

5/11/01  
Rue Nat Sci

This year we integrated our ESSE survey-level effort into the "Foundations of Natural Sciences" course that is required of all non-science or non-engineering students. This dilutes the subject matter somewhat with physics, astronomy and other subjects mixed into the curriculum, but the student contact is greatly increased. Fall 182 students and Spring 225. During the fall semester of the survey-level, natural-science course all students were required to complete a term research project; many of these were related to the Earth System Science subjects in the course.

Tracking the Weather Forecasts in a Local Newspaper and Comparing Forecasts with Actual Weather

Exploring Soil for Ph, Water Content, Organic Matter

Estimating the Total Leaf Surface Area for Trees

Many of the students completed STELLA models for their research projects.

Global Population Dynamics (many variations of this)

Global Energy-Balance Climate Model

Dynamics of the Criminal Population in Texas and the Texas Prison System

The text that follows is from a handout to the survey-level students suggesting appropriate research projects.

### **Suggestions for Natural Science 101 Research Projects**

Checking the forecasts. The Houston Post weather page gives yesterdays actual recorded weather (Tmax, Tmin, & precipitation), and it gives forecasts for 5 days starting with 3P today. Therefore, for each day we can get its 5-day, 4-day, ..... 1-day forecast for comparison with the actual recorded weather by collecting the weather forecasts over several months. How good is the 1-day forecast? How good is the 5-day forecast? Etc.

Observe sunrise or sundown from the same place regularly for several months and record the time and the position on the horizon relative to fixed objects on the horizon.

Quantifying workouts. Chose several workout devices or procedures for which the energy (in SI units) can be calculated for a complete cycle (eg. the potential energy used in lifting a weight set or running up stairs). Then compute the average power expended over a given time or specified number of cycles or to a certain level of fatigue. Compare upper body power capacity with lower body power capacity. Does power capacity change during the day? Do regular workouts improve power capacity? How much. Everything in SI units with rough error estimates.

Hearing range and sensitivity. Using a high quality amplifier and earphone system, an audio signal generator, and a precision high impedance voltmeter, test the frequency range and sensitivity of several of your friends.

Build computer models using STELLA (special tutorials will be provided) for one of the following:

1. Global population models with various assumptions regarding future birth and death rates. Can the global population be stabilized?
2. Compare population models of the industrialized nations with the non-industrialized nations.
3. Use population models of the United States and Mexico coupled with economics to forecast

Students, teachers and scientists working to understand the Earth System. Contains links to useful resources, as well as curriculum plans and student projects. Includes several useful WWW hotlists:

[Ozone Hotlist](#)

[Biosphere Hotlist](#)

[Hydrology Hotlist](#)

[Allegheny College's Project on Teaching Global Environmental Politics](#)

A list containing syllabi and other course materials that were initially posted to the "teaching global environmental politics" email list.

[Consortium for International Earth Science Information Network](#)

CIESIN is "an organization dedicated to making information available to a wide range of users--researchers, policy makers, and the general public."

[Penn State University's Interactive Multimedia Educational Resources](#)

"This site has been established to provide access to a series of interactive multimedia educational resources for teaching introductory earth science."

[Penn State University's Pointers to Earth System Science Educational Resources](#)

"Over 140 sources of lesson plans, images, virtual museums, and raw data."

## **Activist Groups**

[Brown University's Blueprint for a Green Campus](#)

A Directory of 1700 environmental contacts at 750 campuses. Great resource for student groups wishing to see what other like-minded individuals are doing around the country.

[Rain Forest Action Network](#)

The award-winning home page of an activist organization that "works to protect the Earth's rainforests and support the rights of their inhabitants through education, grassroots organizing, and non-violent direct action."

## **Commercial Groups**

[Environmental Industry Web Site](#)

This site provides information about companies which provide environmental services and products, companies which provide services and products to the environmental industry, opportunities for environmentally oriented businesses, and resources for the environmental industry as a whole.

[Voyage Publishing](#)

This is a listing of summaries of articles from 500 publications on environmental topics. You click on the "chapter" headings to get titles that you can call up the summary. It is clearly stated that "All sources are properly referenced." There doesn't seem to be a search engine.



future immigration pressures.

4. Create a computer model of the global stratospheric ozone chemistry.
5. Create a computer model of the global hydrological cycle.
6. Create a computer model of the global carbon cycle.
7. Create a computer model of the global energy balance.
8. Create a predator-prey model and explore the limits of its behavior.
9. To continue.....

#### **Additional Suggestions for Natural Science 101 Research Projects**

Using a small telescope observe the phases of Venus for several months recording the time and estimating the angular distance to the Sun. Make drawings of the phase or shape of Venus and the relationship of the shape to the direction toward the Sun. Use this information to construct drawings of the orbital position of Venus and the Earth.

What's in a cubic foot of soil? Very carefully dig a hole 1'x1'x1' using archeological techniques (eg. trowel and brush no shovels). Proceed in levels 3" thick placing the contents of each layer in a separate plastic bag; label the bags. Determine the mass and density of the soil in each level. Dry the soil and mass again; how much water was in each level? What is the Ph of each level? Examine the soil carefully; what else do you find besides the dirt.

What is the leaf surface area of a mature tree? Identify a large, healthy, isolated tree on campus. Using appropriate technology (photography, surveying, direct measurements) determine the volume of the tree containing leaves. Remove a small branch (you may need the assistance of physical plant for this task). Determine the effective volume of the branch. Measure the surface area of all of the leaves on the branch. There are experts on campus who can advise you on this project.

Using the protected area on the west side of campus known as the Biology Department Prairie, make a detailed inventory of all of the plants found in a well defined area. Check the plants several times during the fall season and record the impact of the seasonal change on the plant population.

## ACKNOWLEDGEMENTS

Grateful acknowledgement is made to the following publishers and authors for permission to reprint material copyrighted or controlled by them:

- "Population, Resources, Environmental Degradation, and Pollution." From LIVING IN THE ENVIRONMENT 7/E by G. Tyler Miller, Jr. (C) 1992 by Wadsworth, Inc. Reprinted by permission.
- "Violence Against Women; Violence Against Nature" by Holly Duncan and Holly Pruett, pp.1, 10-12, vol. 3, no.1, January 1992. (C) 1992 Natural Resources Law Institute, Lewis and Clark Law School.
- "Rating Colleges" by David W. Orr from CONSERVATION BIOLOGY, p. 138-140, Vol. 5, No. 2, June 1991. Reprinted by permission of the Society for Conservation Biology and Blackwell Scientific Publications, Inc. via the Copyright Clearance Center.
- "An Oral Exam for the New Liberal Arts Graduate" by John Agresto from Wall Street Journal, April 23, 1991. Reprinted by permission of THE WALL STREET JOURNAL. (C) 1991 Dow Jones & Company, Inc. All Rights Reserved.
- "Challenge of Sustainability" by David W. Orr, pp.38-40, from Phytopathology, vol.83, no.1. (C) 1993 American Phytopathological Society."
- Risk Assessment and Comparisons: An Introduction," by Richard Wilson and E.A.C. Crouch from SCIENCE magazine. vol.248,no.2,pp.267-270, April 17, 1987, (C) AAAS.
- "Perception of Risk," by Paul Slovic from SCIENCE magazine, vol. 236, p.280-285. April 17, 1987. (C)AAAS.
- "Hazard versus Outrage in the Public Perception of Risk," by Peter Sandman from EFFECTIVE RISK COMMUNICATION edited by Vincent T. Covello, et. al., p.45-49, (C) Plenum Press.
- "Solid Waste and Hazardous Wastes." From LIVING IN THE ENVIRONMENT 4/E by G. Tyler Miller, Jr. (C) 1985 by Wadsworth. Inc. Reprinted by permission.
- "Municipal Waste: Should Recycling Be Promoted as the Key to Refuse Management?." from Taking Sides: Clashing Views on Controversial Environmental Issues. Fifth Edition.(ISBN 1-56134-125-8), edited by Theodore D. Goldfarb. Copyright(C) 1993 by The Dushkin Publishing Group, Inc., Guilford, CT 06437. Reprinted by permission. Taking Sides(R) is a registered trademark of The Dushkin Publishing Group, Inc.
- "Recycled but not Used." Daniel Lazare, The Amicus Journal, Fall 1991. (C) 1991 by the Amicus Journal.
- "Talking Trash." Virginia I. Postrel and Lynn Scarlett, Reason, August/September 1991. (C) 1991 by the Reason Foundation. 3415 S. Sepulveda Blvd., Suite 400, Los Angeles, CA 90034.
- Paper Versus Polystyrene: A Complex Choice" by Martin B. Hocking from SCIENCE magazine. vol. 251, p.504-505, February 1, 1991. (C) AAAS.
- "Changing Climate" by Stephen M. Schneider. Reprinted with permission. Copyright (c) 1989 by Scientific American. Inc. All rights reserved.

Other relevant courses: (this section is year)

Dept. of Environmental Science and Engineering

- 201 Intro. to Environmental Systems - Ward
- 401 Intro. to Environmental Chemistry - Tomson
- 403 Natural Environmental Factors - Blackburn
- 406 Intro. to Environmental Law - Blackburn
- 412 Hydrology and Watershed Analysis - Bedford

Dept. of Ecology and Evolutionary Biology

- 325 Ecosystem Biology - Heronabe

Dept. of Biology and Geophysics

- 101 The Earth - Dunbar et al.
- 341 The Oceans - Draxler et al.
- 522 The Carbon Cycle & Climate Change - Dunbar

RICE

