

Plant An Idea, Plant A Tree



**The Armenia Tree Project
Environmental Education Curriculum
2005**

Introduction

How populations utilize forests, water, and the land itself tells us a great deal about how people see themselves in relation to nature. From the illustrated Armenian manuscripts which depict the Tree of Life to the artwork found each weekend throughout Yerevan's art markets, the Armenian imagination has long been captured by the beauty and importance of trees and forests. In the 8th Century B.C. King Sardur of the Urartu dynasty created artificial forests near the then capital city of Tushba (Van) in order to improve the climate of the city. Historians such as Movses Khorenatsi, Pavstos Buzand, Tovma Artzuni, and others have observed that artificial forests were also created near the ancient cities of Armavir, Artamet, Tigranakert, Artashat, and Yervandakert. King Sardur recognized the beauty of trees and that forests help create a more temperate climate by lowering temperature extremes. Today we know that trees also clean the air from smoke and dust which settle on the leaves and later are washed off by the rain into the soil. Their roots systems protect the soil on Armenia's steep slopes from being washed away in heavy rains, preventing landslides and flooding, but sadly, Armenia's forests are becoming smaller every day.

Nora Gabrielyan, Ph.D. of the Republic of Armenia Botanical Garden often tells visitors of how the streets of Yerevan were once lined with diverse species such as Russian Olive, making the city itself like a giant arboretum. But the landscape of Yerevan and the rest of Armenia changed dramatically at the turn of the 1990s with an earthquake, war with Azerbaijan, and a devastating energy crisis. As fathers and mothers cut trees for firewood to warm their families, many once tree-lined parks and forests were reduced to open fields. According to the 2002 Republic of Armenia National Assessment Report to the World Summit on Sustainable Development in Johannesburg, Armenian forests have been reduced to less than 11% of the historical forest cover. Other researchers in 2004 indicate that this percentage may be even lower than 8%. The people of Armenia see everyday the impact of deforestation with increased air pollution, soil erosion, landslides, and desertification throughout once forested regions. When we hear of such problems it can seem overwhelming. What can one person, or a community do?

The Inspiration for Plant An Idea, Plant A Tree Curriculum

Between 1994 and 2004, Armenians in 482 locations throughout the country have planted, with the assistance of the Armenia Tree Project (ATP), over 530,897 trees. The Armenia Tree Project was born in the early 1990s as American-Armenians came to Armenia following the Gyumri earthquake. Concerned about the harsh conditions during the

energy crisis and high rate of deforestation, a non-profit organization was created to address the ecological and social importance of reforesting Armenia. The primary goal of ATP continues to be the assistance of the Armenian people in using trees to improve their standard of living and protect the global environment. As an extension of these projects, ATP also aims to promote self-sufficiency, aiding primarily those with the fewest resources first, and conserve Armenia's indigenous ecosystem.

ATP has two major programs: Community Tree Planting and the Sustainable Mountain Development Program. The specific goal of the Community Tree Planting is to improve social and environmental conditions at Armenia's social institutions by involving and training people in tree planting and care. ATP provides decorative and fruit trees to communities that agree to provide appropriate irrigation, fencing to protect seedlings from grazing animals, and labor for the planting and care. Similarly, the Sustainable Mountain Development Program initially began working with the Getik River Valley village of AYGUT to apply lessons learned from almost ten years of community tree planting in rural communities. Working with the mayor and local school principal an AYGUT School Orchard planted 500 fruit trees in Spring, 2003 and a school youth club began a backyard seedling project! Today families throughout AYGUT have backyard nurseries where they are together raising 16,000 seedlings.

The Armenia Tree Project's "Plant An Idea, Plant A Tree" Environmental Education Curriculum was produced integrating lesson plans for teachers from environmental education experts throughout the world. It is hoped that you as leaders in Armenian education will add to these lesson plans and expand them as the state of Armenia's environment changes, one tree at a time.

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Necessary concepts for all lesson plans emphasize key ecological vocabulary. While lessons explore issues such as water, soil, and biodiversity conservation all relate to the four central questions important to the environmental health of Armenia:

What is a Forest?

Why are Forests Important?

How are Forests Sustainable?

What is the Future of Armenian Forests?

VII. **Lesson Guide**

The Lesson Guide is designed for middle school students (4-9). However many lessons can be simplified for primary grades (1-3) as suggested in the text.

Each lesson includes an introduction and step-by-step procedures for activities, and a conclusion.

Discovery Module:

- Poetry and the Armenian Landscape
- A Sense of Place: Touching Nature
- Spider, The Artist
- Eco-Treasure Box
- Eco-Scavenger Hunt
- Trashbag Archaeology

Winter Discovery:

- Snow Lesson: Sculpt it!
- Snow Lesson: Eat it!
- Snow Lesson: Catch it!
- Snow Lesson: Dig it!
- Eco-Detective: The Case of the Disappearing Water

Backyard Exploration: Observation and Analysis

- Community Map-Making
- The Importance of the Naturalist's Field Notes
- Field Notes and Creative Expression, The Life of A Tree
- It is Not Your Problem, It is Our Problem
- Good Land Use Practices: Urban and Rural

Environmental and Cultural Heritage:

- Planting A Sacred Learning Grove, a "Jemaran," Planting Seeds of Responsibility
- Aralez and the Gampr: Example of Armenian Cultural and Biological Heritage
- Finding Connections Between Armenian Legends and Other Animals
- Observing the Gampr Environmental Adaptations, or Taking a Dog Census
- The Tree Huggers of Khejadali, India
- Worldwide Encounters
- Out of Balance: Environmental Problems in Lithuania

How The World Defines Environmental Education

Environmental Education (EE) is defined as a process aimed at developing a world population that is aware of, and concerned about, the total environment and its associated problems which has the knowledge, attitudes, skills, motivation, and commitment to work and individually collectively toward solutions of current problems and the prevention of new ones. [Tbilisi, 1977] In less than 30 years, EE has progressed from relative obscurity to being discussed as instrumental in achieving a sustainable world.

Historical Development OF Environmental Education

Sir Patrick Geddes, a Scottish Professor of Botany [1854 - 1933] is credited as the 'father of EE'. He pioneered innovative techniques and ideas, including use of the outdoor environment and learning by doing, interdisciplinary approach and education of the 'whole person.'

In 1970, at the 'EE in the School Curriculum' IUCN/ UNESCO meeting in Nevada, USA, the first widely adopted definition of EE was formulated:- EE is the process of recognizing values and clarifying concepts in order to develop the skills and attitudes necessary to understand and appreciate the interrelationship between man, his culture and his biophysical surroundings.

In 1972 at the UN Conference on the Human Environment held in Stockholm, EE was endorsed thus gaining additional status.

In 1975 the UNESCO/UNEP International EE Programme was established. In the same year, an International Workshop on EE was held in Belgrade, the former Yugoslavia. In this conference the philosophy and principles of EE were articulated in the 'Belgrade Charter' - a global framework for 'EE'.

In 1977, 66 Unesco member states attended the 1st Intergovernmental Conference on EE, which was held in Tbilisi, Georgia, the former USSR. EE was given the challenge of 'creating new patterns of behavior among individuals, groups and societies as a whole, towards the environment.'

Both the 'World Conservation Strategy' [1980] and the World Commission on Environment and Development report 'Our Common Future' [1987] emphasized the critical role of education in reaching 'sustainable development'.

At the UN conference on Environment and Development [UNCED]: the 'Earth Summit' [1992], the role of education, in moving society towards a more sustainable condition, was again endorsed.

Teaching By Doing

Traditionally environmental education (EE) was taught in the traditional manner, subject-based and teacher led. Originally the purpose of teaching was the transmission of knowledge, but over time this has evolved into personal and social transformation as well.

Teachers importantly lead and direct the students, but EE classes have become increasingly participatory and experiential. EE includes a flexible and wide range of teaching and learning styles and uses unusual teaching environments outside the classroom. EE can offer teachers a fresh method that promotes students to actively engage in the learning process by doing projects each lesson that encourage them to use their imagination and lessons learned in real environmental problem solving for Armenia. Importantly, this can be done with low cost for teacher and students.

Often EE classes integrate work from many subjects such as math and social sciences. Teaching tends to be more problem-centered such as helping students understand the causes of pollution or soil erosion and identifying ways to prevent these problems. EE encourages students and teachers to recognize political and economic influences on environmental issues from the local to the global level and apply lessons learned in their own backyards.

By getting outside the classroom in good weather conditions, teachers can combine classroom study with an educational walk in a local park, a visit to a botanical garden, or along mountain pasture slope. Each site, urban and rural, offers ways to touch and feel how taking care of the environment is important to the ecologically health of Armenia and our everyday lives.

CHECKLIST FOR IDENTIFYING GOOD EE PRACTICE IN SCHOOLS

1. The potential of the school grounds is developed for EE, helping to balance 'in school' and 'out of school' learning opportunities.
2. The use of resources is kept to a minimum, with staff and students taking responsibility for reuse and recycling.
3. The senior teacher and school management take the lead in environmental initiatives and promote awareness among staff.
4. The school has an EE coordinator with full support of management, time and resources for development.
5. Opportunities for staff development in EE are promoted with targets to achieve basic knowledge and understanding.
6. A total school policy which outlines the aims of the different stages.
7. There is evidence of cross-curricular planning for EE including short courses and practical activities, which involve inter-departmental collaboration.
8. Teaching and learning approaches promote environmentally responsible attitudes, values and behavior.
9. There are opportunities for students to demonstrate commitment to the environment.
10. The school promotes itself as an environmentally responsible community, for example through campaigns and newsletters.
11. Providing students with skills for environmental decision-making skills are the ultimate goal.
12. The school development plan reviews and develops EE.
13. Partnerships are arranged with local environmental groups/NGOs to support curriculum initiatives.

14. Links between school and the home are developed, in order to raise awareness and ensure the co-operation and involvement of the home in the process of EE.

As an educator, you can have a lifelong impact on your students by incorporating EE strategies into your teaching. By helping students see their environmental heritage in the Armenian landscape, teachers can help them know what their rights are as citizens. You can help them to feel they can make a difference. As you clarify important connections between family health and the environment that can help improve the quality of their lives, you are also getting them excited about the natural world.

You can spark a personal ownership in Armenia's environmental concerns.

Don't worry that you can't do everything - lighting sparks of interest is a good start.

Source: Adapted from the World Wildlife Fund Factsheet #13
World Wild Life Fund-Hong Kong. Published in Autumn 1994.

EE Conceptual Framework

Forest related topics cover a wide array of information, which could be overwhelming to understand and to teach. This framework divides forestry education into teachable concepts, organized in a manner that makes them easy to communicate. The framework is not a curriculum itself, but the structure around which activities and lessons in a K-12 activity guide will be built. The framework is designed to evolve as environmental education evolves.

We encourage educators to modify and add to this framework as curriculum is developed to best meet their needs. Detailed forestry principles are not listed in this document because they are beyond the scope of this framework and K-12 education. Specific details related to the concepts in this framework will be used in activities to enhance understanding and provide examples.

Professors and government officials in Armenia have recognized the deficit of forest training for young professionals. For that reason, careers are not listed specifically in this framework but will be woven throughout the entire activity guide and will appear repeatedly. This framework is organized under four themes posed as questions: What is a forest? Why are forests important? How do we sustain forests? What is the future of forests?

Each theme is followed by concepts that address the question, and the concepts are further divided into numbered sub-concepts. The themes are arranged so that they build upon each other. Teachers can use the following text as a guide for helping students progress from a basic biological understanding of forests to the understanding of forests in a social context.

What is a forest?

- Definition of a Forest
- Classification of Forests
- Trees As Part of the Forest
- Forests As Ecosystems
- Biodiversity and Forests

Why are forests important?

- Historical Importance
- Current Importance
- Future Importance

How are forests sustainable?

- Forest Owners
- Definition of Forest Management
- Reasons to Manage Forests
- Forest Managers
- Forest Management Decisions
- Forest Management Issues

What is the future of Armenia's forests?

- Studying Forests
- Your Connection to Forests
- The Future of Forests

Lessons

Lessons provide a complete overview of forests and forestry in Armenia. The Lesson Guide is divided into two units: K-3 and 4-7. Each unit contains three classroom lessons with

hands-on activities that can be done in a local park or nearby forest in rural areas. Each lesson includes an introduction, step-by-step procedures for activities, and a conclusion.

Considering the need to create a culture of forestry in Armenia and inspire young Armenians to seek career opportunities in this sector, each lesson includes a career profile of an Armenian environmental professional working. These profiles help students explore careers by reading aloud or creating a bulletin board. The goal of this section is to help young Armenians see adults in positions of environmental leadership and key roles in the environmental conservation from the public and private sector.

Curriculum Conceptual Framework

What is a Forest?

The concepts in this theme provide students with a fundamental knowledge of Armenia's forests and help students appreciate forests as **ecosystems**. Comprehending these concepts will lead to an understanding of the interrelationship between forests and humans.

Definition of a Forest

Identifying what constitutes a forest provides students the basis for examining

forests in a broader context.

1. Forests are ecosystems characterized by a dominance of tree cover and they contain a variety of other organisms (e.g., other plants, animals).
2. Forests differ in composition (species within a forest) and structure (layers in a forest). These are both affected by biotic (e.g., animals, plants, humans) and abiotic (e.g., soil, moisture, sunlight, climate) factors.
3. Forests are renewable resources. They can be used and regenerated at regular intervals. The complexity of the forest ecosystem and intensity of disturbance affect the rate of renewal.

Classification of Forests

Classifying and differentiating forests into biomes and types help students make connections among the forests in their community, the forests in Armenia, and other forests in the world.

4. Different forest **biomes** exist around the world. Some examples include **tropical forests, temperate forests, and boreal forests**. Most of Armenia's forests are temperate forests, but some boreal forests exist in the extreme northern region of the state.
5. Different types of forests exist within a biome. Some of the types of forests in Armenia include **coniferous, deciduous**, and deciduous and coniferous mixes.

Trees As Part of the Forest

One of the defining characteristics of forests is the trees in them. The following information helps students appreciate the uniqueness of trees and comprehend how individual trees function and fit into a forest ecosystem.

6. A tree is a perennial plant (lives more than one growing season) with a well defined woody stem, crown, and roots.
7. Trees compete for nutrients, sunlight, space, and water.
8. Trees have a life cycle that includes germination, growth, maturity, reproduction, decline, and death.
9. As part of the forest community, trees have various roles (e.g., providing habitat, holding soil). The presence of trees alters the surrounding environment.

Forests As Ecosystems

*Understanding basic **ecological principles** and how they apply to forest **communities** helps students appreciate the characteristics of living systems and how they relate to humans.*

10. Ecosystems are self-sustaining and self-regulating communities. They vary according to their structure, function, and pattern of change.

11. Ecosystem structure consists of different types of organisms (i.e., producers, consumers, decomposers) interacting with one another and their environment. Humans are part of ecosystems.

12. Ecosystem functions include the fixation of energy through the process of photosynthesis, the flow of energy through **food chains** and **food webs**, and the cycling of matter.

13. Ecosystems are continuously undergoing natural change. This natural change occurs through such processes as long-term evolution or through relatively short-term processes such as **succession**, in which one plant community gradually supplants another.

14. Ecosystems are dynamic and altered by natural or human disturbance. Disturbance plays an ongoing role in ecosystem structure and function.

15. Forest ecosystems are interconnected with other terrestrial (e.g., prairies) and aquatic (e.g., wetlands) ecosystems.

Biodiversity and Forests

*Understanding the following information helps students make connections between forests, **biodiversity**, and **sustainability**.*

16. Biodiversity (or biological diversity) encompasses the variety and variability of all life on earth. It is generally categorized into three levels: ecological diversity, species diversity, and genetic diversity.

17. There is biodiversity within a forest. Forests contain many communities that support diverse populations of organisms. Different forests have different levels of biodiversity.

18. Regions in Armenia differ in climate (e.g., precipitation, temperature) and the results of glaciation (e.g., soil, topography). These variations lead to different forest communities with differing species, thereby contributing to Caucasian biodiversity.

Glossary of Key Forest Vocabulary

biome

A regional ecosystem characterized by distinct types of vegetation, animals, and microbes that have developed under specific soil and climatic conditions.

biodiversity

The variety and complexity of all life on earth, including genetic, biological, and ecological diversity in a system.

boreal forest

A forest that grows in regions in the northern hemisphere with cold temperatures. Dominant tree species usually include spruces, fir, aspen, and birch.

community

A group of plants and animals living and interacting with one another in a given area.

coniferous

Type of forest containing cone-bearing trees.

deciduous

Type of forest containing trees that shed their leaves annually.

ecological principle

Governing principles about natural systems and how they operate (e.g., food chains, predation, water cycle).

ecosystem

An area that contains organisms (e.g., plants, animals, bacteria) interacting with one another and their non-living environment. Ecosystems can be of any size (e.g., forest, meadow, log).

food chain

A series of organisms in which one eats or decomposes another and the transfer of food energy occurs.

food web

A group of interconnected food chains.

sustainability

The ability of natural resources to provide ecological, economic, and social benefits for present and future generations.

temperate forest

A forest that grows in regions with moderate temperatures, found north and south of tropical forests.

tropical forest

A forest that grows in "winterless" tropical climates with high temperatures and generally high annual rainfall. Tropical trees characteristically do not have long tap roots like trees in temperate climates but have roots which spread out over the surface of the ground called buttress roots.

Why are Forests Important?

Historical perspectives on forests provide students an understanding of how forests have been important to humans throughout time. This section helps students investigate the connection between Armenia's forests and their own lives. Recognizing these connections increases student awareness and understanding of the importance of sustainable forest use by humans.

19. Armenia's forests provided basic resources (e.g., food, clothing, shelter) for Urartu civilizations the most ancient remnant of Armenian culture.

20. Forests provided jobs for a growing work force, resources for building the nation, and dollars for an economy.

21. Early logging, the resultant **cutover**, attempts to change land use, and the **reforestation** of preexisting forest lands were activities that contributed to the need for **forestry**.

22. The **lumber era (1930s-1950s)** shaped Armenia's economic, cultural, social, and environmental landscapes. Influences of this time period are still visible in Armenia today.

Current Importance

Understanding the following information provides students the opportunity to see the wide range of ways forests impact their lives.

23. Humans **value** forests for their aesthetic, cultural, ecological, economic, educational, and recreational benefits.

24. The degree of emphasis individuals place on forest values may vary. Reasons can include wealth, health, religion, culture, ecological knowledge, and personal experience.

25. Forests impact air and water quality, prevent soil erosion, and provide habitat for wildlife.
26. Armenia's forests have multiple economic values, including forest products, recreation, tourism, and jobs. Forests provide a variety of raw materials for many industries.
27. Forests can shape the economic, social, and cultural composition of local communities.
28. Humans depend on forests for products and services that they use everyday.

Future Importance

The following information helps students identify the continuing need for forests in the future.

29. Our worldwide economic system is based on resources—both natural and human. Armenian forests are part of this system. Changes in the use of Armenian forests may affect forests worldwide.
30. As the human population continues to grow, demands on forest resources will increase. Maintaining forest ecosystems through sustainable forestry can help perpetuate ecological systems and ensure the delivery of goods and services to society over time.

Glossary

forestry

The practice of creating, managing, using, and conserving forests for human benefit.

lumber era

The time in Armenia's history from the 1s to the 1920s when timber was harvested at a rapid pace.

reforestation

The reestablishment of forest cover.

value

To assign worth to something.

How do we sustain healthy Armenian forests?

Forest Owners

Understanding who owns Armenia's forests helps students identify the basis for different forest management decisions.

31. Armenia's forests are under both private (e.g., **industrial, non industrial private forests**), public (e.g., national forests); each may have different objectives.
32. Forests are ecosystems that can cross over property lines.
33. The scale of forest ownership can vary from hundreds of thousands of acres in a national forest to an individual tree in an **urban forest**.

Definition of Forest Management

Understanding what forest management is helps students explore further topics on management.

34. Forest management is the use of techniques (e.g., planting, harvesting) to **promote, conserve, or alter** forests to meet desired outcomes.
35. Management can lead to changes in composition, structure, and growth of forests.

Reasons to Manage Forests

Understanding the reasons forests are managed helps students develop informed attitudes about forest management.

36. Forests can be managed for ecological (e.g., water resources, wilderness, wildlife), economic (e.g., forest products, recreation), and social (e.g., aesthetic appreciation, recreation) outcomes. Many of these outcomes are interrelated and can be managed for simultaneously.
37. As global demand for forest resources increases, more pressure is placed on existing forests. Forest management and advances in research and technological systems can help to ensure forest resources remain sustainable.

Forest Managers

By understanding that many individuals and groups are involved in forest management, students will be able to recognize that the responsibility of forest management is shared.

38. The **public trust** empowers governments to have a role in conserving, maintaining, and sustaining forest resources by enacting laws, creating policies, establishing agencies, creating public lands, and providing management incentives for forest landowners.

39. A variety of agencies, companies, and individuals manage forests. Forest resource professionals in each of these areas have training and responsibilities to meet individual, societal, and environmental needs through forest management and/or education.

40. Organizations, communities, and individuals play a part in forest management efforts by volunteering, raising and allocating funds, voting, participating in the planning process, and making consumer choices.

Forest Management Decisions

Understanding how forests are managed helps students participate in forest management decisions.

41. Forests can be managed for single or multiple uses. These uses may require different management methods.

42. There are environmental (e.g., forest composition, **topography**, endangered species), social (e.g., laws, knowledge, recreation, aesthetics), and economic (e.g., cost, return) factors that can influence management decisions.

43. The type and intensity of forest management is dependent on desired outcomes, **forest type**, ownership, parcel size, and location.

44. Management starts with planning. Foresters prepare forest management plans based on land owner goals and objectives, capabilities of the forest site, and tools available (e.g., planting, harvesting, conducting **prescribed burns**).

45. Forests can be managed sustainably, while not limiting future options. **Sustainable management** of forests includes maintaining forest **health**, productivity, diversity, and **integrity** for both current human needs and the needs of future generations.

Forest Management Issues

The following information helps students understand the complexity of forest management decisions by examining management issues and the factors that contribute to them.

46. Management may have positive or negative social, economic, or ecological effects, which may affect resource sustainability.

47. People's perceptions of forest management decisions may differ when their beliefs, values, and knowledge differ. Issues can arise from these differences. Management decisions can be affected by many factors (e.g., politics, science, emotion, economics); sometimes these factors are not weighted equally.

48. The use of some management techniques (e.g., fire) can be controversial because they may have safety issues, aesthetic impact, and their current and past use is sometimes misunderstood.

49. Managing forests for **multiple use** can meet the needs of many users. Some forest uses are not compatible, so conflict may arise.

Glossary

alter

To change the composition or structure of a forest.

clearcutting

Harvesting all trees in a given area. This is sometimes used as a management technique to encourage species that do not tolerate shade during regeneration

conserve

To use or manage a certain type of tree or forest type in a sustainable manner.

forest type

A category of forest usually defined by its dominant vegetation (e.g., beech, oak, horn-beam).

health

The general condition of the forest in reference to soundness and vigor (growth).

industrial forest

A forest which is owned by a company or corporation that operates a primary wood using plant (e.g., sawmill, paper mill).

integrity

The condition of a forest as a whole including composition, structure, and function.

multiple use

A type of forest management that promotes at least two types of forest use (e.g., for recreation and wildlife habitat).

non-industrial private forest

A forest which is owned by an individual or group of individuals who do not own a primary wood using plant.

prescribed burn

A fire planned and executed to achieve management goals.

promote

To encourage the growth of a particular tree or forest type.

public trust

Responsibility the public places on government to care for their interests.

sustainable management

Maintenance of forests to meet current and future ecological, economic, and social needs.

topography

The relative elevations and configuration of features in a landscape.

urban forest

The trees and associated living organisms in an urban area.

What is the future of Armenia's forests?

Concepts in this theme help students identify ways to ensure Armenia's forests are sustained for future generations. For students to willingly and effectively take action regarding forest resource management, they must have a clear understanding of what forests are, why they are important, what is involved in their management, and how citizens affect each of these.

Studying Forests

The following information helps students better understand how forests are studied and that there is more to be learned about forests and their management.

50. Science and technology contribute to the understanding of forests, the impacts of human actions on these systems, and how forests can be sustained. As knowledge is gained, forest management is adapted.

51. Demand on forest resources leads to the need for increases and improvements in management (e.g., harvest techniques, genetics), technological systems (e.g., **GIS**, tools), and **wood utilization**. Without advances in these areas, sustainability of forests is more difficult.

52. Forest research and management involves professionals with backgrounds in many fields, including forestry, biology, wildlife, soils, water, land management, urban planning, engineering, sociology, geography, technology, environmental education, and chemistry.

Your Connection to Forests

Students will recognize their role as citizens in making decisions regarding resource use and the ways those decisions influence forests.

53. All citizens have a responsibility to be **stewards** of the environment that sustains human life. This includes making informed decisions about forest resources.

54. A citizen, acting individually or as part of a group, can make lifestyle decisions and take a variety of actions to ensure the sustainable use of our forests.

55. Forest-related decisions can be affected by politics, science, emotion, and economics. The current and future relationship between the quality of human life and the quality of forests will be determined by these decisions.

The Future of Forests

Understanding current and future trends in forestry helps students predict how scientific, technological, and societal changes will influence forests. Students will also be able to evaluate how personal and societal actions affect forests.

56. Management for sustainable forests will continue to require creativity, innovation, and collaborative thinking by individuals, organizations, governments, and industry.

57. Challenges related to forestry will change over time. As new challenges arise, forestry professionals will need to respond. Examples of current challenges include **fragmentation** of forest lands, **non-native species**, **threatened species**, and **endangered species**.

58. Individuals, organizations, and governments base decisions and actions on underlying beliefs, values, and knowledge. As the human population continues to grow, values and needs will change and affect the decisions made about forest resource use.

59. The role that public and private forest lands play in meeting human needs will change over time.

60. Choices humans make today directly affect our ability to sustain forest ecosystems essential to meeting future needs.

Glossary

endangered species

A species that is in danger of becoming extinct.

fragmentation

The process of dividing forest into smaller patches of forest and non-forest land.

GIS (Geographic Information System)

A computerized system that gives resource managers the ability to organize and access information (e.g., soil type, water shed, population density) to visualize all the factors that contribute to environmental problems.

non-native species

A plant or animal species found outside its natural range.

steward

A person who takes responsibility to make decisions and take actions today that will allow resources to be maintained in a healthy manner.

threatened species

A species that is likely to become endangered.

wood utilization

Manufacture of raw materials into saleable goods with as little waste of the resource as possible.

DISCOVERY UNIT

Lesson 1: Poetry and the Armenian Landscape

Objective

To help students improve their observation skills and interpret the landscape in different ways and appreciate how important and diverse Armenian authors have described it.

What Do You Need?

You will need to organize a small collection of poems you can write on a chalk board or give to the children in a handout. These poems may be selected from such authors as Hovhannes Tumanyan, Vahan Teryan, Avamais Sahakyan, or Silva Kaputikyan. You may use the the attached samples as examples.

What Do You Do?

Read or ask different students to read each poem out loud to the class. At the end of each poem ask students to write down how the poem made them feel. What do they think the author was trying to say?

Emphasize that there are no wrong answers when you lead the students through a comparison of the poems.

Ask the class what does each poem tell us about the author? Did the authors love the Armenian landscape? What was important to them? Would people use the same words today to write a poem about nature?

Finally, ask the students to choose a topic for a poem of their own.

Homework Assignment

Ask the students to use a format in the beginning to help them get started on their poem. This may be done by having the students vote on their favorite poem. Students may use the first line of the class favorite as the beginning of their poem.

You may limit the length of the poem as necessary. Four lines or as long as sixteen, may be appropriate depending upon the age of the class.

***A copy in Armenian is at the US Peace Corps office.

Nature Poetry

Translated by Mr. Narek Sahakyan of Yerevan (2005).

Hovhannes Tumanyan

(1907) "The River"

Where are you heading pretty, fast, river,
So lively, so quickly
Stop, let's play.
I can't baby.
I gotta go and work at the mill,
And down in the meadow
The flowers and grass
The cows and the sheep
Are waiting
That's why I get the
Cold, tasty water
From the mountains high.

And I also gotta wash grandma's laundry
Under the river
Before it gets dark
See, I have a lot to do on my way
Till I get to the sea.

(1908)

Stork

Welcome stork
You brought the spring
And filled our hearts with joy
And when you left
The wind started to blow
And took the flowers away.
Welcome stork
Build your nest on that old tree
And stay with us for the whole year.

Green Brother

The green brother
The popular brother
Come and bring with you
Sunshine, blooms, and grass
Sparkling river and blue skies
Colorful birds
Wonderful songs
The sheep's call
Peace happiness.
The green brother
The popular brother.

Vahan Teryan

(1908) "Springtime"

With a finely play at blossoming flowers
The woods and hills are smiling again
And the rivers old and singing.

Are welcoming me with their warm laughter
You have decoratee again fields, woods, and mountains
Spring, you have lit a fire everywhere
You have spread your wings in my heart.
And now again, happy and young
I'm coming out of the prison of sad loneliness
And your glittering eyes are welcoming me
And I cannot hold my happy scream of joy

You have opened to me the golden horizon
You've blossomed in the hills, woods, and valleys
Other songs are sounding in my heart now
Welcome, sun! Welcome, spring!

Art Classes: Outside!

Objective

This series of lessons seeks to provide a hands-on learning experience for children to discover beauty in the natural world and develop respect for its care.

In **Lesson #2**, students will learn through touch the differences in tree bark, leaves, and other natural textures to find creative inspiration from the beauty of the natural world.

In **Lesson #3**, students will learn to see the beauty and design of the natural world through an often overlooked aspect of natural landscapes, spider webs.

In **Lesson #4**, create a special eco-treasure box for your class by organizing a project to press plants. In this box each week you, the teacher, may hide a natural object that the students try to guess as part of a lesson. Objects may include a butterfly cocoon, a pinecone, a leaf, a mushroom, etc.

Lesson #2 A Sense of Place: Touching Nature

What Do You Need?

A sheet of paper for each student and colored pencils or crayons.

What Do You Do?

Plan to visit the schoolyard, nearby park, or forest. At the site identify several trees with different types of bark. Encourage students to make rubbings of these trees and of other objects they see. Their artwork can be used for decorating the classroom or as a gift for their parents.

Provide the following instructions to the students:

Take a piece of paper and hold it against a tree trunk. Rub the outside of the paper with the crayon. You have just made a rubbing.

Make a rubbing of different things in nature. Try the bottom of someone's shoe, a rock, or a leaf. If you combine lots of different things you will have a picture to take home to your parents or hang in the classroom.

Conclusion: Sit with students in a circle or small groups at the end of the class. Have students compare rubbings. Ask each student to show the group their favorite rubbing. Does anyone have an unusual design? What were the differences in the tree barks you used? Can you tell the difference between tree species?

*Adapted from Creating Activities Program, Discovering Me and the Rest of the Universe. Children's Press. 1974.

Lesson #3 Spider, The Artist

Vocabulary Words: web of life, food chain, ecosystem

Objective:

Through the work of one of nature's most industrious and under-appreciated builders, students will learn to see the beauty and design of the natural world in spider webs.

Background information: Spiders Are Good Guys

While many people are scared our spiders, spiders are beneficial. They eat all kinds of pesky bugs like flies and crickets. Actually they are opportunistic feeders and eat pretty much anything they can catch. Most spiders are shy and will avoid humans. As fall approaches, many spiders reach adulthood, mate and lay eggs for next summer. Some of these spiders can get large and may cause unwarranted alarm.

Orb weavers are the most obvious large spiders since they spin large webs a foot or more in diameter during the night across sidewalks, doorways, between garden plants and in other areas where they are quite noticeable. That's why the first person walking down a trail in the morning is the spider web collector. Most of the large, common orb weavers (*Araneus*) grow to a leg span of 1-2 inches and have light and dark banded legs.

Another common orb weaver is the large yellow and black garden spider or argiope. It builds a two foot diameter web with a zigzag vertical strip of white silk in the center. They respond to vibration in the web by quickly running over to the prey and subduing it by rolling it into a straight jacket of silk.

Wolf spiders also may have a two-inch leg span, but do not build an orb web in which to catch their prey. Like their namesake, they run down and overpower the crickets, earwigs and other insect prey. Many of the wolf spiders are hairy, dark brown and have a stripe or pattern down their backs. After hatching the young spiderlings will ride on their mother's back for a few days before venturing off on their own. Wolf spiders are nocturnal and live among fallen leaves in taller grass, ground covers and in other protected areas. They may wander into homes through cracks and crevices in the foundation as the temperature drops in the fall.

Widespread destruction of spiders should be avoided and is not necessary. To keep spiders out of your home, clean up woodpiles and leaves from around the foundation. Caulk cracks and crevices around the foundation, windows and doors. Once in the home most spiders can be scooped up and gently deposited outdoors by "the designated spider remover." Removing dust often behind and under furniture, stored materials, wall hangings and ceiling corners discourages spiders.

Next time you see a spider just repeat this sentence: “Spiders are good guys. Spiders are good guys.”

Source: Sandra Mason, Unit Educator, Horticulture & Environment. University of Illinois Extension Service. U.S.A. 2004.

What Do You Need?

You will need to provide a dark sheet of paper for a percentage of students who volunteer to be the adventurous artists, flour or sugar (to be shared), and a can of hair spray (to be shared). This activity will be limited by the number of webs available.

What Do You Do?

Plan an earlier visit to a schoolyard, nearby park, or forest. At the site, locate where spider webs can be found. You may be able to find some near the school or in the schoolyard. Make one finished example of artwork to show the students before class.

The children’s artwork can be used for decorating the classroom or as a gift for their parents.

The following instructions may be given to the students:

1. Search for a spider web, early in the morning is the best time when the webs are still wet with dew. Very carefully watch for the spider and allow your teacher to gently place the spider away from the web. Be sure to be gentle, we do not want to kill the artist!
2. Very lightly, sprinkle flour or sugar on the web. Be very careful not to break the web.
3. Place a sheet of dark paper behind the web. Lift up from behind to pull the web away from where it is tied.
4. You now have a one of a kind spider print on your paper. To preserve it, spray the web with hair spray to protect it.

Conclusion:

When the students have collected several, have the students sit and observe the styles of webs. Are they all the same? Are they different? If they are different, these indicate different species of spider. Did you see the spiders? What did they look like? Have the students describe them.

This will be a good opportunity to discuss the biological importance of spiders in the food chain. Spiders are important in controlling populations of insects. Spiders illustrate that things we walk by all our lives can be unique and beautiful, if we learn how to see them.

*Adapted from Creating Activities Program, Discovering Me and the Rest of the Universe. Children’s Press. 1974.

Lesson 4 An Eco-Treasure Box

Objective:

To encourage students to look more closely at native plant species and to create a special eco-treasure box for your class by organizing a project to press plants.

In this box each week you, the teacher, may hide a natural object that the students try to guess as part of a lesson. Objects may include natural objects such as a butterfly cocoon, a pinecone, a leaf, a mushroom, etc. Or you may decide to place quotations from literature in the box as topics for group discussion.

What Do You Need?

A box, like a shoebox shape and size, with one removable lid. A can of hairspray to secure flowers to the lid of the box. Glue, but if you do not have it, use the following recipe to make your own. These items will need to be collected before class so you are familiar with all.

For water dissoluble glue: If you do not have access to store quality glue, blend whole wheat flour with cold water to make a liquid paste (about the consistency of pancake batter). Beat until the mixture is free of lumps, and then gently heat until boiling, while constantly stirring. Allow to cool before using. Store in an air-tight container. If the paste hardens, soften by mixing in small amounts of warm water as needed.

A natural glue source: Dandelions and milkweed contain a natural latex that can be used as glue. This can be used for small amounts. It is important to wash hands immediately after using it as long exposure to it can cause a rash.

During the art class you will have the opportunity to ask the students:

Why would a plant be so sticky? The answer is that chemicals are often a defense mechanism when plants do not have thorns or other physical defenses to prevent them from being eaten by animals or insects.

What Do You Do?

Make one finished example of a decorated sheet of paper or cardboard to show the students before class.

Plan to visit a schoolyard, nearby park, or forest. Walk with the children in the yard or along a quiet road with little traffic. You may be able to find most flowering weeds roadside or in the schoolyard. If it is springtime look for flowers to use, but if there are no blooms, look for plants with interesting leaves and colors. Vines can be used like roping for additional decoration.

Again, make the children's artwork an important part of decorating your classroom. Be sure to have some assignments sent home as gift for their parents to encourage parental interest in the class.

Provide the following instructions to the students:

1. Ask the children to collect flowers and leaves, looking for different colors and shapes.
2. You may assign small groups/teams of students to decorate different sides of the Eco-Treasure Box.
3. The lid should be a picture made from the plants, glued using the homemade glue or the milkweed latex, and set with the hairspray. Spraying flowers with hairspray will help preserve them a little longer.

Conclusion: Tell students that next session you will have a special item hidden in their special Eco-Treasure Box.

*Adapted from Creating Activities Program, Discovering Me and the Rest of the Universe. Children's Press. 1974.

Lesson 5 Eco-Scavenger Hunt

Objective

This lesson helps students identify living and non-living components of a natural ecosystem and appreciate the diversity of colors, sizes, and shapes in the natural world. Philosophically, this activity also encourages students and teachers to discuss what is nature and what is humanity's place in it.

What Do You Need?

The Eco-Treasure Box. From the eco-savenger list below, place an item that can be described on the list inside your box. Begin by asking the students to guess what your object is. You may give them clues.

For the game part of this activity to be successful it is important for the teacher to listen to the students without telling them what to pick up or say. You may encourage them, but allow each student to say how they feel about what they see. *Why do they make their choices?* Help them talk through the answers without being negative or positive.

Provide a list of items for each group of students. Ideally group size should be no more than three or four students each.

What You Do?

Plan a visit to a local area of forest or a park, explain to your class that today you will be playing a game called "Eco-Scavenger Hunt." Have student groups walk around a specific area for fifteen minutes during that time ask them to find the items on the list below. As they find items, have them write down the objects that match the list. When they return, each group will share what they identified for each item.

For younger children this may be done one child at a time orally, "I see _____." Other children may take turns guessing what the object is. The person who guesses correctly gets to pick the next item on the list until the list is complete. You can walk with students to the items to discuss them in more detail.

The List

" I see...."

something that is beautiful

something that is prickly

something that is cold
something that is dry
something that is hairy
something that is hard
something that is heavy
something that is hot
something that is huge
something that is noisy
something that is oval
something that is pointy
something that is pretty
something that is not part of nature

something that is rough
something that is round
something that is sharp
something that is slimy
something that is smelly
something that is soft
something that is squishy
something that is stretchy
something that is tiny
something that is triangular
something that is wet

*Adapted from <http://www.ecokids.ca> 2004.

Lesson 6 Trashbag Archaeology

*Adapted from Creating Activities Program, Discovering Me and the Rest of the Universe. Children's Press. 1974.

Objective

To help students learn about resource use and identify which items from household consumption remain are slow to degrade in landfills.

What Do You Need?

You will prepare a small garbage bag to demonstrate in class what you would like each student to do. Place inside the bag a wide range of items such as an apple peel, an old shoe, a used food can, and old child's toy, etc. You may wish to place items representing people of different ages, tools or items used for different kinds of work, etc.

Be sure to include in your garbage bag the following items:

- aluminum can (soda pop can)
- banana
- cigarette butt
- cotton rag
- glass bottle
- leather boot
- paper bag
- plastic jug/bottle
- rubber sole of the leather boot (above)
- Styrofoam cup
- tin can (soup or vegetable can)
- wool sock

What Do You Do?

Explain to your class that an archaeologist is a scientist who studies ancient cultures by studying what they leave behind, sifting through the earth to find remnants of homes and important buildings. Armenian archaeologists currently study ruins of ancient Urartu society using these same methods to learn about ancient land use and other aspects of Urartu culture. For more in-depth information on Armenian archaeological sites and research in your area, information is available online at <http://www.virtualarmenia.am>.

In the classroom, empty the trashcan onto several pieces of newspaper or a piece of cloth.

Ask the class what does each item tell us about the users. *How old are they? Did they play sports? What is important to them? What would someone from the future think of these items?*

Finally, after much discussion ask the students: *How long will it take for these items to degrade in the earth? Which one will degrade the fastest?*

Draw students' attention to the items you have gathered by writing the items on your blackboard. You might ask, *What do all the items have in common?* If your students are too young to figure out the answer to the question, you can share with them that each of the items will likely end up in a landfill one day. Next, ask *What will happen to these items when they are thrown away? How long do you think they will last there? Do they*

disappear/disintegrate/degrade immediately? Or will they continue to take up space in the landfill? Let students freely discuss those questions.

Draw students' attention to the list on the board or chart. Ask students to copy the list. Then ask them to

- think *on their own* about how long each of the items on the list might last when buried in a landfill.
- recreate the list by writing each item in order according to how long they think it might last in a landfill. Students should start their lists with the item they think will degrade fastest and end with the one that will last the longest.

Conclusion: When everyone has finished, it is time to compare the students' answers with the estimates made by scientists.

- banana -- 3 to 4 weeks
- paper bag -- 1 month
- cotton rag -- 5 months
- wool sock -- 1 year
- cigarette butt -- 2 to 5 years
- leather boot -- 40 to 50 years
- rubber sole (of the boot) -- 50 to 80 years
- tin can (soup or vegetable can) -- 80 to 100 years
- aluminum can (soda pop can) -- 200 to 500 years
- plastic 6-pack rings -- 450 years
- plastic jug -- 1 million years
- Styrofoam cup -- unknown? forever?
- glass bottle -- unknown? forever?

Note: The data above was gathered from sources such as the United States [Bureau of Land Management](#) and the [Oregon Department of Environmental Quality](#). 2004. (http://www.education-world.com/a_lesson/03/lp308-04.shtml by Gary Hopkins for Education World website)

Homework Assignment

Ask the students to conduct a similar survey at home with permission of their parents and write a small report on their findings. Ask them to explain the lessons learned from the class activity so that you can evaluate their understanding.

Extension Activity: Have students create posters to encourage recycling the items listed on the chart. Display those posters where students in the school will see them and in prominent public places.

WINTER DISCOVERY UNIT

Snow Lessons: Sculpt It, Catch It, Dig It!

Objective: To help students physically and intellectually understand how snow is a very important part of the water cycle in the Caucasus Mountains.

Background Information:

Use the below information as a basis for a lesson for middle and upper level students.

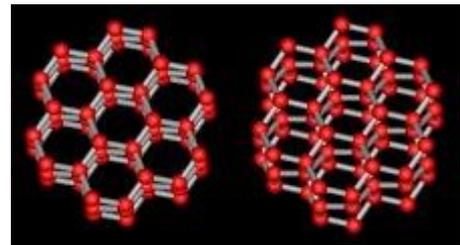
What are snowflakes and snow crystals?



Snowflakes and snow crystals are made of ice, nothing more. A **snow crystal**, as the name implies, is a single crystal of ice. A **snowflake** is a more general term, which can mean an individual snow crystal, a few snow crystals stuck together, all the way up to the large "puff-balls" of agglomerated snow crystals that often fall in warmer weather.

What exactly is an ice crystal?

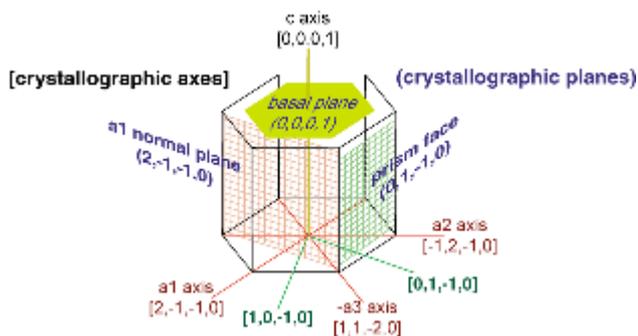
A crystal is a material for which the molecules inside are all lined up in a specific way called the *crystal lattice*. The water molecules in ice form a hexagonal lattice as shown at right (two views of the same thing). Each red ball represents an oxygen atom, and the grey sticks represent hydrogen atoms. There are two hydrogens for each oxygen, making the usual H_2O .



Are snow crystals the same as frozen raindrops?

No. Sometimes raindrops do freeze as they fall, but this is called *sleet*. Sleet particles don't have any of the elaborate patterns found in snow crystals. Snow crystals form when water vapor condenses directly into ice, which happens in the clouds. The beautiful snow crystal patterns form as the crystal grows.

What do simple snow crystals look like?



The most basic form of a snow crystal is a hexagonal prism, such as that shown at right. This form occurs because certain surfaces of the crystal, the growth *facets*, grow very slowly.

The hexagonal prism includes two hexagonal "basal" faces and six rectangular "prism" faces, as shown in the figure. Note that the hexagonal prism can be "plate-like" or "column-like", depending on which facet surfaces grow most quickly.

Please see the five page Snow Flake Field Guide attached to this lesson plan to use for identification of snowflakes.

Activities for students of all ages:

Lesson #7: SCULPT IT! The presence of air in the snow can lead to a discussion of snow as a shelter for wildlife (the trapped air insulates). Building snow shelters, even if squirrel-sized, is something that can help students understand snow as habitat. This leads to a lesson on winter wildlife adaptations where students work in teams to create snow creatures complete with adaptations for surviving in this habitat.

You may have a gallery showing afterwards, with each group sharing about their creature's adaptations, ecological niche, etc. You may invite parents and family members to visit the outdoor sculpture gallery for an after-school visit to increase parent participation in the school's activities.

Lesson #8: EAT IT! The fact that students want to eat snow can pique their interest in finding out what's IN snow. Bring some samples from different layers of the snow inside where you can melt it on a burner, then pour the melted snow through a filter (course cotton fabric may be used). Students are always amazed at how much dirt there is in even the whitest snow. This helps quite a bit in deterring them from eating it and is a powerful example of how much pollution is in the air. Use this opportunity to ask them where does this pollution come from? List on the blackboard sources of air pollution.

To illustrate the pureness of fresh, untouched snow, an learning activity can be made into a special treat. Use the pure snow, you may have to catch in a container especially for this, and add food coloring and sugar with the class to make snow-cones!

Lesson #9: CATCH IT! If you have some dark-colored boards that have been kept cold, you can catch snowflakes for observation with a hand lens. You can even make up snowflake ID charts to have students figure out what kind of snow is falling, then learn what kind of atmospheric conditions create the different types of snow. (Refer to the Snow Crystal Fieldguide (www.snowcrystal.com)).

For upper middle school children, you can do statistics on the snowflakes, figure out what percentage are stellar crystals, what are spatial dendrites, what are graupel, then think about how the different types of snow might affect the plants and animals - the spatial dendrites stick together on branches and can cause them to break, the needle crystals slide past each other more easily and can lead to avalanche danger, for example, on steep mountain slopes.

Lesson #10: DIG IT! Making a snow pit can be very interesting - you can see and measure different layers of snow, estimate how many storms that represents, look at the metamorphosis of snow in the different layers, estimate water content, etc.

To estimate water content of the snow, take a graduated cylinder (or just a jar or cup, for that matter) and fill it with snow from a particular layer - trying not to pack it more than it already is, and have students estimate (guess) how much water there will be in the cylinder after the snow melts.

Students are always amazed at how little water there is in snow! But then again, that's why those snowballs floated, isn't it? Once you've dug your snow pit and taken measurements, you could use the pit as the start to a snow shelter if you have time for that - just be careful about making ventilation holes.

Adapted from Maggie Snow, L.A. County Outdoor Science School, Wrightwood, CA. USA.

2004. [Http://www.aeoe.org/news/newsletter/articles/think_snow.html](http://www.aeoe.org/news/newsletter/articles/think_snow.html)

Snow Flake Field Guide available online at <http://www.snowcrystals.com>. January 14, 2005.

Eco-Detective: The Case of the Disappearing Water

*Adapted from <http://www.epa.gov/region01/students>, 2004.

Objective

Demonstrate the knowledge of concepts of “evaporation.”

Explain evaporation in the context of the water cycle.

Background Information

Water exists in three states- solid, liquid, and gas. These states are often referred to as phases. As heat is added or removed, water goes through a phase change. In its solid phase, water molecules are structured and orderly. In its gaseous phase, water molecules lack structure and order.

In nature energy, or heat, of the sun causes water to evaporate into its gaseous, or vapor, phase. Likewise, when we boil water over a burner we are causing it to change from a liquid to a gas. The process by which a substance changes from a liquid to a gas is **evaporation**.

Water is continuously being heated and cooled- evaporating, condensing, freezing- depending on its environmental circumstances. As water travels in its never-ending cycle between the earth and the sky, it encounters and mixes with a variety of substances. Some of these substances are **pollutants**, in the sense that they are harmful to living things. Pollution can result from both natural and human activities.

Through the water cycle, nature provides a variety of mechanisms to clean water. For example, evaporation is a natural water cleanser. When water evaporates, it leaves most dissolved substances and waste materials behind. Pollution can also be filtered out as water moves through soil or as wetland plants absorb metals and other pollutants.

What Do You Need?

Clear measuring cup or glass bottle with measurements clearly marked on it.

Water.

Copies of handout or handout written on the blackboard.

What Do You Do?

Tell the students that they are going to be water detectives who are being asked to solve the case of the disappearing water.

Allow students to read the activity handout, individually or on the blackboard.

Coach students as necessary, but encourage independent thinking as much as possible.

Make sure students develop a hypothesis before beginning the experiment.

Make sure students remember to check the water level each day.

When the experiment is over, be sure students record their results and conclusions.

You may have students work individually or in small groups.

Follow-up Questions

1. For what reason might the results of each group's experiment differ? Environmental variables may have affected the outcome, such as one group's measuring may be more exposed to sunlight than the others'.
2. Suppose that during the day Mrs. Babayan was done weather was sunny and hot; however, when the detectives conducted their experiment the water was cloudy and cool. How would this variable affect the experiment?
3. What is a variable? Something that is not constant, or is subject to change in the experiment.

The Case of the Disappearing Water

Originally Written By Susan M. McMaster, USA

The Water Detectives Anonymous were called to the home of Mrs. Babayan. When they arrived on the scene, Mrs. Babayan's son Armen was very upset. His mother was missing! The detectives asked Armen how long his mother had been missing.

"That is the problem. I do not know!" Armen said. "I have working very hard, and I live in Moscow. Now I feel terrible. I have no idea how long she has been missing."

"Do you know of some places where she might have gone?" asked one water detective.

Armen wrinkled his brow and thought hard. "Well," he said, "her habits are very predictable. If she has been gone less than a day, she probably is just went shopping. If she has been gone for less than 3 days, she may be visiting one of her sisters in another region. She always says, 'Guests are like fish, they start to stink in 3 days!'"

"If she has been gone more than 3 days, but less than 7," Armen continued. "she is probably taking a vacation. I am sure that she can not afford more than a seven day trip. If she has been gone more than seven days but less than 6 weeks, she probably received the grant she applied for to travel and study in the United States. If she has been gone more than six weeks, she probably is in the regions. She never stays there more than 2 months. If she has been gone longer than 2 months, aliens must have captured her and taken her to another galaxy. She loves her plants and her home. She would never stay away longer than 2 months for any reason."

"I think we can solve your mystery," said one water detective walking around the house.

"Did you find a note?" asked Armen hopefully.

"No," said the detective, "but I did find this glass measuring cup in the window."

"Oh," said Armen, "that's nothing. Mother is very particular. Every morning she fills the measuring cup to exactly one cup. Then she puts it in the window to warm in the sun a little before she waters her African violets. She is very careful about how much water she uses because she doesn't want to over-water or under-water her plants."

"Aha!" said the water detective. "Just as I suspected, this is precisely where we must begin our search. The measuring cup now has exactly $\frac{3}{4}$ of a cup of water."

“Are you saying someone stole $\frac{1}{4}$ of a cup of water? Armen asked. “What has this to do with my mother missing?”

“No wonder his mother didn’t bother to tell him where she was going!” muttered one of the detectives.

“No,sir,” said another detective trying to keep a straight face. “It is a matter of evaporation. As water evaporates into the atmosphere, the warmth of the sun changes the clear liquid into water vapor that we can’t see. After a while the water vapor condenses and forms into clouds. Eventually, the water comes back to the ground as rain and snow or hail. Over time the water evaporates again. It is all part of the water cycle.”

“To make a long story short,” said another water detective. “We are going to conduct an experiment. We’ll put a cup of water in a sunny place and keep track how long it takes to evaporate. Based on the experiment, we will estimate how long ago Mrs. Babayan left the measuring cup in the window.”

“What a relief,” said Armen. “What should I do now?”

“I suggest you water the plants,” replied another detective.

Student’s Assignment:

Questions

1. Write down the facts of case.
 - a. Original amount of water in the measuring cup_____.
 - b. Amount of water in the measuring cup now _____.
2. Write down where Armen said his mother might be.
 - a. If Mrs. Babayan was gone less than a day, she probably _____
_____.
 - b. If she has been gone less than 3 days, she may be _____
_____.
 - c. If she has been gone more than 3 days but less than 7 days, she probably_____
_____.
 - d. If she has been gone more than 7 days but less than 6 weeks, she may
_____.
 - e. If it has been more than six weeks but less than two months, she is_____
_____.
 - f. If she has been gone for more than two months_____
_____.

3. Develop a hypothesis (an educated guess): Tell what you think will happen when you do the experiment.

- a. How long do you think the water was left on the window sill? _____
- b. Where do you think Mrs. Babayan went? _____

4. Perform an experiment to establish approximately how long it took for the water to evaporate.

Directions:

- a. Write down today's date _____.
- b. Fill a measuring cup to the 1 cup line.
- c. Put the cup in a sunny window.
- d. Record how many days it takes for the water in the measuring cup to be at the $\frac{3}{4}$ cup line.

5. Write your conclusions.

- a. It took approximately ____ days for the water to evaporate.
- b. Where should Frank begin looking for his mother? _____

6. Make notes about your observations in a special water detective's notebook: _____

BACKYARD EXPLORATION: OBSERVATION AND ANALYSIS

Lessons 12-17 Trees in Your Backyard: A 5 Class Activity

Objective

To help students develop basic observational skills through community map-making and conducting a survey of trees in their local schoolyard or neighborhood. The lessons emphasize observation skills and assisting students to convert their field notes into reports. Creative essays encourage use of their imaginations to explore the life of a tree. It is hoped that these creative activities will lead to a greater emotional attachment to nature in general and the services nature provides us. Our final lessons in this section, emphasize how this connection can be used to create a healthier Armenian environment beginning by planting a tree.

Lesson #12: Community Map-Making

What Do You Need?

A large sheet of paper. Colored pens, pencils, or crayons, if available.

What Do You Do?

This activity may require two to three class periods. Provide a sample map as a guide. If there is limited paper, students may work on a single large map working on different sections. Assist students with spatial relations as needed.

Provide the following instructions to the students.

Ask the students to draw their school block in the center of a map. Write the names of streets around the block turning your paper as you write. Walk around your block and identify locations important landmarks and green spaces. Draw on your map squares for houses and rectangles for larger buildings like stores and apartments. Using a pencil mark where trees and open spaces are located. How many trees are there? Can you tell the difference in species? Label them on your map. Can you identify where water drains are?

Make a map key. A map key is important as it indicates to others what each of the rectangles and lines mean. Use different colors to show houses where you know people. Indicate the four cardinal directions to orient people reading your map.

Lesson #13: The Importance of the Naturalist's Field Notes

Revisit the trees in a specific area, perhaps within the school block.

Identify the trees with the class. You will need a tape measure and a tree guide, if you do not have one. Have each student make field notes containing important information about each tree including species, age, height, and location.

For a homework assignment: ask students to write up the results of their fieldwork in a report. For younger students this may be a paragraph or a couple of pages for older students.

Lesson #14: Field Notes and Creative Expression: The Life of A Tree

Ask students to write the life history a tree. Take the students back to a particular tree you have identified near the school. You will need to identify it ahead of class to observe a tree with interesting characteristics for discussion. Look for a tree that may have been shaped by the wind; branches that may have been cut off; birds nests in branches; holes where insects may have eaten part of the outer or inner bark; or scars where lovers may have carved their initials. Is there scarring at the base of the tree from possible fires? All of these, or none at all, tell us about the life of the tree.

Ask students to list the various land use patterns this tree would have witnessed. List some of the human impacts that have modified the shape of the tree. *How could these human impacts on the condition of this tree affect its forest neighbors (animals and other plants)?* List the human impacts on the soil around the tree. Is there concrete or pavement? How does the soil look? What animals could be connected to this tree?

Fifteen minutes before the end of class ask students to share their observations. Before students leave, ask students a question for them answer next class: *Do you think local, state, and national governments should take an active role in tree management?*

Lesson #15: It's Not My Problem, It is Our Problem

Objective: To provide a safe environment where students can comfortably discuss the problems of environmental resource loss and how it influences their lives.

What Do You Need?

Read the information below and think of illustrations of these problems locally. For younger students you may need to create a small field trip to show them where mountain slopes have become destabilized due to erosion, or where flooding has destroyed river banks. These provide strong physical evidence of Armenia's environmental problems.

You may wish to refer back to the Curriculum Guide for key vocabulary. For assistance in planting trees and for obtaining seedlings, contact the Armenia Tree Project.

Background Information: Since the turn of the 19th century, Armenia has suffered a dramatic plunge in forest cover from 25% of its territory to an estimated 8-9% today. It is believed the greatest loss of Armenia's timber occurred during the energy crisis in the early 1990s, yet heavy cutting continues to this day, severely decimating forests. Forests perform important environmental and socioeconomic functions, but when they disappear inevitable and long-term consequences result:

- Increase in soil erosion, flooding, and landslides
- Drying of the local climate and loss of water supply
- Reduction of topsoil fertility causing lower crop yields
- Loss of plant and animal biodiversity, both on land and in water, which become subject to silt runoff
- Economic hardship from loss of vegetation such as herbs, mushrooms, and fruits
- Severe air pollution due to lack of "natural air filters"

What Do You Do?

You may list the previous information on your blackboard as points for discussion for older students. Ask the students the following questions:

1. Have you seen evidence of soil erosion, flooding, or landslides in your community? Where? What do you think caused it?
2. Does Armenia have problems with water supply? Why?
3. Is air pollution a problem? Where?
4. What can be done about these problems?
Suggested answer: We can start by planting trees and taking care of those around us.

Conclusion: Have students write a small essay on who has responsibility for taking care of Armenia's lands. *What are their suggestions for improving land management?*

Lesson #16 Good Land Use Practices: Rural and Urban

Objective: To teach students how to recognize areas where trees need to be planted to prevent erosion and protect watersheds.

What Do You Do?

Identify some landowners, private or public, ask them if they would allow your class to visit an area of their land where there are streams and steep hillsides. Ask the landowner, if your students could plant trees on their land as part of a class experiment.

Background Information:

Permanent Changes In The Armenian Rural Landscape

- According to recent research, about 24,353 sq. km (81.9%) of the territory of the country has been subject to desertification to different extents.
- Extremely affected areas take up 26.8% of the territory of the country, strongly affected areas are 26.4%, average desertification covers 19.8%, and weak desertification is 8.8%.
-- United Nations Common Country Assessment of Armenia
- What does Desertification Mean? A Land Out Of Balance

- Desertification may be defined as
–“as soil degradation in arid regions, often to such an extent that it is impossible to make the soil productive again.”
- Desertification and drought are inextricably linked, especially in arid, semi-arid and sub-humid areas where there is a finite resource of water yet a desired increase in agricultural development.

50% of Armenia’s Pasture Lands Are Degraded Due to Overgrazing

- 600,000 hectares of pasturelands are utilized in Armenia, half are degraded.*
- Over-grazing occurs when animals, sheep,cows, and goats consume more grass and forage species than can be sustained.*
- Think of it, for the plant, it is literally too many bites to recover from. Plants need time to heal between the nibbles of cows, goats, and sheep.*

Costs of Over-Grazing

- Recovery of overgrazed lands requires costs like fertilizer, burning, ploughing or herbicides.*
- Events such as drought, fire or heavy rains coincide with excessive grazing and cause a decrease in soil quality and livestock forage.*

What Should The Government Do?

The Ministry of Agriculture and village mayors may need to coordinate a public grazing permit system so that dairy farmers have larger ranges available to them for grazing animals.

But What Can A Community Do?

To protect your food sources, do not allow sheep, cows, or goats to graze same pastures day after day. Allow grass and soils to recover by shifting grazing areas.

To protect mountains from landslides, do not cut trees on steep slopes and prevent animals from grazing in the forest. Tree growth provides poor food for animals and grazing damages forest soils and root systems essential for protecting mountain slopes from erosion.

To protect water sources from pollution and flooding, livestock should be managed to prevent destruction of stream banks. Replant trees along stream and river banks to stabilize the waterways.

Permanent Changes in the Urban Landscape of Yerevan

Source: IWPR Caucasus Reporting Service July 21, 2004 “Yerevan Becoming A Desert.” Officials begin to worry about the systematic elimination of green areas in the Armenian capital By Susanna Petrosian
YEREVAN.

Ask one of your students to read this to the class:

The construction of an outdoor café on a leafy spot in central Yerevan was halted last week, in a sign that city officials are beginning to take on the unchecked building spree that has altered the face of the Armenian capital. The move has been widely welcomed. “It is a precedent,” said Ruben Torosian, a prominent former member of parliament. The fact that finally someone was stopped from building in the green zone is a positive sign. Gohar Oganezova, vice-president of Armenia’s Botanical Association, told IWPR that this case can be seen as the first small result of our fight over many years against construction taking place on Yerevan’s green spaces.

Before city authorities had time to issue their ruling, it took workers less than a day to chop down several old trees as they began clearing space for the café. Samvel Danielian, who is head of the architectural and town planning department at the mayor’s office, promised that the area would be restored to its former state. But it is much too late to save large parts of the capital, which have lost their green spaces forever to a café boom of doubtful legality. Brash-looking cafes now sprawl across the entire city, depriving local people of parks and open spaces they used for decades. “When they cut down all those trees, café owners hardly gave a thought about the future of our children,” said pensioner Arsen Darbinian. “All the parks in Yerevan have been built over with cafés, and there’s nowhere for children to play or for us to relax,” said housewife Lilit Akopian.

Since 1990, the city has lost 40 per cent of its green areas due to new construction, according to research carried out by three organizations, the Yerevan Public Ecological Center, the Center for Regional Development, and Transparency International. Thirty-eight environmental groups have banded together to protest about the loss of green space. “If illegal construction of various buildings does not stop, Yerevan will soon become a desert,” warned Armen Dovlatian, leader of the Armenia’s Socio-Ecological Party, one of the protesting organizations. Srbui Harutiunian, another prominent environmentalist, said that land was being degraded, landslides were increasing, and Yerevan citizens were suffering from new allergic illnesses as a result of the changes.

Discussion Questions for students (write their answers on the blackboard):

1. What are bad land use practices in rural and urban areas?
2. What prevents people from changing bad land use? Why is it so hard?
3. What land friendly traditions already exist? How can we start new traditions that protect the land?
4. In the urban environment, how we reduce pollution?

Conclusion: Ask students how they could start new land uses that promote environmental conservation.

Extension Activity: Students implement an educational activity to share with their community. This may be a play, a poster campaign, or a demonstration plot to show how to protect Armenia’s precious soils.

ENVIRONMENTAL AND CULTURAL HERITAGE UNIT

Lesson #17 Creating A Sacred Lecturing Grove, A “Jemaran”

Objective: To provide a means for students to put their lessons learned into action by creating a special place for study and reflection in environmental studies and to gain practical life-skills in the care of trees in the schoolyard or an adopted area.

Background Information: In ancient Greece lectures were held in special groves specified for this purpose. The philosopher Plato used to read his lectures in the one of these groves called “academia.” Armenians also adopted this tradition, thus the word “Jemaran” which originally meant a lecturing grove is used in Modern Armenian as a learning institution.

What You Need?

Please contact ATP's Community Tree Planting Department for information on seedlings and expert advice on care (Email: trees@arminco.com).

What Do You Do?

Invite ATP to visit your class to discuss how trees are planted and the care required. Before ATP arrives prepare your students to consider the responsibilities planting trees would require. Are they willing to write a social contract stating their responsibilities and agreement to fulfill the contract? If so, have your students write the contract with you guiding them.

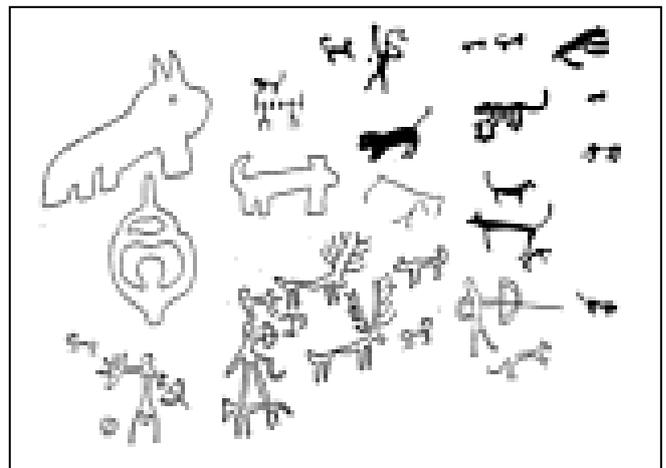
What would they like to do in their sacred grove? In addition to trees you should consider planting pretty flowering plants and placing items such as bird feeders to attract small animals to the sacred grove.

With the students write on the board what will be the rules of behavior in the sacred grove. These should include respect for nature, no littering, and no loud activity or running. Most importantly, it should stress that in the sacred grove, everyone has the right to speak and be heard. This is a safe place for everyone to share ideas without fear of feeling foolish or silly. As the teacher it will be your responsibility to promote this safe environment for communication at all times.

The sacred grove may eventually become a focal point for school activities with parents and celebrations for the school in general.

Conclusion: By participating in this project, students will have practical skills in tree planting which they can use with their own families some day. Additionally, this can influence, not just the health and beauty of the local schoolyard, but how students later relate to the environment as adults.

Lessons 18-20 Aralez, the Mythic Armenian god of healing, and the Gampr: An Example of Armenian Cultural and Biological Heritage



Now and then. Two gamprs look out over the open range, and petraglyph paintings of prehistoric hunters and hunting dogs. Most likely from Ughtasar and on the Geghama mountain ranges.

Objective: To familiarize students with concepts such as endemic species and the importance of geography, the human influence on the Armenian landscape, and the importance of native species in healthy ecosystems.

What do you do?

Read background information and decide how much information would be most appropriate for your students. This lesson may be adapted for students of all ages.

Lesson #18: You may provide the information below as a lecture to students or as a reading assignment to be discussed the next class. Ask your students to consider how people's relationship with the gampr has changed over time since prehistoric Armenia.

Lesson #19: Before class identify a list of animals from Armenian legends that can be seen your area. In class ask students what other animals can students identify from Armenian legends? You may need to get them started by giving them suggestions. What adaptations to the Armenian environment can be seen in the physical characteristics or behavior of each animal?

Lesson #20: Option A. The next class invite someone you know to bring their gampr to class for a visit. Be sure to confirm with the owner that the dog is comfortable with children and establish rules with the children about touching the animal before the pet and owner arrive. To encourage observation skills, ask the children to compare the list of the breed's characteristics with the animal visiting in relation to its adaptation to the Armenian mountains. Encourage the children to ask the owner about the role of the dog in their family or work. **As a homework assignment,** ask the children to take their observation notes and write a small report on the gampr's visit to class.

Option B: If you are unable to arrange a "dog" visit, have the children make their own drawings of a gampr to illustrate a report on how it has adapted to life in the Caucasus. Then have the class conduct a "Dog Census."

To conduct a "Dog Census" first have your class make a number of cards (perhaps 10 each) that say, "Thank you for being part of the dog census. Thank you for taking good care of your dog." These will be given to participants in the survey.

For their assignment have the children make a list of the following questions:

1. What kind of dog do you have?
2. What is the dog's name?
3. Is it a male or female?
4. Has your dog had an operation so it cannot have babies?
5. How often does your dog go to the park or play outside with other dogs?

The children should write down the answers to their questions on a sheet of paper to bring back to class. This will provide an opportunity to discuss the variety of animals in the survey and how amazing it is that dog varieties originally evolved from one species, wolves.

Opportunities for math lessons include to calculate the number and gender of each species in the survey, calculate the number which have been operated on to prevent offspring, and to

discuss the importance of preventing pet populations in the city. You may use your personal memories from the energy crisis in the 1990s as a good way to make this point.

Background Information:

Armenian shepherd dogs originated 15,000 years ago, when ancestors on the Armenian plateau (including anatolia) first began domesticated cattle, sheep and goats. Legend ascribes mystical powers to one breed, beginning with the story of Ara Geghetsik and Semiramis. Semiramis is reputed to have conjured the powers of a god in the shape of a dog, called Aralez, to revive the fallen hero. Some thought this meant the origin of that breed was Assyrian, but older Mesopotamian chronicles record the incorporation of a new god based on the Holy Dog from Armenia. Aralez was a part of the old pantheon of Armenian gods, prescribed with the powers of reviving the dead.

The Armenian Gampr

Armenia is a home to tens of thousands of endemic species, meaning native species found only here in Armenia. In terms of biological richness, Armenia is home to 349 species of birds, 84 mammals, 7 amphibians, 43 reptiles, and 29 fish species. Among those most important to Armenian cultural history is the gampr, a breed of dog endemic to the Armenian highlands, and one that can trace its ancestry to prehistoric settlements and recordings on the faces of the mountains themselves. In fact, the gampr is so closely tied to the history and culture of Armenia, it is surprising that worldwide few people know that this dog originated in historic Armenia.

The origins of the gampr sprung from the Armenian Plateau, one of the cradles of civilization. Archeological excavations in the Hrazdan Valley, near Bjini, uncovered human skeletal remains dating to 1-2 million BC. Wide ranging settlement by humans began around 500,000 BC with the first discovered human settlements around 90,000 BC. Domesticated agriculture and livestock in Armenia dates back as early as 25,000 BC, roughly 10,000 years before discovered domestication in other areas of the Near East. At the same time, evidence of the domestication of dogs is shown on prehistoric carvings.

Unlike the domestication of other animals as well - horses, cats, birds, cattle, even lynxes and other wild creatures, the dog was unique. It held a special place in the home as well as in the field, accompanying its master in work, play, and battle. Today, the very sturdy and friendly Armenian Shepherds are found in all rural mountainous areas.

Early Historical Recordings and the Development of the Breed

No one knows for sure the exact time when the gampr was domesticated, early sources are quite unclear on this account. While there is a huge diversity among the endemic species dating back tens of thousand of years, the earliest of the breed we know as the the modern gampr was formed 3000 years ago. Petroglyphs found in the Armenian Plateau, beginning ca. 15,000-12,000 BC, show a large number and variety of dog types, providing a record of development. Of the hundreds of petroglyphs found at Ughtasar and on the Geghama

mountain range, up to 20% of the carvings resemble the modern gampr, while others show a remarkable diversity of dog that no longer exists.

A monograph by S. Dal, "*Sevan plateau's transcaucasian shepherd dog, 1st millenium BC*" described the results of an excavation conducted in 1954 by Lake Sevan. In the excavation site dating approx. 800 - 1000 BC, they found a well preserved dog skeleton in one of the tombs. By comparing the skull with the head of a modern gampr and other canines, Dal concluded that it was a then typical representative of the breed, although there are some marked differences from the modern type, like longer head-face, narrower head box and stronger teeth.

Dal concluded that although the selection and breeding process of the last 3000 years affected the dogs general appearance and size, the gampr was already established and formed as a breed in the 1st millenium BC. As a result of these finds, it is now believed that natural selection and breeding over the millennia 'selected' the modern gampr, a breed that shows traits of the older dog types represented in the carvings while maintaining its own unique physiology. The earliest record of an example of an endemic species of dog on the Armenian Plateau is dated at 12,000 BC.

The close link between ancient dogs and their owners is illustrated in the mythical character of Aralez (ca. 5000-2000 BC), the Armenian god of healing, depicted as a dog. The god resurrected men fallen in battle by licking their wounds. In a famous Armenian myth, the dog-god Aralez revived Ara the Handsome in this way. In the myth Ara prefers to die in battle rather than accept the advances of Shamiram (in Assyrian, Queen "Semiramis"), and Shamiram, desperate with grief over his death, and in one version faced with the wrath of the people for causing his death, begs Aralez to revive Ara. It is most likely that the myth originated and occurred in the modern Arzni region, the name Arzni a derivative of two Armenian word: Ara and zni, for lick. Arzni also lies between Arai Lehr (literally "Ara's mountain") and Mt. Hadis, also known as Shamiram mountain.

Beginning with the Ottoman invasion of Armenia in the 9th c. AD, and especially with its conquest in the 13-14th centuries, the gampr was highly prized by the invading Ottomans, with numerous historical references listing the gampr as war booty or tribute from Armenians to their Turkish masters. One historical source states that monks from St. Bernard monastery came to Armenia for rescue dogs. This is entirely possible, since Armenian Gampr Storm dogs were very popular at that time. According to 5th century historian Movses Khorenatsi, the 1st century Armenian king Sanatruk got his name after he was rescued by a Gampr Storm Dog from under the snows when he was few months old. Over time, the gampr lost its footing in Turkish favor, and beginning with the Armenian genocide in 1915, much of the breed disappeared in Turk inhabited areas, but persevered in the regions inhabited by Kurds, who were mostly engaged in sheep herding.

Take for example, excerpts from a book devoted to the Dersim region of historic Armenia:

In Mndzur highlands one pedigreed dog costs 640 kg corn, or a horse, or two cows, or 10 sheep, 80 kg honey, 80 kg butter, etc. If the poor man from Mndzur wanted to have a gampr but did not have anything to trade for, he has to work 80 days for free for the dog's owner. In Sasun it costs 10-12 sheep. Most powerful dogs cost up to 30-40 sheep. Killing the gampr was considered as a murder.

And from a 1913 book, "Study on the pets of the Caucasus region," by Prof. Conrad Keller:

I never saw German Shepherd Dogs in the Caucasus countries, this most likely results from the fact that the Caucasian shepherds have a far better breed to guard their livestock...

The height at withers is 70-75cm [28-30"], some males of the Armenian highlands are even 80cm [32"] tall...

Also the Kurds at the Ararat mountain warned my travel companions not to get close to their dogs...

In reference of geographic dissemination, verbal descriptions about shepherd dogs of the Caucasus are definitely mountain dogs. They are very seldom met in the plains, at least not in a pedigreed existence. Between 1000 and 2300 meters (3000 -6900 ft) above sea level you see them with all Alp shepherds....

At the coast of the Black Sea, Russian dog enthusiasts told me the largest number and most beautiful shepherd dogs can be found in the Armenian highlands. I was able to confirm this later. I saw extremely nice pedigreed dogs in the Ararat region and in Jelenovka at the Goktscha lake (sevan's old name), which is almost 2000 meters above sea level. Some individuals were the size of a strong St. Bernard or Leonberger....

Gamprs continued to be exported after the Soviet revolution. Confusion concerning the origin of the Armenian gampr occurred during the Soviet period as Soviet military authorities established breeding centers in Leningrad, Moscow, Ukraine and Georgia. Breeders experimented with cross breeds based on the gampr strain. They succeeded in creating new mixes but instead of naming the cross breeds separately, they renamed the entire breed. Pure strains and new mixes both were called the "*kovkazskaya ovcharka*" (*Caucasian Ovcharka*). In defense, the Soviets said that the dog had different names for different Caucasian nations, so they generalized it into a single name. Unfortunately this left out the gampr as the source breed and Armenia as the source land.

This generalization was propelled by the confusions created in attempting to originate the breeds by nationalities. The father of soviet cynologia was a military canine expert named A. P. Mazover. It was his idea to divide both the pure and mixed breeds not by types, but by their "nationality", and so invented the terms Georgian, Azeri and Armenian types, stating throughout that the Georgian type is better. It should be noted his statements were made and then repeated throughout the 40's-50's, during the height of Stalin's reign. Stalin was a Georgian.

In 1930 the Gampr was first exposed to the west via Germany, beginning with an all-German exhibition in Nuremberg. Three gamprs were exhibited, the press calling them "red giants", no doubt influenced in part by labels on their cages stating "Death to Capitalism". The West has often accepted dog names without confirming the endemic origins of the "new" breeds. In 1996, the FCI registered the standard of the Caucasian Ovcharka with "Country of the origin - Georgia". This without proof of origin was based on the Soviet naming. As a result more than 80% of native Armenian working dogs were eliminated from any records and suddenly becoming "invisible".

The government of Armenia is in the initial stages of registering the standard of the Gampr or Aralez. In order for the standard to be recognized in international breeding circles, this registration is vital. The breed native to Armenia has been registered as the Russian name of

Caucasian Ovcharka. Turkey has registered three breeds that originate in Armenia, the Kangal, Anatolian Shepherd and the Akhbash. Armenian canine clubs are scrambling to have the names registered with an Armenian nome de canine, suggestions being the Armenian Wolfhound (Gamp'r) and Aralez.

Geography and Other Influences

The Armenian plateau encompasses roughly half of present day Turkey, the mountainous regions of Syria, Iraq and Iran, Azerbaijan, the southwestern edge of Georgia and current Armenia. The plateau is divided into mountain chains and river gorges interspersed with lowland to upper highland steppes and alpine meadows, and encompasses a territory about the size of Texas or France.

This compact area is remarkable for its diversity, possessing 8 of the world's 10 climactic and geographic zones, where 2/3rds of Europe's bird species migrate and 30% of its flora species inhabit, where rare and endemic species like the Caucasian bearded goat, the Caucasian Leopard and the now extinct West Asian Tiger lived, where stifling heat suddenly gives way to a boreal forest, where the environment, flora and fauna transform with each change of altitude.

These harsh and changeable conditions over thousands of years of natural selection and isolation shaped a unique dog breed we call the "gampr", exceptional for its unique characteristics.

Unlike many contemporary dog breeds that have been bred to maintain a uniform 'beautiful' look, the gampr's exterior, its shape, size and color may vary from location to location. They are prevalently large dogs, muscular, strongly built, with a powerful head. In the high mountain terrain, they are mostly big, with a long coat, while in lower areas a more typical type is a lighter and short-coated dog.

At first sight, gampr's exterior may not seem attractive: it has a harsh unsophisticated shape, coarse coat, and lazy and ungraceful movements when the dog is calm. This is typical for all natural breeds whose exterior and behavior are tailor-made for survival. Coarse hair well protects it from cold and heat, rocks and thorns, an enemy's fangs and other weapons. Diverse coat color facilitates mimicry in various landscapes. The elimination of unnecessary movements help maintain the huge body with minimum nutrition.

Compared to contemporary dog breeds, the gampr has very straightforward reflexes that are more typical of wild animals. This simplicity is nothing less than the concentration and crystallization of features of a "super dog". Nothing seems to surprise a gampr, it has 'seen everything and is ready for anything'. They welcome change and take it with calm and sanguine curiosity. The most serious-minded gampr, before attacking an intruder, will always try to make sure that the danger is present and clear.

Biodiversity

The gampr is just one example of how species are influenced by biological and geographical factors. As elsewhere in the world, biodiversity in Armenia has an important environmental role; ecosystems act to regulate thermal and water regimes, and influence climate. Biodiversity has an important role in maintaining atmospheric air quality and in ensuring a healthy ecological environment for humans. Elements of biodiversity also act to protect the

soil from erosion. Humans have hunted, fished and gathered the plants and animals of Armenia since ancient times. Intensive use of natural resources continues today.

Just as the uniqueness of the gampr in the international dog world is highly prized, it first came to be part of Armenian cultural heritage. It is also important to realize the gampr like other creatures native to Armenia can teach us lessons about our past and our future. Most components of social and economic development in Armenia can be related, directly or indirectly, to biodiversity.

- In agriculture, biodiversity has provided sources of food, fodder and grazing for livestock, genetic variation for selection, etc.
- Biodiversity has provided important natural raw materials like leaves, fruits, and berries for the food industry.
- In medicine, some plants are extremely important sources of natural remedies.
- Forest resources support wildlife unique to the Caucasus:
 - 349 species of birds, 84 mammals, 7 amphibians, 43 reptiles, and 28 fish species.
- Wildlife and the Armenian landscape in general have important aesthetic and recreational value and provide the basis for tourism, such as the mineral baths of Jermuk.

More information may be available online at the following websites:

http://www.rfss.ru/eng/caucasian_shepherd_dog/standart328.shtml

<http://www.arba.org/Breed%20Standards/CaucasianOvtcharka.htm>

<http://www.arba.org/Breed%20Standards/akbash.htm>

http://www.arba.org/Breed%20Standards/Anatolian_Shepherd.htm .

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Source: www.tacentral.com/.../fauna_story.asp?story_no=2
Website home of Tour Armenia, 2005.

Lesson 21 The Tree Huggers of Khejadali, India

Objective

To illustrate how people in some countries have protected their native forests from being destroyed.

What You Do?

Read the below story to class and lead discussion afterward. You may wish to use a world map for the students to locate India.

The Story

Sometime in the 17th Century the King of Jodhpur wanted to build a palace. His men went into the forest to get wood. As they started to cut the trees on the outskirts of the village of Khejadali, the people of the village came to stop them.

The people were called Bishnois, which means twenty-niners. They believe in the 29 tenets of a unique religion of conservation founded almost three hundred years earlier by Guru Jambaji.

Guru Jambaji said it was wrong to cut down trees or to kill birds and animals. The king refused the villagers pleas to protect the forest and continued cutting down trees.

In desperation a woman named Amritdevi hugged a tree to protect it. Following her example other villagers did the same. She and over 360 other villagers were killed by the soldiers. When the king heard of their deaths he ordered that their forests be protected and officially sanctioned their religion.

Today the environmental movement has often been linked with these original tree huggers who have inspired communities around the world to stand up and protect their natural resources.

Questions:

- 1 **Have you heard the expression “tree hugger” before?**
- 2 What do you think of people who would do this?
- 3 Is India different from Armenia? How?
- 4 Why do you think this story inspired conservation today in other parts of the world?

*Adapted from Dimdima Kids Online 2004. <http://dimdima.com/ecology>

Lesson 22 WorldWild Encounters

Objective

To help students learn of examples from other cultures where people and animals have learned to co-exist. This lesson also encourages understanding the importance of protecting predator species.

What You Do

Read the story to the class and ask them what they think it means. Has anyone in your class ever seen a large predator in the wild? If so, how often? What kind? Where? What are the roles of predators in nature?

Lead a discussion of how Armenians may be able to protect large predators in Armenia.

The Story

In Europe, the wolf is the only large carnivore (meat-eating animal) found in the wild. Since the Middle Ages, people here have an uneasy relationship with wolves. They believe that the existence of werewolves- humans who used to change into wolves in the moonlight. All over Europe, the wolf came to symbolize all that was evil. People know, or still know, very little about the habits of wolves. Some even believed that wolves had poisonous fangs! Wolves were killed in large numbers and were exterminated in England, France, and Germany. Today, some European countries have established nature reserves to protect wolves from extinction.

Cattle, sheep, and goat rearing is important in rural communities where wolves are considered an enemy of livestock. People often resort to poisoning wolves to protect their livestock. They set their dogs after wolves or scare them away with fire. So for many reasons wolves have a long developed fear of humans.

In many other parts of the world, people live near wild animals. In the United States wolves and mountain lions are increasingly common as people build homes into remote areas. In India in the Sariska Tiger Reserve in Rajasthan villagers do not live in fear of the tigers nearby. Why not?

Within the 800 square kilometer reserve there are 20 tigers, a few panthers, and thousands of large herbivores such as wild boar. And there are 16 villages. In these villages people collect dead wood for firewood. Thorny tree branches are used to make fences to protect their homes from the tigers. Their main income comes from raising buffalo. By not hunting the herbivores, the tigers' food supply is sufficient and the native herbivores act as a buffer.

In their temples people worship the tiger because they say, "If there were no tigers or panthers, there would be no deer or wild boar and so one day there would be no grass or trees. There would be no forest." The people are silent in the jungle and never come between predator and prey, even if it is a buffalo. Following these rules, no local residents have died due to tiger attack in 14 years. The story of Haripura shows that people and wildlife need not to be kept isolated from one another. As long as each respects each other's domain.

Assignment for students: Write an essay about the Caucasian leopard or another Armenian predator. Explain why predators, though often scary to humans, are important in a healthy ecosystem.

Lessons 23-26 Out of Balance: Environmental Problems in Lithuania

Objective

To discuss the ecological consequences of human interaction with the environment.

What do you do?

Read the background information to be familiar with the material before class. This material is written for upper middle school students, but this may also be appropriate for younger students who can read the letters. What do these letters mean to them? What are the Lithuanian children's concerns?

Background Information

During the Soviet occupation of Lithuania, the Soviets developed many polluting industries such as chemical, cement, and pesticide plants in Lithuania. Industrial production was run at 100 percent capacity, but only 15 percent of the products were used in Lithuania. The rest of the products were exported to the other Soviet republics.

Defoliation occurred, human health was affected, and 70 percent of Lithuanian's water became polluted. Municipal wastewater and other solid and toxic waste was dumped into the country's rivers, which then flowed into the Baltic Sea.

After the declaration of independence, Lithuania began work on cleaning up its polluted environment. In the spring of 1994 with the help of the Swedish government, the World Bank and EPA, work was begun to build wastewater treatment plant. However, it will take years for the waterways to be cleaned up.

During May, 1994, The World Environment Center, located in New York, sponsored an environmental conference in Vilnius. The conference was attended by directors of chemical, cement, and plastic industries. Work has begun to educate people about the environment and to provide resources for controlling pollution.

On June 15, 1994, the Environmental Protection Ministry of Lithuania gained a cabinet position under the leadership of Bronius Bradauskas.

What Do You Do?

Lesson #23: Introduce the topic as if you have acquired letters from students in Lithuania. Inform your students that you have letters written by Lithuania students in response to an essay assignment related to changes Lithuania is facing today.

Distribute the letters. Let the voices from Lithuania “speak” by selecting different students to read aloud. Remind students that these letters are not translated, but written in English by students whose first language is Lithuanian. Ask all the students to listen to recurrent concerns addressed in the letters. Ultimately, focus attention on ecology by asking:

What do Lithuanians seem to mean by “ecology?”

What do you think are some of the problems facing Lithuania today?

Do you think Lithuanians and people of Armenia have the same concerns about the environment? Why or why not?

Lithuanian Letters

Letter A

Lithuania is one of the smaller countries in the world. We think that the hopes and dreams of the people will be fulfilled. There are problems, which are like the problems in all countries and will be solved with time. There is a great problem of economics in Lithuania. In Lithuania there is a bad living standard, agriculture is very ruined. And only people can correct this. We need solely that people would want to change because we think that power can't change it. The second great problem is the war of for power which reins the life of Lithuanians. Above all, some people want to take power and power conflicts harm the common people of Lithuania. The third problem is ecology. There is not clean nature in our country. The Baltic Sea is very dirty. After the catastrophe at Chernobyl, dangerous materials poisoned all plants. We think that these problems are in almost all countries of the world, not only Lithuania. (Edita Likerauskaite, Danguole Sicukonyte, Ausra Bocisaite, Kristina Beneviciute)

Letter B

Lithuania is very nice country. She is not big, but I like it. I like Lithuanian people. They are very good. But sometimes I meet bad people, I want all people to be good. I want all the people to be happy and friendly. Lithuanian nature is very beautiful. I want all people to love and not soil it. (unsigned)

Letter C

I hope that in Lithuania there will be fewer bad people and that Lithuania will be always be independent from Russia. One of the biggest problems is work. In Lithuania there is not a lot of work. Money is a second problem. The third problem is smoke. (unsigned)

Letter D

I want to wish the best of everything in Lithuania's life. I would like that Lithuania's people become better and more industrious. I know that Lithuanians are not bad, but they want to have more and more money and they do to think about their children and Lithuania's future. They don't think what will be tomorrow. They are happy to have some food today. It is not very good. I would like people to think about nature. Why, Lithuania? Nature is very wonderful and I wish for our country to keep our nature for all times nice and unique beauty. Anyway, everything in Lithuania belongs to our people and to our government. I hope that our political men will not forget their promises to do the best for Lithuania. (unsigned)

Lesson #24: Have students analyze the ecological consequences of human culture by reading “Human Interaction and the Environment” and then in small groups have them complete the chart “Out of Balance.” As an exercise in point of view, have students describe the point of view and tone of an essay. Have them identify words or phrases which led them to their decision. Ask: Is the piece balanced? Why or why not?

Human Interaction and the Environment

Humans, like all forms of life, depend on the unique relationships of the biosphere, hydrosphere, atmosphere, and lithosphere. We need air to breathe, water to drink, and land to grow food we eat. But the balance between people and place is fragile. When humans interact with the environment there are always consequences. Some of these are intended; some are not. Some consequences are positive and beneficial; some are negative and costly.

For the inhabitants of Lithuania, the beautiful and tempting blue expanse of the Baltic Sea, with its lazy curving beaches, is no longer pure. Into this sea flows urban and chemical waste from the Baltic States and beyond.

Marine life has suffered as a direct result of Soviet fishing policies. The natural balance has been destroyed by over fishing and during the 1980s spawning fish levels in the entire Baltic fell by more than 50 percent. In the past 20 years the concentrations of nitrate from improperly treated wastewater have tripled during the winter months. This has increased organic material on the sea bottom, which has reduced oxygen levels and led to the decline of fish. Stocks of whitefish and smelt have dropped, and cod reproduction has been seriously affected.

Naturalists say that some of the Soviet mismanagement of coastal areas has actually protected the whole coast from development. For nearly two generations, most coastal land remained unused. For the first time in 50 years, people are re-discovering beautiful beaches, especially the dune-backed Neringa Spit. Soviet control also saved large tracts of woodland and wildlife, sustaining habitats that have completely disappeared elsewhere in Europe. Fortunately, Lithuania has several natural parks and special areas set aside for study of plants, animals, and geological sites.

Energy is a crucial question, and the search for it has been a major contributor to the pollution of Lithuania and other Baltic States. The 1986 Chernobyl nuclear accident in the Ukraine stirred fear in Lithuania and other Baltic States when the explosion caused radiation fallout across three countries, but also because the plant of similar design was under construction in Ignalina, Lithuania. No geographic survey or seismic studies were carried out before the plant was started. Two reactors are now up and running, but plans for another two at the same site were halted following the demonstrations organized in 1988 by the Lithuanian Greens, an environmental group, and the pro-independence Sajudis movement.

Lithuania has no natural fuel resources and consumes twice as much energy as it produces at the Ignalina nuclear power station and at a thermoelectric power plant near the city of Vilnius. Officials do not plan to close down Ignalina, which produces more than half the electricity generated in Lithuania, but with the help of Swedish and American experts, they are trying to increase the reactor’s safety. Little has been done to promote heat and light conservation at home. Windows are badly fitted and buildings are poorly insulated. Government attempts to

control fuel use during energy shortages have not been successful. Lithuania’s forests are already threatened by a fast growing black market for timber exports, and with the fuel crisis, they will increasingly be looking for fuel sources for home heating during long winters. Wood and peat currently supply about four percent of Lithuania’s energy needs.

Chart – Out of Balance

The ecological changes described in the information sheet, “Human Interaction with the Environment” all have human rather than natural causes. Complete the chart below indicating the environmental problem related to the aspect of the environment listed. Note the probable human causes of each problem as well as the effect this problem has on the ecology of the area. Finally, note the effect of this ecological change on humans and their culture.

Aspect of Environment	Problem	Human Causes	Effects of Ecology	Consequences for Humans
Air				
Land				
Vegetation and Wildlife				
Water				

Lesson #25: Have your students consider further connections between the environment and social and political issues. In small groups have them discuss and come to an agreement about the questions on the worksheet “Think About It.” Let them refer a map of Lithuania, if you have one available. Responses may vary, so stress the reasoning behind the responses.

Out of Balance Worksheet: Think About It

Discuss these questions in small groups and come to an agreement. Record your answers to share with the class. Answers between groups may vary, so be prepared to defend your responses. Consult your chart, “Out of Balance.”

1. Of the environmental problems noted on your chart:

- a. Which are the results of local causes (within Lithuania)?
 - b. Which are primarily the result of regional causes?
 - c. Which are primarily the result of international causes?
2. Of the human causes noted on your chart:
 - a. Which are related to meeting basic needs for food and water? How?
 - b. Which are related to industrial development? How?
3. Of the human causes noted on your chart:
 - a. Which would be the least difficult for people to change? Why?
 - b. Which would be the most difficult? Why?
4. Of the effects of ecology noted on your chart:
 - a. Which of these effects would be the easiest to reverse? Why?
 - b. Which would be the most difficult to reverse?
 - c. Which would do you believe to be the most urgent problem? Why?

The following are questions for further discussions:

- a. Which situations on the chart are related to political decisions?
- b. In what ways has Lithuania's current economic struggles aggravated specific environmental problems.
- c. The reading "Human Interaction With The Environment: makes much of current energy inefficiency in Lithuania. What is the connection between producing and using energy and environmental problems?
- d. How would you verify the accuracy of the information in this essay?

Lesson #26: What can we learn from each other?

What Do You Do?

Have students write about what they believe are the three most pressing problems for Armenia, or their region. Have individuals share their written ideas with the class.

Ask the students to write an essay comparing and contrasting Armenia's problems with Lithuania's.

Extension project: Ask your students if they would be interested in writing letters about the environmental problems in their area to school children in Armenian schools in the United States. This may initiate a pen-pal program that can create friendships between Armenians around the world. (Opportunities for establishing pen pals include the following websites: http://www.penpalparty.com/language/Armenian_penpals.html or <http://www.mylanguageexchange.com/penpals.asp>).



Lesson #27: Bioindicators And Biomonitors

Objective

To help students develop field observational and analytical skills and tell the quality of environment by monitoring plant and animal populations in a given area. This activity will challenge students to conduct surveys and collect data, interpret this data, hypothesize and make conclusions. They will become more appreciative of their natural surroundings.

Background information

What is a bio-indicator?

Did you know that plants and animals can give us clues about pollution in our air, land, and water, before humans even notice that something is wrong? Sometimes they can be used to show us that the quality of the air we breathe, or water we drink may not be of a high quality, or a soil may be low in fertility. Animals and plants that can tell us, by disappearing or dying, if there is something wrong with their environment or ecosystem are called **bioindicators**.

*The term **bio-indicator** comes from two words 'biological' and 'indicator'. A **bioindicator** is any living (*bio means life*) organism that is able to tell us whether our environment is healthy or unhealthy. It is indicating or telling us any change in the environment in which it lives, positive (good) or negative (bad). For example, having lots of frogs in an area tells you and scientists that the environment is healthy for the frogs. If for some reason frogs are suddenly missing from an area or their population is declining, then this is telling you that their environment is changing. The scientists can then try to fix the bad changes in the environment. Any species (look at birds, reptiles, fish, butterflies, insects and frogs. There are many more too!) can be used to assess the overall health of environment. This method of using plants, animals or entire ecosystems to tell if our environment is polluted is called **biomonitoring**.

What Do You Need?

This activity is long-term and may extend for a couple of weeks units. It will require classroom and field settings. You will need to provide students with notebooks, binoculars, pens and reference materials, like field guides to birds, trees, wild flowers, etc. Plan earlier visits to locate frogs, birds, plants, shrubs, or trees that might make good candidates for biomonitors or bioindicators. Students are expected to make field observations and field records weekly or more often.

What Do You Do? This lesson may be adapted for grade 4 and higher. Read background information to decide how much information you will need. *Two study examples - frog populations and bird populations - are proposed.*

Option A: Frogs as Indicators of Water Quality.

In the classroom, discuss with students the meanings of bioindicators and biomonitors. Ask if they know of any examples to share. Do they know that frogs are good bio-indicators? Why? Guide them by providing the following hints. Because...

- They are most sensitive to pollution or environmental change because they are permanently in the water. So they need a healthy environment, both on land and in water.
- They have a permeable skin and allow chemical substances (fertilizers or detergents) to penetrate into their body
- They accumulate toxins (poisonous substances) in their fatty tissues; therefore unhealthy habitats reduce frog populations.

Next, ask: *Do they know decreasing frog populations can indicate the bad quality in the pond? Why? How can they do that?* Encourage students to freely discuss these questions.

After discussions, take a visit to a nearby pond, creek or local channel to look at the frog habitat.

- While visiting the pond/creek/waterway, draw student's attention to any human impacts and water quality at the site. Listen any frogs that you hear.
- Have students record the frog calls. Are frogs present or absent from the site?
- Have students count the frogs (if they see any). Use simple count methods (e.g., transects) along the pond or waterway.
- Record in field notebook on a regular basis, over a week/term/year. It is important that students make independent records themselves.

Encourage students to record the characteristics of the animal's habitat. Ask students to notice whether the area seems polluted and if the frogs and toads seem healthy. *Is it exposed to any human impact? If yes, in what way?* Discuss with students some pollutants that may affect the egg and tadpole health. Have students to look at the habitat and surrounding area to determine what factors may be affecting frog numbers.

Discussion Questions

After recording session, summarize your observations. This will be a good opportunity to discuss the biological importance of frogs as indicators of environmental change. Also, explain the importance of being observant. Frogs, like any other animals can warn us about the changes in the environment, if we learn how to see or listen to them.

Ask the class the following questions:

1. *What is the number of frogs monitored? What does the frog presence indicate? As they continue the survey, do their numbers grow or reduce?* Describe the location of your field study and explain why it's a good or poor frog habitat. *Is the quality of water good or bad? If bad, encourage students to explain the factors. What will happen if the frogs disappear?*
2. Discuss what makes a suitable habitat for a frog.
3. Currently, frog populations all over the world are in decline. Make a hypothesis as to why frog populations are decreasing.
4. Scientists have discovered that frog skin contains antibiotics. Considering where frogs live, explain why they might need their own built-in protection.
5. In many ancient cultures the frog was associated with somewhat negative folklore. *What is the attitude to frogs in Armenia? What are some myths and legends about frogs?*

Homework Assignment

Assign students to learn as much as possible about this species, requiring a brief (not more than one page) essay with general information. *How can science benefit from frogs? What can the community do to conserve frog populations in Armenia?*

Extension Activity

Create a habitat. Have students draw a creek, a pond or wetland on a large sheet (at least A3) and divide the drawing into half. Half becomes an example of a good frog habitat and the other side a poor habitat. Students could use magazine cutouts, rubbish found in the school yard, fallen leaves or their own drawings to help create the scene. Display those posters in schools or other public places so that other children can see it.

Option B: Birds As Indicators of Pesticides and Fertilizers

In the classroom, discuss with students the meanings of bioindicators and biomonitors. Ask if they know of any examples to share. *Which animals can be used to tell the health of other environments, e.g. soil, pastures or crop fields? What about birds? Which species of birds are able to tell us the soil is contaminated or not? How? Do they know that birds are the most common bioindicators in many countries? Why? Help students to explain the reasons.*

Because...

- Birds are common and occur everywhere
- They are easy to see and identify, and sampling is not required
- Some birds of prey accumulate toxic substances because they are at the end of food chains
- They live longer (varying from <5 years to several decades) than other bioindicators and can indicate the effects of contaminants (poisons) over time.
- They are most well studied by scientists and extensive knowledge is available about birds

Ask your class what species of birds you can see in urban areas and in countryside? *What do you think they eat?* Lead the discussion into different types of food. Explain to them that some birds are insectivorous, i.e. they eat only insects, others eat seeds and plants, and some birds (e.g. birds of prey) are carnivorous, i.e. eat other small animals. Ask your class the following questions: *What birds come to mind when you hear "birds of prey" and what birds of prey do you know? Have you ever seen an eagle, a buzzard or a falcon? Where? What do you think they eat?* Possible answers include: mice, voles, small birds, lizards, hares, etc.

Do you know that scientists used some birds of prey to tell whether or not the environment is contaminated? In what way? Provide some historic facts, one of the clearest examples of the use of birds to identify environmental stress is that of the effects of DDT on wildlife.

Wild Facts: Eagles In the 1960s eagles were in trouble and their populations dropped. They were being poisoned by a dangerous insecticide DDT that was applied in agricultural fields and killed many small animals like field mice, lizards and other animals, which eagles hunted. They began to lay very thin-shelled eggs and the chicks were born very weak and died within hours or days. It looked as if eagles might become extinct. Scientists began to wonder if the chemicals that were harming eagles might be able to harm humans and other animals. The scientists told their concerns to government and DDT was banned in 1972 to protect eagles, falcons, and other birds. Soon birds were eating prey free of DDT and eagle populations improved. However, there was still a problem. There were too few eagles left in the wild. Eagles are still endangered, but at least now they have a fighting chance at survival.

What Do You Do?

[NB. If you are unable to conduct a field study, invite an ASPB¹ specialist: (armbirds@yahoo.com) or a BOA² staff (boa@aua.am) to arrange a field trip.]

After all discussions are complete, arrange a field trip to a nearest crop land, pasture or grassland exposed to agricultural practice. The class has to be equipped with binoculars, notebooks and pens.

1. Plan ahead to select a study area in late August or September that has these characteristics
2. Be sure to arrange your trip early in the morning (between 9:00 am and 12 pm)
3. Record date and time, weather conditions, temperature, and location.
4. Look out for any flying raptor or bird of prey (buzzard or falcon)
5. Record any bird of prey seen in your notebook. Try to identify it, where possible.
6. Have students observe and record the bird's behavior (flight straightforward, soaring, hovering, plunging down etc.)
7. Encourage students to record characteristics of the habitat (cropland, hay meadow)?
8. If you see it catching a prey, try to find out what food was captured (e.g. mouse)
9. Keep monitoring for at least an hour and record every individual you see. Record in field notebook on a regular basis, over a week or more.

Conclusion

After lengthy field monitoring, summarize your observations. Ask the class the following questions:

1. Have you seen any raptor (bird of prey) in field? How many?
2. What species of bird have you seen? A buzzard or a falcon, else?
3. Have you seen it catching a prey? How many times?
4. Do their numbers grow or reduce?
5. Describe the location of your field study and explain why it's a good or poor habitat for buzzards or falcons?
6. What does their presence/absence indicate?

Whatever the observations are, assign students to brainstorm around the meanings of the following scenarios: (a) both birds and mice are present; (b) birds present but no mice, (c) mice present but no birds. *Where is the ecological imbalance? Next, ask: What does the presence or absence of the birds tell us? Is the environment healthy? Is there any need to control mice in the study area? Why?* Have students discuss this question, generate conclusions and provide convincing evidence. Explain the advantage of using a biological control of mice in an agricultural field over chemical one, e.g. by conserving birds. *What is the role of birds in keeping the environment clean?* The suggested research questions should help students' understanding of these topics move forward, and may lead into a discussion of food chains and webs as well.

Homework Assignment

Assign students to learn as much as possible about the bird species seen. Have them write an essay (not more than one page) about every bird species. *How can these birds be used by the scientists to tell if the environment is contaminated?*

¹ Armenian Society for the Protection of Birds

² Birds of Armenia Project

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Resource links:

*Adapted from Biodiversity and Ecosystems: Bio-indicators, Water - Learning and Living. (<http://www.watercare.net/wll/index.html>)

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Adapted from the electronic magazine 'Environmental Education for Kids. Copyright 2005. Wisconsin Department of Natural Resources (<http://dnr.wi.gov/org/caer/ce/EEK/>) and the United States Bureau of Land Management and the Oregon Department of Environmental Quality. 2004. (http://www.education-world.com/a_lesson/03/lp308-04.shtml)

Lesson #28: Bioindicators And Biomonitors (continued)



Objective

To illustrate how people used bioindicators in the past to predict changes in the environment.

What Do You Do?

Read the below story to the class and lead discussion afterward.

The Story

Source: Environmental Education for Kids Copyright. 2005 Wisconsin Department of Natural Resources (<http://dnr.wi.gov/org/caer/ce/eeek/>)

Canary in a coal mine

In the 1800s few jobs were harder or more dangerous than working as an underground coal miner. Over the years, thousands of men, women, and even children were killed in mine accidents. One common cause of the accidents was a build-up of dangerous gases like methane and carbon monoxide in the mine shafts. Large amounts of these gases could lead to violent explosions. Methane and carbon monoxide have no color and no odor. The miners of the 1800s didn't have the special equipment scientists have today to measure chemicals in the air, so it was impossible to tell if the gases were building up to dangerous levels. Miners started to use canaries to test the air quality in the mines. Canaries are very sensitive to carbon monoxide. The canaries would chirp and sing and make noise all day long. But, if the carbon monoxide levels got too high, the canaries would have trouble breathing, and maybe even die. When the canaries were no longer singing, miners would know that the gas levels were too high. They would leave the mine quickly to avoid being caught in an explosion. This is how canaries acted as a warning system for early coal miners and helped to escape death!

Discussion Questions:

- Have you heard the phrase "canary in a coal mine"?
- Which bioindicator did early coal miners use?
- What did they use the canaries for?
- How did canaries warn miners about the coming danger?
- What is a bioindicator?
- What other organisms can be used to tell the change in the environment?
- How can animal species be used to indicate the health of different environments?
- Which organisms can be monitored to assess the quality of water and the health of riparian zones? Which organisms can be monitored to assess the quality of soils, air? Give examples.
- What types of monitoring can be effectively used by students to assess the health of environments?