

***This was written by Becky E. Bauer in Menasha, WI and presented to the Board of Education as the curriculum proposal for an Environmental Science class that would receive science credit. Before this the Environmental Education course was only offered for one semester and was an elective credit. When the Board changed the graduation requirement to include 3 years of science, this course was designed to meet the needs of lower level students, EEN students in an inclusion classroom, and those students pursuing a career in natural resources.

Only a portion of the actual curriculum is included.

ENVIRONMENTAL EDUCATION/SCIENCE CURRICULUM

- The high school environmental education/science course curriculum should include/make use of the following areas:
- Technology/Computers (word processing, multimedia presentations, modem/bulletin board communications, Internet access, electronic testing devices)
- School to Work/Education for Employment/Career Information with hands on skills being taught. This might also include career shadowing or mentoring.
- Necessary content/skills for higher education courses in ecology, forestry, water, natural resources, etc.
- Concern for gender equity in class opportunities and class materials.
- Investigation of current community environmental issues.
- Active citizenship/participation/community service on local environmental projects. Care should be taken to have school/parental permission if the projects are controversial in nature.
- Student projects that involve independent and group research (library and scientific experimentation) as well as student presentations. Where possible opportunities should be provided to share information with peers, elementary students, and/or the community.

The student, upon completion of the identified unit, will be able to:

**denotes objectives that cannot be accomplished without specific equipment not currently available within Menasha High School.

A. ECOLOGY

Describe the components and goals/objectives of environmental education

Identify and categorize class activities that pertain to specific environmental education objectives

Create a personal definition of the environment and compare to a class generated definition

Identify the major threats to the environmental quality in North America

Understand ecological vocabulary and prefixes, suffixes, and roots from Latin or German

Define, draw, and give examples of food chains, food pyramids, and food webs

Explain energy transfers in the environment

List biotic and abiotic components of the environment

Define and give examples of biomes of the world and their locations

Present information gathered through research on one individual biome which includes characteristics, adaptations and locations
Describe predator/prey relationships and explain cyclic patterns
Define and give examples of different types of competition

B. FORESTRY

B1. TREE/PLANT IDENTIFICATION

Identify common tree/plant species in the Wisconsin and the community
Describe/define tree/plant parts necessary for plant identification
Describe a forest community and structure
Define world forest types
Use a tree/plant key to identify trees/plants
Define and create a dichotomous key
Identify tree species involved in terrestrial succession and describe the process
Understand shade tolerance/intolerance as it relates to succession
List important commercial tree/plant species and their uses
Describe various methods of forest sampling
Describe timber stand improvements
Describe/define different methods of timber harvest
**Prepare an analysis of a timber plot for timber stand improvement needed or for commercial value of the stand

B2. COMPASS/TOPOGRAPHIC MAPS

Define parts of a compass
Define the eight cardinal points of a compass
**Use an orienteering compass to follow and give a sequence of azimuths
Distinguish between bearings and azimuths
Use a compass and topographic map for outdoor navigation during labs or activities
Define declination and its importance to navigation
Define the parts of a topographic map
Interpret landscapes based on a topographic map
Create/Draw a simple map to scale
Define stride/pace
Determine their own pace length and use pace as a means of marking distance for field work.

B3. FORESTRY TOOLS

Define and use chains as a unit of measure in field activities
Identify basic forestry tools
Define a variety of forest management concepts
**Use a variety of common forestry tools to complete a timber stand analysis

B4. HISTORY OF FORESTRY, ENVIRONMENTAL MOVEMENT, AND RELATIONSHIPS TO WISCONSIN HISTORY

Create a time line of major state, national, and international historical forestry events and describe their impact on Wisconsin

Compare and contrast historical events with environmental philosophies of a particular time in history

B5. FORESTRY ISSUES INVESTIGATION

Understand the controversy in Yellowstone National Park related to fires.

Describe positive and negative effects of fire on ecosystems.

Describe the historical perspective of fire use and management for the US Forest Service and the general population

Identify how fire impacts society in the United States and how people can increase or decrease conditions for fires or contribute to the controversy

Write a letter to an elected official which identifies the student's support or opposition to the "Let Burn" policy within a wilderness area. Use facts to support position

C. SOILS

C1. TYPES OF SOIL/SOIL IDENTIFICATION

Define and locate major soil categories of the world

Identify a soil sample by using a variety of field and chemical attributes (color, pH, texture, porosity, permeability, etc.)

Describe, define, and locate horizons in a soil profile

Describe the process of soil development

Describe how geological events form soil and surrounding land structures

C2. SOIL STRUCTURE/SUITABILITY FOR DIFFERENT USES

Identify the causes and prevention of soil erosion

Describe how soil type impacts land uses

Define and describe various soil conservation methods

Compare and contrast historical human uses of land/soil and the resulting human impacts

C.3 LANDFILLS/SOLID WASTE

Describe the structure of a sanitary landfill

Illustrate how a sanitary landfill operates

Describe how solid waste is handled in the local community

Compare and contrast societal/cultural generation of waste throughout history and its impacts

C4. RECYCLING

Identify and sort recyclable materials in the local community

Describe how composting works

Identify consumer products that are over packaged and devise ways to be an environmental or "green" consumer

Compare Wisconsin with other states that recycle

Compute solid waste and recyclables generated by Menasha High School

Participate in home/school/work recycling programs
Compare and contrast the economics of using recycled materials
Describe economies of scale as related to the recycling market
Understand how the “Game Theory” applies to individuals and the city in terms of enforcement of recycling mandates
Understand/Interpret the state mandates for recycling in Wisconsin
Describe how the legislative process affects the siting of landfills

C5. HAZARDOUS WASTES/PESTICIDES (SILENT SPRING BY RACHEL CARSON)

List common household chemicals that are considered hazardous waste and their impact on the environment
List alternatives to common hazardous household chemicals
Identify concerns about hazardous waste expressed in Silent Spring by Rachel Carson
Explain how hazardous chemicals enter the environment
Define bioaccumulation and biomagnification and its impact on food chains
Detail options for disposal of hazardous waste
Identify actions that can be taken locally to minimize generation of hazardous material
Identify several of the government agencies that regulate hazardous waste disposal

D. AIR

D1. POLLUTION

Define the types of chemicals that contribute to air pollution
Identify regions or areas of the country and world suffering from air pollution
Define types of technology available to combat air pollution
Describe acid precipitation and its effects
Compare and contrast outdoor and indoor air pollution
Describe the effects of air pollution on living and nonliving organisms
**Monitor the indoor air of Menasha High School

D2. CLEAN AIR ACT LEGISLATION/LEGISLATIVE PROCESS

Describe the legislative process and how it is used to develop environmental legislation
Describe the Clean Air Acts of 1970, 1977, and 1990
Describe the Clean Air Act implications for Wisconsin consumers and businesses

D.3 ECONOMICS

Describe the economic costs and benefits of clean air
Describe how the sale of credits for non-attainment areas is used by major industry to avoid meeting standards
Describe the effects of pollution on human health

D4. OZONE

Define ozone, greenhouse effect, and global warming
Describe how world air currents affect weather patterns and serve to transport air pollutants

Describe the effects on human health from ozone depletion
Define the various layers of the atmosphere
Detail consumer/individual actions to reduce the depletion of the ozone

E. WATER

E1. PROPERTIES/USES OF WATER

Exhibit an awareness of topics relating to water in Wisconsin, such as, groundwater, the Fox River, and Lake Michigan/Superior
List at least 10 uses and abuses of water in our community
Describe the chemical properties of water
Explain the energy cycle/food chain in an aquatic system
Identify 5 areas of water conservation in the home and 5 areas of conservation as a consumer
Determine the location of the world's fresh water resources
Diagram the water cycle
List non consumptive, recreational uses of water
List water safety concerns for ocean/tide areas, freshwater lakes and rivers, and winter ice recreation
Diagram the process for the Fox Valley in obtaining drinking water and processing waste water
Describe what the maximum contaminant levels of drinking water are and how these standards are developed
Describe the Clean Water Act and its implications on society and the environment

E2. GROUND WATER

Define components of groundwater and an aquifer
Explain how land use affects groundwater quality
Explain how parent soil affects groundwater quality and susceptibility to pollution
Discuss how soil permeability affects groundwater
Describe the effects of pesticides/irrigation on groundwater
Identify areas of contamination and predict areas of future contamination using the case study "Trouble in Paradise"
**Use a groundwater model to show effects of irrigation and pesticides

E3. WETLANDS

Define a wetland
Illustrate succession from open water to a lowland forest
Discuss reasons for destroying wetlands and ways to preserve them
Identify human impact on wetlands such as Heckrodt Wetlands Preserve, Okefenokee Swamp, and the Sand Counties of Wisconsin
Define the benefits of a wetland
Compare and contrast the habitats of a northern bog, a freshwater wetland, and an estuary
Describe the cultural and historical significance of the Okefenokee Swamp
Identify unique plant and animal life of a wetland

E4. RIVERS

Describe types of point and non-point pollution

Describe plant and animal adaptations for rivers/currents

**Perform basic water quality tests for items such as temperature, turbidity, dissolved oxygen, pH, fecal coliform, total phosphorus, and nitrates

Identify 3 indicator species of positive or negative water quality

Explain how land use affects surface water quality

Describe the process of stream formation from headwaters to delta

Discuss the concept of a “working” river

Identify positive and negative consequences of hydroelectric power

Identify the current structure in a river and its effect on bottom matter and stream formation

Define the watershed for the Fox River Valley area

Discuss water rights/law and international treaties

***Testing the Waters program involvement

E5. INLAND LAKES AND THE GREAT LAKES

Compare and contrast the 5 Great Lakes in areas of rainfall, depth, water temperature, economic use, surrounding land uses, etc.

Describe how the Great Lakes are linked to the Atlantic Ocean and how that has impacted the fisheries of the Great Lakes

Explain current issues facing the Great Lake, such as zebra mussel infestation, lamprey eels, non-point pollution, etc.

Determine how land use in Wisconsin affects Lake Michigan

Analyze the recreational and economic value of Lake Michigan and Lake Superior

E6. OCEANS

Map world fisheries

Discuss the economics of the world fishing industry

Define and locate upwellings

Outline major ocean currents and how they correspond to upwellings

Discuss international fishing treaties and international waters

List types of ocean pollution

Identify international efforts for the protection of the oceans

Identify species in danger because of destruction of ocean habitat

**Use the Fish Banks computer simulation to show the effects of international overfishing

F. ENERGY

F1. PRODUCTION AND CONSERVATION

Define renewable and non-renewable resources, fossil fuels, cogeneration, fusion, fission

Identify areas within the home and school where energy is lost and where it can be conserved

Identify how electrical power is produced in Wisconsin and Menasha

Describe how Winnebago County is saving energy by using propane for county trucks and by using cogeneration at the Correctional Facility

Detail ways energy could be produced without the use of fossil fuels

Compare the US's use of energy with other nations of the world

F2. NUCLEAR ENERGY

Define nuclear energy and describe how electricity is produced using nuclear fission
Describe thermal pollution associated with nuclear energy and its impact on surrounding water
Describe the benefits and risks associated with nuclear energy
Detail what types of waste are generated, how they are handled, and how they are stored
Describe the nation's plan for permanent, longtime storage of nuclear waste
Compare the use of nuclear energy in the US with other nations
Describe how the legislative process affects the siting of nuclear waste disposal
Detail the workings and plan for shut down of the Point Beach Nuclear facility in Wisconsin

G. LAND USE/ETHICS

Identify who Aldo Leopold, John Muir, Rachel Carson, and Jacques Cousteau are
Compare and contrast the philosophical differences of these noted environmentalists
Describe the literature associated with these people
Describe an almanac and the significance of the Sand County Almanac
List the history and land use associated with the Sand Counties of Wisconsin
Describe Leopold's "Land Ethic" and describe its impact on the environmental movement
Describe society's historical philosophy on the environment
Compare and contrast cultural philosophies on the environment
Describe the controversy over Native American rights in Wisconsin and how the state/nation are dealing with the controversy
Review land use issues of the Fox Valley
Identify ways that local land use impacts on society, development, and the environment
Define land zoning terminology
Describe how local legislators affect land use planning through zoning
Describe government regulation and incentives to dictate land use
**Use integrated, collaborative problem solving to complete the computer scenarios of "Decisions, Decisions--the Environment"

H. POPULATION

Define population, community, food chain, food pyramid, food web, predator, prey, etc.
Describe an animal population that is cyclic and how the cycle works
Compare and contrast the human population curve over the course of history with technological advancements
Describe consequences of population/over-population on the environment
Define death rate, birth rate, zero population growth, exponential/geometric growth, and the J-curve
Graph the growth of a population
Compare and contrast population pyramids for several nations
Describe the significance of Garrett Hardin and his predictions
Define/describe "Tragedy of the Commons"
Explain how "Tragedy of the Commons" applies to the world environment currently

I. CAREERS/HIGHER EDUCATION/POST-SECONDARY OPTIONS

Identify and investigate environmental career possibilities
Investigate the Technical College/University course work required to pursue environmental careers
Use a college catalog to select a course of study

List classes needed to fulfill a college degree

Describe the difference in degree programs and general courses needed to complete them for a particular institution

Identify ways to obtain skills necessary for an environmental career

Describe the various paid, intern, or volunteer programs for youth to experience environmental/natural resource careers (i.e. Wisconsin Youth Conservation Corps, camps, workshops, etc.)

**Possible career shadowing/mentorship for interested students