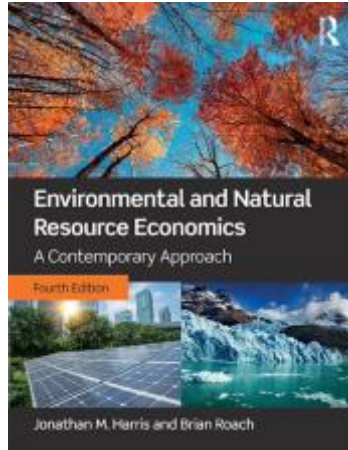


# **Environmental and Natural Resource Economics: A Contemporary Approach**

by Jonathan M. Harris and Brian Roach



This text introduces the student to the expanding field of ecological economics. It balances coverage of standard environmental economics topics with a global perspective on current ecological issues such as population growth, global climate change, "green" national income accounting, and the relationship between trade and the environment.

**Learn more by visiting**  
[www.gdae.org/environ-econ](http://www.gdae.org/environ-econ)

## Chapter 1: Changing Perspectives on the Environment

1. The text refers to the Global Environment Outlook 5 report:

<http://www.unep.org/geo/assessments/global-assessments/global-environment-outlook-5>

Download Chapter 1 of the report dealing with “Drivers” of environmental trends. This gives an overview of trends in population growth, economic development, energy use, and resource demands. What do you think are the most important environmental threats facing humanity? Does the report offer a basis for hope that these threats can be successfully controlled or reversed? What kinds of policies are most relevant in responding to environmental challenges?

2. Environmental information for different U.S. states can be found by going to the state web address such as [www.mass.gov/](http://www.mass.gov/) (Massachusetts), [www.ca.gov/](http://www.ca.gov/) (California), or [www.ny.gov/](http://www.ny.gov/) (New York). You can then locate the state agency that deals with environmental quality, normally called something like the “department of environmental quality” or “department of environmental conservation.” Identify some major environmental issues in your state and see what measures are being taken to respond to them. Reviews for other countries can be found at <http://www.oecd.org/env/country-reviews/> and reports specifically on climate change issues at <http://newsroom.unfccc.int/climate-action/>

## Chapter 2: Resources, Environment, and Economic Development

1. In 2002 the authors of the original Limits to Growth model published *Limits to Growth: The 30-Year Update*. A synopsis of it is available at:

<http://donellameadows.org/archives/a-synopsis-limits-to-growth-the-30-year-update/>

Browse through the synopsis including the last sections on “Transitions to a Sustainable World” and “The Sustainable Society”. Briefly discuss whether you think these views on sustainability are similar to, or different from, the discussion of sustainability in Chapter 2 of the text. Also, do you believe that the world is headed towards a “collapse” or “sustainable world” scenario? What kinds of policies might make the difference?

2. Download the chapter “Achieving Economic Growth and Reducing Environmental Pressures” from the book *Cents and Sustainability: Securing Our Common Future by Decoupling Economic Growth from Environmental Pressures* (Smith, et al., 2010) at:

<http://www.naturaledgeproject.net/Documents/CentsandSustainability-Chapter2.pdf>

Define what is meant by relative and absolute decoupling (see page 32 of the chapter). Briefly summarize at least three examples of decoupling presented in the chapter.

## Chapter 3: The Theory of Environmental Externalities

1. Read through the 2009 report “A Green Tax Shift for Vermont,” available at:

<http://www.leg.state.vt.us/jfo/Tax%20Commission/Green%20Taxes%20-%20Flomenhoft%2012-2009.pdf>

Summarize what is meant by a “green tax shift”? What types of taxes do the report propose increasing, and what types does it propose decreasing? Based on the material in Chapter 3, would the green tax shift increase economic efficiency? Explain.

2. An introduction to the theory of environmental externalities is presented in the 1995 report “Electricity Generation and Environmental Externalities: Case Studies” by the U.S. Energy Information Administration. Read Chapter 2 of the report (pages 5-10) available at:

<http://www.psc.ky.gov/pscscf/2007%20cases/2007-00477/OCI%20Workpapers%20II/Environmental%20Externalities%20Case%20Studeis.pdf>

What does the report indicate is “the single most critical requirement” for a market to produce an outcome that maximizes social welfare? (see page 5 of the report.) Is this requirement likely to be met in the real world? Summarize at least one example of an externality presented in the report? What are some of the possible remedies to externalities discussed in the report? Finally, what are some of the externalities associated with electric power generation?

## Chapter 4: Common-Property Resources and Public Goods

1. The original article on the “Tragedy of the Commons” by Garrett Hardin , published in 1968, is available at

<http://dieoff.org/page95.htm>

Read the article and consider how well its arguments apply to global environmental problems today. Consider the implications of Hardin’s argument for theories of property rights and the appropriate role for governments or international agencies in protecting the global commons. What are the implications of the “tragedy of the commons” for approaching difficult current problems like global climate change?

2. Go to the website of the Global Policy Forum and look at some of the examples of global public goods at

<http://www.globalpolicy.org/social-and-economic-policy/global-public-goods-1-101.html>

What are some of the resources and environmental assets that can be considered to be global public goods? What do some of the articles on the site indicate about potential conflict between global public goods and private property?

## Chapter 5. Resource Allocation over Time

1. The U.S. Geological Survey has published a report on the historical prices of many metals in the United States over a 40-year period. The report is available at:

[http://minerals.usgs.gov/minerals/pubs/metal\\_prices/](http://minerals.usgs.gov/minerals/pubs/metal_prices/)

Summarize the historical price trends (in constant dollars) for aluminum, copper, iron ore, mercury, and silicon. Would you conclude that the price of these non-renewable resources has increased or decreased over time? Do your findings support or refute Hotelling's rule? Explain. What factors may affect the prices of these resources?

2. Read the paper "Three General Policies to Achieve Sustainability" by Robert Costanza. It is available at:

<http://dieoff.org/page87.htm>

What are the three environmental policies advocated by Costanza? Summarize how a natural capital depletion (NCD) tax would work. Why does Costanza suggest that a NCD tax should be welcomed by both technological optimists and skeptics? What are environmental assurance bonds? How could environmental assurance bonds help to deal with the uncertainties of estimating environmental externalities?

## Chapter 6: Valuing the Environment

1. Read through the report titled “Ecosystem Services: Benefits Supplied to Human Societies by Natural Ecosystems” published by the Ecological Society of America at:

<https://www.esa.org/esa/wp-content/uploads/2013/03/issue2.pdf>

Summarize the various ecosystem services that benefit humans. What are some of the threats to ecosystem services? What does the report state on the value of ecosystem services to humans?

2. As noted in the text, there have been hundreds of contingent valuation studies conducted over the past several decades. Use your college or university’s online library resources to locate an academic journal article about a contingent valuation study, published in the last 5 years (and not included in Table 6.2). Summarize the article, including the following points:
  - What resource was valued?
  - What economic value(s) is/are obtained in the study?
  - Did the study follow the recommendations of the NOAA panel?
  - Can you identify any potential biases in the study?

## Chapter 7: Cost-Benefit Analysis

1. The U.S. Office of Management and Budget publishes the real and nominal discount rates to be used by federal agencies when evaluating projects using CBA or cost-effectiveness analysis. These rates are normally updated annually. Search the web to locate the current real and nominal rates recommended by the OMB for 30-year projects. Based on your reading of the textbook, do you think these rates are appropriate for evaluating environmental costs and benefits? Why or why not?
2. Search the web to locate a recent cost-benefit analysis of an environmental issue, either by a government agency, interest group, or academic source. Some examples include:

Biofuels: <http://www.hcs.harvard.edu/~res/2014/05/a-cost-and-benefit-case-study-analysis-of-biofuels-systems/>

Wind energy: <http://www.sciencedirect.com/science/article/pii/S0960148108004217>

Electric vehicles:

[http://cjbradley.com/sites/default/files/MA\\_PEV\\_CB\\_Analysis\\_FINAL\\_17nov16.pdf](http://cjbradley.com/sites/default/files/MA_PEV_CB_Analysis_FINAL_17nov16.pdf)

Summarize the methodology and results of the study, including:

- What is the project/regulation being analyzed?
- What discount rate(s) is/are used in the study?
- Can you think of any important costs or benefits that were excluded in the analysis?
- Does the study use any of the valuation methods discussed in Chapter 6 to obtain estimates?
- Does the study rely upon benefit transfer?
- Does the study include any sensitivity analysis?



## Chapter 8: Pollution: Analysis and Policy

1. Download the 2012 EPA report titled “Our Nation’s Air: Status and Trends through 2015,” available at:

<https://gispub.epa.gov/air/trendsreport/2016/>

Summarize the main points of the report, including the changes in emissions levels for common (or “criteria”) and toxic air pollutants? For which pollutants has the most progress been made in reducing air pollution? Where is further progress needed? If you are living in the United States, how would you describe air quality in your area based on this report?

2. Download the 2011 OECD brief “Taxation, Innovation and the Environment,” available at:

<http://www.oecd.org/dataoecd/24/25/48178034.pdf>

Summarize the various benefits of environmental taxation discussed in the brief. Then discuss the recommendations in the brief regarding the design of policy instruments.

## Chapter 9: Ecological Economics - Basic Concepts

1. Go to the website on the precautionary principle at:

<http://www.sehn.org/ppfaqs.html>

Summarize the “Wingspread” statement on the precautionary principle. What are the basic principles of precautionary action? When can the precautionary principle be useful for decision-making?

2. Read an excerpt of Kenneth Boulding's famous article “The Economics of the Coming Spaceship Earth,” discussing the implications of a finite earth at:

<http://dieoff.org/page160.htm>

Discuss Boulding's conclusions regarding the perception of the earth as a space ship. What is his moral?

## Chapter 10: National Income and Environmental Accounting

1. Read through the 2006 paper “The Genuine Progress Indicator 2006: A Tool for Sustainable Development,” available at:

[http://ase.tufts.edu/gdae/genuine\\_progress\\_indicator\\_2006.pdf](http://ase.tufts.edu/gdae/genuine_progress_indicator_2006.pdf)

Summarize the limitations of GDP discussed in the paper. Briefly summarize how the Genuine Progress Indicator (GPI) is calculated. What have been the trends in the GPI in the United States over the past 50 years? Discuss why the growth of GDP may not always equal progress.

2. Go to the OECD’s Better Life Index website at:

<http://www.oecdbetterlifeindex.org/>

What are the top five countries if all 11 dimensions are weighted equally? Then, use the site to assign your own weights to the different dimensions. What dimensions do you rank the highest, and why? Then, what are the top five countries after you’ve assigned weights. Can you provide explanations for why the rankings of particular countries changed based on your weights?

## **Chapter 11: Energy - The Great Transition**

1. Search the web for an estimate of current global oil reserves. Potential sources include (among others) the U.S. Energy Information Administration, the CIA's World Factbook, and the oil company BP. Next, locate the most recent estimate of annual global oil consumption. Calculate how long global reserves will last if global oil consumption remains constant. Be careful about the units to be sure you are making a direct comparison of the two values.
2. Search the web for the most recent data on the global consumption of energy by source, published by the International Energy Agency. Use the data to prepare an updated version of Figure 11.1 from the text (using Excel or a similar program). How has the global energy mix changed since the 2013 data published in the text? Do you find reason for optimism or pessimism based on the new data?

## Chapter 12: Global Climate Change: Science and Economics

1. The effects of future climate change will vary in different parts of the United States. The Union of Concerned Scientists website contains information for different U.S. regions:

[http://www.ucsusa.org/global\\_warming#.WYCjVk0m6JA](http://www.ucsusa.org/global_warming#.WYCjVk0m6JA)

(Scroll down for regional impacts and policies). Summarize the potential impacts of global climate change in your region. Do you think state-level policies should be taken to reduce carbon emissions? What is the major problem with state-level policies? What do you think is the most appropriate level (state, region, nation, global) for responding to global climate change? Why?

2. Read through the Executive Summary of the “Stern Review on the Economics of Climate Change,” available at:

[http://webarchive.nationalarchives.gov.uk/+http://www.hm-treasury.gov.uk/d/Executive\\_Summary.pdf](http://webarchive.nationalarchives.gov.uk/+http://www.hm-treasury.gov.uk/d/Executive_Summary.pdf)

Summarize the report’s conclusions regarding the economic analysis of the costs and benefits associated with climate change. What are some of the impacts of climate change mentioned in the report? What are the three essential elements of policies to reduce greenhouse gas emissions?

## Chapter 13: Global Climate Change: Policy Responses

1. Review the official summary of the Paris climate agreement, available at:

<https://www.c2es.org/docUploads/cop-21-paris-summary-02-2016-final.pdf>

What are the main goals and mechanisms of the Paris agreement? How do you think these will be affected by the withdrawal of the United States under the Trump Administration from the agreement? Consider possible responses by other countries, U.S. states and regions, corporations, and non-governmental organizations.

2. A game has been created based on the climate stabilization wedges concept. The objective is to come up with a plan for stabilizing the global emissions of carbon by choosing eight wedges. The web page for the game is available at:

<http://cmi.princeton.edu/wedges/game.php>

Download the “Teacher’s Guide” for instructions on how to play the game. Either on your own or with a team, come up with your carbon mitigation strategy and prepare a “Wedge Worksheet.” Explain your choice of mitigation approaches. What do you think are the main challenges to implementing each of your wedges?

## Chapter 14: Greening the Economy

1. Go to the United Nations Environment Programme's "Country Profiles" describing efforts by various countries to achieve a greener economy, at:

<http://www.unep.org/greeneconomy/country-profiles>

Pick one country from the list that interests you, and summarize the steps that country is taking to green its economy. How much of an impact do you think these steps will have? Do you see any potential problems with their efforts?

2. (Note: Requires Excel skills.) Prepare your own Environmental Kuznets Curve for particulate matter, using data from the World Bank's World Development Indicators databank, available at:

<http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators>

You will need to make selections for "Country," "Series," and "Time." Select all countries, but not the "Aggregates." For "Series," you will need data on GDP per capita (use PPP data in current international dollars) and particulate matter concentrations (coded as PM10, in micrograms per cubic meter). For "Time," choose a recent year which provides data for most countries – you'll probably need to go back a years from now. Then download the data into an Excel file. Organize the data into an appropriate format to create a scatter plot—this will require some sorting and editing. Finally, present your graph and discuss whether the results are consistent with the EKC hypothesis.

## Chapter 15: Population and the Environment

1. The United Nations has produced population projections for 2050 and 2100 (“World Population Prospects” The 2015 Revision). Population projections are summarized at:

<https://www.un.org/development/desa/publications/world-population-prospects-2015-revision.html>

What are the major projections for the world as a whole and for major countries? Which areas have the highest fertility and most rapid population growth? What major changes in age distribution are expected? What are the major factors that are likely to affect future population growth and its impacts?

2. Read the article by the American Statistical Association, “World population likely to surpass 11 billion in 2100; US population projected to grow by 40%”:

[http://www.un.org/esa/population/publications/wpp2009/Publication\\_govtviewpolicy.pdf](http://www.un.org/esa/population/publications/wpp2009/Publication_govtviewpolicy.pdf)

Do you think these population growth projections are inevitable? What factors could possibly lead to lower total population growth? What are the likely economic impacts of higher and lower population projections? Consider the “alternative scenario” presented in Figure 15.5 in the text and the final section in Chapter 15 on “Population Policies for the Twenty-First Century”.



## Chapter 16: Agriculture, Food, and Environment

1. Look at the executive summary of the UN Food and Agriculture Organization (FAO) report on the current world food outlook, available at:

[http://www.agri-outlook.org/Outlook\\_flyer\\_EN\\_7July2017\\_WEB.pdf](http://www.agri-outlook.org/Outlook_flyer_EN_7July2017_WEB.pdf)

(full report at <http://www.agri-outlook.org/>)

What does this indicate about the prospects for demand, production, and food prices in the next decade? In which areas is demand expected to increase significantly? What will be the sources of increases in supply? What resource and environmental issues are mentioned in the focus section on Southeast Asia?

2. Go to the FAO's conservation agriculture website at:

<http://www.fao.org/ag/ca/>

Summarize how farmers practice conservation agriculture. What are the advantages of conservation agriculture over industrial farming? What are the disadvantages?

## Chapter 17: Resources - Scarcity and Abundance

1. Go to the U.S. Geological Survey's Minerals Information historical statistics site at

<https://minerals.usgs.gov/minerals/pubs/historical-statistics/>

Look up the recent price trends for various minerals other than those cited in the text's Figure 17.4 (copper, lead, and zinc). Try, for example, aluminum, nickel, and tin. What are the price trends for these minerals since 2000? (Look at the columns headed "unit value" and "unit value in 1998 dollars".) What do you think this indicates about supply and demand for nonrenewable resources?

2. The text mentions the Green Dot recycling program, initiated in Germany, as an example of a policy that increases manufacturer "take back" responsibility. Search the web for at least two stories from the last few years about the Green Dot program. Do these stories indicate that the program has been successful? What, if any, recommendations are made for improving the program.

## Chapter 18: Renewable Resource Use - Fisheries

1. Download Part 1 (World Review of Fisheries and Aquaculture) of the FAO's 2012 report "The State of World Fisheries and Aquaculture," available at:

<http://www.fao.org/docrep/016/i2727e/i2727e01.pdf>

Go to the section of "The Status of Fishery Resources" starting on page 52. What are the trends in the percentage of global fisheries classified as "underexploited," "fully exploited," and "overexploited"? Briefly discuss which regions of the world and which fisheries are the biggest concerns.

2. The National Marine Fisheries Service maintains annual statistics on commercial fishery catch and values. Go to:

<http://www.st.nmfs.noaa.gov/commercial-fisheries/index>

And select "Commercial Landings, annual". Look up some species by name: for example COD, ATLANTIC or TUNA, YELLOWFIN. Query the data base to determine the trends in the physical catch of these three species over the past 50 years. (You can find other species by common name and the refine your search to focus on a single area or subspecies). Summarize these trends. Do you think any of these species are currently being harvested at sustainable rates? Explain.

## Chapter 19: Ecosystem Management: Forests

1. Read through the 2004 Congressional Research Service report titled “Below-Cost Timber Sales: Overview”. It is available at:

<http://research.policyarchive.org/2130.pdf>

What is a below-cost timber sale? Why do below-cost timber sales occur? What could be done to reduce below-cost timber sales? Finally, what do you think should be done, if anything, about below-cost timber sales?

2. The Food and Agriculture Organization’s report *State of the World’s Forests 2016* is available at

<http://www.fao.org/publications/sofo/2016/en/>

with a brief version at

<http://www.fao.org/3/a-i5850e.pdf>

Look over the brief version, or for more detail consult the full report. What picture does the report present of the state of world forests? How does the situation vary by major region? How do the problems and policy issue vary by region? What are the prospects for sustainable forestry and protecting the world’s remaining primary forests?

## Chapter 20: Water Economics and Policy

1. Download the Executive Summary of the 2012 “UN World Water Development Report 4: Managing Water under Uncertainty and Risk,” available at:

<http://www.unesco.org/new/en/natural-sciences/environment/water/wwap/wwdr/wwdr4-2012/wwdr4-executive-summary/>

Read through Chapter 2 (“Water demand: What drives consumption?”) and Chapter 10 (“Unvalued water leads to an uncertain future”) of the Executive Summary. Summarize the challenges of meeting water demands for various needs: agriculture, energy, industry, human settlements, and ecosystems. Then summarize how economics can be used to meet these challenges. Based on this report, as well as material from the text chapter, what policy responses do you feel are necessary to promote more sustainable management of global water supplies?

2. Download the 2007 report “Managing Water Demand: Price vs. Non-Price Conservation Programs,” available at:

<https://scholar.harvard.edu/stavins/publications/managing-water-demand-%E2%80%93-price-vs-non-price-conservation-programs>

Read through the Executive Summary of the report and summarize the advantages and disadvantages of price and non-price options for reducing water demand. If you were a water manager in your area, which policies do you think would be most effective in reducing water demands?

## Chapter 21: World Trade and the Environment

1. Go to the following World Trade Organization web page on trade and environment issues:

[http://www.wto.org/english/tratop\\_e/envir\\_e/envt\\_intro\\_e.htm](http://www.wto.org/english/tratop_e/envir_e/envt_intro_e.htm)

Do you think the WTO structure and rules are adequate to deal with environmental issues related to trade? The web page asserts that “the aims of upholding and safeguarding an open and non-discriminatory multilateral trading system, on the one hand, and acting for the protection of the environment and the promotion of sustainable development, on the other, can and must be mutually supportive.” Do you think that the implementation of the WTO rules and its dispute settlement process bear this out? (See, for example, the US Shrimp/turtle case linked from this page).

Download the Handbook on Trade and Green Economy produced by the International Institute for Sustainable Development and the United Nations Environmental Programme:

<http://www.iisd.org/sites/default/files/publications/trade-green-economy-handbook-third-edition-en.pdf>

Look at Section 2.3 on Multilateral Environmental Agreements including the box on “Trade-Related Provisions in MEAs” (page 23). When is it appropriate to restrict or ban trade in certain products? Are there other ways in which MEAs may come into conflict with trade agreements, and how can these conflicts be resolved?

Also look at Box 5.4 on eco-labelling on page 77. What do you think is the potential for eco-labelling as a voluntary approach to trade and environment issues?

## Chapter 22: Institutions and Policies for Sustainable Development

1. Go to the website of the Global Environmental Facility

[http://www.thegef.org/gef/gef\\_projects\\_funding](http://www.thegef.org/gef/gef_projects_funding)

Look up GEF projects in a developing country that you are familiar with, or interested in. What environmental areas are covered? Does this appear to be a productive way of promoting environmentally sustainable development? What do you think could be problems or limitations of this approach?

2. Read through the original Agenda 21, adopted by the Rio Conference on Environment and Development (the “Earth Summit”) in 1992 at:

<http://www.un.org/documents/ga/conf151/aconf15126-1annex1.htm>

And look over the document “The Future We Want” from the Rio + 20 conference in 2012:

<https://sustainabledevelopment.un.org/content/documents/733FutureWeWant.pdf>

Given the acknowledgment in the document that “since 1992 there have been areas of insufficient progress and setbacks in the integration of the three dimensions of sustainable development” (page 7), do you think that there has been progress in achieving sustainable development?

Then look at the United Nations Sustainable Development Goals adopted in 2015:

<http://www.un.org/sustainabledevelopment/sustainable-development-goals/>

Click on some of the goals to find evidence of progress and remaining challenges.