

HON 260

The Idea of Nature: Pollinators as a Case Study in Systems Thinking and Sustainability

Tuesday and Thursday 9:35-10:50 in JE 335

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“ Pollinators: These hardworking heroes of nature are not well understood but are clearly in peril. Loss of habitat, poisonings, and fragmentation of plant life on which they depend is reducing the number of pollinators alarmingly.”

U.S. Secretary of the Interior, Bruce Babbitt, September 30, 1998, speech in Austin, Texas

“It is important to remember that no species exists in isolation. Each is part of an ecological web. And as we lose more and more pieces of that web, the remaining structure must eventually collapse.” Carol Ann Kearns and David Inouye University of Maryland

Over 200,000 invertebrate species such as bees, moths, butterflies, beetles and flies serve as nature’s pollinators. There are also over 2,000 species of vertebrate animals such as birds, mammals, and reptiles that contribute to the process. While some plants are wind-pollinated or self-pollinated, over seventy percent of flowering plants including most fruits, some nuts, coffee, chocolate, and vanilla require the activities of living organisms for pollination. The survival of many of the plants we depend on for food, clothing, medicine, and aesthetic quality of life depend on nature’s pollinators. The single most important pollinator for agricultural purposes is the honey bee. The current decline in honey bee populations, known as Colony Collapse Disorder, as well as declines in other pollinators is challenging beekeepers, scientists, farmers, and ecologists. The factors driving this decline are complex and numerous and include pesticide use, loss of habitat, mono-crop farming, globalization, and economics. Consumers have an important role in influencing these factors through their decisions to use pesticides, the foods they consume and the types and sources of the honey they consume.

The best solutions will lie in shifts to our industrial agricultural system, our societal consumption habits, our and conceptions of Nature. Instructors will challenge students to learn to view nature as a system and to identify where in the system problems exist to make it unsustainable. Through class activities and projects students will make recommendations for methods to help make this system more sustainable and help prevent the continued threats to honeybees and other pollinators. These issues will be presented in an interdisciplinary manner to help better prepare students for making decisions in their daily lives and prepare them for the future.

Course Objectives

- Students will gain a global perspective of pollinators and the importance of pollination from scientific, economic, cultural, and social perspectives.
- To increase student awareness and understanding of the threats to pollinators from pesticides, environmental degradation, and human activities.
- Using a systems thinking approach enhance understanding of the complexity and inter-relationships that exist within ecosystems and how those factors may influence pollinator health.
- To have students critically evaluate research articles, media reports and corporate documents to determine the scientific validity of these reports and prepare them to prioritize their actions in terms of ecological benefit.
- Through student/beekeeper interviews, field experiences and site visits, engage students in discourse involving local and global concerns about pollinator health to help them transition their behavior from passive understanding to civic action.
- Students will enhance their understanding of the “three legs of sustainability” so they can apply these principles in identifying potential solutions that may prove to be successful in the long-term.
- Students will enhance their appreciation for observation, reflective thinking and direct experience in nature through reflective journaling, beekeeper and pesticide retailer interview poster presentations.
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- Students will develop strategies and/or recommendations for enhancing pollinator health. These strategies may be residential, campus-wide and will be posted on the Sustainable Southern Website.

Learning Outcomes

By the end of this course students will be able to do the following:

- Using a *Systems Thinking* approach, students will identify and describe the activities and relationships within ecosystems that are dependent on pollinators.
- Relate the ecologic and economic value that bees and other pollinator services provide and their influence on agricultural and ecological health.
- Identify and describe the scientific processes related to the potential causes or factors involved in Colony Collapse Disorder.
- Describe how recent outcomes of globalization affect the potential causes of Colony Collapse Disorder including chemical use, the spread of diseases, agricultural practices and economic

drivers.

- Analyze current environmental conditions affecting pollinator health in order to make recommendations based on principles of sustainability.
- Critically evaluate research and media for scientific, social and environmental information regarding bees, pollination and food production for its impact on the quality of human life.
- Develop strategies for action to help optimize the potential for long-term survival of pollinators.
- Through a new lens of systems thinking, sustainability and reflections on nature, identify a personal action plan to help pollinators.

Course Outline by Topic

Week 1 Introduction: The Idea of Nature, "Why a course about Pollinators?"

Changing perspectives: The "Pest" stigma, the importance of insects (including pollinators) in maintaining ecologic health, human dependence on insects. Pollinators as a window to the beauty and complexity of nature. Generalists and Specialists in systems health. Are bees a "canary in the coalmine?" Students identify the extent to which their favorite foods depend on pollination.

Week 2 The Elegance of Pollination

Science of pollination, review of insect and mammal pollinators, co-evolution of plants and pollinators. Basic bee biology, hive structure and dynamics, and the waggle dance. The most important varieties of honey bees for pollination (Italian, Russian, African and others). Our limited understanding of insect relationships in ecosystems. What is biodiversity, and why is it important? View Ted Talk *The Hidden Beauty of Pollination*, by Louie Schwartzberg.

Week 3 Colony Collapse Disorder

Using Systems Thinking to better understand the possible connections between chemical use, agriculture, globalization and the decline of pollinators. Looking at pollinators as part of a much larger ecological system using both a local and global perspective. Systems elements, interconnections, functions. "It's more than the honey..." "Pollination, human nutrition, and health. Students research individual nutrients and the foods where we find them. Can we be healthy in a honey bee free world?

Week 4 Understanding Pesticide Products and Use

The history, science, and current practices of pesticide use, including insecticides, herbicides, fungicides and their impact on pollinators as well as broader ecosystems. Learning to read labels, understanding LD₅₀ and MSDS information. . "Less toxic to

humans" is not the same as safe: Organophosphates, organochlorines, carbamates, pyrethroids, neonicotinoids... Examining the use of pesticides possibly linked to the decline of pollinators, including glyphosate, fipronil, imadacloprid, and other neonicotinoids. "The unregulated chemical stew" in a dynamic environment. Sharing what we learned from the pesticide sales interviews.

Week 5 The Science of Soil: It Is Not Just Dirt

Why soil serves as the foundation for life. Factors influencing soil viability, erosion, and ecological health. Outside lab examining soil horizons and the role of organic matter in soil.

Week 6 The Role of Agriculture

The three thousand mile hive: What are the unintended consequences of treating honey bees as livestock? Impacts of biotechnology, and plant diversity on bee health. Why are 80% of US honeybees in California in February? Feedback loops: the virtuous and vicious cycles. What role do corporations such as Monsanto, Bayer and DuPont play in CCD? The difference between maximizing and optimizing resources. The Precautionary Principle as a guide in decision-making.

Week 7 Pressures on Pollinators: What do Bees Need?

The relationships between pollinators and habitat quality, seasons, migration, and the unique challenges of "specialists" versus "generalists." How do the pressures from CCD influence these relationships? Climate change and the honeybee. Resilience and robustness in bees. In class and take home mid-term questions.

Week 8 How Can Learning about Sustainability Help Pollinators?

How environmental, social, and economic factors work together to either support or harm pollinators. Systems Thinking and identifying points of intervention. Analyzing specific practices and policies to determine their ability to support our environment today and for the future. "An ounce of prevention..."

Week 9 From Honey Hunters to Beekeepers, 3500 BC –today.

The role bees played in cultures from Egypt and Asia to Europe and the Americas. The reverence given to bees and honey in medicine, culture, the "honeymoon," literature, and the development of political and social systems. Students research their own cultural heritage and their relationship with bees.

Week 10 The Economics of Beekeeping

From pollinating almonds in California in February to blueberries in Maine in May, the experience of commercial pollination, honeybees as livestock and honey production. A look into countries that have lost their bees, and now, require human pollination of crops.

Week 11 The Story of Honey

Over 1 million pollinated flowers to make 1 pound of honey. The magic of honey- the

many varieties, and unique qualities of different honeys. Honey dumping and laundering (the importation of illegal honey). Is there such a thing as “organic” honey? How to read supermarket labels (natural, pure or honey flavored). Honey lab. Identifying various honey compositions, presence of pollen and sugar types.

Week 12 Current Research

Latest research on pests, diseases, possible links of pesticide use to Colony Collapse Disorder and pollinator health. Taking a look at current issues such as Citrus Greening, Bacillus Thuringensis, robo-bees and GMOs. Is the research using a systems approach?

Week 13 Sustainable Beekeeping

How to take advantage of local, federal and global initiatives to help pollinators. Funding sources for K-12 education, community pollinator garden and the rapid growth and success of urban beekeeping. Pests, parasites and diseases in the hive: to treat or not to treat? Sharing results from beekeeper interviews.

Week 14 What We Can Do to Help Pollinators?

Pollinator gardens and pathways, organic farming, open space habitat protection, the role of native plants, mason bee and bat houses. How do you make it worthwhile for bees to visit your garden all season?

Week 15 People to Know. Hope for the Future

The growth of local beekeeping. Michael Bush, Vandana Shiva, Michael Pollen, Marina Marchese and others. In class final question.

Week 16- Take Home Final Due

Required Reading

Texts:

Carson, Rachel, *Silent Spring*, Houghton, Mifflin Inc., 1962. ISBN-978-0-618-24906-0

Jacobsen, Rowan, *Fruitless Fall: The Collapse of the Honey Bee and the Coming Agricultural Crisis*, New York, Bloomsbury, 2008. ISBN 978-1-59691-639-5

Meadows, Donella H., *Thinking in Systems*, Vermont, Chelsea Green Publishing, 2008. ISBN 978-1-60358-055-7

Additional readings in the form of articles, websites and book chapters will be used as supplemental reading. Ted Talks and videos will be placed on Blackboard.

Course Reading Outline –readings assigned by the week.

Silent Spring and Thinking in Systems (Chapters will be read throughout the course)

Week One-	Introduction , Chapter 1-A Fable for Tomorrow, Chapter 2- The Obligation to Endure, Chapter 3- Elixirs of Death
Week Two	Chapters 4-Surface Waters and Underground Seas, Chapter 5-Realms of the Soil, Chapter 6- Earth’s Green Mantle. Meadows, Intro-ch.2 <i>Thinking in Systems</i> , Chapter 1-The Basics
Week Three	Chapters 7, Needless Havoc, Chapter 8-And No Birds Sing, Chapter 9-Rivers of Death <i>Thinking in Systems</i> , Chapter 2 - A Brief Visit to the Systems Zoo
Week Four	Chapter 10-Indiscriminately from the Skies, Chapter 11-Beyond the Dreams of the Borgias, Chapter 12-The Human Price
Week Five	Chapters 13-Through a Narrow Window, Chapter 14-One in Every Four <i>Thinking in Systems</i> , Chapter 3 - Why Systems Work So Well
Week Six	Chapters 15-Nature Fights Back, Chapter 16-The Rumbblings of an Avalanche
Week Seven-	Chapter 17-The Other Road <i>Thinking in Systems</i> , Chapter 4-Why Systems Surprise Us?
Week Eight T-15, R-17	No reading from text
Spring Vacation	<u><i>Fruitless Fall</i></u>
Week Nine	Prologue- Florida, November 2006, Chapter 1-Breakfast in America, Chapter 2-How the Honey Bee Conquered the World <i>Thinking in Systems</i> , Chapter 5-System Traps...And Opportunities
Week Ten	Chapters 3-Collapse, Chapter 4-Whodunit, Chapter 5-Slow Poison <i>Thinking in Systems</i> , Chapter 6 – Leverage Points
Week Eleven	Chapters 6- Florida, November 2007, Chapter 7-The Almond Orgy <i>Thinking in Systems</i> , Chapter 7- Living in a World of Systems

Week Twelve	Chapters 8-Bees on the Verge of a Nervous Breakdown, Chapter 9-Resilience and the Russians
Week Thirteen	Chapters 10- The Birth of Beauty, Chapter 11-Fruitless Fall
<u>May</u>	
Week Fourteen	Epilogue-First Frost through Afterword and Appendices
Week Fifteen	Final Exam. Bring texts.

Grading

15 written responses @ 3 points	=45%*
Projects	=20%
Include two interviews @ 5%, poster @ 10%	
Attendance and participation	=10%
Mid term 10% and Final 15%	= <u>25%</u>
	100%

* Each week you will have an assignment. You maybe asked to submit a written response to readings from the text, reading supplied in class or response to other media such as film, or to work individually or in a group on an assignment.

Attendance

Attendance is mandatory. Be on time, every day, prepared with all assignments. We take daily attendance. Arriving late will be penalized. If you have more than three absences, we will meet to discuss your ability to pass the class. Speak to us directly if you have a conflict. You will automatically fail if you miss more than five classes.

Classroom Expectations:

Be on time, prepared with all homework assignments, ready to participate.

Turn **off** all electronic devices with the exception of a laptop, which can be used for class purposes, but not for surfing the net or playing games, etc.

Be respectful of classmates' contributions to discussions and activities

Turn in all work **on time**

There may be class activities that take place outside of class time. You are expected to attend. If you have a conflict, you must discuss it with me beforehand.

Accommodations for Students with Documented Disabilities:

SCSU provides reasonable accommodations, in accordance with the Americans with Disabilities Act and section 504 of the Rehabilitation Act, for students with documented disabilities on an individualized basis. If you are a student with a documented disability, the University's Disability Resource Center (DRC) determines appropriate accommodations through consultation with the student. Before you may receive accommodations in this class, you will need to make an appointment with the Disability Resource Center, located in EN C-105A. To speak with us about your approved accommodations or other concerns, such as medical emergencies or arrangements in case the building must be evacuated, please make an appointment as soon as possible.

Academic Honesty:

Please see the relevant section on academic honesty in the Student Handbook. Academic dishonesty will result in a failure for the course. Your name will be passed on to the Academic Dean and the Dean of Student Affairs.