Fair Lawn High School
Course of Study

Environmental Science
(401, 402, 403, 404)

2004
Mr. Paul Schreiner
Supervisor of Science K-12

June 2011
Scope & Sequence Updated To Reflect 2009 Standards
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The following course outline, developed by the environmental science teachers during 2010-2011, is to be followed for the 2011-2012 school year, and thereafter, to promote collaboration amongst the environmental science teachers and to promote a common course of study for our students, in anticipation of midterm and finals which are mostly common, as well as to promote the development of a common MP 5 project.

I. Introduction to Environmental Science (5.1.12*) *Reflected Throughout Course
   a. Chapter 1 - Understanding our environment
      i. Define environmental science
      ii. Timeline of environmental change
      iii. Main environmental problems
         1. resource depletion
         2. pollution
         3. loss of biodiversity
   b. Chapter 2 - Scientific Methods
      i. The Scientific Method steps
      ii. Statistics - mean, median, mode, probability
      iii. Models
      iv. Informed Decisions
         1. decision making model steps

II. Ecology (5.3.B.12.1, 3, 4, 5, 6; 5.3.C.12.1, 2; 5.3.E.12.4; 5.4.G.12.1-7)
   a. Chapter 4 - Ecosystems - everything is connected
      i. Ecosystem and components
         1. biotic factors
         2. abiotic factors
         3. organisms, populations, communities
         4. habitat
      ii. Evolution
         1. Natural Selection
            a. adaptation
            b. heredity
            c. evolution, coevolution
2. Artificial selection
3. Resistance

iii. Diversity of Living Things
   1. Characteristics of Kingdoms

b. Chapter 5 - How Ecosystems Work
   i. Energy Flow in Ecosystems
      1. Energy source - The Sun
         a. photosynthesis
         b. producers
         c. consumers
         d. deep sea hydrothermal vent communities - the exception
   2. What eats what?
      a. herbivore
      b. carnivore
      c. omnivore
      d. decomposer
   3. Cellular Respiration
      a. burning energy - reverse of photosynthesis
   4. Energy Transfer Through Ecosystems
      a. Food Chain vs. Food Web
      b. Trophic Levels
      c. Energy Pyramids
      d. Energy Loss in ecosystems

ii. The Cycling of Materials
   1. carbon cycle
      a. all steps
      b. human impact
      c. carbon sinks
   2. Nitrogen cycle
      a. nitrogen fixing
      b. role of decomposers
   3. Phosphorus cycle
      a. slow cycle
      b. all steps
   4. Human impact
      a. fertilizers
      b. algal bloom
      c. acid rain

iii. How Ecosystems Change
   1. Succession
      a. primary
         i. role of lichens
      b. secondary
i. pioneer species
ii. climax community
iii. role of fire
iv. Old-Field Succession

c. Chapters 6 and 7 – Biomes and Aquatic Ecosystems
   i. definition
   ii. vegetation types
   iii. biomes and climate
      1. temperature and precipitation
      2. latitude and altitude
      3. Forest biomes
         a. tropical
         b. layers
         c. temperate forests
         d. Taiga
      4. Grassland, Desert and Tundra – plants, animals and features
         a. Savanna
         b. Temperate grasslands
         c. Chaparral
         d. Deserts
         e. Tundra
iv. Salt Water and Fresh Water Ecosystems

VII. Chapter 11 – Water (5.4.12.C.1, 2; 5.4.12.E.1, 2; 5.4.12.F.1, 2, 3)
   1. Water cycle
   2. Global Water distribution
   3. Surface water
      a. Rivers and watersheds
   4. Groundwater
      a. Aquifer
      b. Porosity and permeability
      c. Recharge zone
      d. Wells
   5. Water use and management
      a. Global use
      b. Residential use
         i. Water treatment
         ii. Pathogens vs. potable
            a. Industrial
            b. Agricultural
            c. Management projects
            d. Conservation
            e. Future solutions
2. Water pollution
   a. Point vs. non point sources
   b. Water pollutants – main cause/source - details
      i. Wastewater
      ii. Eutrophication
      iii. Thermal
      iv. Groundwater pollution
      v. Ocean pollution
   a. Water pollution and ecosystems
   b. Cleaning up

VIII. Chapter 12 Air  (5.4.12.C.1, 2; 5.4.12.E.1, 2; 5.4.12.F.1, 2, 3)
   1. define
   2. primary vs. secondary pollution
   3. sources of pollution
      a. motor vehicles
      b. industrial
      c. case studies in smog
      d. indoor air pollution
      e. noise pollution
      f. light pollution
   4. Short term vs. long term effects
   5. remediation
   6. Acid precipitation
      a. Cause
      b. Impact

IX. Chapter 13 – Atmosphere and Climate  (5.4.12.C.1, 2; 5.4.12.E.1, 2; 5.4.12.F.1, 2, 3)
   1. factors that determine climate
   2. global winds
   3. ocean circulation
   4. topography
   5. other factors
   6. seasonal changes
   7. Ozone shield
      a. Chemicals that are involved
      b. Ozone hole issue
   8. Global Warming
      a. Greenhouse effect
      b. The role of carbon
      c. Models that predict warming
      d. Consequences of warming
ε. Reducing the risks

X. Chapter 17 - Nonrenewable Energy  (5.4.12.C.1, 2; 5.4.12.E.1, 2; 5.4.12.F.1, 2, 3; 5.4.G.12.1-7)
   1. Energy resources and fossil fuels
   2. Nuclear energy

XI. Chapter 18 - Renewable Energy  (5.4.12.C.1, 2; 5.4.12.E.1, 2; 5.4.12.F.1, 2, 3; 5.4.G.12.1-7)
   1. Renewable Energy Today
   2. Alternative Energy and Conservation

Labs and Activities:
   I. Introduction to Environmental Science
      a. Toilet Paper Lab
   II. Ecology
      a. Population Lab
      b. Owl Pellets
   III. Water, Air, and Land
      a. Acid Rain (Vernier)
Minimum Proficiencies

Environmental Science (Grade 9) 405

In accordance with the Guidelines set forth by the New Jersey Department of Education (N.J.S.A 18A: 7C et seq. (P.L. 1979,241) and Fair Lawn Board of Education Policy, #6142, 1981 for the implementation of minimum proficiencies in courses of study, the following criteria have been set by the Fair Lawn Board of Education. In order that every student may fully understand the requirements for the successful completion of each course, this proficiency form is being distributed.

Routine Classroom Responsibilities

1. Students will attend each class session in accordance with the District Attendance Policy.
2. Students will report to designated classrooms or locations on time with required materials.
3. It will be the responsibility of each student to make up tests, assignments, or work missed because of excused absences or other mitigating circumstances.
4. Students will complete all assignments, participate in the class activities, and avail themselves of extra help when necessary.

Objectives

Students should be able to do the following:
1. Demonstrate a working knowledge of the components of an ecosystem, types of ecosystems and how ecosystems change.
2. Display knowledge of the interactions of food chains and food webs within an ecosystem.
3. Describe the properties of water and how human activities affect fresh and saltwater systems.
4. Demonstrate an understanding of human impacts on air quality and the impact of air pollution on the environment.
5. Display an understanding of the earth's atmosphere and the importance of the greenhouse effect and the ozone layer.
6. Describe various properties of soil and the importance of soil conservation as it pertains to agriculture.
7. Demonstrate a working knowledge of land use management and the politics and economics of land use planning.
8. Describe the advantages and disadvantages of different energy sources.
9. Demonstrate an understanding of solid waste generation, disposal and management.
10. Describe the fundamentals of population growth and distribution problems as they relate to overpopulation.
11. Demonstrate an understanding of how environmental laws, policies and economics impact the state of the environment.
12. Achieve an appreciation for the need to obtain a sustainable world, through international efforts, environmental public policy and individual action.
13. Develop laboratory skills that are consistent with safety.
14. Demonstrate the ability to understand and apply the scientific method.
15. Read and interpret scientific literature.
16. Develop skills to collect data and interpret results.
17. Develop study habits and note-taking skills.
18. Improve critical thinking, problem solving, analysis and reasoning skills.
19. Have an encompassing understanding of environmental topics and issues.
20. Understand the interrelationships between biology, chemistry, physics and the mathematical disciplines.

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Student Statement of Understanding

I, ______________________ have read and understand the proficiencies required for Environmental Science.

(Student's name)

proficiencies required for Environmental Science.

Date       Signature of Parent       Signature of Student

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Environmental Science Course Philosophy

The ninth grade science program is designed for the student:

1. To understand and be able to apply the scientific method.

2. To understand the interrelationships between biology, chemistry, physics and the mathematical disciplines.

3. To develop skills to collect data and interpret results.

4. To develop study habits and note taking skills.

5. To develop laboratory skills that are consistent with safety.

6. To acquire the ability to read and interpret scientific literature.

7. To promote the ability to work effectively within a group.

8. To have an encompassing understanding of environmental topics and issues.

9. To improve critical thinking, problem solving, analysis and reasoning skills.
Outcomes and Objectives

1. Knowledge of components of ecosystems, types of ecosystems and how ecosystems change.

2. Knowledge of the interactions of food chains and food webs within an ecosystem.

3. Knowledge of properties of water and how human activities effect fresh and saltwater systems.

4. Knowledge of human impacts on air quality and the impact of air pollution on the environment.

5. An understanding of the atmosphere and the importance of the greenhouse effect and the ozone layer.

6. An understanding of soil properties and the importance of soil conservation as it pertains to agricultural needs.

7. An understanding of land use management and the politics and economics of land use planning.

8. Knowledge of the advantages and disadvantages of different energy sources.

9. An understanding of solid waste generation, disposal and management.

10. An understanding the fundamentals of population growth and distribution problems as they relate to overpopulation.

11. To gain an understanding of how environmental laws, policies and economics impact the state of the environment.

12. To achieve an appreciation for the need to obtain a sustainable world, through international efforts, environmental public policy and individual action.
Scope and Sequence

Bold faced numbers correspond to the NJ Core Curriculum Content Standards. Note: Standards 3.1, reading; 3.2, writing; and 3.4, listening; are used in every lesson in the curriculum.


I. Science skills

   A. Course expectations and laboratory safety  5.1.12C1, 9.1.12B4, 9.2.12F1

   B. Notebook requirements 3.1, 3.2

   C. Review of mathematical skills
      1. graphing 4.4, 5.3.12A

      2. metric system 4.1, 4.3, 4.5, 5.3.12B

II. Introduction to Environmental science

   A. Overview of environmental issues 5.10.12B

   B. Scientific Method 5.1.12A1, 8.1.12A3

   C. Decision making models 5.1.12A1, 2, 4, 5.4.12B1, 5.10.12B2

III. Introduction to ecosystems 5.4.12A1

   A. components of an ecosystem (2.1)

   B. niche and habitat (2.1)

   C. environmental adaptations (2.3) 5.5.12B1, 2, 5.5.12C1
      1. evolution
      2. extinction

   D. Biodiversity (10.1) 5.10.12A1, 5.10.12B2, 8.1.12A1, B3, B4, B7, B12
IV. How ecosystems work

A. energy flow (3.1) 5.5.12A1,2,3
   1. sun's energy
   2. photosynthesis and cellular respiration
   3. energy transfer through food chains and webs

B. water and nutrients (3.2) 5.8.12A1, 5.10.12B1
   1. water cycle
   2. carbon cycle
   3. nitrogen cycle

C. ecosystem changes (3.3) 5.10.12A1
   1. primary succession
   2. secondary succession

D. types of ecosystems (4.1) 8.1.12A5,9
   1. tropical rain forests
   2. temperate forests
   3. taiga
   4. grasslands
   5. deserts
   6. tundra

V. Water

A. freshwater sources (5.1) 5.3.12C1, 8.1.12A3
   1. surface water
   2. groundwater
   3. water shortages

B. freshwater pollution (5.2) 5.1.12B1,2, 5.10.12B1
   1. point and nonpoint sources
   2. wastewater treatment
   3. eutrophication
   4. thermal pollution
   5. groundwater pollution

C. ocean pollution (5.3)
   1. sources
   2. prevention
VI. Air pollution

A. sources (6.1) 5.10.12B1
   1. transportation
   2. industry
   3. thermal inversions

B. effects on human health (6.2)
   1. bronchitis and asthma
   2. emphysema and lung cancer
   3. indoor air pollution 5.6.12A1-4, 5.7.12B4

C. acid rain (6.3)
   1. effect on ecosystems 5.6.12A4
   2. solutions
   3. international policy

VII. Atmosphere and Climate

A. composition of the atmosphere (7.1) 5.8.12C3
   1. impact of photosynthesis
   2. layers of the atmosphere

B. climate (7.2) 5.8.12A1, B1
   1. topography
   2. ocean circulation patterns 5.9.12A
   3. atmospheric circulation patterns

C. greenhouse effect (7.3) 5.10.12A1
   1. roles of greenhouse gases
      a. natural
      b. anthropogenic
   2. global warming

D. ozone layer (7.4) 5.10.12A1
   1. good vs. bad ozone
   2. impact of elevated CFC's
   3. solutions
VIII. Soil 5.10.12A1, B1

A. agriculture (9.2)
   1. soil fertility
      a. nutrient content
      b. particle size
      c. soil layers
      d. properties
   2. soil conservation
   3. pest control (9.3)
      a. chemical
      b. biological

B. soil pollution

C. land use (8.2)
   1. forests
      a. harvesting management
      b. deforestation and reforestation
      c. wilderness protection
   2. ranching
   3. mining
   4. public land use (8.3)

IX. Energy 8.2.12A3

A. fossil fuels (11.1) 5.7.12B2,3
   1. renewable
   2. nonrenewable
   3. electricity

B. nuclear energy (11.2) 5.7.12A5
   1. nuclear reactions
   2. advantages vs. safety concerns

C. sustainable energy (11.3)
   1. conservation
   2. alternative sources
X. Solid waste 5.10.12B1, 8.2.12C1

A. solid waste management (12.1)

B. recycling (12.2)

C. hazardous waste (12.3)
   1. policy
   2. management and disposal
   3. home

XI. Populations 5.3.12D1

A. population dynamics (13.1)

B. human populations (13.2)
   1. agricultural revolution
   2. industrial revolution
   3. demographic transition

C. overpopulation (13.3)
   1. population distribution
   2. depletion of resources
   3. urban crisis

D. urban planning (8.1)
   1. urbanization
   2. land use planning

XII. Sustainable future 5.10.12B2, 9.2.12A4

A. international environmental policy (14.1)

B. U.S. environmental policy (14.2)
   1. national
   2. state
   3. local
Activities

I. Science skills
   1. graphing skills (teacher made) 5.3.12A, 4.4
   2. metric system skills (teacher made) 5.3.12B, 4.1, 3, 5

II. Introduction to Environmental Science 3.1, 3.2, 3.4, 3.5
   1. Plant Growth lab (students design) (teacher made) 4.2, 4.4, 5.1.12A1-4

III. Introduction to ecosystems
   1. miniecosystems in petri dishes (teacher made) 5.1.12A1-2
   2. Productivity of natural waters lab (teacher made) (light/dark bottle exp.) 4.1, 5.1.12C1, 3.1, 3.2, 3.4
   3. video- The flooded forest 5.1.12B1-2, 3.4, 3.5

IV. How ecosystems work
   1. Laser disc- The water cycle 3.5
   2. Water cycle model
   3. Biome presentations 3.3, 8.1.12A1, B3, B4, B7, B12
   4. Laser disc- biome types 3.5
   5. video- rainforest 3.5
   6. video- "The Medicine Man" 3.5

V. Water
   1. laser disc- the water cycle 5.1.12A1-4, 3.5
   2. dissolved oxygen in water (BOD lab) (teacher made) 4.1, 4.4, 5.1.12B1-2
   3. groundwater simulation model
   5. How safe is our groundwater (text; 146) 3.1
   6. laser disc- oceans 3.5
   7. water quality testing (teacher made) 3.5, 3.2, 4.1, 4.2, 4.4, 4.5
      a) biochemical oxygen demand laboratory
      b) colormetric water testing

VI. Air pollution
   1. Indoor Air Pollution (video) 3.5
   2. collection of indoor air pollution (teacher made) 3.1, 3.2, 4.1, 4.2, 5.1.12A1-4, 5.1.12B1-2, 5.1.12C1
      (air quality testing)
VII. Atmosphere and climate 5.10.12A1, B2
   1. greenhouse effect lab (teacher made)
   2. laser disc- the greenhouse effect 3.5
   3. video- ozone depletion 3.5

VIII. Soil 4.4, 5.1.12A1-4, 5.1.12B1-2, 5.1.12C1
   1. soil screening tests/ Munsell color charts (teacher made)
   2. soil nutrients and pollution (teacher made) (soil testing kits)
   3. Hydroponic cultivation (Nicholls)
   4. mining for peanuts (text;222)

IX. Energy 4.4, 5.1.12A1-4, 5.1.12B1-2, 5.1.12C1
   1. Oil spill lab (Rowa;89)
   2. solar power design your own solar home (text;298)
   3. PSE&G energy survey's 3.1, 3.2, 3.4, 4.1
   4. solar collectors (teacher made)

X. Solid Waste 4.4, 5.1.12A1-4, 5.1.12B1-2, 5.1.12C1
   1. landfill model
   2. recycling activity (teacher made)
   3. video- recycling 3.5

XI. Populations 4.4, 5.1.12A1-4, 5.1.12B1-2, 5.1.12C1, 3.1, 4.1, 4.4
   1. carrying capacity (Rosenthal;63)
   2. human bean activity (Rosenthal;34)
   3. doubling time (Rosenthal;21)
   4. population explosion (text;350)

XII. Sustainable Future 4.4, 5.1.12A1-4, 5.1.12B1-2, 5.1.12C1
   1. Scientific literature review project 3.1, 3.2
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