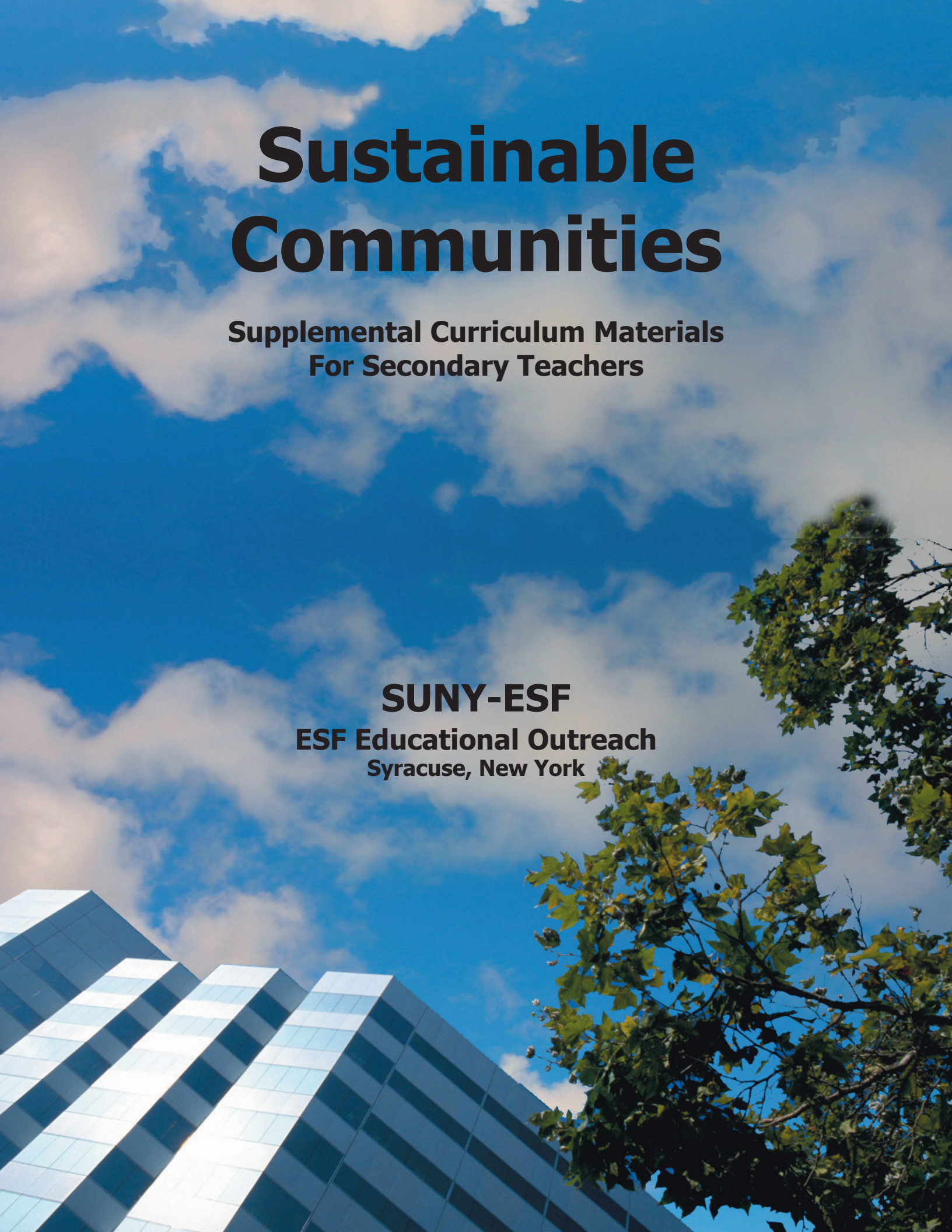

Sustainable Communities

Supplemental Curriculum Materials For Secondary Teachers

SUNY-ESF

ESF Educational Outreach

Syracuse, New York

Sustainable Communities

ESF in the High School 

Sustainable Communities

Supplemental Curriculum Materials for Secondary Teachers and Students in Science, Social Studies, English, and Technology

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Sustainable Communities

	Introduction
Lesson 1	What is a Community?
Lesson 2	The Community as Part of a System
Lesson 3	What does Sustainable Mean?
Lesson 4	Ecological Footprint and Sustainable Communities
Lesson 5	Case Studies of Sustainable Communities

** This project was made possible, in part, by a gift from the Walbridge Fund, Ltd.*

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SUNY-ESF Educational Outreach

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Dear Colleague,

The State University of New York College of Environmental Science and Forestry's specialized mission focuses on environmental science, design, policy, management, and engineering. ESF has eight academic departments (Chemistry, Construction Management and Wood Products Engineering, Environmental and Forest Biology, Environmental Resources and Forest Engineering, Environmental Studies, Forest and Natural Resources Management, Landscape Architecture, and Paper Science Engineering). With its main campus in Syracuse, New York, ESF's regional instructional and research campuses are distributed across 25,000 acres in central and northern New York State, ranging from the Appalachian Mountains and Great Lakes basin to the St. Lawrence River and the Adirondack Highlands. ESF is one of the eight doctoral granting research institutions of SUNY and its sponsored research funding awarded per faculty member is the highest of all SUNY units (excluding the health science centers). Graduate students comprise approximately one-third of ESF's student body.

ESF has a ninety-year history in educational outreach to the community. Collectively, ESF faculty and staff members contribute more than 6,500 hours annually in service to New York schools, teachers, community groups, non-profit organizations, and other government and non-non-government agencies. ESF's Office of Educational Outreach and its Council coordinate numerous innovative community outreach programs (www.esf.edu/outreach/). ESF's significant contributions to secondary education are derived from its strength as a major research institution in the natural and social sciences and its high academic rigor. The development of a series of new **Environmental Science Educational Units,** including Sustainable Communities, is an initial step toward expanding our educational outreach to the community--by making ESF's vast resources available to partnering high schools and students.

SUNY ESF **Environmental Science Educational Units** will fulfill an expressed need of New York State high school educators resulting from the newly implemented New York State Department of Education high school standards for Math, Science,

and Technology (MST), as well as and Social Studies. The new standards stress the essential roles of problem solving, critical thinking skills, and hands on experiences for high school teaching and learning. Moreover, the new standards promote the use of inquiry-based learning techniques and student research that promote in-depth understanding of both content and the process of self-directed inquiry. In fact, the use of "inquiry approaches" is acknowledged as one of the five guiding principles of best practices in Mathematics, Science, and Technology. The new SUNY ESF **Environmental Science Educational Units** are specifically designed to provide interesting and engaging topics in the Environmental Sciences that will enable teachers to cover the new state standards in MST, and Social Studies. ESF faculty and staff worked in cooperation with a team of New York State teachers to ensure the utility of each lesson in the high school classroom environment.

Sincerely,

Rick Beal PH.D.
SUNY ESF Educational Outreach Associate

Instructor Overview

The Sustainable Communities Educational Unit is a series of lessons designed to cover specific New York Department of Education standards for high school students. Using interesting and interactive activities that enhance student participation and understanding, the interdisciplinary nature of the unit encourages team teaching and collaborative learning between subjects as diverse as Math, Science and Technology, Social Studies, English, and Art. The lessons in the educational unit focus on the ecology of human-dominated ecosystems and the creation of livable, sustainable communities.

Ecological topics are particularly timely now; the human population is currently more than six billion, with projections of a population greater than twelve billion. For the first time in history, more people are living in cities than any other type of community, and these cities are increasingly dependent on nonrenewable resources. Dependence on nonrenewable resources, such as fossil fuels, creates sustainability challenges. The United States and other developed nations are facing problems stemming from poor community design and sprawl. Sustainable communities are critical for human health and the protection of other ecosystems; air and water quality must be improved in the developing world, where most of the largest communities will be located in the future. The Sustainable Communities Educational Unit, using a multi-disciplinary approach, will help students evaluate community sustainability from social, economic, and environmental perspectives.

Unit Objective:
The ESF Environmental Science Educational Units will provide high school teachers with student-centered, interdisciplinary lessons that cover NYS MST standards and focus on the concept of sustainability in human communities.

Student Objectives:

- List several definitions for the concept of *community.*
- List different types of communities.
- List different characteristics of communities.
- List different functions of communities and why these functions are important.
- Describe both favorable and unfavorable characteristics found in different communities.
- Define *system.*
- Give simple examples of systems.
- List examples of flows of materials and energy in systems.
- List examples of storage of materials and energy.
- Explain how positive and negative feedback or other processes control systems.
- Use Odum Symbols to create simple systems diagrams.

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- Describe the components of community systems and the interactions of the local community system with parts of a larger system.
- Compare systems such as reefs, streams, forests, and human communities.
- Define *sustainability* from social, economic, and environmental perspectives.
- Discuss *sustainable development* from a number of perspectives.
- Discuss examples of systems that demonstrate sustainability and those that fail to demonstrate sustainability.
- Discuss the concept of *sustainable communities*.
- Utilize Odum Symbols to represent sustainable and unsustainable communities.
- Define the key goals of *smart growth*.
- Discuss the relationship between smart growth and sustainable development.
- Compare and contrast the results of two different strategies for urban planning.
- Describe the concept of *Ecological Footprint*.
- Explain how the concept of Ecological Footprint can be applied to sustaining communities.
- Determine an Ecological Footprint.
- Calculate the Ecological Footprint of the local community.
- Lists ways to reduce an Ecological Footprint.
- List ways to influence others to reduce their Ecological Footprint.
- Analyze a sustainability case study and determine how the authors defined sustainability.
- Write a research report summarizing the methods and findings of a case study in sustainability.
- Present the results of a research report to a group of peers.
- Hypothesize how future development may be sustained in the case study system.

Sustainable Communities

Series of Lessons:

Lesson 1: What is a Community?

Every day we hear and use the word *community*. People talk about concepts such as the *importance of community involvement* or *giving back to the community*. In this lesson, students will explore the concept of community. Is there more than one definition of community? What are examples of a community? What are the important components of local and other communities? Are there healthy and unhealthy communities? What type of community do students want to help create?

Lesson 2: Community as a System

H.T. Odum was one of the most influential ecologists of the 20th century. His work revolutionized the use of systems science in the field of ecology. He is especially known for utilizing and promoting the use of a type of circuit language diagram normally used in physics and engineering to model ecosystems. These circuit language diagrams represent the stocks, flows, and controls of both energy and materials within ecosystems. Odum also championed the novel idea of using ecological concepts and methods to study systems such as agricultural lands, towns, and cities. By conceptualizing human communities as ecosystems and utilizing the methods normally utilized for studying "natural" ecosystems, scientists often gain a clearer understanding of human communities. In this lesson, students will learn several techniques to represent various human communities as ecosystems. Students will learn about the important components of an ecosystem and gain first-hand knowledge of Odum's Circuit language.

Lesson 3: What does Sustainable mean and what is Smart Growth?

References to *sustainability*, *sustainable development*, and *smart growth* appear frequently in the scientific, economic, and popular press. Although these concepts are often regarded positively, people employ many different definitions of the terms. In this lesson, students will explore these definitions, apply the concepts of sustainability on a community scale, and diagrammatically represent and evaluate the sustainability of various community systems and the impact of smart growth strategies.

Lesson 4: Ecological Footprint and Sustainable Communities

All plants and animals require space to live. Every organism requires an area to produce or obtain food and effectively dilute or recycle waste products. Carrying capacity is an ecological concept that describes the number of a species that can survive in a defined area. Many scientists believe that although humans differ in many ways from other organisms, applying the concepts of carrying capacity to examine human society is useful when dealing with issues of sustainability. Mathis Wackernagel and William Rees employed the idea of carrying capacity to create the concept of the Ecological Footprint. The Ecological Footprint represents the amount of area required to support an individual human or a human community. In this lesson, students will learn about the Ecological Footprint and use an automated method to calculate their own Ecological Footprint and the Ecological Footprint of their community.

Lesson 5: Case Studies of Sustainable Communities

In this lesson, students will use case studies of programs designed to create sustainable communities. Under the guidance of their teacher and the guidelines provided in this lesson, students will choose one or more case studies from a country of interest. Students will then apply what they learned in previous lessons to quantify the potential sustainability of these projects and the communities that they impact. They will analyze each case study to determine how the authors define sustainability and use techniques such as Odum circuit diagrams, the concept of carrying capacity, and the Ecological Footprint to determine the methods of increasing community sustainability. Students will present the results of their research in an oral presentation and written report, using feedback to revise their findings into a final written document.

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Mapping Sustainable Communities to the New York State Learning Standards for MST, Social Studies and English at Commencement Level

MST Standards For Lessons	**1**	**2**	**3**	**4**	**5**
MST Standard 1 Analysis, Inquiry, and Design	**1**	**2**	**3**	**4**	**5**
Mathematical Analysis	**1**	**2**	**3**	**4**	**5**
Key Idea 1					
Key Idea 2					
Key Idea 3					
Scientific Inquiry	**1**	**2**	**3**	**4**	**5**
Key Idea 1	**1a,b, c, d**	**1a, c, d**	**1a,b, c, d**	**1b, c, d**	**1b, c, d**
Key Idea 2	**2a, b**	**2a, b**	**2a, b**	**2a, b**	**2a, b**
Key Idea 3					
Engineering Design	**1**	**2**	**3**	**4**	**5**
Key Idea 1					
MST Standard 2 Information Systems	**1**	**2**	**3**	**4**	**5**
Key Idea 1	**1c**	**1c**	**1c**	**1c**	**1c**
Key Idea 2					
Key Idea 3					
Standard 3 Mathematics	**1**	**2**	**3**	**4**	**5**
Key Idea 1		**1c**	**1c**		
Key Idea 2					
Key Idea 3					
Key Idea 4					
Key Idea 5					
Key Idea 6					
Key Idea 7					
Standard 4 Physical Setting	**1**	**2**	**3**	**4**	**5**
Key Idea 1					
Key Idea 2					
Key Idea 3					
Key Idea 4					
Key Idea 5					

Standard 4 Living Environment	1	2	3	4	5
Key Idea 1	**1a**	**1a**			
Key Idea 2					
Key Idea 3					
Key Idea 4					
Key Idea 5					
Key Idea 6	**6a, b**	**6b, c**	**6**	**6a**	**6**
Key Idea 7	**7a, b, c**	**7a, b, c**	**7a, b, c**	**7a, b, c**	**7a, b, c**
Standard 5 Technology	1	2	3	4	5
Key Idea 1					
Key Idea 2					
Key Idea 3	**3c**	**3c**	**3c**	**3c**	**3c**
Key Idea 4		**4a, b**	**4a, b**	**4a, b**	**4a, b**
Key Idea 5					
Key Idea 6					
Key Idea 7					
Standard 6- Interconnected-ness: Common Themes	1	2	3	4	5
Idea 1	**1**	**1a, b, c**	**1a, b, c**	**1a, b, c**	**1a, b, c**
Idea 2		**2**			
Idea 3					
Idea 4		**4a**			**4a**
Idea 5				**5b**	**5b**
Idea 6				**6b**	**6b**
Standard 7- Interdisciplinary Problem Solving	1	2	3	4	5
Key Idea 1	**1a**	**1a**	**1a**	**1a**	**1a**
Key Idea 2	**2**	**2**	**2**	**2**	**2**
Skills and Strategies for Interdisciplinary Problem Solving	1	2	3	4	5
Working Effectively					
Gathering and Processing Information					
Generating and Analyzing Ideas					
Common Themes					
Realizing Ideas					
Presenting Results					

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Learning Standards for Social Studies	**1**	**2**	**3**	**4**	**5**
Standard 1 History of U.S. and New York State	**1**	**2**	**3**	**4**	**5**
Idea 1	**1a**				
Idea 2					
Idea 3					
Idea 4					
Standard 2 World History	**1**	**2**	**3**	**4**	**5**
Idea 1					
Idea 2					
Idea 3	**3a**				
Idea 4					
Standard 3 Geography	**1**	**2**	**3**	**4**	**5**
Idea 1	**1e**	**1a**	**1a**	**1e**	**1e**
Idea 2					
Standard 4 Economics	**1**	**2**	**3**	**4**	**5**
Idea 1	**1a**	**1a,c**	**1a,c**	**1a,c**	**1a,c**
Idea 2		**2d**	**2d**		
Standard 5 Civics Citizenship and Government	**1**	**2**	**3**	**4**	**5**
Idea 1					
Idea 2					
Idea 3					
Idea 4	**4e**	**4e**	**4e**	**4e**	**4e**