# Understanding and Using the Manual

## Goals, Concepts, Objectives, and Assessment

*Wild Wonderful Wyoming: Choices for the Future* is a comprehensive environmental education program. Since college preparation to teach in Wyoming does not at this time specifically require preparation to teach about principles of natural resources conservation, there is an assumption that many teachers who will use this program are unfamiliar with methods and ways to teach about sustaining our natural resources. So we begin with a definition and the primary goal of environmental education, which is also the primary goal of *Wild Wonderful Wyoming*. The definition of environmental education is within the goal as stated in a single sentence taken from the popular *Guide to Curriculum Planning in Environmental Education,* produced by the Wisconsin Department of Public Instruction.

> **The goal of environmental education is to help students become environmentally knowledgeable, skilled, dedicated citizens who are willing to work individually and collectively toward achieving and maintaining a dynamic equilibrium between the quality of life and the quality of the environment.**

Other goals and concepts adopted and written for *Wild Wonderful Wyoming: Choices for the Future* are listed in the Goals and Concepts appendix in the back of this manual. The goals were taken primarily from the document "Learner Outcomes for Environmental Literacy," produced by the Wyoming Environmental Education Task Force, 1991. The "Outcomes" were endorsed by the Wyoming Department of Education and the University of Wyoming in 1992 and mailed to Wyoming school district superintendents and curriculum directors with the hope that the "Outcomes" might be incorporated into the educational outcomes of Wyoming school districts. The “Outcomes” are the goals of *Wild Wonderful Wyoming,* plus one more. The original advisory board for the project added goal F. The goals are listed in the Goals and Concepts appendix were chosen from several significant environmental education reference documents and materials. Two of special importance were *Essential Learnings in Environmental Education* (1990), produced by the North American Association for Environmental Education, and the *Comprehensive Plan for Environmental Education*, developed by the Arizona Governor's Task Force on Environmental Education (1992).

Not all SICEP concepts are taught at a particular grade level. The program is K-12 and some concepts are best introduced in the upper grades. The Goals and Concepts section on the first page of each activity quickly leads the teacher to the specific *Wild Wonderful Wyoming* goals (lettered A-F in the Goals and Concepts appendix) and the numbered

concepts associated with the goal. The Goals and Concepts section of each activity is also a quick reference to the Wyoming State Standards in science, math or social studies, or a combination of these standards.

Student performance objectives are listed on the first page of each activity. They are specific for the activity. Suggested Assessment is a component of each activity. These suggestions allow the teacher to authentically evaluate the performance of the students on each instructional objective of the activity.

# The Focus

"Think globally, act locally" is a popular bumper sticker slogan that captures the philosophy of *Wild Wonderful Wyoming: Choices for the Future*. Aldo Leopold, the father of wildlife management, penned the idea seventy years ago when he said, "What good is it to win the battle in the legislature if you lose the one on the back forty." Much legislation has been enacted at the local, state and federal levels of government to protect the environment and many agencies go about their business of enforcing the laws: game laws, forest management laws, recreation laws, and air and water quality laws. Conservation is a state of harmony between people and the land, and it is in the mind too. Leopold said, "We can not heal the land by government proxy. The changes that can bring about land health have to come from within us." The best practices of conservation are voluntary actions of people based upon an understanding of ecological principles. Citizens must know what a state of harmony is and why it is worth achieving. As Wyoming's stewards of the resources, we must be aware of our state as part of the global environment and make our contribution to conserve and protect the whole earth. But we are most affected by our immediate environment. Each of us is the caretaker of a part of Wyoming and our focus with *Wild Wonderful Wyoming* is Wyoming. In caring for our part we care for the whole. We each have a back forty to look after.

What do children ages 5 through 18 need to know about their environment, what can they understand at certain ages and what are meaningful actions they may carry out to sustain and improve their environment? The famous sociologist and educator Thorstein Veblen said of choosing what should be in the school curriculum, "It is like choosing the best stems of hay from a hay stack." Choosing the concepts children should know about their environment and selecting and designing the activities that will make the concepts meaningful so they will act on the knowledge is a huge challenge.

It was difficult to categorize Wyoming's diverse resources and multiplicity of issues. However, we settled on six topical sections for inclusion in *Wild Wonderful Wyoming:* Earth Systems, Water Resources, Energy Resources and Recycling Resources, Wildlife Resources, Forest Resources and Agriculture Resources. Air resources are considered in each of the sections. For the initial printing of the elementary manual, 77 activities were chosen for grades K-6. The secondary manual (grades 7-12) includes 75 activities. On the Worldwide Web, activities are quickly added, or deleted. At both levels activities were compiled from many sources. Individual teachers contributed some. Each activity has been modified for the needs of Wyoming and may not closely resemble the original

activity. The activities selected follow **concept strands** that extend through the *Wild Wonderful Wyoming* manuals at both elementary and secondary levels.

# Concept Strands

The five strands represent primary concepts or ideas every citizen should understand to accomplish our goal of living in harmony with the systems that sustain life. These major concepts make a framework around which activities may be clustered within each of the six resource sections. The activities of the cluster reinforce the major concept. Each concept strand needs further clarification.

### The Earth-Time Strand

The limits of the human condition cause us to live in what the late anthropologist Loren Eisley called "cosmic prisons." Our physiological condition — length of our lives, the limits of our vision, our cognitive ability — do not allow us to easily understand the meaning of the age of the earth (4.6 billion years), and other abstractions of the universe. Do we really understand the distance to the nearest star system (four light years), the size of water molecules, or the relativity of matter and energy? Distance in the universe is measured in light years because our familiar measurements of distance are not practical for the cosmos.

What is the importance of understanding Earth time to environmental education? Everything. The Declaration of Independence was signed in 1776 AD, 231 years ago this in 2007. Two hundred and thirty-one years is to 4.6 billion (the age of the earth) as 6 tenths of a second is to a year! Earth's resources were formed in Earth time or "cosmic time," not our time. The coal of Wyoming was formed over millions of years, millions of years ago. Soils that have been forming for thousands of years may be lost in less than the lifetime of a careless farmer. A species that may have lived through the perils of the last Ice Age (which lasted two million years) may be lost in our time because we did not understand it needed a particular habitat to survive. Earth time relative to our time is very important when we relate to our natural heritage, our economy, and our use of resources. Within each section of the curriculum a deliberate effort is made to relate the resource of the section to the time frame of the resource development, which is Earth time.

### The Geological-Geophysical Strand

Why is the north slope of a canyon in Wyoming lush with vegetation and the south slope across the canyon dry like a desert? Why do sugar beets grow in Torrington, Wyoming and not in the Laramie Basin? When were Wyoming's great deposits of coal formed and how long might they last at our increasing rate of consumption? These are questions of the geological-geophysical variety. Are we humans with our pollution changing the geophysical conditions of our atmosphere and the climate regions that sustain our food supply? Geology sets the stage for the conditions of the land: where the rivers flow, the temperature and rainfall, the locations of the mineral resources, where the glaciers formed in the last Ice Age and continue to exist today. Because of the geology and the

geophysical conditions of any location, the activities of humans are played out. There is a harbor, there is mining, there is grass hay farming, oil is found, or there is a dry hole. This strand of the curriculum is especially important to Wyoming economics and other human activities.

**The Ecosystem Functions Strand**

Ecosystem was a new term in the twentieth century and it is central to understanding ecology, which was also a new science of the twentieth century. The ecosystem concept has become important in many areas of human activity. When a big trout rises to the surface and takes a moth on the water's surface, and later a grizzly bear slaps the trout from the water for its lunch, the ecosystem is functioning. Every organism lives in an ecosystem and in every ecosystem there are functioning subsystems. The energy subsystem of most ecosystems is the sun's energy. Organisms that carry on photosynthesis store the sun's energy in their bodies. Bacteria and fungi, the organisms of decay, function to turn the accumulating organic material into inorganic materials so the cycle may start over. The dead organisms recycle. Producers go on taking in the non-living materials produced by the organisms of decay—carbon dioxide, nitrates and other inorganic elements and compounds—and organize them into living materials once again. Consumers eat the photosynthetic organisms that stored the sun's energy. And consumers are eaten (the grizzly eats the trout). When we study any organism or population of organisms we must understand the ecosystem it lives in. Otherwise we don't know much about it. To survive every species must have a functioning ecosystem. For modern humans and our life style it is many ecosystems. In Wyoming we may eat codfish from Nova Scotia one day and strawberries from Argentina the next day. Our furniture may be a forest product from the tropics. It is interesting to read a Wyoming newspaper and see the issues that fall into the Ecosystems Functions strand: bison with brucellosis leave Yellowstone, grizzly attacks hiker, antelope cut off from winter range, timber sale proposed.

Our use of energy is within both the Ecosystem Functions and the Geological-Geophysical strands. We use many times the energy necessary for our metabolic processes each day to carry out other activities of modern living: driving to work, watching TV, washing our clothes. Nearly seven billion humans now live indirectly off of once living organisms that stored the sun's energy millions of years ago. A Kansas family on a farm can raise enough wheat to feed hundreds of people, but to do this they must run tractors that pull plows and equipment that may be forty feet wide. The tractors run on fossil fuels, the sun's energy stored in another geologic time. The activities of modern societies dependent upon fossil fuels that are of finite supply. What are the replacement fuels for our societies when the fossil fuels run out? Wyoming produced more energy total last year than any other state, mostly from fossil fuels. The Powder River Basin of Wyoming produced two fifths of the nation's coal last year. Now we harness the wind. These are topics of the Ecosystem Functions strand.

**The Evolution-Adaptation Strand**

Were it not for evolution, ptarmigans would not live in Wyoming's alpine areas, there would be no paintbrush to grace the meadows, or sage grouse would not be strutting in their leks in the spring trying to win the mating privilege. Understanding the processes of evolution has been to modern biology what understanding the atom has been to chemistry. To say a plant or animal is adapted to its environment means it evolved by inheriting a particular survival package that works and allows its kind to go on surviving. Like so many science concepts, evolution is very abstract and not easily understood. Maybe that is why it was not until the middle of the nineteenth century that its operating principles were discovered. Today it is the concept of evolution that ties modern biology together, but it may be the most neglected concept in our education curriculum. It explains why bats can pick mosquitoes out of the air on a black night, why salmon can return to their place of birth after a four-year cruise in the ocean, and why humans are able to build cars and computers. Though evolution is like so many science concepts, very abstract, even at the elementary school level, many fun and fascinating activities may be carried out that will allow for students to later understand the subtleties of nature's greatest detective game, what came from what and how. Today evolution is not just an interesting debate as in 1929 when Tennessee challenged John Scopes for teaching the concept. Today this understanding is vital to each of us for our personal and community health (resistance of bacteria to new antibiotics), production of new varieties of foods resistant to diseases and pests, and saving endangered species. With our modern day abilities to cause major changes in Earth's ecosystems, we have our hands on the controls of evolution — at least for a while. We must understand how it works.

**The Population Strand Concept**

Understanding the dynamics of population growth for any species, but especially humans, is critical to sustaining ecosystems. Each species has the capacity to overpopulate its habitat. But all individuals produced will not live to reproduce. Biologists call a species reproduction capacity its biotic potential. An oyster may release114, 000,000 eggs in one spawning. If all of the eggs survived, in only a few generations the ocean would be full of oysters. In their lifetime most female elephants breed between the 30th year and 90th year and produce about six young. In 750 years if all of the young from a single pair of elephants survived, the descendants would number 19,000,000. As we near the end of 2007 the population of the United States is more than 300 million and this year the population of earth will reach nearly 7 billion. The population of the U.S. was 151 million in 1950. Fifty-nine years has meant 149 million more Americans to use the same amount of fresh water, and space. We have the same amount of arable land. The U.S. Census Bureau predicts that the U.S. population will double in the 21st Century. The world population was 2 billion in 1930. It took 4.5 billion years for the human population of earth to reach 2 billion and it only took 77 years for 5 billion more humans to be added to the world population. The generation born in the1930s is the only generation to see world population double, let alone triple, in their lifetime. In 2006 the earth's human population grew by more than 90,000,000. That increase equaled 180 Wyomings. The world population increase in 2006 means the equivalent of more than a new United States every four years. Like the evolution

concept, the age of the earth, or the speed of light, implications of population growth are subtle and abstract. But the mathematics is rather simple. We know the doubling time of the Earth's population is now less than 61 years. There are 7 billion of us today. That is 14 billion in 61 years. In 2068 there will still only be 1/32 of the earth's surface with arable lands to grow the food. Today the oceans are fished at their capacity. Many activities and concepts fit within the Population Strand, even at the elementary level.

# Integration of Subjects

Environmental education is a wonderful avenue to integrate school subjects. It belongs in all subjects of the curriculum. Allow your students to learn about the environment as they become critical readers with "The Ant Gap" activity, or use algebra with "Growthville USA," or chemistry in "Ozone Tag." In "Wanted: A Place to Rest" physical education can be mixed with learning about habitat needs for the migration of birds from nesting grounds to wintering grounds. In the elementary manual students learn math skills in "Earth Time/Our Time" and "Water, Water Everywhere: (or not)." In "Wyoming Animal Clues Game" students learn to recognize the characteristics and habitat requirements of regional wild animals as they integrate science, language and art. The activities ideally meet the national and state standards.

# Quick Information and a Growing Curriculum

The information in the green box in the right hand column on the first page of each activity quickly guides the teacher concerning the use of the activity in the daily lesson plan, or the unit plan. The activity lists appropriate Grade Levels, Time Needed, Subjects to Integrate, Topics, and Skills to be learned. The Goals and Concepts and Objectives component on the first page quickly lets the instructor decide which State Standards and objectives are met with the activity

Since *Wild Wonderful Wyoming* will be a continuing project with new activities produced for the manuals and the on line production, each topic is keyed with a symbol. Topics and symbols are given below. The symbol makes quick filing of an activity to its topic. Each resource section of the manual is numbered **separately** so additional activities may be added to sections.

**Sections and Symbols**

Earth Systems 

Water Resources 

Energy, Minerals and Recycling Resources 

 Wildlife Resources

Forest Resources

 Agriculture Resources

# Being a Contributor to Wild Wonderful Wyoming

Wild Wonderful Wyoming is a cooperative plan including many institutions, agencies, and individuals with the goal of achieving and maintaining a dynamic equilibrium between the quality life and the quality environment in Wyoming. Create an activity and test it with students of the appropriate age to see if it helps students reach the goals and learn the concepts of the WWW curriculum. It will be reviewed by the Wyoming Natural Science Education Advisory Board. Send or e-mail your activity to Dr. Duane Keown at the Science and Math Teaching Center, Dept. 3992, University of Wyoming, 1000 E. University Avenue, Laramie, Wyoming 82071 (dkeown@uwyo.edu). Your activity may go on line as a part of the curriculum and be used by many other teachers in this state and beyond.