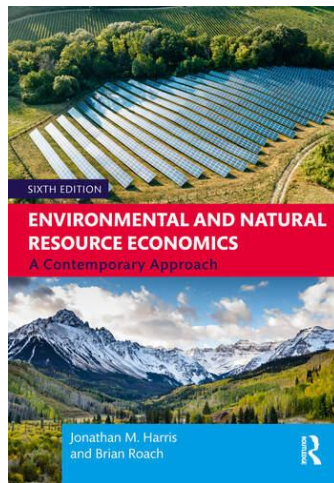


# **Environmental and Natural Resource Economics: A Contemporary Approach, 6<sup>th</sup> Edition**

**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**

**<https://sites.tufts.edu/gdae/environmental-and-natural-resource-economics/>**

# Chapter 1: Changing Perspectives on the Environment

1. The text refers to the Global Environment Outlook 6 report:

<https://www.unep.org/resources/global-environment-outlook-6>

Download the Summary for Policymakers and look at section 2.1 dealing with “Drivers of environmental change”. 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?

Also look at section 4 on “Changing the path we are on”. Does the report offer a basis for hope that major environmental threats can be successfully controlled or reversed? What kinds of policies are most relevant in responding to environmental challenges?

Global Environment Outlook 7 is due for publication in 2025. Check the website for updates:

<https://www.unep.org/geo/global-environment-outlook-7>

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/>

How well do you think the evaluations and projections in this report have held up? 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. Go to the website for the World Resource Institute

<https://www.wri.org>.

What are some of the most pressing global environmental issues? What do you think these issues imply for future economic growth and sustainable development?

## Chapter 3: The Theory of Environmental Externalities

1. The use of “green” taxes to respond to environmental externalities is relatively advanced in Scandinavia. See:

<https://www.climatechangenews.com/2021/08/16/green-taxation-can-help-us-recover-covid-19-crisis-heres/>

What are some of the advantages of the use of “green taxes in Scandinavian countries? Why do you think other countries have not adopt them so readily?

2. As briefly mentioned in the chapter, one potential critique against the broad imposition of environmental taxes is that such taxes tend to be regressive, impacting lower-income households (as a percentage of income) more than higher-income households. Read this 2025 article that addresses the relationship between green taxes and social justice:

<https://wedo.org/tax-justice-the-missing-element-on-the-road-to-belem/>

Summarize how green taxes can be used to promote social justice, rather than increase existing economic inequalities.

## 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

[https://www.garretthardinsociety.org/articles/art\\_tragedy\\_of\\_the\\_commons.html](https://www.garretthardinsociety.org/articles/art_tragedy_of_the_commons.html)

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 maintains historical data on prices for most common minerals at:

<https://www.usgs.gov/centers/national-minerals-information-center/historical-statistics-mineral-commodities-united>

Access the Excel data files for aluminum, copper, iron ore, mercury, and silicon. Looking at the historical price trends (in constant dollars) for these minerals, 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:

<https://jayhansonsdieoff.net/three-general-policies-to-achieve-sustainability-by-robert-costanza/>

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?

## 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. In 2025 the U.S. Office of Management and Budget indicated that federal agencies use a discount rate of 7% when evaluating government projects using cost-benefit analysis, see:

<https://www.floods.org/news-views/fema-news/fema-rolls-back-bca-rates-for-mitigation-projects/>

However, this article suggests the use of lower discount rates based on effects on consumption rather than on investment profitability.

<https://www.rff.org/publications/issue-briefs/discounting-for-public-benefit-cost-analysis/>

Briefly explain why the authors reject the use of a 7% discount rate?

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:

Air pollution standards:

<https://www.aeaweb.org/articles?id=10.1257/aer.20230761>

Climate change adaptation:

<https://academic.oup.com/jeea/article-abstract/23/5/1950/8090509>

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. Look at the current EPA data on air quality trends in the United States:

<https://www.epa.gov/air-trends/air-quality-national-summary>

Summarize the main trends, including the changes in emissions levels for common (or “criteria”) air pollutants. For which pollutants has the most progress been made in reducing air pollution? Where is further progress needed?

2. Download the 2020 OECD brief “Green Budgeting and Tax Policy Tools to Support a Green Recovery,” available at:

[https://www.oecd.org/en/publications/2020/10/green-budgeting-and-tax-policy-tools-to-support-a-green-recovery\\_c5842256.html](https://www.oecd.org/en/publications/2020/10/green-budgeting-and-tax-policy-tools-to-support-a-green-recovery_c5842256.html)

Summarize the various benefits of environmental budgeting and tax policy discussed in the brief. Then, discuss the recommendations in the brief regarding the design of policy instruments.

## Chapter 9: Ecological Economics - Basic Concepts

1. Read this brief by the International Institute for Sustainable Development on the precautionary principle:

<https://www.iisd.org/articles/deep-dive/precautionary-principle>

What are the basic principles of precautionary action? What are some examples of the use of the precautionary principle in policy making, and what are some criticisms of it?

2. Go to the website of the Ecological Footprint Network and review data for various countries.

<https://www.footprintnetwork.org/our-work/ecological-footprint/>

Which countries seem to have ecological footprints exceeding their biocapacities and which seem to have adequate or surplus biocapacity? Do you think this information is useful or could it be misleading in some ways?

## Chapter 10: National Income and Environmental Accounting

1. Go to the description of the Genuine Progress Indicator at:

<https://gnhusa.org/genuine-progress-indicator>

Summarize the limitations of GDP discussed on the website, and some of the alternatives presented there including GPI and others (Check “GPI Progress Highlights” and “Recent Posts”).

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

<https://www.oecd.org/en/data/tools/well-being-data-monitor/better-life-index.html>

What are the top five countries if all 11 dimensions are weighted equally? The bottom five? (Use the sort function) Try assigning your own weights to the different dimensions. How does this change the rank ordering? (Experiment with assigning a high value to “income and wealth”, which would make the measure more like standard GDP, and compare with assigning a high value to “environmental quality” and “civic engagement”).

## Chapter 11: Energy - The Great Transition

1. Review the most recent *International Energy Outlook* from the U.S. Energy Information Administration:

<https://www.eia.gov/outlooks/ieo/>

What does the report indicate about future consumption and production of energy? Based on the section in the text on “Energy Projections”, how do you think these projections should be evaluated?

2. Look at the Executive Summary of the 2025 *World Energy Outlook* published by the International Energy Agency:

<https://iea.blob.core.windows.net/assets/dfe5daf4-dbc1-4533-abe8-faf1faee0f9/WorldEnergyOutlook2025.pdf>

What are some of the most hopeful and the most problematical aspects of the global energy picture?

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

1. The Fifth National Climate Assessment by the U.S. Global Change Research Program contains information on risks, impacts, and responses to climate change :

<https://nca2018.globalchange.gov>

Look at Chapter 1: Overview. What are the main impacts of climate change for the United States, and what responses have been implemented? How are these likely to change in the future?

2. Read through the Summary for Policymakers of the Intergovernmental Panel on Climate Change Sixth Assessment Report:

<https://www.ipcc.ch/report/ar6/wg1/>

Summarize the report's conclusions regarding the current state of global climate change and possible future scenarios for emissions and climate impacts. According to the report, what is needed to reduce damages from future greenhouse gas emissions? (See section D: "Limiting Future Climate Change")

## Chapter 13: Global Climate Change: Policy Responses

1. Review a summary of outcomes of the 2025 international COP30 climate negotiations, available at:

<https://www.weforum.org/stories/2025/12/what-happened-cop30-whats-next/>

What are the main achievements claimed for COP30? What do you think was lacking in the agreement?

2. Go to the World Resources Institute's Climate page at:

<https://www.wri.org/initiatives/climate-watch>

At this site, users can “compare countries’ climate progress and commitments under the Paris Agreement, access the latest historical greenhouse gas emissions data, track net-zero targets and explore nationally determined contributions (NDCs) and long-term strategies to reduce GHG emissions.” Review the data for specific countries that you are interested in. How well or poorly are the countries doing in terms of reducing emissions (or, in the case of some developing countries, reducing the rate of growth of emissions)?

## Chapter 14: Greening the Economy

1. Go to the United Nations Environment Programme's web page on making economic transformations to support environmental sustainability:

<https://www.unep.org/topics/finance-and-economic-transformations>

Look for publications or initiatives that interest you and present a brief summary of that publication or initiative.

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 PM2.5, 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 few 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 2024 Revision). Population projections are summarized at:

<https://population.un.org/wpp/>

Look at the section on “Graphs/Profiles”:

<https://population.un.org/wpp/graphs?loc=900&type=Demographic%20Profiles&category=Line%20Charts>

What are the main trends for world population? What is the range of possibilities? What is happening with population growth rates and fertility rates? At what point is world population likely to peak? Also look at projections for different countries and major regions. (Compare, for example, Sub-Saharan Africa and China). What patterns stand out?

2. Go to the Population Reference Bureau website for more detailed data and projections, and articles on specific issues:

<https://www.prb.org>

Download the “World Population Data Sheet” for current information on a variety of population-related issues. What factors affect total population growth in regions such as Africa and Asia? What population and economic policy issues are associated with different patterns of fertility, population growth, urbanization, and population age profiles? How do the population prospects for 2050 differ for countries such as the United States, China, and India?

## 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:

[https://read.oecd-ilibrary.org/agriculture-and-food/oecd-fao-agricultural-outlook-2021-2030\\_e41f9e13-en#page1](https://read.oecd-ilibrary.org/agriculture-and-food/oecd-fao-agricultural-outlook-2021-2030_e41f9e13-en#page1)

(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? What regional and income differences in food demand are projected? What will be the contributions of yield and crop area expansion to increases in supply? What are the climate implications of future agricultural production and what policy changes are needed to reduce climate impacts?

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

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

What are the main principles of conservation agriculture? What are the advantages of conservation agriculture over industrial farming? What are some examples from case studies? What are some of the barriers to implementing conservation agriculture (see "Impact/Considerations")?

## Chapter 17: Nonrenewable Resources - Scarcity and Abundance

1. Go to the U.S. Geological Survey's Minerals Information Mineral Commodities Summaries for recent years:

<https://www.usgs.gov/centers/national-minerals-information-center/mineral-commodity-summaries>

Look up the recent price trends for various minerals other than those cited in the text's Figure 17.4 (copper, lead, zinc, and aluminum). Try, for example, lithium, nickel, and tin. What are the price trends for these minerals since 2015? (You'll need to collect data from Summaries for multiple years.) What do you think this indicates about supply and demand trends 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. A discussion of recycling in Germany can be found at:

<https://earth911.com/business-policy/recycling-in-germany/>

Compare this to the situation with recycling in the U.S., as described in an article by Columbia Climate School on recycling problems and solutions:

<https://news.climate.columbia.edu/2020/03/13/fix-recycling-america/>

## Chapter 18: Renewable Resource Use - Fisheries

1. Download the most recent FAO's report "The State of World Fisheries and Aquaculture," available at:

<https://www.fao.org/publications/fao-flagship-publications/the-state-of-world-fisheries-and-aquaculture/en>

Go to the section on "The Status of Fishery Resources". What are the trends in the percentage of global fisheries classified as "underfished," "maximally sustainably fished," and "overfished"? 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:

<https://www.fisheries.noaa.gov/national/sustainable-fisheries/commercial-fisheries-landings>

Using the searchable database on "Annual Commercial Landings Statistics", select a species of interest and determine the trend in the physical catch of this species in a selected region over the past 50 years. Try, for example, Atlantic Cod/New England. Summarize the trend. If proficient in Excel, prepare a time series graph.

## Chapter 19: Forests and Land Management

1. The organization American Forests provides extensive information about U.S. forest policy as well as existing and pending legislation related to forests:

<https://www.americanforests.org/our-programs/policy/#>

Browse their website to find recent information on such issues as reforestation, tree cover in urban areas, and the history of U.S. forest policy. What do you think are the most important and productive initiatives related to forest policy?

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

<https://www.fao.org/publications/fao-flagship-publications/the-state-of-the-worlds-forests/en>

Read the Executive Summary of the most recent report. What picture does the report present of the state of world forests?

## Chapter 20: Water Economics and Policy

1. Download the Executive Summary of the 2021 “UN World Water Development Report: Valuing Water,” available at:

<https://www.unesco.org/reports/wwdr/2021/en>

What different elements go into valuing water? Is this valuation a strictly economic one? To what extent can it be expressed in a market price? How can investment and funding for water, sanitation, and health services (WASH) be provided? Based on this report, as well as material from the text chapter, what policies, including water pricing and other systems for water provision and management do you feel are most effective?

You can also review the 2024 and 2025 UN Water Development Reports, focusing respectively on safe water and sanitation, and water stored in mountains and glaciers:

<https://www.unwater.org/publications/un-world-water-development-report-2024>  
<https://www.unwater.org/publications/un-world-water-development-report-2025>

2. Look at the website for the Water Footprint Network:

<https://waterfootprint.org/en/water-footprint/what-is-water-footprint/>

What are green, blue, and grey water footprints? Taking into account both direct and indirect water use, the patterns of water footprints can be surprising, with a large portion of the water footprints of some nations being external to their borders. What are the main factors determining water footprints? Use the personal water footprint calculator to see the main components of your own water footprint and how it compares to the global average:

<https://waterfootprint.org/en/resources/interactive-tools/personal-water-footprint-calculator/>

## Chapter 21: World Trade and the Environment

1. Review the World Trade Organization and Organization for Economic Cooperation and Development (OECD) web pages 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)

<https://www.oecd.org/trade/topics/trade-and-the-environment/>

Do you think the current international trade structure and rules are adequate to deal with environmental issues related to trade? The WTO 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?

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

<https://www.iisd.org/system/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

<https://www.thegef.org/>

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

<https://www.unep.org/resources/report/rio20-outcome-document-future-we-want>

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

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

and the current United Nations website on SDGs:

<https://sdgs.un.org>

Click on some of the goals to find evidence of progress, setbacks, and remaining challenges. Do you think there has been progress since 2012?