Introduction to Environmental Science

The National STEM Consortium
Environmental Technology

This Teaching Toolkit is part of the Introduction to Environmental Science course created by the National STEM Consortium Environmental Technology team. The National STEM Consortium (NSC), a collaborative of ten colleges in nine states, was funded by a Trade Adjustment Assistance Community College and Career Training (TAACCCT) grant from the U.S. Department of Labor to develop one-year certificate programs in five technical fields.

Introduction to Environmental Science is one of the seven core courses in the NSC Environmental Technology certificate program and was developed by Jeremiah Sawma, Florida State College at Jacksonville, Jacksonville, Florida.
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Introduction

This Introduction to Environmental Science course was developed by Jeremiah Sawma at the College of Lake County in Grayslake, Illinois, and is one of seven core courses in the NSC Environmental Technology certificate program. This teaching toolkit for the course includes a course overview (this Read Me First document), a learning outcomes map, a suggested syllabus, lesson plans, and supplemental materials. The course also includes online modules that are designed to help students through common sticking points and better prepare them for face-to-face instruction.

NSC courses are designed for instructors with subject matter expertise and/or industry knowledge. NSC materials are freely and openly licensed, and are intended for instructors to customize according to their local needs. NSC materials offer resources, recommendations, and examples; they may be revised and redistributed provided that proper attribution and citation are used. See the About These Materials section below.

NSC materials are located in Platform+ by OLI, the Open Learning Initiative at Carnegie-Mellon University.

To access NSC Environmental Technology materials:

1. Navigate to the NSC Environmental Technology section of the OLI course library at http://oli.cmu.edu/learn-with-oli/see-our-free-open-courses/
2. Explore courses and online modules as a guest.
3. Apply for an Instructor account to access Instructor Resources (i.e., the Teaching Toolkit) for a particular course.

Platform+ online modules can be mixed and matched to create customized courses. Platform+ integrates with common learning management systems so students only have to log in once. Instructors should contact their college instructional technologist to enable single sign-on and set up Platform+ for use at their institution.

To use NSC Environmental Technology online modules:

1. Read the OLI instructions at https://oli.cmu.edu/teach-with-oli/find-educator-resources/creating-a-customized-course/
2. Follow the instructions to choose online modules to use, create a customized course, enroll students, and track their progress on the Instructor Dashboard.
3. Contact OLI with technical support questions.
The NSC Introduction to Environmental Science Course

Course Overview

Introduction to Environmental Science is intended as a first college-level science course. It is designed to equip students with the knowledge and skills to evaluate scientific problems in environmental science and related fields, and to gain appreciation for the structure and function of the environment as it relates to human activities. This course consists of 13 lessons along with corresponding quizzes, homework, and classroom activities.

Course Learning Outcomes

The NSC Environmental Technology certificate program has learning outcomes related to pollution management and remediation, environmental policy and regulations, workplace safety standards, lab equipment operation, and data collection and analysis. This represents program-level outcomes to be achieved across multiple courses. See the Learning Outcomes Map spreadsheet in this Teaching Toolkit for more information.

NSC Introduction to Environmental Science also has course-level learning outcomes that support program outcomes. Course outcomes are more detailed than program outcomes; they can be achieved in a single lesson or, often, across multiple lessons or class sessions. Course learning outcomes are student-centered and action-oriented, describing what students should be able to do after completing the course based on the knowledge, skills, and attributes developed.

NSC Introduction to Environmental Science has the following course-level learning outcomes:

Environmental Systems

- Demonstrate knowledge of the basic function of the major biogeochemical cycles in the environment
- Appreciate the complexity of environmental systems
- Understand how altering biogeochemical cycles through pollution or other methods can alter their function

Scientific Process

- Understand the explanatory power of science and the role of uncertainty in science
- Recognize common features of pseudoscience

Reviewing Scientific Research

- Distinguish reliable and unreliable sources
- Synthesize a conclusion based on information from multiple sources
• Correctly cite sources in written work

**Effective Communication**
• Hold a logical discussions on issues in environmental science
• Write fluently in brief, accurate technical style.

**Human Interaction with Environmental Systems**
• Identify major local and global environmental issues
• Propose solutions to environmental problems
• Weigh the needs of various stakeholders when considering environmental issues

The learning outcomes map spreadsheet in this toolkit links program to course learning outcomes and course to lesson learning outcomes. It is intended to help establish an outcomes-driven framework for the course, in which each learning outcome is established, taught, and assessed.

**Course Structure**

**Syllabus**
The suggested course student syllabus in this toolkit is a starting document for instructors to customize and fill in with local college information such as policies, procedures, and resources.

**Lessons**
The following lessons are included in Introduction to Environmental Science:

• Lesson 1: Introduction to Environmental Science and Scientific Method
• Lesson 2: Matter, Energy and Life
• Lesson 3: Population Dynamics
• Lesson 4: Evolution and Biodiversity
• Lesson 5: Human Population and Impact
• Lesson 6: Land Use, Forests and Rangelands
• Lesson 7: Water Resources and Use
• Lesson 8: Soil and Agricultural Resources
• Lesson 9: Natural Resources Extraction
• Lesson 10: Fossil, Nuclear and Renewable Energy
• Lesson 11: Climate Change
• Lesson 12: Air and Water Pollution
• Lesson 13: Solid and Hazardous Waste
Supplemental Materials

Supplemental materials are noted in the lesson plans and are labeled according to their type: Slides, Handout, Quiz, Worksheet, and so on.

Online Modules

NSC online modules address common student sticking points and better prepare students for face-to-face instruction. They offer mini-lessons and online drills for extra instruction and practice in key concepts. Five online modules specifically support this course:

- Understanding the Scientific Process
- Case Study: West Virginia Water Contamination Incident
- Mapping Your Career Landscape
- Recognizing Chemical and Physical Hazards
- NIOSH Guide

Instructors may use these and/or any other modules in Platform+ when creating a customized course.

Prerequisites and Requirements

Introduction to Environmental Science is given in the first term of the NSC Environmental Technology certificate program; no Environmental Technology courses are required as prerequisites. However, to succeed in this course, students should be proficient in English and Technical Mathematics, for example: Combined English Language Skills Assessment (CELSA) score of 50 or higher, or Academic Proficiency Test (APT) score of 80 or higher, or college basic English and Mathematics (basic Algebra) courses.

The NSC STEM Readiness course offers three one-credit units on Mathematics, Effective Workplace Communication, and Professionalism. The Mathematics unit is recommended as prerequisite to this technical course. NSC certificate programs are built around STEM Readiness, which rapidly provides a skills refresher to ensure student success in NSC technical courses. Colleges can deliver STEM Readiness in the first term as a standalone three-credit course, throughout the program as any combination of its one-credit units, or embedded into existing courses. STEM Readiness is located in the OLI course library as detailed in the Introduction.
Student Performance Standards
NSC programs are developed to a 70% passing performance standard. Lesson plans note specific cases where performance standards are higher, for example, when students must perform perfectly on a safety assessment because safety is non-negotiable.

Student Texts and Materials
There are no textbooks required for this course. References to several online videos and reading materials are included in lesson plans. In addition, the following materials are needed for specific lesson plans:


Kenner, R. (2009.) Food, Inc. (a documentary)

About These Materials

The NSC Environmental Technology Program
The NSC Environmental Technology certificate program is a stackable academic credential built on a one-year, 30-semester-credit model to rapidly prepare students by providing the rigorous instruction that workers need and employers value.

All NSC programs include the following materials in Platform+:

- **NSC Program Guide**: Information on program design and delivery to help administrators and instructors customize NSC programs for their institution.
- **NSC Teaching Toolkits**: Downloadable curricular materials to help adopting instructors create their own version of an NSC technical course.
- **NSC Online Modules**: Interactive learning activities for students.
- **NSC STEM Bridge Guide**: Information on the NSC STEM Bridge to help administrators and instructors integrate foundational skills into technical programs.
- **NSC STEM Readiness**: Online skills-refresher course in Mathematics, Communication, and Professionalism, designed to help college-ready students succeed in NSC technical courses.
- **NSC STEM Foundations**: Downloadable curricular materials for instructors plus online modules for students, designed to prepare lower-level learners to enter an NSC program.

The NSC Environmental Technology team developed the program based on the best practices of its partner colleges:
Florida State College at Jacksonville in Jacksonville, Florida (Environmental Technology team lead college)
College of Lake County in Grayslake, Illinois
Ivy Tech Community College – Northwest Central in Valparaiso and South Bend, Indiana
Anne Arundel Community College in Arnold, Maryland

NSC Environmental Technology comprises 21 credit hours of core courses that all students take plus nine credit hours in either of two separate tracks - Water Quality or HazMat, Safety and Health. Colleges offer either of the two tracks depending on local employer and industry needs. Core courses include: Fundamentals for Environmental Professionals, Introduction to Environmental Science, Environmental Sampling Procedures, Environmental Compliance, Introduction to OSHA, Hazardous Materials, and Industrial Hygiene. The HazMat, Safety and Health track courses include: Hazardous Materials Risk Analysis, Hazardous Materials Technician, Hazardous Materials Lab, and Industrial Hygiene Lab. The Water Quality track offers: Introduction to Water Resources, Chemistry and Biology of Natural Waters, and Field Work.

The job outlook for environmental science and protection technicians is bright. Employment for such technicians will grow 19 percent between 2012 and 2022, faster than the average for all occupations, according to U.S. Bureau of Labor Statistics (BLS).¹ NSC Environmental Technology graduates are qualified to work in at least 13 occupational categories, according to Advanced Technology Environmental and Energy Center. These include air quality, emergency preparedness and response, energy technologies, environmental laboratory services, environmental site management, natural resources management, safety and health, solid and hazardous waste management, and water supply and treatment.² These positions exist in a broad range of settings, including government agencies, testing laboratories, insurance providers, chemical and petroleum manufacturers, utilities, the military, nonprofit organizations, and construction, transportation, and waste management companies.

For more information, see the NSC Environmental Technology Program Guide in Platform+.

The National STEM Consortium
These materials were developed by the National STEM Consortium (NSC). NSC, a collaborative of ten colleges in nine states, was funded by a U.S. Department of Labor grant to develop one-year certificate programs in five technical fields: Composites Technology, Cyber Technology, Electric Vehicle Technology, Environmental Technology, and Environmental Technology. For more information visit the NSC website: http://www.nationalstem.org.

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