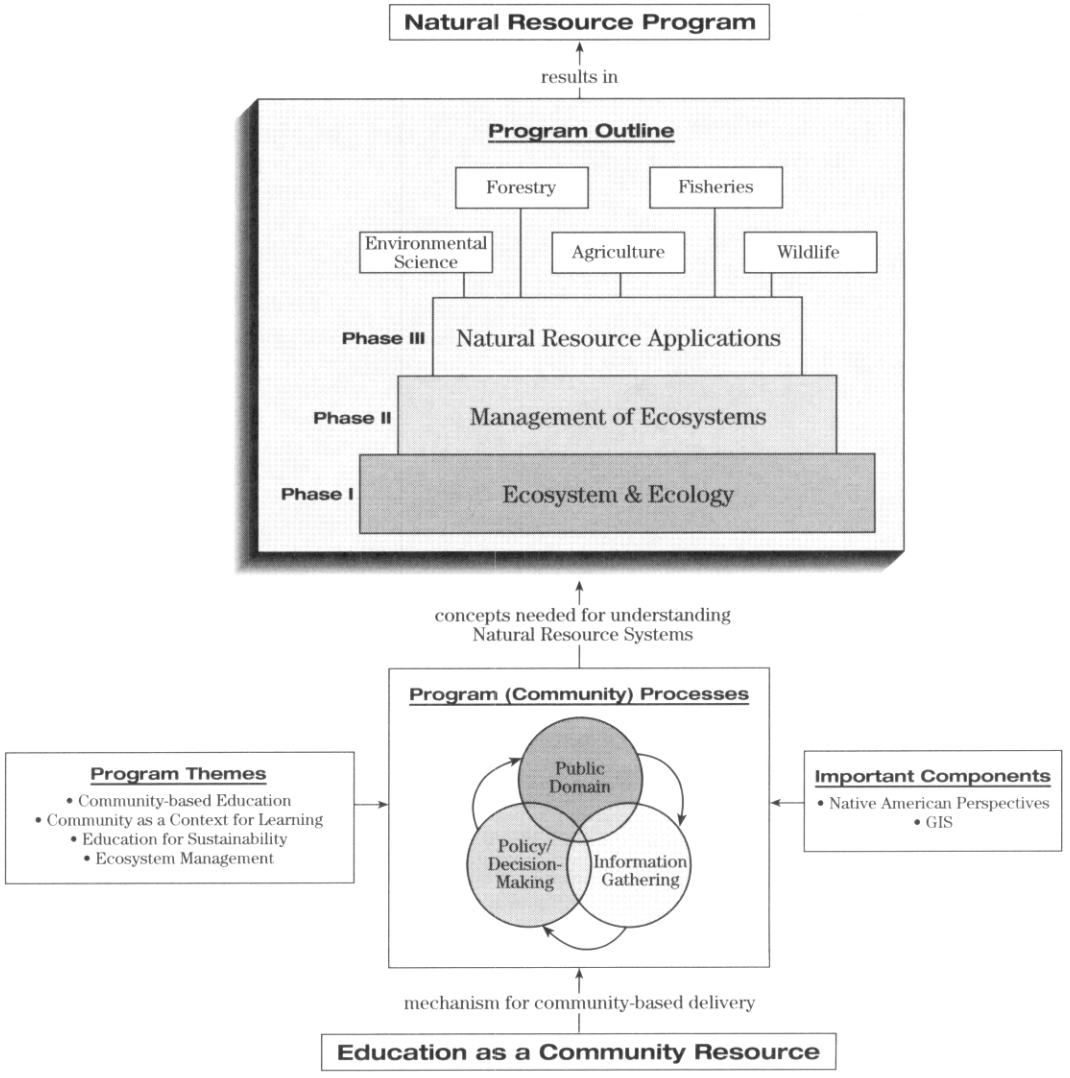
In this section we have suggested a process of education that is similar to the process that occurs in communities. By accessing public documents, or being invited directly by agencies who operate by these documents, students become connected and engaged in the authentic experiences of community.

The learning and work students do now take place within the context of authentic community processes, and students now are viewed as a resource and as participants in these processes.

The products produced by the students-citizens can then be used to raise the awareness and capacity for change for the entire community. Modifications to current policy and decision-making can occur as students showcase their products.

In the next section of the manual we will examine a framework for a national resource program. Remember that the processes discussed in this section should be used at each phase in the program outline of the next section.

Framework for a Community-based Natural Resource Program



PROGRAM OUTLINE

Phase I — Ecosystems and Ecology

Phase II — Ecosystem Management

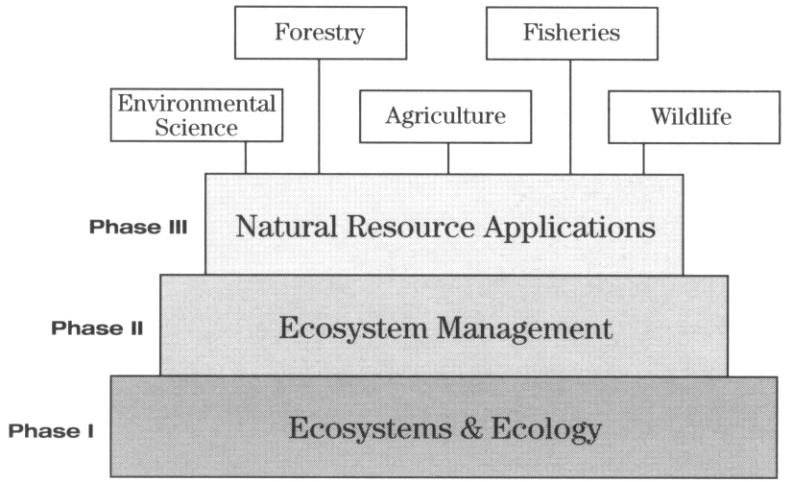
Phase III — Natural Resource Applications

PROGRAM OUTLINE

This section of the manual will lay out a possible program outline or framework which contains program processes alluded to in the previous section.

The NCSR format has been to divide the program outline into three phases.

These phases may be covered within a two to four year period of time. It should be noted that although our focus in this section is on secondary education, the ideal natural resource program would be kindergarten through adulthood.



PHASE I - ECOSYSTEMS AND ECOLOGY

The foundation of a natural resource program is having an understanding of ecosystems and human interactions within ecosystems. These are concepts that can be covered within a current science program during the 9th and/or 10th grade years or as a separate course or courses.

There are a variety of science textbooks that can be used as resources and background for the ecological concepts you will teach. A typical biology text covers chapters on ecology and ecosystems directly, while units on other topics such as plants and animals can be linked together as well. A number of texts have outlined an ecological approach that unites concepts around ecosystems. However, the educator now needs to have these concepts taught in the context of the community.

An example of phase I of a program would involve a study of a local site on or near campus. After determining who was involved in using and managing the natural resources at the site, a variety of *needed* projects could be selected. In conducting the inventories or surveys, the scientific method and principles of ecology could be learned. Using experts from the community, teachers can facilitate and guide student experiences while providing the necessary content pieces as background information from the text or other reference materials.

Students would learn about biotic and abiotic factors, transfer of energy, interactions of living things, populations, and community distribution through the community invitation.

Student products may take a variety of formats that should be shared with decision-making agencies and the community to raise their awareness and knowledge level. Think about these products out in the community year after year where this information will then become part of the community's knowledge of natural resource systems.

You may use this approach with many of the current topics taught in Biology classes today. For example, if you are dealing with a unit on Arthropods, student projects could provide information to an agency about the health of a stream and details about ecology and aquatic life cycles. Now the student has been engaged as a participating citizen, has a context for their learning, and provides feedback to increase the awareness and understanding of the community to improve future decision-making.

The difficulty for educators has been to connect Biology, the learning of life, to a living environment. The content and labs previously used do not have to be abandoned—but the context in which they occur needs to change. There are

The foundation of a natural resource program is having an understanding of ecosystems and human interactions within ecosystems.

usually some modifications needed for labs, and the creation of students/community products needs to be considered. For ideas or topics to choose from, look in appendix B (pp. 64-68) on ecosystem management topics.

Once again—a reminder that the program processes of accessing the community, monitoring and inventorying, and participation in policy and decision-making—are the critical elements in determining the student experiences within each phase. In this way the concepts of ecosystems and ecology are the umbrella concepts, but students will also gain some understanding of elements needed for phase II and III.

In phase 1, you may want to focus on development of a local site to become a training ground for work and studies your students will become involved in. These field sites can be useful in establishing connections and ties to the community. This will be valuable as you look for future opportunities and experiences to engage your students in.

In appendix C (pp. 69) you will find a *Field Study Site Checklist* to help in the establishment of a school study site.

PHASE II - ECOSYSTEM MANAGEMENT

In this part of the natural resource program, the umbrella concept is focused on the use and management of ecosystems. Selected student experiences should highlight how resources are used and managed in their communities. Higher levels of involvement and commitment to longer-term projects should occur at this level.

This phase should be incorporated at the 9th and/or 10th grade years and then again in greater depth of study in the 11th grade year.

At the 11th grade level, more in depth research and monitoring should occur and more sophisticated community products should be produced. Greater consideration should be given to understanding the social, economic and ecological components of management policies. Examination of careers can begin here, with opportunities for individual mentoring or job shadowing. The focus is on use of skills and knowledge in the applied context of a functioning citizen.

PHASE III – NATURAL RESOURCE APPLICATIONS

The final step in a natural resource program is the active participation in natural resources from a life role perspective. Experiences in applying specialized knowledge and skills in more specific areas of study in a more specific role begins here. Involvement in internships and capstone projects that are done individually may occur over a semester, or could occur at the end of this phase.

Facilitating experiences for all your students in this phase can become difficult unless you have established connections to agencies, industries, businesses, and other community groups. These experiences would occur during the 12th grade year.

Important Components

Recognizing the importance of cultural perspectives and technology use in natural resources, the Center advocates for two additional components for your program—American-Indian cultural perspectives and Geographic Information Systems (GIS). Study in these areas may occur throughout Phases I, II, or III, or be a separate focus area.

Cultural Perspectives

Traditional ecological knowledge (TEK) is increasingly being sought as a potential source of ideas for emerging models of ecosystem management. TEK, the knowledge of relationships among humans, nonhumans, and the physical environment, held by peoples in relatively nontechnological societies that are directly dependent on the land, differs from *scientific ecological knowledge* in important ways, and there may be value in partnership between them (Kimmerer, Robin Wall. 2000. *Native Knowledge for Native Ecosystems.* Journal of Forestry. 98(8):4-9).

In addition to ties among indigenous cultures and ecosystem-based sciences, students should become familiar with local tribes and their history and culture. Their cultural and historical perspectives are an integral part of any community.

"I'm a member of the Confederated Tribes of Warm Springs. My family's been involved in fisheries for as long as anybody knows...My family's been fishing forever...Anything that involves water is a part of why any of us are here, because without it, we won't be..."

— Assistant Manager, Warm Springs National Fish Hatchery

"Over the past decade, Geographic Information Systems (GIS) have emerged as promising tools for analyzing natural resource management and policy alternatives. GIS and remote sensing provide resource managers with the ability to: 1) inventory and monitor resources; 2) plan both site specific and regional management; and 3) analyze policy alternatives."

— GIS firm representative

GIS Technology

GIS and remote sensing hold tremendous potential as tools for facilitating natural resource management. Use of currently available satellite imagery is rapidly expanding. Because increasing demands on the land are increasing land values, the need to use GIS and remote sensing technology will continue to grow.

It is difficult to find any natural resource agency, business, or industry that does not use this technology. For students preparing to enter this area as a career, it is essential they have some exposure to this technology. Tutorials can be purchased for minimal costs, although a full-blown program will be more costly. Contact a local natural resource agency or state government for more information on how GIS is used.

Program Outline Summary

The program outline will take on a variety of forms depending on the community and school where implementation occurs. Courses may be integrated with other disciplines and the time-table may vary from a two to four year program. It will be important to receive input from and take advantage of the strengths of your school and community.

In considering the program outline, it is our recommendation that all students in the school need to be in courses that cover phase 1 and phase 2. However, phase 3 may be for those students who are looking for a more focused area of study that examines careers and further applications in natural resources.

We realize that this is a major undertaking and will need to involve others in your school and community. With help from others, begin by designing an ideal program. Then chose beginning places and small steps for implementation. It may take many years to get there, but setting goals and a framework to work within is an important place to begin. Be patient and persistent and you, your students, and your school will all enjoy and benefit from this approach.

CASE STUDIES

It is with some hesitancy that case studies are used to highlight the various components of a natural resource program. What a program may look like will vary from community to community and teacher to teacher.

These examples should be reviewed for ideas that you might be able to revise and modify for your program. Perhaps you may only be able to use small parts of them. What you eventually develop should suit your school and your community, and not necessarily look like these case studies.

However, there are some critical elements discussed earlier in this manual that you should be able to identify.

The two case studies highlighted are from North Salem High School in Salem, OR (Jon Yoder) and Churchill High School in Eugene, OR (Tim Whitley).

The Mill Creek Project

The *Mill Creek Project* has created educational opportunities along Mill Creek at North Salem High School and the State Archives Building for the citizens of Salem. Students, teachers, agencies, and community groups have worked together to develop this innovative, outdoor learning lab that educates the entire community about fish, wildlife, plants, and water quality throughout the Mill Creek watershed.

The Oregon Department of Fish and Wildlife and North Salem High School collaboratively planned for the restoration and enhancement of Mill Creek. Students, along with community partners, were involved in clearing out blackberry vines, cleaning trash from the stream, installing in-stream structures, paving trails, placing interpretive signs, planting native vegetation, building benches and observation decks, and installing an irrigation system. This was a major effort that involved a variety of agencies, community groups, and students. Funding came from a $23,000 Governor's Watershed Enhancement Board grant, $50,000 from ODFW litigation monies, and $14,000 from Salem Rotaries.

With the assistance of a $33,000 Christa McAuliffe Fellowship and a half-time sabbatical leave, a Field Biology course was developed that connects students to the creek and the surrounding community. The course involves connecting students to their community through a variety of community-base activities. The water quality monitoring at Mill Creek to help meet the Endangered Species Act requirements for the City of Salem is one example of this. In addition, students carry out monitoring and inventorying in preparation for a variety of other projects they are asked to do by the community.

Other tasks that students were involved in included: partnering with a local retirement center to assist in the development of a landscape plan, building trails, creating educational materials at a nearby 4-H Center, and partnering with State Water Resources in monitoring stream flow in Mill Creek in the newly built gauging station on our campus. The gauging station will eventually be electronically connected to a proposed 1.2 million-dollar school-community environmental learning center to be built on site within the next year. This Center will provide educational opportunities and resources for students, teachers, and all members of our community.

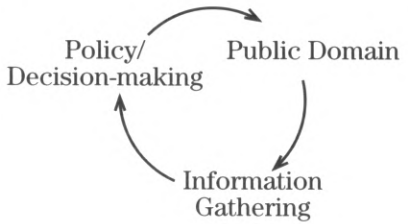
Many of the student experiences change every year as different community opportunities are explored. The community now views the school as a resource, and calls are received asking students to participate and help in a variety of ways. Students become confident, self-directed learners familiar with the use and management of natural resources and familiar with their role as citizens and potential workers.

Currently students go through Phase I (Ecology and Ecosystems) in their 10th grade science class, *Environmental Biology*. They complete Phase II in the *Field Biology* course, and the science department will be working on developing the Phase III experiences—where there will be more life-role focus and a capstone project implemented.

The program has sustained itself over the past eight years because of the tremendous support that continues to come from building administration, strong partnerships that have formed in the community, and the preparation to meet Oregon's *Natural Resources Certificate of Advanced Mastery (CAM) goals.*

The Mill Creek Project has resulted in unique and exciting learning opportunities for students and community members. Students gain a variety of leadership and citizenship skills as well as content knowledge in the context of a participating member of the community.

The following will provide examples of how the program process is used in the Mill Creek Project.



Public Domain

The community is accessed in a number of ways to develop authentic learning experiences. Documents such as the Endangered Species Act, Forestry Practices Act, and others have provided invitations by agencies like the City of Salem's Public Works Department, Oregon Department of Fish and Wildlife, and State Parks Department. The program is now viewed as a resource for agencies and community groups that look to fulfill their mission and goals. Each year phone calls are made and received establishing new partnerships and tasks.

Information Gathering

Students are involved in numerous information-gathering projects for agencies and groups throughout the year. Inventorying trees from a previous Earth Day planting on behalf of a local state park is an example of one such project. Students not only had to learn field techniques and tree identification, but also about riparian zones, buffer strips, and streamside ecology. Thus, the content knowledge was learned within the context of community participation.

Policy/Decision-making

Students need to produce products that go back to the agencies and community that will then raise the capacity for informed policy and decision-making. Following the example of the Earth Day tree planting project mentioned above, students developed reports and gave presentations to the Park Superintendent and colleagues. The result will be to adopt a new management strategy for the 4-5 thousand trees. The new strategy will involve students in carrying out the policy by organizing and coordinating an adopt-a-section program with area schools. The agency will supply funds with which students will order replacement trees and run an Earth Day replanting.

This approach is incredibly rewarding for both students and teachers. In addition, students who are not always successful in a traditional classroom are often more engaged and motivated to learn in this way. The resulting positive publicity for the school is yet another benefit for this type of program.

Rachel Carson Center for Natural Resources

Web site — [schools.4J.lane.edu/carson/]

The *Rachel Carson Center for Natural Resources* offers an alternative to the traditional high school curriculum, providing students with experience, knowledge, and skills that relate to natural resources and environmental studies. The curriculum integrates science, social studies, physical education, and language arts using watersheds as the central theme. Students' learning experiences will focus on acquiring the skills and knowledge in core academic subjects necessary to reach the 10th and 12th grade benchmarks for the *Certificate of Initial Mastery* (CIM) and *Certificate of Advanced Mastery* (CAM). This program is open to all Eugene/Springfield School District juniors and seniors who wish to embark on a two-year course of study that offers small group seminars, extensive field studies, access to current technology, and learning experiences in a state-of-the-art greenhouse. Individualized graduation plans are available for students who wish to participate in the creation of a customized two-year program emphasizing course work

and experiences related to natural resources and environmental studies. Successful completion of this program will lead to achievement of a CAM with an endorsement in Natural Resource Systems.

The Center is comprised of a community of learners working together to gain a balanced, in-depth understanding of the natural environment. Students learn experientially by applying knowledge and skills to real world situations. Students are provided with the opportunity and the necessary tools to create positive change within the school and nearby environments. This program is dedicated to promoting partnerships with the community that result in a shared commitment to stewardship and a sense of responsibility to the world around us.

The Rachel Carson Center for Natural Resources is developed around the following core beliefs:

- The key to generating attitudes of civic responsibility, collaboration, and discovery lies in taking students into the world.
- The value, depth, and retention of learning increases when it is applied to real world situations that matter.
- Experience-based learning provides for the development of knowledge, skills, and attitudes necessary for successful and active participation as a world citizen.
- Non-traditional learning, whereby subject areas are integrated and arbitrary class times eliminated, facilitates active engagement for the students.

Components of the Program

Seminar: Small group seminar sessions led by a teacher who encourages substantive interactions among students and will promote an atmosphere in which the students benefit from one another's work. The seminar will be a place to share ideas for projects, learn from local professionals, and facilitate the exchange of information between students and teachers.

Field Studies: This unique aspect of the program provides a rich variety of hands-on learning experiences outside the school's walls in surrounding natural areas. The focus will be on learning and applying skills and concepts used by professionals in assessing, monitoring, and restoring impacted areas.

Field Camp: This optional activity provides students with an enriching and challenging opportunity to expand their learning beyond the confines of the school building. These 3-6 day camping trips offer students hands-on, field-based opportunities to study Oregon's ecology, geology, history, and cultural diversity. These excursions typically tour the High Desert region of Central Oregon and the coastal and redwood areas of Northern California. A goal of these trips is to provide a forum for participants to explore cooperative learning, develop a sense of social responsibility, and broaden their respect for the environment.

Technology: An important aspect of the Carson Program is the appropriate use of state-of-the-art technology. A significant amount of the student's learning will involve the application of current technologies including: computers, Internet, digital cameras, and water-testing equipment. Grant funds have furnished the Carson Center with a full range of brand new equipment for student use.

Greenhouse: A recently completed 30 by 60 foot greenhouse provides a variety of learning opportunities for students interested in horticultural, botany, and small business management.

Additional course descriptions and course of study outline is provided in appendix D (pp. 70-72).

PROGRAM DEVELOPMENT

— Programs versus Projects

— Program Design

— Program Sustainability

— Hurdles versus Barriers

PROGRAM DEVELOPMENT

Developing a Program

This manual is providing information on designing natural resource programs that contain the following:

1. *Program themes of sustainability, ecosystem management, and community-based education.*
2. *Program processes that connect students to the community to conduct "citizen science" and produce community products.*
3. *Program outlines that address the concepts of ecosystems and ecology, ecosystem management, and natural resource applications.*

Examples have been provided to highlight and clarify each of these elements in program design.

Now it is time to address some critical elements and concerns as you look towards development and implementation of a natural resources program at your school.

PROGRAMS VERSUS PROJECTS

A natural resource program is more than a single course or a number of projects strung together.

A natural resource program consists of a clear mission with goals and objectives that take students, over a number of years, through experiences that will fulfill those goals. It is more than a single course or a number of projects strung together.

A project is an experience that may or may not occur within a designed program. Too often projects occur as isolated events without a common thread that unifies them into a program. Each project selected should follow the process outlined early in this manual of; public domain—information gathering—policy/decision-making.

It is therefore important to develop a program before you take on a project. Once the program is designed, then you can begin to look for a starting point, which may be a single project or unit. Establishing a four-year program at the secondary level is a daunting task within our current educational constraints. Finding a small step to take, such as a single project, may be an appropriate starting point in program implementation. Remember, however, that whatever starting point you take, it needs to occur within a program design.

A form to guide you through project development is included in appendix F (pp. 74-76). Students should be involved in reviewing this document to understand the community processes and context of the project chosen.

PROGRAM DESIGN

In addition to the program design elements that have been suggested in this manual, there are several other considerations that need to be addressed. The building Principal needs to be informed and involved in program development from the beginning. Gaining administrative support is critical, and communication and inclusion are important factors. Principals can be your greatest ally and advocate.

Organizing an advisory group to assist in program design will begin the process of community involvement and support for the program. Invite agencies, industry, business, parents, tribal representatives, and other interested community members to assist in program design. They may also be able to continue providing ideas for community-based experiences.

Your district's mission statement and goals, along with the community's mission and goals, can provide the basis and rationale for program development.

A general outline for program design is as follows:

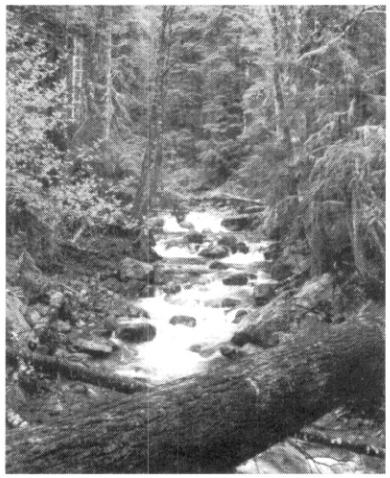
— Program Title (provides a unique identity to your program)
— Mission Statement/Vision
— Goals/Objectives (action to reach learning outcomes)
— Course Titles
  — outline major concepts (Phase I,II,III)
  — content standards addressed
— Potential Partners
— Budget (transportation, etc.)
— Funding Sources
— Timeline for implementation

You will want to use the program mission statement and the goals and objectives when you fill out the project form in the appendix as a check to see if the project you chose meets the program goals. The budget and funding sources section will be more general as specific costs are accounted for on the project form. However, you may be able to anticipate some commonly used equipment and transportation needs in developing an overall program budget. A program design form is included in appendix E (pp. 73).

PROGRAM SUSTAINABILITY

Once a program is developed and implemented, it is important to ensure that it can sustain itself when the developer leaves the program. Many wonderful programs disappear when the educator who has developed the program leaves. To ensure program sustainability, you may want to consider the following approaches. As mentioned earlier, you should include your Principal in program development. If administrators are committed to the program, it becomes a building or district program and not an individual teacher's program. When a replacement is then hired, their job is to continue a school program. Communication with the principal and community will build a strong foundation of support for program sustainability.

A more formal approach can also be an effective way to ensure program sustainability. Formal agreements between schools and city and county governments can be signed that connect government agencies and education of all citizens. One such agreement is between the city of Seaside and the local school district. In this example, a third party brokered and facilitated the arrangement. There may be groups in your community, such as watershed councils or educational service districts, that can help to develop this kind of relationship.



HURDLES VERSUS BARRIERS

In developing a natural resource program, you may hear from colleagues that there are too many barriers to implementing new programs. The most common barriers are time, funding, transportation, and administrative support. NCSR has observed enough programs, particularly in the northwest region of the U.S., to conclude that these perceived barriers are hurdles that can be cleared.

However, program development is time consuming. You may need to spend a good part of a summer lining up community partners and designing student experiences, and the other components of the program. The school year is most often a more difficult time for this planning. It can, and is, being done.

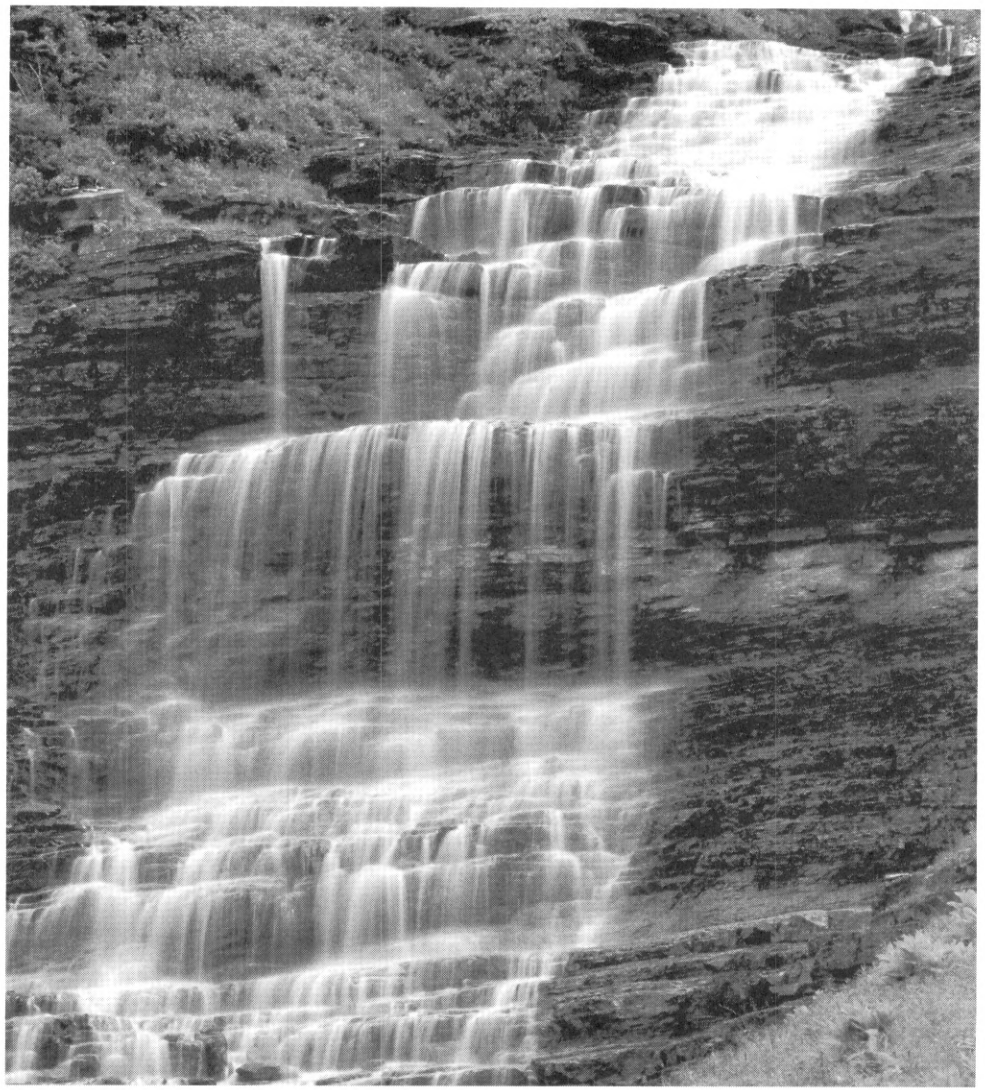
Funding can be a hurdle to clear in order to operate a program. You may need to write grants to supplement school funding. The more experience you gain, the better you will become. You can often find a parent or other community member to do this for you. There are many examples of programs that have secured significant amounts of money. Check the NCSR web site for a comprehensive list of grant sources. Again, it can, and is, being done.

Transportation is often mentioned as a perceived barrier and is related to funding concerns. In addition to grant funds, you can become creative in seeking out solutions for further funding. Again, parents and community members are assets to tap. If purchasing a van is impossible, having parents drive and using city transportation are solutions that have been observed.

Administrative support can be yet another hurdle to clear. Repeating earlier statements, communication and inclusion are important. Getting community support and publicity are two ways that get administrators eager to climb on board. A good place to start is to call your local newspaper and promote student work.

In addition to administrators, it will be necessary to communicate plans and ideas to colleagues. Including other staff in program development broadens your base of support and helps reach that critical mass for implementation. There are endless possibilities for interdisciplinary collaboration, so look to involve those outside the science arena for participation.

Above all, patience, persistence, and creativity are necessary. Always remember to allow all those involved to claim success and be a contributing member of the program. In this way, most perceived barriers become hurdles that can be cleared.



NEXT STEPS

After completing a high school level natural resource program, students should be prepared to take the next steps.

Providing information on a variety of options is worth including throughout all three phases of the program.

MODEL COMMUNITY COLLEGE PROGRAMS

When a student chooses not to continue their formal education and assume their life role in the community, they should now have a clear idea of what that means from all the practice and participation they have had. However, other students may move on to a two- or four-year institution and need information on these programs. This can come from the schools' guidance office or from searches on the Internet. Students can often access a variety of connecting programs, such as 2+2, to the local community college before leaving high school.

NCSR has been involved in the development of ecosystem-based natural resource programs at a number of community of community colleges throughout the United States.

NCSR sets precedents in both forming a unique consortium of community colleges, and in instituting changes in NCSR's partners' programs. These improvements will endure long after grant activities are finished. Programs have been restructured to provide ideal sequencing, course content has been updated and core courses have been developed or added. The hope of the Center is that its efforts will be used as a model by others who seek to improve their programs. Programs of five of the "lead colleges" are summarized.

The test sites listed below are institutions where NCSR curriculum is taken from the lead institutions and implemented.

Shasta College

Located in Redding, CA
Total Students: 10,500 Full Time: 6,700
Replication Site: Blue Mountain Community College, Pendleton, OR
www.shasta.ss.ca.us

Agriculture Technology

Shasta College is a lead college specializing in Agriculture Technology.

Natural resource management is undergoing significant changes as new philosophical approaches which emphasize resource management from an ecosystem perspective are being developed. Shasta College's Environmental Resources and Technologies Department offers Agriculture, Equine, Horticulture, and Natural Resources Associate of Arts degree programs. Current theories and methods of ecosystem management, watershed analysis, and holistic resource management are being taught and courses have been added and upgraded based on the goals and objectives of NCSR.

The Agriculture program is emphasizing the Holistic Management (HM) model as a teaching tool. The essence of HM is that decisions relating

to the quality of life, future landscape prescriptions, and economic production are derived from a goal statement in which a thorough understanding of ecosystem relationships is essential.

The 90-acre Holistic Management Lab at Shasta College provides student-directed learning, combined with hands-on opportunities in applying the HM model and ecosystem management concepts, to work toward sustainable agricultural practices.

Overall, the structuring of the Agriculture program strives to improve traditional methods of education by teaching a broader approach to environment resource management.

Grays Harbor College

Located in Aberdeen, WA
Total Students: 3,000 Full Time: 2,000
Replication Site: Mount Hood Community College, Gresham, OR
www.(to access site)ghc.library.ctc.edu- click on "Academia", then — "Academic Divisions", then — "Natural Resources Technology Program"

Natural Resources/Fisheries Technology

Gray's Harbor College s the lead college in Fisheries Technology. Grays Harbor College's Natural Resources Department includes a long-standing Fisheries Technology Program, and more recently-implemented programs in Natural Resources Technology (started in 1995-96), and Geographic Information System (GIS) Technology (launched February 1997).

Through the NSF/ATE grant, major objectives have included curriculum development for new programs and revision of existing curricula. All new and revised curricula include concepts and practices of ecosystem and adaptive management philosophies as they apply to sustainability of Pacific Northwest natural resources, including timber, fish and wildlife. Watershed analysis and ambient monitoring relating to riparian and stream ecosystems are primary areas of focus, and the GIS Technology program provides students "state-of-the-art" analytical tools for examining the complexities of aquatic, marine and terrestrial ecosystems.

Central Oregon Community College

Located in Bend, OR
Total Students: 3,200 Full Time: 1,200
Replication Site: Allegany College of Maryland, Cumberland, MD
www.cocc.edu/

Forest Resources/Eastside and GIS

Central Oregon Community College (COCC), located on the eastern edge of the Cascade Mountains in Bend, Oregon, is serving as the lead college in Forest Resources/ Eastside and GIS Technology programs.

The two-year Associate of Applied Science degree program at COCC is Forest Resources Technology (FRT) provides students with the education and practical skills needed to succeed as technicians in forestry and related natural resource fields throughout the western United States. Course work includes biological sciences, natural resources, surveying, mathematics and statistics, computer skills and other subjects. COCC's forestry program is recognized by the Society of American Foresters.

The Geographic Information Systems (GIS) program at COCC prepares students for employment as GIS technicians as well as providing a basis for understanding the place of GIS in problem analysis and decision making. The curriculum includes course work based on GIS computer software and course work in surveying, natural resources, mathematics and other topics.

Through the NSF/ATE grant, COCC has made important curriculum improvements in ecosys-

tem science, mathematics and statistics in the FRT and GIS programs. As a result, technicians entering the workforce from these programs will be better prepared to address complex contemporary natural resource management issues.

Chemeketa Community College

Located in Salem, OR
Total Students: 41,000 Full Time: 11,000
Replication Site: Allegany College, Cumberland, MD
www.chemeketa.edu

Forest Resources/Westside

Chemeketa Community College (CCC) is the lead college in Westside Forest Resources for NCSR. CCC's Forest Resources Technology (FRT) program, through the NSF/ATE grant, is undergoing curriculum updating to ensure that students are well prepared to work in today's complex field of forestry.

As forest resource management undergoes significant changes, new philosophical approaches which emphasize resource management from an ecosystem perspective are being developed. CCC's FRT program is undergoing major changes and in effect, the program is providing a more broadly-focused, ecosystem-based curriculum which incorporates environmental science, watershed analysis, wetland restoration, forest policy, sociology, more relevant mathematics and state-of-the-art technologies (e.g., GIS, GPS), along with basic forestry courses.

Overall, the restructuring of the Forest Resources Technology program is striving to improve traditional methods of education with collaborative learning approaches to produce a more comprehensive program.

Feather River College

Located in Quincy, CA
Total Students: 2,400 Full Time: 1,042
Replication Site: Itasca Community College, Grand Rapids, MN
www.frcc.cc.ca.us

Wildlife Technology

Feather River College (FRC) is the lead college in Wildlife for the NCSR. A primary objective under the NSF/ATE grant is to produce a model for incorporating ecosystem management into Wildlife curricula for community colleges.

FRC's Natural Resources/Wildlife Technician curriculum has been revised to encompass the goals and objectives of NCSR. Using one definition of ecosystem — "a spacially explicit unit of the earth that includes all of the organisms, along with all the components of the abiotic environment, within its boundaries"— FRC is incorporating into its revised curriculum biodiversity study and protection, a major element of ecosystem management. To this end, curriculum developers believe in minimum management to maintain biological and habitat diversity which allows for the integrity of natural ecosystems. All courses emphasize ecosystem management principles and concepts, recognized by the North American Wildlife Technology Association.

MANUAL SUMMARY

This manual has attempted to explain a program process that resembles the community process and a program framework of general concepts to be addressed to assist educators in developing a community-based natural resources program. Important themes and components were suggested for inclusion into your programs as well as some forms in the appendix to help in getting you started.

The path that you follow in developing this type of program will be unique to your school, your community, and yourself. Inclusion and involvement by those at school and in the community will be critical for long term success and sustainability of any program. You as a teacher will need to step forward as a leader to help initiate, coordinate, and maintain the effort.

It will not be easy and may take a number of years of concentrated effort to make significant progress. Having a program plan or map is important and can help guide the small steps you take to accomplish the larger goal. Any publicity you can generate will also help your cause and bring more people to the table to be involved.

The benefits and rewards to students, teachers, and the community make the effort and hard work well worth it. Students come alive and become connected to school and to their communities. Most students remember little of the numerous facts they are bombarded with throughout their years in school. However, the tools they are equipped with and the processes they participate in become part of who they are: a citizen in the community. As we aim towards developing sustainable communities and a sustainable world for future generations, it seems appropriate for education to embrace an approach that has student-citizens directly engaged in reaching towards that goal as well.

APPENDIX

— Appendix A - NCSR background

— Appendix B - Applications of Ecosystem Management

— Appendix C - Field Study Site Checklist

— Appendix D - Program Case Study

— Appendix E - Program Planning Outline Form

— Appendix F - Project Planning Outline Form

— Appendix G - Community Resource Reference Form

APPENDIX A - NCSR BACKGROUND

Northwest Center for Sustainable Resources — NCSR

What is the Northwest Center for Sustainable Resources?

Mission Statement

The Northwest Center for Sustainable Resources (NCSR) is a collaborative effort among educators, employers, and others which is enhancing natural resources programs at community colleges and high schools and providing a clearing-house for information on sustainable natural resources. A Center of Excellence funded by the National Science Foundation's Advanced Technological Education program, the Center is incorporating innovative teaching methods, state-of-the-art technology, knowledge from cutting-edge research, and hands- on field experiences into natural resource technology programs. Major goals for the project include integrating community college programs into a "seamless education" from K-12 through university, working closely with employers in curriculum development, emphasizing work experience for students through internships, and developing core programs that prepare students to work as technicians for organizations dealing with aquatic and terrestrial ecosystems. Programs feature environmental monitoring, mapping, instrumentation, and other related skills woven within the context of managing complex ecosystems. Program graduates are receiving technician degrees, and have advanced skills, or they are receiving degrees which transfer to four-year colleges and universities. Combining improved curricula with an information clearinghouse for natural resources education, the Center is providing an effective model for education/employer alliances for the nation.

"NCSR—Education for a Sustainable Future"

The Northwest Center for Sustainable Resources is a collaborative effort of partners from Oregon, Washington, northern California, and Maryland, including high schools, community colleges, four-year colleges and universities, private industries, government agencies, and Native American tribes. The Center's main activities focus on *curriculum development, faculty and teacher enhancement institutes, and national dissemination of products.*

The Center is developing natural resource technology programs which incorporate higher levels of mathematics and science, using an ecosystems-based approach which emphasizes sustainable methods for resource use.

Key Objectives:

Curriculum development: Five "lead site" colleges and six "test site" colleges are developing advanced technological curricula in natural resource-based associate degree programs.

Faculty and teacher enhancement institutes: Field- and laboratory-based experiences are being offered for teachers from all levels of education around the country, along with tours of world-class research sites, and other professional development activities.

Promotion and dissemination: NCSR materials are being showcased at key national and regional conferences and symposia, and are being posted in an electronic clearinghouse. Promotional products are being disseminated, including a videotape and reports entitled *"Visions for Natural Resource Education and Ecosystem Science for the 21st Century"* and *"American Indian Perspectives: Nature, Natural Resources, and Natural Resources Education."*

NCSR has over 100 partners from education, employment, Native American tribes, professional societies, and research groups.

Resources We Can Provide:

— Field- and lab-based faculty development institutes, including the *Ecosystem Institute, Natural Resource Institute*, and GIS institutes.

— Curriculum materials in natural resources technology two-year programs (available over the next 2 years); materials reflect an ecosystem approach, and advancements in science, mathematics, and technology. Programs include agriculture, fisheries, forestry, geographic information systems, and wildlife.

— Up-to-date publications, videotapes, and other materials for institute participants and other NCSR partners.

— A website with connections to model research sites, Native American tribal home pages, national secondary education ecology-based projects, job sites, and other natural resource-related information.

— A national model for natural resource educational programs which incorporate employers' needs, science and research-based activities, Native American perspectives, and working partnerships.

For More Information:

Contact Susie Kelly, NCSR Director
503-315-4583/kels@chemeketa.edu

Visit our website at: **www.ncsr.org**

APPENDIX B - APPLICATIONS OF ECOSYSTEM MANAGEMENT

Listed below are some topics that may be considered as elements of EM in major areas of natural resources management — forestry, agriculture, and fish and wildlife. Sustainability is a frequent component of these topics and the margins between EM and "sustainable development," "sustainable forestry," "sustainable agriculture," etc., often blur. This is not intended to be an exhaustive list, but rather a starting point for components to be addressed in an ecosystems-based curriculum.

Forestry

In forest ecosystem management, the products taken from the system are an important secondary objective — integrity of the forest ecosystem comes first. Ecosystem management would identify forest sustainability as the foremost goal of national forest management, and use the conservation of bio-diversity as the mechanism to that end.

Topics:

— Use of historic disturbance patterns (fire, floods, etc.) to use as models for designing harvest patterns that more closely mimic natural conditions
— Riparian zone management (buffer zones, restoration of native vegetation, etc.)
— Ownership patterns and stand conditions at landscape scale
— New forestry — incorporation of "biological succession and materials flow into forest"
— Agroforestry
— Incorporation of an understanding of ecological succession and materials flow into forest management
— Recognition of secondary forest products (fungi, pharmaceuticals, vegetation, etc.)
— Soil processes and productivity (e.g., use of fungal spores to restore fire-damaged soils in forests)
— Harvest patterns - mosaics vs. large blocks
— Roles of mycorrhizae in forest production
— Nitrogen fixation in forest soils
— Forests role in carbon cycle (including global warming)
— Impacts of forests on global climate change and vice versa
— Role of disturbance events in maintaining community compositions
— Role of gaps in forest canopy
— Role of course woody debris in forest ecosystems
— Controversy concerning salvage logging as a tool for improving "forest health"
— Management on watershed and landscape scales — using remote sensing techniques as a tool (satellite imagery, aerial photos, GIS, etc.)
— Bio-diversity — old growth-associated species and their ecological requirements
— Edge effect and habitat fragmentation and consequences for forestry/bio-diversity
— Roles of keystone species
— Roles of core reserves, corridors and buffer zones in preservation of forest bio-diversity
— Use of natural forests as models for managed forests
— Integration of any of the above

Agriculture

Sustainable agriculture is a systems-level approach to understanding the complex interactions within agricultural ecosystems. It produces adequate amounts of high quality food while protecting other resources by using practices that are both environmentally safe and profitable. A sustainable farm relies as much as possible on beneficial natural processes and renewable resources drawn from the site itself.

Topics:

— Integrated pest management
— Land use issues
— Poly-culture as an alternative to mono-culture
— Recognition of problems associated with introduced "exotic" species
— Agriculture as a competitor for other natural resources (wetlands, forests, etc.)
— Role of folk crop varieties in sustainable agriculture
— Conservation tillage — "No-till/low-till" options
— Soil rehabilitation through crop rotation, crop diversification, cover cropping
— Biological control of weeds and insects as alternatives to chemical herbicides and insecticides
— Grazing control
— Confined Animal Feeding Operation (CAFO) waste management
— Alternative uses for agricultural byproducts (e.g., composting crop residue, grass straw uses in construction)
— Water issues — irrigation, water rights, salmon recovery efforts
— Erosion control
— Biotechnology/genetic recombination - advantages and disadvantages (e.g., development of crops that fix their own nitrogen)
— Nutrient cycling in agriculture ecosystems
— Increased use of under-utilized or untested crop species
— Matching agricultural crops to native vegetation
— Management of reparian zones in grazing lands
— Agricultural lands as wildlife habitat (e.g., use of cover crops, fallow fields, fence rows, "green manures")
— Social issues as they relate to agriculture (e.g., urban-rural conflict, right to farm legislation, etc.)
— Development of environmentally inert pesticides
— Search for naturally produced insecticides in fungi and bacteria
— Manipulation and planning of agricultural landscape to reduce fragmentation and isolation of natural habitats and resulting loss of bio-diversity
— Role of government agencies (e.g., crop subsidies, Low Input Sustainable Agriculture
— Conservation Reserve Program, Wetland Reserve Program
— Interrelationships between the above - e.g. selection of tillage methods, planting times, crop rotations and plant residue management practices to optimize conditions for population growth of beneficial insects

Fish and Wildlife

Since populations of fish and wildlife are impacted by human land use activities, EM will play an integral role in maintaining viability of both commercially important and indigenous species.

Topics:

— Gap analysis
— Application of island bio-geography theory to wildlife management
— Minimum Critical Size of Ecosystem studies
— Application of GIS technology to wildlife management
— Ecological Preserve design — core reserves, buffers and corridors
— Role of United Nations global conservation programs (UNESCO, FAO, and UNEP)
— Role of private global conservation programs (WWF, TNC, ESA, etc.)
— Stream restoration efforts
— Preservation of free-flowing conditions of streams
— Mitigation of detrimental impacts of damming

— Fishery-Forestry-Agriculture-Energy conflicts
— Impact of exotic species
— Impact of hatchery population on native populations
— Application of population biology principles to management of fish and wildlife
— Wildlife habitat enhancement efforts in managed landscapes
— Maintenance of genetic diversity in managed fish and wildlife populations
— Wetland protection
— Role of extractive reserves in wildlife management
— Controversy over modification of endangered species legislation ("Endangered Ecosystems Act")
— Role of keystone species in ecosystems
— Role of captive breeding programs in ecosystem management
— Introduction of artificial disturbances to increase bio-diversity
— Special concerns for migratory species
— Impact of global climate change on fish and wildlife populations
— Game management vs. Non-game wildlife management
— Impact of pesticides on wildlife populations
— Successions and species diversity

Books & Publications

1. Grumbine, R.E. 1994. *What is ecosystem management?* Conservation Biology 8(1):27-38.

An excellent article used for many of the Center's (and my) original materials.

2. Nielsen, L.A. and D.J. Decker. 1995. *Educating natural resource professionals for ecosystem management.* Renewable Resources Journal. Spring 1995:12-17.

This article addresses some of the issues concerning the preparation of natural resource workers in a world where ecosystem management is implemented.

3. Seastedt, T. 1996. *Ecosystem science and society.* BioScience 46(5):370-372.

4. Several authors. 1996. Ecological Applications 6(3)

This issue contains a series of articles from a number of authors who describe their insight on ecosystem management. Authors include representatives of the wood products industry, universities and federal agencies.

5. Kohm, K.A. and J.F. Franklin (eds.) 1997. *Creating a forestry for the 21st century: the science of ecosystem management.* Island Press, Washington, D.C. 475 pp.

This book addresses ecosystem management as it applies to forestry. It represents the first attempt to place ecosystem management in an "operational context"; i.e. from theory to practice.

6. Christensen, N.L. 1996. *The scientific basis for ecosystem management: an assessment by the Ecological Society of America.* Ecological Applications 6: 665-691.

This document is available via e-mail. You can order a copy at esahq@esa.org.

7. LaRoe, E.T., et al. 1995. *Our living resources: A report to the nation on the distribution, abundance and health of U.S. plants, animals and ecosystems.* U.S.D.I. National Biological Service, Wash., D.C. 530 pp.

This report is the first comprehensive publication to come out of the biological science branch of the Department of the Interior—the National Biological Service. It is a large collection of short articles that addresses most biological resource issues in the United States. GIS- generated maps and data summaries are found throughout the document. I have found it to be a valuable resource and a good starting point for researching any biological resource issue. It is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402; Stock # 024-010-00708-7

8. Baker, J.P. et al. 1995. *Ecosystem management research in the Pacific Northwest—five year research strategy.* U.S. Environmental Protection Agency, Corvallis, OR 251 pp.

This report outlines EPA's view of ecosystem management and describes this agency's plan for implementation in the Pacific Northwest. The document number is EPA/600/R-95/069 and it is available from:

Western Ecology Division
National Health and Environmental Effects Research Laboratory
U.S. Environmental Protection Agency
200 SW 35th Street
Corvallis, OR 97333

9. Logan, R.S. and R.A. Fletcher. 1996. *Forest Ecosystem Stewardship.* Montana State University Extension Service #EB141. 49 pp.

This document describes current thinking on forest ecosystem management to a person without an extensive background in forestry or ecosystem science. Jargon is kept to a minimum, yet the most important ecosystem principles are introduced, defined and examples are given. The use of "ecosystem science" as a basis for natural resource management is a dominant theme. There is a good balance between principles/theory and practical, "how to" information that could be applied by a timber owner. The document represents a good approximation of the level of understanding of EM for students in natural resources technician programs.

10. Oliver, C. 1996. *Forest Ecosystem Management: A Graphic Overview.* Boise Cascade Corporation, LaGrande, Oregon. 52 pp.

This document is a bit more technical than Logan and Fletcher (1996) and addresses ecosystem management on industrial forests. It contains a wealth of information and flashy graphics to illustrate major points. The main elements of ecosystem management are addressed in the document—maintaining biodiversity, ecological processes, and site productivity while managing on larger scales of time and space and meeting human needs. Expectedly, there is a clear emphasis on the latter and the message of meeting the social and economic need of humans receives priority.

11. Yaffee, S.L., A.F. Phillips, I.C. Frentz, P.W. Hardy, S.M. Maleki and B.E. Thorpe. 1996. *Ecosystem management in the United States: An assessment of current experience.* Island Press, Washington, D.C. 352 pp.

This publication is a collaborative effort of the University of Michigan and the Wilderness Society. Using the definition proposed by Grumbine (1994), the authors examine in detail 105 ecosystem management projects throughout the U.S. General characteristics, goals, challenges and expected outcomes are described for ecosystem management projects.

12. Bennett, M. 1996. *Ecosystem management— opportunities and implications for woodland owners.* EC 1469, Oregon State University Extension Service, 11 pp.

This short Extension Service bulletin is designed to explain ecosystem management to private woodland owners. Various definitions of ecosystem management are given and the characteristics and rationale for implementation of EM are succinctly explained.

13. Forest Ecosystem Management Team (FEMAT). 1993. *Forest ecosystem management: An ecological, economic, and social assessment.* U.S. Departments of Agriculture, Commerce and the Interior and Environmental Protection Agency, Washington, D.C.

14. Lackey, R.T. 1995. *Seven pillars of ecosystem management.* The Environmental Professional. 17(4)

15. Moote, M.A., Burke, S., Cortner, H.J. and M.J. Wallace. 1994. *Principles of ecosystem management.* Water Resources Research Center, Univ. of Arizona. 14 pp.

16. Cortner, H.J. and M.A. Moote. 1999. *The politics of ecosystem management.* Island Press, Washington, D.C. 179 pp.

For those interested in the social and political aspects of ecosystem management, this book provides both historical context and a look to the future. The underlying theme is that natural resources management is not, and never has been, driven solely by science.

17. U.S. Department of Interior, Bureau of Land Management. 1993. *Grazing administration regulations: proposed rules.* Federal Register 58(155):43208-43231. August 13, 1993

18. Cunningham, W.P. and B.W. Saigo.1999. *Environmental Science: A Global Concern.* Wm. C. Brown/McGraw-Hill Publishers, Boston, MA. pp. 85-86.

I believe this widely used text is the first non-majors Environmental Science text to discuss ecosystem management. EM is described as a "new discipline in environmental science that attempts to integrate ecological, economic and social goals in a deteriorating environment or economy." Grumbine's 1994 article forms the basis for the description of principles and goals of EM while a forest management project from Peru is used as an example.

Videotapes

1. *Managing the Ecosystem—More than the Sum of Its Parts.* (19 min.). Blue Mountain Natural Resources Institute, 10901 Island Ave., LaGrande, OR 97850; 503-962-6590

This video describes ecosystem management and gives views of EM from different people involved in natural resource management.

2. *Perspectives on Ecosystem Management.*1988. College of Forestry, Oregon State University, Corvallis, Oregon.

3. *Forest Fragmentation and Implications.* 1990. College of Forestry, Oregon State University, Corvallis, Oregon.

APPENDIX C – FIELD STUDY SITE CHECKLIST

Checklist for establishing a Field Study Site

Site Description

Watershed Maps

(larger area than study site: Watershed perspective)

- ☐ Watershed boundaries
- ☐ Site location in larger watershed
- ☐ Stream locations
- ☐ Wetland locations
- ☐ Population (human)
- ☐ Rainfall
- ☐ Fish distribution
- ☐ Topography
- ☐ Zoning
- ☐ Land Cover and/or Vegetation
- ☐ Geology
- ☐ GIS data on CD ROM

Aerial photographs

- ☐ Scale
  - ☐ Black and White
  - ☐ Color
- ☐ Stereo pairs of photographs

- ☐ **USGS quad map**

Detailed site maps

- ☐ Topography
  - ☐ Contour interval
- ☐ Vegetation cover &/or habitats
- ☐ Tax maps showing property boundaries
- ☐ Soils map from NRCS (SCS)
  - ☐ Mosaic of photos

Inventory of site

- ☐ Plant species list
  - ☐ Forbes, shrubs, trees, fungi, lichen
- ☐ Mammals species list
- ☐ Retile & amphibian species list
- ☐ Bird list
- ☐ Migration patterns-arrival dates & departure dates
- ☐ Insects list
- ☐ Water quality
- ☐ Set photo points
- ☐ Study plots

History of the site

- ☐ Historical photographs
- ☐ Oral Histories
- ☐ Resources use histories
- ☐ Legends or rumors about the site
- ☐ Natural history &/or site specific geology
- ☐ Native American History

Access agreements

- ☐ Documentation that you can be on the site with students

People

- ☐ List of Resource People
- ☐ List of Teachers
- ☐ List of Volunteers
- ☐ List of Agency (City, County, State, Federal and NGO's)
- ☐ Peer teaching plan
- ☐ Hunting and fishing groups
- ☐ Plan to discuss stewardship of the site as well as use of the site
- ☐ Community Interface
- ☐ What are we doing and why?
- ☐ Partnerships within the community
- ☐ Organizations and agency involvement
- ☐ Connection with resource people
- ☐ Knowledge of the Zoning Ordinance
- ☐ Knowledge of other Community Documents
- ☐ Plan to involve the press and other news sources in your work
- ☐ Community event: celebration/ recommendations/recognition
- ☐ Teacher's Guide
- ☐ Activities
- ☐ Equipment needs
- ☐ Evaluation students
- ☐ Standards (benchmarks)
- ☐ Protocols
- ☐ Student behavior contract
- ☐ Overheads: aerial photos, topography, stream, satellite imagery, fisheries, information

APPENDIX D - PROGRAM CASE STUDY

Rachel Carson Center for Natural Resources Course of Study

YEAR ONE

First Semester

Natural Resources Seminar (.5 hours)
Natural Resources Field Studies (.5 hours)
Basic Ecology (.5 hours)
Environmental Studies Project (.5 hours)

Second Semester

Natural Resources Seminar (.5 hours)
Natural Resources Field Studies (.5 hours)
Botany/Horticultural (.5 hours)
Environmental Studies Project (.5 hours)

YEAR TWO

First Semester

Natural Resources Advanced Seminar (.5 hours)
Natural Resources Advanced Field Studies (.5 hours)
Technical Writing (.5 hours)
Independent Study (.5 hours)

Second Semester

Cultural and Natural Resources Advanced Seminar (.5 hours)
Natural resources Advanced Field Studies (.5 hours)
Public Policy (.5 hours)
Internship/Career Seminar (.5 hours)
Senior Project (.5 hours)

Students enrolled in the Rachel Carson program are expected to take at least 1 hour within the program's offerings each semester. They are required to be enrolled in the Seminar and Field Studies classes and may take any of the other selectives as their schedule permits. Students wishing to earn a Natural Resources Systems Certificate of Advanced Mastery (CAM) must work with the instructors to establish a two year, individualized graduation plan that includes at least 1.5 hours of course work each semester within the Rachel Carson program's offerings. Work leading toward the CAM must include the internship/career seminar in year two.

Rachel Carson Center for Natural Resources Course Descriptions

course #600
Natural Resources Seminar
1 hour SS 11,12
Pre-requisite: Completion of Biology and Algebra I

This course serves as the anchor for all other Rachel Carson courses. These small group seminars will meet to discuss and debate topics to natural resource issues. The seminar will be a place to discuss current events, learn from local professionals, and facilitate the exchange of information between students and teachers. The seminar will also provide instruction in computer use, accessing online resources, and address logistical concerns relating to other Rachel Carson classes. Students should expect to spend a portion of their seminar time on-line, outside of normal class times.

course #601
Natural Resources Field Studies
1 hour SC 11,12
Pre-requisite: Concurrent enrollment in Natural Resources Seminar

This course will provide students with hands-on learning experiences outside the school walls in local natural areas. The focus will be on learning and applying the skills and concepts used by professionals in assessing, monitoring, and restoring natural areas. It is expected that all participants in this course will make a positive

contribution to Lane County's environmental health though active involvement in team-oriented field experiences and action projects. Many of the components of this course will be taught by local natural resource professionals. Students should expect to spend a large portion of their time outdoors during the class time.

course #602
Basic Ecology
.5 hours SC 11,12

The focus of this course will be the in-depth investigation of the relationships and interactions of living things with one another and with their environment. Topics to be covered include: population studies involving native plants and animals, energy and nutrient flows in the ecosystem, and the detailed study of local freshwater and forested environments. This is primarily a cyber-school course. Students should expect to spend the majority of their class time working independently on-line completing projects and the course web lessons.

course #603
Botany/Horticultural
.5 hours SC 11,12

This course is devoted to the study of plants and their relationship to the environment. Topics will include: plant structures, classification, growth and development, ecology, and diseases. Students will have the opportunity to use Churchill's new green house for plant research and for raising ornamental plants for sale to the public. This exciting new class will look at many aspects of plants not normally covered in regular Biology classes and will include a field oriented component. Much of the course will be delivered over the internet. Students will work independently on green-house and field study components.

course #604
Public Policy
.5 hours SS 11,12

The essence of public policy is meeting the needs of society. Students in this course will immerse themselves in the study of public policy through a school improvement project in the micro-society of Churchill High School. Students will work in teams where they will identify, analyze, propose and implement solutions to issues or problems on campus. The Internet will be used extensively for research and communications. Project examples include: campus-wide recycling, school grounds improvement, integrated pest management, promoting alternative transportation.

course #605
Technical Writing
.5 hours LA 11,12
Pre-requisites: Successful completion of 1 year of high school English

This course is primarily a cyber-school course. This course teaches students writing skills they will need most of their adult lives. A college preparatory course, students will also be exposed to writing for the world of work as well as for their own personal needs. Sample writing assignments include business letters, resumes, memos, directions, specifications, and compliant and adjustment letters. This course is for students who are able to work independently, can meet deadlines, and enjoy working with computer technology.

Environmental Studies Project
.5 hours, SS 11,12

This project period provides Rachel Carson students the time needed for independent research and development of a final project. Project topics related to natural resources and/or environmental studies will be chosen by each student. The end result will be a significant product with written, visual, and verbal

components. Presentation of the final projects will be showcased at the spring term Watershed Summit. The majority of the work in this class will be completed independently with the guidance of the Rachel Carson teachers.

Cultural and Natural Resources Advanced Seminar
1 hour SS 12

This course is offered to Rachel Carson students returning for their second year. The focus is on a more in-depth study of issues related to cultural and natural resources. Students will be expected to produce independent research projects, present information on current events, and engage in debates on controversial issues.

Natural Resources Advanced Field Studies
1 hour SC 12

This course builds upon the technical skills developed in the previous years' field studies. Students will work on special projects in the field (such as bird population surveys, restoration projects, etc.), assist with training of first year students, maintain water monitoring equipment, and work in the greenhouse.

Senior Independent Study Project
.5 hours SC,SS,LA,PE

Students in this course will engage in significant research projects. The focus of the projects will be on community service and could include: lesson delivery at elementary schools and middle schools, production of educational videos, web page construction and maintenance, publishing of the Rachel Carson newsletter, organization of public work parties, development of Public Service Announcements for KRVM radio.

Internship/Career Seminar
.5 hours SS,LA

Students in this class will be involved in a 6 – 10 week internship at local businesses, government agencies, or non-profit organizations. During this time they will interview and job shadow natural resource professionals. They will also receive job training and become a contributing member of the organization they choose to work with. The remainder of the semester will focus on the development of skills related to planning for post secondary experiences, leadership, self-awareness, and communication.

APPENDIX E – PROGRAM PLANNING OUTLINE FORM

OVERALL PROGRAM PLANNING OUTLINE

The purpose of this form is to provide an outline for a comprehensive natural resource program. This can be used to make proposals to your principal, school board, and community. In addition, many grant proposals contain these elements as well. The outline is structured in such a way that you will need to develop the program out of public domain documents. A needs assessment of your community may indeed be the first step necessary before completing this form.

A. Program Title _____

B. Mission Statement _____

_____

_____

C. Goals (lifelong learning skills) _____

_____

D. Course Title/Descriptions/Standards Addressed

1. Phase I _____

_____

2. Phase II _____

_____

3. Phase III _____

_____

E. Public Documents to Access _____

_____

_____

F. Potential Partners _____

_____

G. Budget (long range) _____

_____

H. Funding Sources _____

_____

I. Timeline for Implementation _____

_____

APPENDIX F – PROJECT PLANNING OUTLINE FORM

PROJECT PLANNING OUTLINE

I. Program Information

A. Program Title _____

_____

B. Program Mission Statement _____

_____

_____

_____

_____

C. Appropriate Goals _____

_____

_____

_____

_____

D. Objectives to Reach Goals _____

_____

_____

_____

_____

II. Project Information

A. Project Overview _____

_____

_____

_____

_____

_____

_____

B. Project Process

1. Public Domain (page 8)

a. Community invitation (specific document(s), request(s), etc. _____

_____

_____

_____

b. Partners _____

_____

_____

2. Information Gathering

a. Skills required (page 8) – include both community and content skills _____

_____

_____

_____

b. Knowledge/content standards (page 8) – include both community and content knowledge _____

_____

_____

_____

c. Attitudes to be developed (page 8) _____

_____

_____

d. Community theme(s) addressed (page 9) _____

_____

_____

_____

3. Policy/Decision-Making

a. Community product/participation_____

_____

_____

_____

b. Life role(s) addressed (page 10) _____

_____

_____

_____

C. Specific Needs

1. Budget

a. Equipment/Materials _____

_____

_____

_____

b. Transportation _____

_____

_____

_____

2. Timeline _____

_____

_____

3. Approval(s) needed

a. Administration _____

_____

_____

b. Staff Collaboration _____

_____

_____

c. Parents _____

_____

_____

d. Public Governance _____

_____

_____

APPENDIX G – COMMUNITY RESOURCE REFERENCE FORM

ORGANIZATION	CONTACT PERSON(S)	PHONE #	ADDRESS	E-MAIL
National Agencies:				
US Corp of Engineers				
US Fish and Wildlife				
US Forest Service				
US Dept. Agriculture				
Dept. of Environmental Quality				
Bureau of Land Management				
Natural Resource Conservation Service				
Soil and Water Conservation Service				
Environmental Protection Agency				
OTHER				
State Agencies (OR):				
Dept. of Forestry				
Dept. of Agriculture				
Dept. of Water Resources				
Dept. of Fish and Wildlife				
Division of State Lands				
State Parks Dept.				
(University) Extension Service				
GIS Services				
OTHER				
County Agencies:				
Parks Dept.				
Public Works Dept.				
Community Development				
Information Services				
OTHER				

ORGANIZATION	CONTACT PERSON(S)	PHONE #	ADDRESS	E-MAIL
City Agencies:				
Public Works Dept.				
Parks Dept.				
Community Planning				
Community Development				
OTHER				
Community Organizations:				
Watershed Council				
Audubon Society				
Nature Conservancy				
"Friends" Groups				
Land Trust Organization				
Fishing Groups				
Ducks Unlimited				
Environmental Organizations				
OTHER				
Business and Industry:				
Water Labs				
Weyhauser/Willamette Industries				
Landscape Designers				
Environmental Services				
Wetlands Consultants				
OTHER				
Private Land Owners/Resources:				

"The need for educational reform is on the agenda of nearly every group that is in any way connected to public welfare in America. Increasing day-to-day needs for citizens to be scientifically, technologically, ecologically, and socially literate underscores that there is reason to be concerned about the educational preparation of our student-citizen."

Jon Yoder,
Secondary Education Coordinator for NCSR

Neal Maine,
Secondary Education Consultant for NCSR