Ohio Science

Environmental Science Content Elaborations: Grades 9-12

Adopted 2018

Environmental Science

Earth Systems: Interconnected Spheres Of Earth

1. Students understand that in this course, the focus is on the connections and interactions between Earth's spheres (the hydrosphere, atmosphere, biosphere and lithosphere). ENV.ES.1.1
2. Students understand that ground water and surface water velocities and patterns are included as the movement of water (either at the surface, in the atmosphere or beneath the surface) can be a mode of transmission of contamination. ENV.ES.1.2
3. Students understand that geomorphology and topography are helpful in determining flow patterns and pathways for contamination. ENV.ES.1.3
4. Students understand that the connections and interactions of energy and matter between Earth's spheres are researched and investigated using actual data. ENV.ES.1.4
5. Students understand that one event, such as a petroleum release or a flood, can impact each sphere. ENV.ES.1.5
6. Students understand that some impacts are long-term, others are short-term and most are a combination of both long- and short-term. ENV.ES.1.6
7. Students understand that it is important to use real, quantifiable data to study the interactions, patterns and cycles among Earth's spheres. ENV.ES.1.7

Earth's Resources

1. Students understand that this topic explores the availability of Earth's resources, extraction of the resources, contamination problems, remediation techniques and the storage/disposal of the resources or by-products. ENV.ER.1.1

a. Students understand that conservation, protection and sustainability of Earth's resources are also included. ENV.ER.1.1.A

2. Students understand that to understand the effects that certain contaminants may have on the environment, scientific investigations and research should be conducted on a local, national and global level. ENV.ER.1.2

3. Students understand that water, air, land and biotic field and lab sampling/testing equipment and methods are utilized with real-world application. ENV.ER.1.3

4. Students understand that quantifiable field and/or lab data are used to analyze and draw conclusions regarding air, water or land quality. ENV.ER.1.4

5. Students understand that examples of types of water-quality testing include: hydraulic conductivity, suspended and dissolved solids, dissolved oxygen, biochemical oxygen demand, temperature, pH, fecal coliform and macro-invertebrate studies. ENV.ER.1.5

6. Students understand that wetland or woodland delineations and analysis, land use analysis and air monitoring (e.g., particulate matter sizes/amount) are all appropriate field study investigations. ENV.ER.1.6

7. Students understand that comparative analysis of scientific field or lab data should be used to quantify the environmental quality or conditions. Local data can also be compared to national and international data. ENV.ER.1.7

8. Students understand that the study of relevant, local problems can be a way to connect the classroom to the real world. ENV.ER.1.8

9. Students understand that within Ohio, there are numerous environmental topics that can be investigated. ENV.ER.1.9

    a. Students understand that examples include wetland loss or mitigation, surface or ground water contamination (including sediment, chemical or thermal contamination), watershed management, acid rain, septic system or sewage overflows/failures, landfill seepage, underground storage tank/pipe releases, deforestation, invasive species, air pollution (e.g., photochemical smog or particulate matter), soil loss/erosion or acid mine drainage. ENV.ER.1.9.A

10. Students understand that at the advanced science level, renewable and nonrenewable energy resources topics investigate the effectiveness, risk and efficiency for differing types of energy resources at a local, state, national and global level. ENV.ER.1.10

11. Students understand that nuclear and geothermal energy are included in this topic. ENV.ER.1.11

12. Students understand that feasibility, availability, remediation and environmental cost are included in the extraction, storage, use and disposal of both abiotic and biotic resources. ENV.ER.1.12

13. Students understand that environmental impact is evaluated as it pertains to both environmental and human risks. Examples include chemical hazards, radiation, biological hazards, toxicology and risk analysis studies. ENV.ER.1.13
14. Students understand that learning about conservation and protection of the environment also requires an understanding of the existence and rationale for laws and regulations to conserve resources and reduce and/or remediate contamination, but the emphasis should be on the science behind the laws and regulations. ENV.ER.1.14
15. Students understand that relating Earth's resources to a global scale and using technology to collect global resource data for comparative classroom study is recommended. ENV.ER.1.15
16. Students understand that in addition, it is important to connect the industry and the scientific community to the classroom to increase the depth of understanding. ENV.ER.1.16
17. Students understand that critical thinking and problem-solving skills are important in evaluating resource use, management and conservation. ENV.ER.1.17
18. Students understand that new discoveries and research are important parts of this topic. ENV.ER.1.18

Global Environmental Problems And Issues

1. Students understand that case studies, developing and using models, collecting and analyzing water and/or air quality data, conducting or researching population studies and methods of connecting to the real world is emphasized for this topic. ENV.GP.1.1
2. Students understand that technology can be used for comparative studies to share local data internationally so that specific quantifiable data can be compared and used in understanding the impact of some of the environmental problems that exist on a global scale. ENV.GP.1.2
3. Students understand that researching and investigating environmental factors on a global level contributes to the depth of understanding by applying the environmental science concepts to problem solving and design. ENV.GP.1.3
4. Students understand that examples of global topics that can be explored include building water or air filtration models, investigating climate change data, monitoring endangered, introduced or invasive species and studying the environmental effects of an increasing human population. ENV.GP.1.4
5. Students understand that researching contemporary discoveries, new technology and new discoveries can lead to improvement in environmental management. ENV.GP.1.5