

Environmental Science

ENV221H
Sept 15, 2020

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Outline

- Review course mechanics & Orr Reading – What is education for?
- Introduction to Environmental Sciences
 - What is science?
 - Scientific assumptions
 - Scientific method
 - Limitations of science
 - Challenges of environmental science

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Readings

- No textbook or course reader
- All readings “should be” electronically accessible
- Lecture video will be posted after lectures

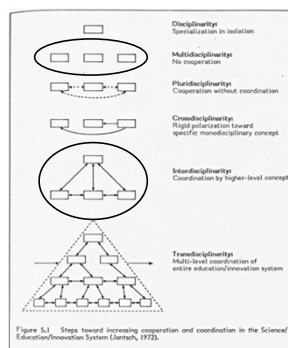
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Tutorials

- Each student will attend four tutorials:
 - Sept 30, Oct 21, Nov 4 and Nov 25.
- You should have signed up for a tutorial timeslot on ACORN.
- You should receive tutorial invite by 5pm Mon Sept 28th

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Disciplinary to Transdisciplinary



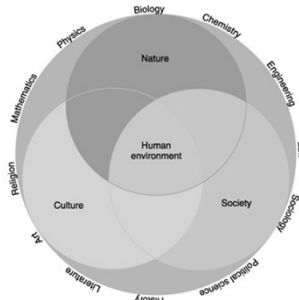
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The Charter of Transdisciplinarity Basarab Nicolescu – 1994

- recognition of the existence of different levels of reality governed by different types of logic is inherent in the transdisciplinary attitude.
- complements disciplinary approaches... does not strive for mastery of several disciplines but aims to open all disciplines to that which they share and to that which lies beyond them.
- No single culture is privileged over any other culture. The transdisciplinary approach is inherently transcultural.
- Authentic education cannot value abstraction over other forms of knowledge. It must teach contextual, concrete and global approaches.
- *Rigor, opening and tolerance* are the fundamental characteristics of the transdisciplinary attitude and vision

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Environment as an Interdisciplinary Pursuit



Source: Cunningham, WP, & MA. Cunningham. 2004. Principles of Environmental Science Inquiry and Applications. McGraw Hill.

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Course Subject

- The contribution and complex of many disciplinary approaches to achieve the interdisciplinary linkages needed to address current environmental problems.

Env Issues

- Climate change
- Environmental Health

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Course Format

- Examination of disciplinary contributions to the study of environment
 - Introductory lectures: environmental science, ethics, policy, and economics.
- Two Environmental Issues:
 - physical nature of the issue
 - action addressing the issue by governments and others
 - cultural, ethical and philosophical dimensions of the issue

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Upcoming Lectures: Disciplinary Perspectives

- Scientific Worldview
- Ethical Worldview
- Economic Wordview
- Political Worldview

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Orr Reading

- What are the disciplinary contributions to the study of the environment?
- How does the discipline approach the study of environmental issues?
- What questions does it ask?

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- "More of the same kind of education will only compound our problems"
- Einstein: " the significant problems we face cannot be solved at the same level of thinking we were at when we created them"
- Myths of education
- Every student should have basic comprehension of...

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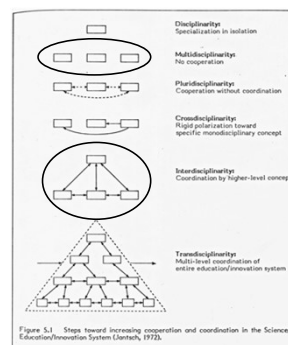
Tutorial #1

- Prepare for your first tutorial by submitting online (further instructions to come), a half page paragraph(s) which addresses your reactions to the Orr readings, which questioned the value of the current education system.
- <http://www.context.org/ICLIB/IC27/Orr.htm>
- Evaluated on a pass or fail basis
- Why isn't ignorance a solvable problem?
 - Ignorance: lack of knowledge, uninformed

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Disciplinary to Transdisciplinary



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Disciplinary Lectures

- What are the disciplinary contributions to the study of the environment?
- How does the discipline approach the study of environmental issues?
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ENVIRONMENTAL SCIENCE

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The War on Science: Who's Waging It, Why It Matters, What We Can Do About It

scientific advances in public health, biology and the environment are being resisted or rolled back.



'We're seeing right now a titanic battle between the power of science and the power of money and money is winning. This book explains why, and offers some pointers that might get us back on the right track.' -**Bill McKibben, author and co-founder of 350.org**

'Otto makes a case that can't be refuted. Science is important to all of us, especially the US government. He backs it up with peer reviewed studies, carefully researched numbers, and his own extensive experience. He uses the process of science to prove that we need science in order to remain free. Here's hoping all voters everywhere take him seriously-soon.' -**Bill Nye the Science Guy**

'Science is not a body of facts, but rather a structured approach to uncovering the fundamental laws that govern the natural world. As *The War on Science* shows, policymakers who choose to ignore those fundamental laws imperil us all, for the laws of nature will always trump the laws of man.' -**Marcia McNutt, president of the US National Academy of Sciences**

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Learning Objectives

- Develop understanding of what science is and what it is not
- An appreciation of the holistic and integrative approach of environmental science
- Challenges associated with environmental science
- Appreciation of environmental science as foundational to developing solutions

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Many Ways to Approach Knowledge & Understanding of the World

- Science is a way to understand the world
- Science seeks to explain HOW things work,
- Study of natural phenomena vs. human constructs

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What is science?

- Does not deal with things that do not have the potential to be tested by observations, i.e. is it possible to disprove?
- “For an idea to be scientific, it must have the capacity to be incorrect”

Cornelia Dean – Making Sense of Science

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Scientific Assumptions

- World is knowable
- Universal patterns
- Inductive reasoning: specifics->general
- Change in knowledge is inevitable
- If generalizations cannot be tested, then not a scientific statement
- Science can never provide absolute proof
- BUT can provide increasingly accurate approximations

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Scientific Method

- Make observations
- Formulate a hypothesis
- Design experiments to test hypothesis
- Collect data
- Interpret data
- Draw conclusions

Consult prior knowledge

Note: general guide with many variations

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Experimentation

“First I shall do some experiments before I proceed farther, because my intention is to cite experience first and then with reasoning show why such experience is bound to operate in such a way. And this is the true rule by which those who speculate about the effects of nature must proceed.”

Leonardo Da Vinci c. 1513

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Science Corrects Itself

Scientists test ideas by critically examining evidence

“One of the reasons for its success is that science has built-in, error correcting machinery at its very heart. Some may consider this an overbroad characterization, but to me every time we exercise self-criticism, every time we test our ideas against the outside world, we are doing science. When we are self indulgent and uncritical, when we confuse hopes and facts, we slide into pseudoscience.”

Carl Sagan

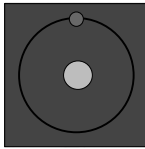
The Demon-Haunted World: Science as a Candle in the Dark

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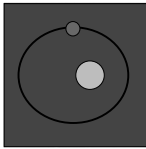
Ideas Are Modified

- Heliocentric model of the solar system



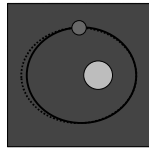
Nicolaus Copernicus
(1479-1543)

Circular orbit



Sir Isaac Newton
(1643-1727)

Elliptical orbit



Milutin Milankovich
(1879-1958)

Eccentric variation

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Uncertainty in Science

- Science cannot provide 100% certainty
- Uncertainty is inherent in science, e.g. variability in nature, measurement error

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Theory

- In everyday usage
 - A guess, hypothesis, prediction, notion, belief
- In science
 - A grand scheme that relates and explains many observations supported by great deal of evidence, e.g. evolution through natural selection, theory of general relativity

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The limitations of science

- is science value-neutral? Is it unbiased?
- do the answers we get depend on the questions we ask?
- can science explain everything?
- what drives scientific research?

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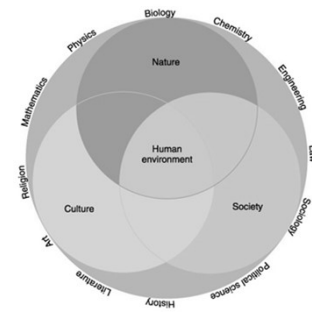
What is “Environmental” Science

- Environment – circumstances & conditions that surround an organism or groups of organisms
- Science – derived from “knowing” in Latin, process for producing knowledge
- Study of how the natural world works, how our environment affects us, and how we affect our environment

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Environmental Science as an Interdisciplinary Pursuit



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Challenges of Env Science

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However...

- Action on environmental issues must begin with examination of relevant scientific information
- Vital to ensure recognition of a problem
- Promotes critical thinking which involves questioning and synthesizing information to achieve better understanding

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Summary

- disciplinary contributions?
- disciplinary approach?
- What questions does it ask?

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Thursday Environmental Ethics

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