

# Ecology, Development, & Sustainability

## Environmental Science Lab Manual, Instructor Edition

### Third Edition

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ECOLOGY, DEVELOPMENT, & SUSTAINABILITY

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\* All these activities can be adapted for online use because they only involve a computer. I do not recommend assigning movies or documentaries online because it deprives students of the social experience of watching movies together.

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## **About the Author**

Antonio Chaves graduated from the University of Maryland in 1982 with a B.S. in fish and wildlife. After serving two years in the Peace Corps, he stayed in Ecuador to work in the shrimp-farming industry. Eventually, he made his way back to college and earned a Ph.D. in zoology at Texas A&M University in 1999. Dr. Chaves currently teaches biology, chemistry, and environmental science in the Washington D.C. area, and uses his spare time to write articles on science and policy.

**Introduction:**

The third edition contains seven new activities that involve watching videos, reading articles, or gathering data from online sources. Website navigation instructions for all the pre-existing activities that involved online research were also updated to keep up with ongoing re-arrangement of links and pages in the World Health Organization, Center for Disease Control, and Department of Energy. For all other activities involving images, text was re-organized and images were resized to cut back on the number of pages instructors need to photocopy. I also re-worked questions at the end of each lab for clarity and added more questions to some labs so as to standardize the time students spend answering questions. Lastly, I included a checklist at the end of every lab to address the problem of students turning in assignments that are incomplete.

Hands-on activities in Sections 1, 2, and 3 were also roughly re-arranged in order of increasing difficulty so that the more “doable” labs (easier for teachers to set up and execute) are listed earlier in their respective sections. This categorization does not apply to Section 4 because all these activities only require a computer with internet access.

To facilitate balance, the manual is organized into four sections related to the title; the Natural Environment (Ecology), Pollution Mitigation (Sustainability). Energy (Sustainability) and Quality of Life (Development).

Most lab manuals contain between 30 and 40 labs and activities. This one officially contains 28, but some activities can require more than one class meeting if you involve students in the set-up (1.1), choose to evaluate more samples (1.1 and 1.3), or involve students in the generation of spreadsheets from scratch (1.6 and 4.2).

**For Instructors:**

The lab manual contains more than enough activities to satisfy the lab requirement for a semester college course that incorporates one 3-hour lab per week. Below are the 12 labs that I used for the 15-week course I taught at a community college:

<b>Week</b>	<b>Activity</b>
1	1.2) Physical Conditions and Dissolved Oxygen
2	1.4) Interpreting Water Quality Data from the US Geological Survey
3	1.3) Water Sample Analysis*
4	1.6) Carbon Cycling Between Fish and Producers
5	1.1) Evaluating Soil Texture
6	4.1) Quantifying Urban Sprawl
7	3.2) Transportation Energy
8	3.3) Batteries and Biofuels
9	3.1) Energy Measurement
10	4.3) Worldwide Risk Factors and Health Outcomes
11	4.2) Development and Quality of Life
12	4.6) Movie: <i>Contagion</i>

\*Arrange your schedule to do this during the warmer months for best results.

The following activities are suitable only as home projects or for classes that meet five days a week:

Week	Activity
?	1.7) Diurnal and Seasonal Pond Dynamics
?	1.8) The Population Dynamics of <i>Paramecia</i>
?	1.9) Feed Conversion in Mealworms
?	2.4) The Nitrogen and Phosphorus Cycles

The following activities are suitable only for honor students:

Week	Activity
?	2.5) The Chemistry of Flue Gas Desulfurization
?	3.5) Fuel Cell Dynamics

**A Note on Equipment:** Even though product guidelines can be found at the end of each lab description in the "Instructor's Guide" section, it should be noted that the two items you will need the most (but may not already have) are an oxygen meter and a DC wattmeter. Watt-hours can be roughly estimated with a multimeter and a stopwatch, but setting up a DC wattmeter is far easier than setting up a multimeter to measure amps. Please refer to the "Instructor's Guide" sections for more complete information on these items.