

Rudiments of Ecology Through Literature and the Environment

Jason Sanchez

Academic Setting

This curriculum unit is created for use in teaching seventh grade life science students at Harrison Middle School, which is located in the south valley of Albuquerque, New Mexico. Harrison is located in a semi-rural area within walking distance of the Rio Grande River and bosque, an endangered riparian environment. The Rio Grande bosque is a narrow wooded area along both sides of the river that is populated by large cottonwood trees, tamarisks, Russian olives, pocket gophers, hawks, beaver and a host of other native and non-native inhabitants.

Early Hispanic settlers built their farms along the bosque and many of the students who attend Harrison are the descendants of these settlers. Other students are of more recent arrival. Some are immigrants from Mexico, a few Native Americans have moved into the area from surrounding pueblos and others are the children of people who have come to the area from other parts of the city in pursuit of moderately inexpensive housing. Most of the students come from households that range from the middle to lower socioeconomic echelons.

There is a very wide range in literacy levels among these students. Many of these students often read at third or fourth grade levels (if not lower). While some read at high school levels. In addition, some of these students are bilingual, some monolingual (English and non-English) and some have other special needs. A high percentage of middle school students in the south valley eventually drop out of school. While a few complete high school, even fewer move on to college.

Goals

This unit is intended to facilitate understanding of the concepts of nature, ecosystems, habitats, niches, limiting factors, carrying capacity and to investigate human effect upon ecosystems. Teaching these concepts will also fulfill the following New Mexico Standards and Benchmarks:

Standard Two (2)

Students will use evidence, models, and explanations to explore the physical world.

Benchmark for Standard Two

Students will identify and organize evidence needed to predict changes in natural and artificial systems...

Standard Eleven (11)

Students will know and understand the synergy among organisms and the environments of organisms.

Benchmarks for Standard Eleven

Describe how organisms obtain and use resources, grow, reproduce, and maintain a stable internal environment while living in a constantly changing external environment; Predict behavior in relation to changes in an organism's internal and external environments; Use knowledge of population characteristics to distinguish specific populations; Categorize organisms based on the function they serve within their ecosystem; Examine the impact humans have had on other species and natural systems over time.

Standard Fourteen (14)

Students will know and understand the differences between the interactions of science and technology.

Benchmark for Standard Fourteen

Students will design and conduct experiments that distinguish between natural and artificial objects and materials.

Standard Sixteen (16)

Students will know and understand the relationship between natural hazards and environmental risks for organisms.

Benchmark for Standard Sixteen

Students will analyze environmental risks for personal and social costs...

Personal Goals

It is my intent to help students formulate what might be called a scientific morality or spirituality. That is, to assist students in developing and utilizing positive character traits that they can apply to their scientific experience. I will also attempt to teach science and present the literature in context. I will integrate nature walks and bosque activities with environmental readings and student reflective writing. Generally, science is taught using textbook information in conjunction with laboratory experiments in the classroom. In teaching environmental issues, the lab should be extended outside of the classroom. This will provide the student with an introduction to field work at a very basic level.

I will also attempt to have the literary pieces, discussions, activities, and research lead up to the community presentation in an effort to provide students with a tangible goal to work towards. To my way of thinking this provides a logical sequence as it will gradually prepare the students for the roles of activists, public awareness advocates, or just responsible citizens regarding environmental issues.

Finally, the lessons are intended to serve as "hooks" to increase student awareness and interest in scientific and literary areas in general. It is my belief that the local natural environment, environmental literature, and activated student interest can provide a three-fold chord that will act as a life line of salvation to these endangered students and their endangered environment.

Narrative

Nature

In order for students to be literate in the discipline of ecology, they must be able to understand the fundamentals of environmental concepts and should be familiar with the "jargon" of environmentalism. The first of these concepts is the concept of "nature." Students must gain some understanding or appreciation for what nature is. The acquisition of this concept is actually difficult for people of all ages. Many members of society never attain an "environmentally friendly" realization of this basic concept. This, in part, may be because nature is "so many things." It is like a multifaceted gem whose sparkle and color varies with the perspective of the observer. Even the definition of nature is multiplex. *The Random House College Dictionary* describes nature as "the particular combination of qualities belonging to a person, animal, thing or class by birth, origin or constitution...the material world, esp. that unaffected by man...largely free of human influence...the sum total of forces at work throughout the universe." Ralph Waldo Emerson says that nature is "all that is NOT ME" or those "essences not changed by man." He says that we should develop an "original relation" to nature, rather than one mediated to us by others. A personal assessment, reevaluation, and altering of one's own perception of nature is often the result of exposure to nature and literature that deals with nature. It is hoped that such explorations into the subject of nature will start students upon the path that leads to an environmental-friendly understanding of nature. Emerson also says that "the aim of science is to find a theory of nature."

An "environmentally friendly" understanding of nature, in this unit, will be defined as one in which the student is able to make responsible decisions in regard to the environment. Students should gain practice in making choices based upon his or her constructs of nature and that involve the least destructive consequences to the environment possible. These constructs of nature may be seen as an evolutionary process, because studies indicate that the more students know about a subject, the more they can learn about that subject. This actually creates somewhat of a "snowball" effect. That is, my students will base their learning upon their current understanding of nature, which in turn will increase their knowledge base, which, in turn, will increase their potential for increasing their understanding of nature, etc. Their current understanding of nature may be based upon past experiences of nature that they have had.

Jean Piaget described learning in terms of experience. According to him, it is experience that produces "schema" or thought patterns that help the student understand the world around him or her (McCormick 154). These schema may be thought of as templates or frames that are used to categorize subsequent experiences. In turn, they may be altered by new experiences. Sometimes new schema are created. Experiences are then necessary for the production of schema used in acquiring new knowledge. Experience also provides education for the human spirit. The wonder of nature may be seen in the glory of the sun as it appears in a single dew drop. The pathos of nature is heard in the cry of the mourning dove. Its grandeur may be felt each time the sun offers her bloody

sacrifice upon earth's altar at days end. Uneducated, indeed, is the soul that does not allow himself to experience the sanguinary splashes of scarlet, rose, and deep violet as they are pierced by needles of gold in a New Mexican sunset. "Having eyes, they see not and having ears, they hear not." We must encourage students to let themselves experience nature and capitalize upon their experiences. Lawrence Buell states that good environmental literature brings about a "recalibration of familiar landscapes" resulting in "environmental consciousness" (Buell 261, 262). Good environmental literature should cause familiar places and notions to be seen in new ways.

We humans have also have a need to express ourselves and to appropriate the experiences of others. Therefore, students must be given the means to mediate their experiences through language. The experienced student should be able to read about ecological concepts in literature and through literature increase his or her knowledge base upon which to build an even better understanding of environmental concepts (such as nature) and experiences.

Ecosystems

The second concept that is addressed in this unit is that of the ecosystem. An ecosystem may be defined as a system in nature made up of "living things and non-living things in an environment, together with their interactions" (GlobeFearon 54). This interactive system may be viewed as a web in which "vital energy" flows through nature. The web has been described by John Bruckner in *Philosophical Survey of the Animal Creation*, as fragile, delicate, "admirable in its construction" and "subject to ten thousand accidents" (qtd. in Buell 282). Charles Darwin said that in nature there existed "a web of interwoven lives, each in some way related to the others" (Buell 282). Thus, in the concept of the ecosystem each living thing and non-living thing affects every other living thing in some way, directly or indirectly. Since the word ecosystem "represents an idea more than a place or set of things" (Project Wild 350). Therefore, it can be used to describe the entire planet as well as more localized subsystems, however small.

Habitats and Niches

Within an ecosystem, organisms (living things) inhabit certain places and perform certain jobs or roles. These are called habitats and niches, respectively (GlobeFearon 56). Habitats and niches are essential for the continuation of the web of life or ecosystem. Not only is a habitat defined and the place where an organism lives, but it is also where it must carry out the functions that help ensure its survival. These functions include obtaining nourishment, reproducing, and even dying. They affect the surrounding environment and other organisms in many ways and may be engaged in intentionally or unintentionally. When an organism performs its function, job, or role in a community of organisms, it is said to be occupying a niche in that community. A community is comprised of different species (kinds of organisms) within an area. The population of one species may determine the population of another. For example, the number of plants (whose

niche involves changing sunlight into food) determines how many sheep can live in one area. This in turn determines how many wolves (whose role it is to eat sheep) can be supported, *etc.* Ecosystems tend to balance themselves in this way. Only a certain number of organisms can be supported in a community and an increase or decrease of any of these interrelated niche occupiers is adjusted over time. If any organism does not occupy its niche for any reason another organism that performs the same functions may often take over that role. If a "replacement" does not arise the entire web may eventually collapse.

Limiting Factors and Carrying Capacities

In any ecosystem, resources necessary to sustain life are limited. When an absence of any resource prohibits life or limits the number of organisms in a system, this resource is called a limiting factor. Examples of limiting factors are water and food supplies. Limiting factors determine the number of organisms that may reside in any system. The largest number of organisms that an area can support is called carrying capacity (GlobeFearon 58). For example, New Mexico's carrying capacity for black bears is approximately 5,000 bears (New Mexico State Department of Game and Fish). This in turn is limited by factors such as the amount of water and food available for bears.

Human Factors

One of the biggest questions that students may be interested in is "how do humans affect ecosystems?" There is no doubt that humans have the ability to affect ecosystems, but to what extent can humans affect them? Many scientists tell us that our decisions and actions are producing very undesirable consequences for the planet as a whole, while others voice their opinion that, as a race, we can have very little impact on a permanent planetary basis.

It is my intention to utilize experience along with environmental literature to further facilitate understanding of these concepts. These tools include classroom activities, discussion, outdoor activities, and a community awareness event.

Justification for Use of Environmental Literature in the Science Classroom

There are several reasons why I have decided to incorporate environmental literature into the science class. (Environmental literature in this context is literature that deals with or contributes to the study and exploration of natural environments or ecology).

First, literature is not only important in helping students understand environmental concepts, but it is also important in shaping the scientist of tomorrow. My students are these future "scientists." True, most of them will probably not work in positions that society regards as scientific in nature nevertheless, as responsible citizens they must be aware of the scientific issues they must face. Increasingly, science affects every aspect of our lives. Therefore, it behooves every student to strive to become

a "scientifically responsible citizen." A scientifically responsible person keeps him or herself informed about important issues and is able to make informed decisions that take moral, environmental, spiritual, and humanitarian factors into consideration. "Because literature reaches beyond the dispassionate intellect, it can also educate the heart - a curriculum very much on the mind of the nations business leaders and educators" (Trelease 57). The second reason for integrating literature into the science classroom is that literacy in other areas will be promoted along with scientific literacy. This is desirable because men and women who know how to use biological warfare should also be able to appreciate the writings of Emerson. The third reason for integration of literature into the science classroom is that chances of student overall academic success will be increased (ecological concepts included). Finally, to be truly literate a student should be able to express him or herself in writing.

Traditionally, topics in the science classroom have been divorced from literature. This may serve to create individuals who may be knowledgeable in the sciences, yet be illiterate in other areas. A very dangerous situation. Literature remains one of humanity's greatest vehicles for the dissemination of spiritual and moral concepts. One might argue that science is a discipline based on observation alone and that it does not deal with morality or spirituality, however, such an argument is not satisfactory. A society in which we know how to do things, but lack the insight necessary for comprehending what we are accomplishing in a societal, moral or spiritual sense, is a society blind to its own possibilities and mistakes. Solomon wrote "where there is no vision, the people perish" (Prov. 29:18).

A chemist, physicist, or even a medical doctor may know the mechanics of his or her trade, yet be ignorant of what role he may be playing in society and nature. He becomes like the mountaineer who climbed Everest simply "because it was there." Was that man ever able to understand his own motivations? Such a scientist pulls the trigger, then asks questions later. Mary Shelley's Dr. Frankenstein serves as an example of what this type of ignorance may produce. In her story she writes about Dr. Frankenstein who has the knowledge and technology that enables him to bring forth life, yet does not possess the insight or comprehension of what he has actually done. Does he ever stop to consider what sorrow or grief he will give birth to before he creates the monster? Does he first consider whether history will bless him or look upon his deeds in horror? As the character of Ian Malcolm, in movie *Jurassic Park*, says "you were so busy asking yourselves whether you could, that you never stopped to ask yourselves whether you should." When we choose to be preoccupied solely with scientific mechanics, ignoring the literature written by those who may provide us with insight, we place ourselves and those in our sphere of influence in danger. The result might be dinosaurs capable of wreaking havoc upon us. Environmental literature serves to open our eyes to what may be at stake if humanity continues to utilize technology and resources simply "because we can," while not considering consequences. One example is the question of whether cloning of beloved pets should occur. In a recent article, the *Albuquerque Tribune*

stated that scientists will soon be able to reproduce the deceased pets of our past, but is this ethical? Are there not enough dogs and cats now needing good homes? A better example might be the issue of genetically engineering "super" species of plants and animals that might have the capability of pushing naturally occurring species to extinction. Students should be allowed to explore, through literature, why humans may not want to employ technology that will drastically and irreversibly alter an environment or an ecosystem. Literature may also provide the student with reasons for conserving natural resources.

Another reason for incorporating environmental literature in the classroom is that most (not all) students who enter the seventh grade are not reading, in my experience, at grade level. Research and common sense indicate that the only way to remedy this situation is to expose students to reading opportunities. Integrating literature into the science classroom may then be seen as an investment into the students overall academic success in all disciplines, including science (Trelease xxv).

One of the reasons for this may be that integrating literature into the science class may create a symbiotic relationship between literacy and scientific knowledge. Researchers have found that the more a student knows, the more he or she can learn (McCormick 108, 109).

Implementation

In Jim Trelease's, *The Read-Aloud Handbook*, he indicates that one of the most effective tools for increasing literacy, in general, is to begin by reading aloud to students. These readings should be taken from materials that students will find enjoyable and should not be used as assignment generatives (8, 35). In my own experience, people love to be read aloud to if the material is half-way interesting. It is my intent to use environmental literature to this effect. Examples of two literary pieces that can be used in this way are "The Daisy" by Hans Christian Anderson (441), which is a highly anthropomorphized narrative involving a lark, a daisy, and human whim, and a passage taken from Edward Abbey's "Desert Solitaire" in which he humanizes the behavior of a bee in a cactus blossom (29). Classroom discussions or reflective activities may be used to compare these two pieces. Indeed, they may be compared in several ways. For example, one is tragic and sacrificial in nature, the other is festive and humorous. In "The Daisy," both the flower and the lark grieve and die because they are removed from their respective habitats by a group of boys who dramatize this grief after the fact. Edward Abbey presents a comical view of a bee bacchanalia inside of a flower. In this scenario both the cactus and the bee benefit. These passages may be used in describing the roles of organisms within an ecosystem. I may also wish to lead the students in a discussion concerning whether the readings are realistic or not. Is it true as Abbey says that "many of the nonhuman undomesticated animals experience emotions unknown to us?" Such questions may interest students in a way that mere definitions of organismic roles in an habitat or ecosystem may not. The use of

debate as a tool may also be of benefit in providing students with motivation for exploring literary texts.

It is my intent to provide the students with an introductory level of exposure to environmental literature in this curriculum unit. None of the works of any of the authors is used in its entirety, as I feel this would not be appropriate for my particular students. Rather, I have attempted to provide them with a variety of passages from a variety of authors. These have included popular literature and poetry, as well as a portion of the more traditional environmental writing from Emerson.

Finally, I will use literary pieces in teaching students about ecosystems, habitats, *etc.* in order to present them with examples of how they might write about nature (or any other topic for that matter). I have heard it said that one does not truly learn something until one has to teach it. By extension, one could argue that one never truly reads until he or she writes. I will provide my students with opportunities in which they could write about environmental issues. It has been my practice to have students write an animal report in which they research an animal of their choice and write a scientific paper in scientific format, complete with an abstract. It is my intention to continue this practice as well. I will also give students opportunities for writing reflective journal writing about whether they agree or disagree with the authors and what feelings the passages evoked in them. My tentative implementation plan is as follows.

Lesson 1 - Nature (1 day)

Materials/Resources:

Resources needed are copies of *National Geographic* magazines and of *Popular Mechanics* magazines, a copy of Ralph Waldo Emerson's "Introduction" to *Nature*, access to a local area in which students may take "nature walk," examples of natural and unnatural objects. Students will also need to maintain lab notebooks for recording experiments and observations. These notebooks will also serve as journals for reflective writings.

Lesson

Standard sixteen (16) which says "students will know and understand the relationship between natural hazards and environmental risks for organisms" and standard 14 which says "students will know and understand the differences between the interactions of science and technology" will be met by this lesson. Benchmark for standard sixteen is "students will analyze environmental risks for personal and social costs..." and benchmark for standard 14 is "students will design and conduct experiments that distinguish between natural and artificial objects and materials."

Students will be asked to describe what nature means to them and to write these descriptions in their journals. They will then be shown different copies of *National*

Geographic and *Popular Mechanics* magazines. Examples of the type of articles and photos may be pointed out. They will be asked "do these *National Geographic* magazines coincide with your view of nature? What about the *Popular Mechanics* magazines?" The purpose of this exercise is to formulate an idea of the natural versus the unnatural. Different objects will also be displayed and students will be asked to distinguish between those that are of natural origin and those that are not. Students will be asked "what are the criteria for making these distinctions?" Students will be asked to verbally complete the following statement: "When I think of nature, I think of." (Alternatively, I may have them complete this open sentence as a journal entry).

I will then read portions of Ralph Waldo Emerson's introduction to *Nature*. In particular, I wish to lead the discussion on the topic of "enjoying an original relation to the universe" and what is the "theory of nature." I will ask students whether nature is separate from them or if they are a part of nature. I will also give background information on Emerson.

Students will be asked "why should nature be preserved?" Students may collaboratively work in groups for a short period of time during which they will come up with reasons why nature should be preserved.

Students will be taken on a campus nature walk in which they list as many natural objects/organisms as possible. They may wish to create a second list in which they record "unnatural" objects as well. Students will be asked to write reflectively in their journals on the topic of "What distinguishes the natural from the unnatural?"

Lesson 2 - Ecosystems (2-3 days)

Materials/Resources:

The teacher will need a copy of Michael Crichton's *Jurassic Park* and access to transparencies of food webs, food chains and food pyramids. Students will need access to textbooks or other resources from which they may look up definitions. They will also need construction paper and other art supplies for use in making models and plans of artificial ecosystems. The teacher will need to prepare a container for every one or two students in which there are three types of seeds or buttons in each. For example, each container may have five dried lima beans, ten dried peas and three pinto beans.

Lesson

Standard two (2) which states that "students will understand science concepts of order and organization" will be met by this lesson. Benchmark is that "students will apply information about the predictability and organization of the universe and its subsystems and apply prediction to scientific problems and events."

As an introduction to ecosystems and habitats, I will have students list or discuss their current understanding of an ecosystem, habitat, and environment. Some may

already be familiar with these concepts and may simply need some prompting. The students may then look up textbook definitions of these terms and these may in turn be discussed.

At this point I will incorporate a reading from *Jurassic Park*, which begins "well, we want Jurassic Park to be as real an environment as possible..." and ends "...our problem was solved" (111,112). This passage gives an explanation of the problems and solutions that were encountered by the Jurassic Park scientists in the story. Students might then be asked to describe necessary components in an ecosystem, problems and solutions. Of course, most students also know that the artificial environment in Jurassic Park "went haywire." Students may contend that such environments can be created successfully. Artificial environments and ecosystems might be compared to natural environments. After all, a zoo is an example of an artificial environment. Whether natural systems are static or dynamic may be addressed. Questions such as "how do humans affect ecosystems?" may also be addressed. The concepts of populations and communities may be introduced at this time.

Students will be asked to plan or "construct" an artificial ecosystem. This plan must specify what organisms will be present, what their needs are, what potential problems may be taken into consideration and a disaster plan. Students will be asked to compare their ecosystem to one of natural origin.

Another activity that may help students grasp the concepts of populations and communities is one in which they are given containers containing three different types of seeds or objects. One type of seed may represent scavengers, another primary consumers or prey and another predators. Students may then be asked to use these representatives of organisms to answer the following questions: How many "organisms" are represented? How many organisms are in each "population?" How many populations are represented? What is the number of "communities?" How might the addition of four more predators affect the population?

The topic of energy transfers within an ecosystem may be broached at this time as well. This would include food chains, webs and pyramids. Students can be given lists to arrange in food chains, webs, and pyramids. Organisms that are commonly found in the Rio Grande bosque can be arranged in this way. Students will need to be introduced to the concepts of producers and consumers. They should be able to grasp the differences between primary, secondary and tertiary consumers if they are shown pictorially that the tertiary consumers eat the secondary and primary consumers, the secondary consumers eat the primary consumers and the primary consumers eat the producers (plants).

Lesson 3 - Habitats and Niches (2-3 days)

Materials/Resources

Resources the teacher should have for sharing with the class are: Hans Christian Anderson's "The Daisy" from *The Complete Fairy Tales*, Edward Abbey's "The Serpents of Paradise" from *Desert Solitaire*, access to third chapter of Genesis from the Bible (or an artistic representation depicting serpent this scene), pamphlets from Carlsbad Caverns or other sources of bat data and a copy of Mary Oliver's poem "Field Near Linden, Alabama." The teacher may provide copies of these to the students if desirable.

Lesson

Standard eleven which states that "students will know and understand the synergy among organisms and the environments of organisms" will be met by this lesson. Benchmark is "categorize organisms based on the function they serve within their ecosystem."

During the second lesson, I would use the "The Daisy" (Anderson 441) and the account of the bumblebee (Abbey 29) as mentioned above. I might also incorporate Edward Abbey's chapter "The Serpents of Paradise"(17). A discussion of the literary passages may then lead to a discussion of the role of snakes in an ecosystem. Discussion about how preconceived notions in society affect our understanding of the role of an organism in nature may ensue. The Genesis passage of the serpent in paradise (Gen. 3) may be incorporated in order that students might understand Abbey's titular reference. Other examples, such as the beneficial work performed by bats in New Mexico, might be given. This would include statistical data of bat populations, bat diets, and the data concerning how many insects bats consume each day (or night rather).

Students can use this data to calculate how many insects are consumed by bats each year. How many years would it take for us to be knee deep in insects were it not for bats? Students will be asked to create flow charts depicting the effects that elimination of one member of an ecosystem might produce, such as the elimination of owls. Such reasoning might be as follows: no owls, more mice, less grain, more diseases. Students might be asked to reflect upon whether some members of nature might be truly "bad," "good," or indifferent toward humans.

At this time, I will consider taking students on a short walking trip to the Rio Grande bosque during which they keep a log of what components of an ecosystem they see, what organisms and habitats they may observe and what the niches of some organisms observed may be.

The poem "Field Near Linden, Alabama" by Mary Oliver will be read aloud and students will be allowed to express their own conclusions as to its meaning. A second or third reading may be necessary before students realize that the subjects of this poem are vultures. This poem provides a "nice" image of the work of the scavenger. Conversation should be guided so that students realize that the work of nature is being viewed as sacred in this poem.

Students will be asked to create poems of their own using the Bosque or natural subjects as a themes. They will be required to present these in the diamante or haiku styles, formats (Project Wild 70).

Lesson 4 - Limiting Factors and Carrying Capacity (2 days)

Materials/Resources

Resources needed are a copies of Mary Austin's *Land of Little Rain*, a newspaper article or other source of information on earth's population, "Black Bear" article from the New Mexico Wildlife Publication (or other source of bear data) and access to the "How Many Black Bears Can Live in this Forest" activity from Project Wild. One blindfold, one envelope for each student, five colors of construction paper (1 sheet of each color) and one marking pen.

Lesson

The benchmarks indicating compliance with standard 11 for this lesson are "students will describe how organisms obtain and use resources, grow, reproduce, and maintain a stable internal environment while living in a constantly changing external environment; predict behavior in relation to changes in an organism's internal and external environment."

Chapter one of Mary Austin's *Land of Little Rain* might be read after which students might be asked "what is the most limiting factor in a desert?" The obvious answer is water. How does Mary Austin's description make the student feel? Does she give a picture of bleakness or of diverse life? Students may then be asked to consider or do research on how desert organisms overcome the obstacle of water scarcity. What are other limiting factors in an environment besides water? If an organism cannot overcome these factors what is the consequence?

Students will choose two plots of ground, each measuring 3m x 3m, in different locations for observation. One should be in an area of low vegetation and the other in an area of high vegetation. Students will be required to create written descriptions of each area in their journals, noting the number of organisms and describing what might be limiting factors for each area and how they affect carrying capacity.

Students may investigate how limiting factors affect organismic capacities (carrying capacity). Activities for this lesson include the "How Many Black Bears Can Live in this Forest" activity from Project Wild (134), in which all of the students are black bears, *etc.* Background information and population data may be read from the "Black Bears of New Mexico" pamphlet (New Mexico Department of Game and Fish) and discussed.

A newspaper article, "Sarajevo Welcomes Baby 6 Billion" (*Albuquerque Tribune*) will be read and discussed. Students will make a list of earth's limiting factors and create a hypothesis of what earth's carrying capacity might be.

Lesson 5 - How Do Humans Affect Ecosystems (4-5 days)

Materials

Students should have Internet and library access for research purposes. They may also wish to use photographs or video tapes to record natural images for use. Other materials needed are old magazines or newspapers for collage making and construction paper or poster board.

Lesson

The benchmark indicating compliance with standard 11 for this lesson is "students will examine the impact humans have had on other species and natural systems over time."

Students will be required to choose a research topic in ecology for a two page written paper. They will be encouraged to choose a "local" issue, preferably one that deals with the Rio Grande or bosque. Sources may include the school library, the public library and the Internet. Students may also conduct interviews of community members (especially older inhabitants of the community) for information on how the area has changed ecologically over time. In addition, students will be required to create one of the following as support materials for their paper: a collage, map/s, time lines, a graph or a photographic album. Students will be given the opportunity to conduct computer research in the computer lab and will be greatly encouraged to use computer software in preparing data for presentation. (This will allow students to gain computer experience as well.)

The issue of bosque deforestation will be introduced along with the introduction of species that are not indigenous to the area. (Most Albuquerque natives do not realize that most of the trees located along the Rio Grande Bosque are approximately fifty years old. This indicates that new trees are not being generated. Students will explore why this is so). Students may be taught how biomass measurements are made and discussions of how these measurements might be used to make comparisons or evaluations. Students may not realize that some organisms common to the Albuquerque area are not native (e.i. tumbleweeds, Russian olive trees, roly pollies). Students will explore/discuss how introduction of non-native species changes the local ecosystem.

I may have students investigate how human intervention has affected the river and its course as well. These investigations will also necessitate the formation of an hypothesis on the student's part concerning the present state and the future of our local ecosystem. Fortunately (or unfortunately), many other factors are involved. Therefore, there is no limit to possible factors students might investigate.

Other supplementary materials may be located that provide information regarding the world-wide loss of rainforests and deforestation in general. Comparisons may be made between the tropical rain forests of South America and the Rio Grande

Bosque.

Finally, I intend to have students display their research and work during the first open house. This will, hopefully, motivate students into producing work that they can take pride in while giving them a sense of activism. At the same time, community awareness concerning these issues will be facilitated.

Assessment

Tools that will be used for assessment purposes are science note books and reflective writings. These will provide me with some idea of student growth because they will allow me to compare "before" and "after" the lesson writings. For each lesson students will be given homework questions and readings from assigned text books (GlobeFearon). An end of unit test will be given with essay and multiple choice type questions. The finished products that result from the fifth lesson will be used as assessment tools as well. Finally, questioning technique will be used throughout the unit as an assessment tool.

Conclusion

I have endeavored to integrate field and laboratory experience with an exploration of literature in order to bring about understanding of environmental concepts. Unfortunately, I am unable to focus solely upon ecology in my current situation. Indeed, I am not certain that I would desire to. In a seventh grade life science class I am constrained to teach a variety of topics; however, I shall not abandon environmental/ecological issues and literature in teaching science. Instead, I will continue to integrate literature and ecological issues throughout the school year into the science classroom. This is not difficult since every aspect of science, of life itself relates, sooner or later, to ecology. There is also too much good writing about science, in general, to not take advantage of it in the classroom. Works by Annie Dillard, Jules Verne, Willa Cather and even popular writers, such as Robin Cook and Michael Crichton, to name a few, beg to be incorporated into classroom learning. In fact, it is often the popular writers who deal with the relevant issues of the day. They present us with the possibilities, often bizarre, that humanity faces. Thus, we shall read about cloning run amok or the horrors of modern medicine. These writings help us envision the direction that we do not want science to take.

These writings may help students understand the environmental/scientific issues that surround them in particular, especially since these issues are of a local nature. Why overburden the student with environmental issues half-way across the globe (although these are quite important) when there are concerns that need to be addressed locally? In a sense, they are practicing voicing their environmental concerns. Their parents become the guinea pigs for these budding activists. It is not my intent to create fanatics, but to create citizens who are aware of the issues and of what is at stake.

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