READINGS IN THE FIELD
OF
NATURAL RESOURCE & ENVIRONMENTAL ECONOMICS

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This is the latest version of a document periodically produced since the early 1980’s. It combines an outline of the field of natural resource and environmental economics with a bibliography of 945 references. In the past, this reading list has been used in a variety of ways: as a guide to the literature for graduate students in departments of economics which do not offer a Ph.D.-level survey course of the field; as a resource for Ph.D. students who wish to develop a directed readings course in the field; and as an aid to students at the masters and undergraduate levels who wish to explore selected areas in greater depth.

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We welcome suggestions of ways to improve this document, including additions and other changes to the outline and reading list. Please send your suggestions to Rob Stavins at the John F. Kennedy School of Government, Harvard University, 79 John F. Kennedy Street, Cambridge, Massachusetts 02138; phone 617-495-1820; fax 617-496-3783; e-mail: robert_stavins@harvard.edu.

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• Krautkraemer 1998
• Hanley, Shogren, and White 1997
• Neher 1990, Ch. 4
• Hartwick 1989, Ch. 1-5
• Conrad and Clark 1987, Ch. 3, pp. 117-145
• Neary and van Wijnbergen 1986
• Johansson and Lofgren 1985, Ch. 2, 3
• Fisher 1981, Ch. 2
• Dasgupta and Heal 1979, Ch. 6-10
• Peterson and Fisher 1977
• Weinstein and Zeckhauser 1975

b. Single-Owner Private Production (or Public Management)

(1) Overview

• Dasgupta and Heal 1979, Ch. 6-8
• Stiglitz 1979
• Schulze 1974
• Solow, R.M. 1974a
• Vousden, N. 1973
• Cummings, R.G. 1969
• Herfindahl, O.C. 1967
• Gordon, R.L. 1967
• Gray, L.C. 1914

(2) The Hotelling Rule

(a) Theory

• Caputo, M.R. 1990b
• Caputo, M.R. 1990a
• Devarajan and Fisher 1981
• Levhari and Liviatan 1977
• Solow 1974a
• Hotelling 1931

(b) Effects of Uncertainty

• Harris and Vickers 1995
• Gaudet and Howitt 1989
• Brannan and Schwartz 1985
• Pindyck 1980
• Dasgupta and Heal 1979, Ch. 13-14
• Heal 1979
• Dasgupta and Heal 1974
(3) Backstops
• Heal 1976

(4) Discount Rate Effects
• Farzin 1984

(5) Stochastic Time Horizons
• Long 1975
• Henderson and Salant 1978

(6) Increasing Extraction Costs
• Stollery 1983
• Eswaran, Lewis, and Salant 1983
• Hanson 1980

(7) Risk Aversion
• Lewis 1977

(8) Variable Technological Capabilities
• Cropper et al. 1978

(9) Exploration
• Fulton and Just 1989
• Swierzbinski and Mendelsohn 1989
• Ayres 1988
• Bohi and Toman 1984
• Arrow and Chang 1982
• Devarajan and Fisher 1982, pp. 327-336
• Uhler 1979
• Loury 1978
• Pindyck 1978b

(10) Multiple Deposits
• Ambigues et al. 1998
• Kolstad 1994
• Hartwick 1978
• Weitzman 1976b

(11) Multiple Uses/Users
• Chakravorty, Roumasset, and Tse 1997
• Chakravoty and Krulce 1994
• Swallow 1994
• Kolstad 1994
(12) Recycling

• Fullerton and Wu 1998
• Weinstein and Zeckhauser 1974

(13) Durables

• Karp 1996
• Karp 1993
• Levhari and Pindyck 1981
• Malueg and Solow 1990
• Stewart 1980

(14) Multi-Sector Economy

• Gale 1967

(15) Imperfect Competition

(a) General

• Bohi and Toman 1984, Ch. 5
• Dasgupta and Heal 1979, Ch. 11
• Kharalbari 1977
• Sweeney 1977
• Heal 1976
• Hotelling 1931

(b) Monopoly

• Pindyck 1987
• Gilbert 1978
• Lewis 1976
• Stiglitz 1976
• Weinstein and Zeckhauser 1974

(c) Oligopoly

• Reinganum and Stokey 1985
• Lewis and Schmalensee 1980
• Pindyck 1978a
• Pindyck 1977
• Salant 1976

2. Renewable Resources

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(1) The Basic Model

(a) General

• Swallow 1990
• Dasgupta 1982, Ch. 3, 5-7
• Smith 1977a
• Fisher and Peterson 1976
• Plourde 1970

(b) Basic Forests

• Clark 1990, Ch. 9.1
• Neher 1990, Ch. 2
• Swallow, Parks, and Near 1990
• Dasgupta 1982, Ch. 9
• Faustmann 1849

(c) Basic Fisheries

• Clark 1990, Ch. 1-4
• Neher 1990, Ch. 1
• Dasgupta 1982, Ch. 6-7
• Gordon 1954
• Schaefer 1954

(2) Other Theoretical Formulations

• Mitra and Wan 1986
• Mitra and Wan 1985
• Samuelson 1976
• Binkley 1987
• Chang 1984
• Hartman 1976
• Reed 1993
• Swallow and Wear 1993
• Vincent and Binkley 1993
• Newman, Gilbert, and Hyde 1985

(3) Endogenous Prices

• Clark 1990, Ch. 5
• Levhari et al. 1981

(4) Uncertainty

• Clark 1990, Ch. 11.2, 11.4
• Morck et al. 1989
• Pindyck 1984
• Lewis 1981
• Brazee and Mendelsohn 1988
• Cropper 1988
• Clarke and Reed 1989
• Haight and Holmes 1991
• Norstrom 1975
• Plantinga 1998
• Thomson 1992

b. Public Management (or Single-Owner Private Production)

• Clark 1990, Ch. 2.4-4.6
• Anderson 1986
• Kellogg 1988
• Collins and Headley 1983
(1) **Stock Externalities**
- Kolstad 1996a
- Berck 1981
- Falk and Mendelsohn 1993
- Newell and Pizer 1998

(2) **Irreversible Investment**
- Clark *et al.* 1979
- Charles 1983

(3) **Limited Entry**
- DuPont 1990
- Clark 1990, Ch. 8.3
- Wilen 1988

(4) **Contracting**
- Johnson and Libecap 1982

(5) **Enforcement**
- Anderson 1989
- Sutinen and Anderson 1985

(6) **Taxation**
- Chang 1982

(7) **Information Management**
- Arnason 1990

(8) **Multispecies Management**
- Wilson 1982

(9) **Downstream Sectors**
- Clark and Munro 1980

(10) **User Group Conflicts**
- Bishop and Samples 1980

(11) **Congestion**
- Brown 1974
3. External Effects

a. General

(1) Open Access

• Feeny et al. 1996

(2) Common Property

• Schlager et al. 1994
• Ostrom and Gardner 1993
• Schlager and Ostrom 1992
• Dutta and Sundaram 1993
• Seabright 1993
• Ostrom 1990

b. Nonrenewable Resources

(1) Open Access

• Brooks, Contraceo, Murray, and Salant 1999
• Negri 1990
• Wiggins and Libecap 1985
• Bohi and Toman 1984, Ch. 3
• Berck and Perloff 1984
• Dasgupta 1982
• Heal 1982
• Kamien and Schwartz 1982
• Dasgupta and Heal 1979, Ch. 3
• Hardin 1968

(2) Common Property

• Karp 1992
• Ciriacy-Wantrup and Bishop 1975

(3) Information Spillovers

• Hendricks and Kovenock 1989

c. Renewable Resources

(1) Open Access

• Provencher and Burt 1994
• Clark 1990, Ch. 1, 2.1-2.3
• Neher 1990, Ch. 12
• Bjornadl and Conrad 1987
• Berck 1979b
• Dasgupta and Heal 1979, Ch. 5
• Bell 1972
• Heal 1982
• Scott 1955
(2) **Common Property**

- Sethi and Somanathan 1996
- Thompson and Wilson 1994
- Bardhan 1993
- Clark 1990, Ch. 5.4
- Munro 1990
- Salchenberger 1989
- Kaitala and Pohjola 1988
- Clarke and Munro 1987
- Levhari and Mirman 1980
- Sobel 1982

4. **Appendix: Topics in Dynamic Optimization**

   a. **Calculus of Variations**

   - Kamien and Schwartz 1991, pp. 1-120

   b. **Optimal Control--Maximum Principle**

   - Kamien and Schwartz 1991, pp. 218-221
   - Clark 1990, Ch. 4, pp. 88-121
   - Conrad and Clark 1987, pp. 25-31
   - Dorfman 1969
   - Pontryagin 1962

   c. **Deterministic Dynamic Programming**

   - Kamien and Schwartz 1991, pp. 259-263
   - Stokey and Lucas 1989
   - Williams 1989
   - Conrad and Clark 1987, pp. 22-24
   - Beckmann 1968
   - Bellman and Dreyfus 1962
   - Bellman 1957

   d. **Analytical Solutions**

   (1) **Phase Diagrams**

   - Clark 1990, pp. 97-102
   - Conrad and Clark 1987, pp. 158-159

   (2) **Computational and Numerical Techniques**

   - Chapman 1987
   - Conrad and Clark 1987, pp. 40-56

   e. **Additional Topics**

   (1) **Constraint Qualification**

   - Seierstad and Sydsaeter 1987, p. 83
(2)  **Sufficiency**

- Seierstad and Sydsaeter 1977
- Arrow and Kurz 1970
- Mangasarian 1966

(3)  **Free Horizon**

- Kamien and Schwartz 1991, pp. 57-64
- Hotelling 1931

(4)  **Infinite Horizon**

- Seierstad and Sydsaeter 1987, pp. 379-385
- Michel 1982

(5)  **Commitment and Time Consistency**

- Laibson 1991
- Cohen and Michel 1988
- Kahn 1986
- Reinganum and Stokey 1985
- Bulow 1982
- Coase 1972
- Pollak 1968
- Strotz 1956

(6)  **Bang-Bang Control**


(7)  **Most Rapid Approach Paths**

- Clark *et al.* 1979
- Spence and Starrett 1975

f.  **Stochastic Dynamic Optimization**

(1)  **Metric Spaces**

- Malliaris and Brock 1982

(2)  **Stochastic Calculus**

- Malliaris and Brock 1982, Ch. 2, pp. 65-140

(3)  **Blackwell’s Theorem**

- Sargent 1987, pp. 339-363

(4)  **Stochastic Dynamic Programming**

- Kelly and Kolstad 1999
- Clark 1990, Ch. 11, pp. 343-364
• Bertsekas 1987
• Conrad and Clark 1987, pp. 176-223
• Mangel 1985
• Cropper et al. 1978
•Dasgupta and Heal 1974

(5) Stochastic Optimal Control

• Kamien and Schwartz 1991, pp. 264-271
• Sargent 1987, pp. 29-40
• Malliaris and Brock 1982, pp. 108-117

(6) Bounded and Unbounded Payoffs

• Bertsekas 1987

B. Numerical Measures

1. Resource Scarcity

a. Theory

• Dale 1984
• Devarajan and Fisher 1982
• Solow 1974a
• Stiglitz 1974a
• Stiglitz 1974b

b. Measuring Scarcity

• Krautkramer 1998
• Farzin 1995
• Cleveland 1993
• Farzin 1992
• Norgaard 1990
• Halvorsen and Smith 1984
• Harris and Skinner 1982
• Smith 1980
• Brown and Field 1979
• Fisher 1979
• Barnett and Morse 1963

c. Testing Hotelling

(1) Valuation Principle

• Berck and Bentley 1997
• Smith and Jin-Tan 1989
• Farrow 1985
• Miller and Upton 1985
• Slade 1982

(2) Price Paths

• Berck and Roberts 1996
2. Adding Up The Numbers

a. Resource Accounting

(1) National Income Accounts

• Maler 1991
• Devarajan and Weiner 1990
• Repetto 1989
• Stauffer 1985
• Weitzman and Lofgren 1997
• Weitzman 1999

(2) Growth Accounting

• Squires 1992
• Hartwick 1988
• Weitzman 1976a

(3) Valuing Resource Holdings

• McDonald 1994
• Boskin 1985

b. Applied Benefit-Cost Analysis

• Browder et al. 1996
• Jacoby and Laughton 1992

C. Policy

1. Overview

• Clark 1990, Ch. 8
• Neher 1990, Ch. 19
• Gamponia and Mendelsohn 1985
• Helliwell and Heaps 1985
• Dasgupta and Heal 1979, Ch. 12
• Nordhaus 1973

2. Individual Instruments

a. Property Rights

(1) Establishing Rights

• Provencher 1993
• Razzaz 1993
• Townsend 1992
(2) Unitization of Common Pools

- Libecap and Wiggins 1985
- Uhler 1979

b. Regulation

- Jones 1993
- Bjorndal 1993

c. Taxes/Subsidies

- Wolfson and Koopmans 1996
- Hyde 1992
- Amundsen et al. 1992
- Karp and Livernois 1992
- Burness 1976
- Krautkraemer 1990
- Conrad and Hool 1981

3. Issues

a. Market Structure

- Gilligan 1992

b. Resource Security

- Bohi et al. 1996

c. Trade

- Khanna and Harford 1996
- Barnes 1996
- Karp and Newbery 1992
- Karp and Newbery 1991

d. Effects on Growth

- Krautkraemer 1995
- Barham and Coomes 1994
- Teisberg 1993
- Benjamin et al. 1989
- Corden 1984
- Roemer 1970

e. Effects on Distribution

(1) Cross-Sectional Distribution

- Geisler 1995
- Bull et al. 1994
- Prahladachar 1994
- Sutherland 1994
- Gaffney 1992
(2) Temporal Distribution and Sustainability

- Chichilnisky 1997
- Chichilnisky 1996
- Norton and Toman 1997
- Page 1997
- Woodward and Bishop 1997
- Heijmam 1991, Ch. 6
- Norgaard and Howarth 1991
- Solow 1991
- Barbier and Markandya 1990
- Howarth and Norgaard 1990
- Batie 1989
- Pezzey 1989
- Dasgupta and Heal 1979, Ch. 16
- Eagan 1987
- Hartwick 1977
- Solow 1974b

4. Policy Formulation

- Ando 1999
- Metrick and Weitzman 1996
- Salant 1995
- Kunioka and Rothenberg 1993

5. Specific Resource and Energy Studies

a. Nonrenewable Resources and Energy

(1) General

(2) Oil/Gasoline

- Borenstein and Shepard 1996
- Gulen 1996
- Gately 1995
- Shepard 1993
- Gately 1992
- Griffin 1985
- Gately 1984
- Newbery 1981
- Loury 1980
- Hnyilicza and Pindyck 1976
- Salant 1976

(3) Natural Gas

- King and Cuc 1996
- Hendricks and Porter 1996
- Porter 1995
- Crocker 1994
- Doane and Spulber 1994
- De Vany and Walls 1993
- Hendricks et al. 1993
b. Renewable Resources

(1) Water

• Booker and Young 1994
• Kanazawa 1993
• Moncur and Pollock 1988
• Young and Haveman 1985
• Gisser 1983
• Turvey 1976
• Burt 1967a
• Burt 1967b

(2) Land/Soil

• Miller and Plantinga 1999
• Pfaff 1999
• Innes 1997
• Hardie and Parks 1997
• Plantinga 1996
• Wu and Segerson 1995
• Parks 1995
• Lohr and Parks 1995
• Parks and Murray 1994
• Miceli and Segerson 1994
• Barrett 1991
• Zinkham 1991
• Stavins and Jaffe 1990
• Stavins 1990
• Clark and Furtan 1983
• McConnell 1983
• Burt 1981
• Dales 1968

(3) Biological Diversity

(a) Genetic Diversity and Its Value

• Rausser and Small 1999
• Simpson et al. 1996
• Weitzman 1993
• Solow et al. 1992
• Weitzman 1992
• Randall 1991
• Bachmura 1971

(b) Endangered Species/Resource Management

• Ando 1999
• Metrick and Weitzman 1996
• Norton-Griffiths and Southey 1995
• Simon et al. 1995
• Sedjo 1992
• Conrad 1989
• Brown and Goldstein 1984
• Miller and Menz 1979
• Berck 1979b
• Bishop 1978
• Miller 1978
• Clark and Munro 1978
• Amacher et al. 1976
• Simpson 1998
• Brown and Shogren 1998
• Metrick and Weitzman 1998

(c) Habitat and Protected Areas

• Dixon and Sherman 1991
• Barbier et al. 1991
• Pearce and Maler 1991
• Nickerson 1990
• Ehui and Hertel 1989
• Fisher and Krutilla 1985
• Porter 1982
• Clark 1973

(4) Forestry

(a) Theory

• Deacon 1995
• Swallow, Talukdar, and Wear 1997
• Binkley 1987
• Hellsten 1988
• Hartman 1976
• Samuelson 1976
• Chang 1984
• Albers 1996
• Plantinga and Birdsey 1994
• Swallow and Wear 1993
• Vincent and Binkley 1993

(b) Empirical

• Neher 1990
• Bowes and Krutilla 1985
• Baldwin et al. 1997
• Provencher 1995
• Berck 1979a
• Johnson and Libecap 1980
• Washburn and Binkley 1990

(5) Fisheries

(a) Theory

• Clark 1990, Ch. 8.1-8.2, 9.2-9.7
• Neher 1990, Ch. 10-11
• Munro and Scott 1985
• Smith 1977b
• Clark and Munro 1975
• Spence 1974

(b) Empirical

• Homans and Wilen 1997
• Graddy 1995
• Deacon 1989
• Bell 1972

II. ENVIRONMENTAL ECONOMICS

A. Theory of Pollution Control

1. Overview

• Hanley, Shogren, and White 1997
• Bromley 1995
• Cropper and Oates 1992
• Daly 1992
• Tolley et al. 1981
• Fisher and Peterson 1976
• Mills and Peterson 1975
• Maler 1974
• Ciriacy-Wantrup 1952
2. Efficiency, Public Goods and Truthful Revelation

   a. Optimality Conditions
      • Ballard and Fullerton 1992
      • Varian 1984, Ch. 7.1
      • Just et al. 1982, Ch. 2
      • Bergstrom and Cornes 1983
      • Bergstrom and Cornes 1981
      • Weisbrod 1964
      • Samuelson 1954

   b. Public Good Decision Problems and Implementation Mechanisms
      • Teoh 1997
      • Epple and Romano 1996
      • Hochman et al. 1995
      • Andreoni 1995
      • Cornes 1993
      • Chander 1993
      • Andreoni 1993
      • Gradstein 1992
      • Varian 1984, Ch. 7.2
      • Mueller 1979, Ch. 3-4

3. Efficiency and Externalities

   a. General
      • Varian 1994
      • Baumol and Oates 1988, Ch. 2-4, 6-8
      • Conrad and Clark 1987, Ch. 4, pp. 147-156
      • Laffont 1987
      • Varian 1984, Ch. 7.3
      • Oates 1983
      • Just et al. 1982, Ch. 12
      • Dasgupta and Heal 1979, Ch. 3
      • Haveman 1973
      • Turvey 1963

   b. Individual Instruments
      • Simpson 1996
      • Dasgupta 1982, Ch. 2-3
      • Just et al. 1982, Ch. 12

(1) Property Rights

   (a) Coase Theorem
      • Shogren 1998a
      • Farrell 1987
      • Demsetz 1967
      • Coase 1960
(b) Common Property
   • Gordon 1954

(c) Exchange/Enforcement
   • Demsetz 1964

(d) Efficiency
   • Richer and Stranlund 1997
   • de Meza and Gould 1992
   • Farrell 1986

(2) Quantity-Based and Markets
   • Manne and Rutherford 1994
   • Baumol and Oates 1988, Ch. 8
   • Krupnick et al. 1983
   • Montgomery 1972

c. Dynamic Externalities

(1) General Theory
   • Conrad and Clark 1987, Ch. 4, pp. 157-175
   • Cropper 1984
   • Smith 1977a
   • Keeler et al. 1972
   • Conrad 1992

(2) Consumption Planning
   • Forster 1973

(3) Catastrophic Effects
   • Cropper 1976

(4) Effects of Government Policies
   • Stavins and Jaffe 1990

d. Uncertainty

(1) General
   • Metcalf and Rosenthal 1995
   • Baumol and Oates 1988, Ch. 11-12
   • Segerson 1988
   • Nichols and Zeckhauser 1986
   • Dasgupta 1982, Ch. 4
   • Dasgupta 1982
   • Just et al. 1982, Ch. 11
   • Dasgupta and Heal 1979, Ch. 13
   • Hochman and Zilberman 1978
   • Viscusi and Zeckhauser 1976
(2) Instrument Choice

- Newell and Pizer 1998
- Hoel and Karp 1998
- Pizer 1997
- Stavins 1996a
- Kolstad 1987
- Mendelsohn 1986
- Roberts and Spence 1976
- Yohe 1976
- Adar and Griffin 1976
- Weitzman 1974

e. Private Information

- Lewis 1996
- Herriges, Govindasamy, and Shogren 1994

f. Market Structure

- Kohn 1985
- Asch and Seneca 1976

g. Nonconvexities

- Helfand and Rubin 1994
- Fisher and Karp 1993
- Burrows 1986
- Cooter 1980
- Starrett 1972

h. Experimental Evidence

- Shogren 1993
- Harrison and Hirshleifer 1989
- Plott 1983

B. Numerical Measures

1. Theory of the Measurement of Economic Welfare

- Debreu 1951

a. Consumers' and Producers' Surplus

(1) General Theory

- Slesnick 1998
- Varian 1984, Ch. 7.4-7.5
- Just et al. 1982, Ch. 4, 5, 7
- Hausman 1981
- Randall and Stoll 1980
- Willig 1976
(2) Willingness to Pay vs. Willingness to Accept

- Hanemann 1999
- Pratt and Zeckhauser 1996
- Shogren et al. 1994
- Hanemann 1991
- Coursey et al. 1987
- Knetsch and Sinden 1984
- Randall and Stoll 1980
- Willig 1976

(3) Deadweight Loss

- Haveman et al. 1987
- Hausman 1981

b. Aggregation across Individuals

- Varian 1984, Ch. 3.16, 5.7, 4.5-4.7, 7.7-7.8
- Dasgupta 1982, Ch. 5
- Just et al. 1982, Ch. 8
- Dasgupta and Heal 1979, Ch. 9
- Rawls 1972

c. Alternative Approaches to Aggregation and Welfare Evaluation

- Slesnick 1998
- Jorgenson and Slesnick 1984
- Jorgenson 1984
- Jorgenson et al. 1983
- McKenzie 1983, Ch. 1-3, 8
- Jorgenson et al. 1980

d. Temporal Aggregation: Discount Rates and Intergenerational Equity

(1) General Theory

- Weitzman 1994
- Asheim 1991
- Just et al. 1982, Ch. 13
- Lind 1982, Ch. 1-3, 12
- Georgescu-Roegen 1979
- Daly 1973
- Baumol 1968

(2) Distributional Weights

- Harberger 1978

(3) Opportunity Costs of Public Projects

- Bradford 1975
- Harberger 1970
- Feldstein 1964
- Marglin 1963
(4) **Inter- vs. Intra-Generational Equity**

- Dasgupta and Heal 1979, Ch. 10
- Solow 1974b

(5) **Imperfect Capital Markets**

- Arrow 1982

(6) **International Capital Mobility**

- Lind 1990

(7) **Ethical Basis for Discount Rate**

- d’Arge *et al.* 1982
- Schulze *et al.* 1981

(8) **Uncertainty**

- Wilson 1982
- Arrow and Lind 1970
- Hirshleifer 1966
- Weitzman 1998

**e. Uncertainty**

(1) **General**

- Gallagher and Smith 1985
- Cook and Graham 1977
- Henry 1974

(2) **Option Value**

(a) **General**

- Cory and Saliba 1987
- Adams *et al.* 1984
- Freeman 1984c
- Smith 1983
- Bishop 1982
- Dasgupta 1982, Ch. 10
- Graham 1981
- Dasgupta and Heal 1979, Ch. 13
- Bohm 1971
- Schmalensee 1971
- Weisbrod 1964

(b) **Transactions**

- Fischoff and Furby 1988

(c) **Supply Uncertainty**

- Freeman 1985b
(d) Empirical Applications

- Cameron and Englin 1997
- Fisher and Hanemann 1986
- Smith and Desvouges 1987

(3) Quasi-Option Value

- Hanemann 1989
- Fisher and Hanemann 1987
- Samples et al. 1986
- Freeman 1984b
- Miller and Lad 1984
- Conrad 1980
- Fisher et al. 1972
- Arrow and Fisher 1974
- Krutilla 1964

2. Environmental Risk Measurement

a. General

- EPA 1990

b. Risks to Life, Health, and Safety

(1) General

- Shogren and Crocker 1999
- Viscusi 1998
- Viscusi 1993
- Cropper et al. 1992
- Shogren and Crocker 1991
- Cropper and Portney 1990
- Lichtenberg et al. 1989
- Lichtenberg and Zilberman 1988
- Smith and Desvouges 1988b
- Schulze and Kneese 1981
- Lave and Seskin 1977
- Freeman 1993

(2) Empirical Methods

- Smith and Desvouges 1988a
- Smith and Desvouges 1987
- Viscusi 1983, Ch. 6

(3) Private Market Choices

- Atkinson and Halvorsen 1984

(4) Individual Perceptions of Risk

(a) Decision Analysis

- Howard 1979
(b) **Reference Theory**

- Smith 1992

(c) **Ex Ante vs. Ex Post Values**

- Freeman 1989

(d) **Learning**

- Poe and Bishop 1999
- Smith, Desvousges, and Payne 1995
- Ippolito and Mathios 1990
- Smith, Desvousges, Johnson, and Fisher 1990
- Smith and Desvousges 1988b
- Viscusi and O’Connor 1984

3. **Measuring the Benefits of Environmental Improvement**

a. **Estimating Benefits from Market Data**

- Bockstael and McConnell 1993
- Cameron 1992
- Hanemann 1992

(1) **General**

- Kling and Herriges 1999
- Phaneuf, Kling, and Herriges 1999
- Freeman 1993
- Braden and Kolstad 1991
- Bockstael, McConnell, and Strand 1991
- Bockstael *et al.* 1987
- Freeman 1985a
- Burt and Brewer 1971

(2) **Welfare Evaluation of Price Changes**

- Brookshire *et al.* 1987
- Knetsch and Sinden 1984

(3) **Household Production Functions**

- Smith 1991
- Bockstael *et al.* 1987
- Bockstael and McConnell 1983
- Bockstael and McConnell 1981

(4) **Hotelling-Clawson-Knetsch Model**

- Bockstael 1996
- Smith 1990
- Smith 1989
- Kling 1988
- Ward and Loomis 1986
- Freeman 1985a
• McConnell 1985
• Smith and Desvouges 1985
• Freeman 1993

(5) Hedonic Price Analysis

• Smith and Huang 1995
• Palmquist 1991
• Kohlhase 1991
• Clark and Kahn 1989
• Blomquist, Berger, and Hoehn 1988
• Bartik 1988a
• Freeman 1985a
• Ragozin and Brown 1985
• Scotchmer 1985
• Atkinson and Halvorsen 1984
• Brown and Mendelsohn 1984
• McConnell and Phipps 1984
• Bartik and Smith 1984
• Brown and Rosen 1982
• Vaughan and Huckins 1982
• Freeman 1993
• Harrison and Rubinfeld 1978
• Rosen 1974
• Adelman and Griliches 1961

(6) Hedonic Travel Cost Method

• Brown and Mendelsohn 1984
• Smith, Palmquist, and Jakus 1991

(7) Defensive Expenditures

• Bartik 1988b

(8) Private Options for Public Goods

• Stavins 1996b

(9) Parallel Private Markets

• List and Shogren 1998
• Crocker, Shogren, and Turner 1998
• Vaughan and Russell 1982

(10) Event Studies

• Hamilton 1993
• Hamilton 1995a

(11) Experimental Markets

• Cummings, Harrison, and Rustrom 1995
• Dickie, Gerking, and Fisher 1987
• Bishop et al. 1983
• Bishop and Heberlein 1979
b. Estimating Benefits from Non-Market Data: Contingent Valuation

(1) General

• Bishop and Heberlein 1990
• Mitchell and Caron 1989
• Cummings et al. 1986
• Smith and Desvousges 1986
• McConnell 1985
• Just et al. 1982, Ch. 12
• Freeman 1993

(2) Nonuse Value

• Rollins and Lyke 1998
• Madariaga and McConnell 1987
• Brookshire et al. 1983
• Harrington and Fisher 1982

(3) Sources of Bias

• Diamond 1996
• Smith and Osborne 1996
• Phillips and Zeckhauser 1989
• Hanemann 1984b
• Bishop and Heberlein 1979
• Cameron and Englin 1997

(4) Reliability

(a) General

• Carson, Hanemann, Kopp 1997
• Fischoff 1991
• Kahneman and Thaler 1991
• Smith 1990
• Boyle and Bishop 1988
• Brookshire and Coursey 1987

(b) Arbitrary Values

• Smith 1991

(c) Closed-End Surveys

• Hanemann and Kanninen 1999
• Cameron and James 1987

(d) Test-Retest

• Loomis 1989

(e) Nature of the Good

• Kealy et al. 1990
(f) **Dichotomous Choice vs. Open-Ended**

- Loomis 1990

(5) **Discrete Choice Methods**

- Johnston and Swallow 1998
- McConnell 1995
- McConnell 1990
- Bowker and Stoll 1988
- Cameron 1988
- Hanemann 1984a
- Hanemann 1984b
- Hanemann 1983

(6) **Conjoint Analysis**

- Louviere, Hensher, and Swait 1998
- Swait, Adamowicz, and Louviere 1998
- Adamowicz, et al. 1996
- Mazzotta and Opaluch 1995
- Carson, et al. 1994
- Louviere 1994

c. **Combining Revealed and Stated Preference Data**

- Cameron 1992
- Adamowicz, Louviere, and Williams 1994
- Huang, Haab, and Whitehead 1997

d. **Comparison of Valuation Methods**

- Burness, et al. 1991
- Smith and Kaoru 1990
- Smith, Desvousges, and Fisher 1986
- Sellars, et al. 1985
- Brookshire, et al. 1982
- Bishop and Heberlein 1979

4. **Adding Up The Numbers**

a. **Environmental Accounting**

(1) **National Income Accounts**

- Lintott 1996
- Kaufmann 1995
- da Motta 1994
- Pearce and Atkinson 1993

(2) **Valuing Environmental Holdings**

- Unsworth and Bishop 1994
- Crocker and Shogren 1993
b. Applied Benefit-Cost Analysis

(1) General Theory

• Viscusi 1994
• Hoehn and Randall 1989
• Dorfman 1976

(2) Regulatory Flexibility

• Harrison and Nichols 1983

(3) Applications

• Carson, Flores, and Hanemann 1998
• Arrow et al. 1996
• Kopp 1992
• Krupnick and Portney 1991
• Boyle and Bishop 1987
• Kalt 1983
• Schulze et al. 1983
• Porter 1982

(4) Uncertainty

• Graham 1992
• McDonald and Siegel 1986
• Mendelsohn and Strang 1984
• Graham 1981
• Hammond 1981
• Zeckhauser 1981

(5) Critiques

• Lave 1991
• Bromley 1990
• Norgaard 1989
• Kneese and Schulze 1985
• Smith and Krutilla 1982
• Kelman 1981
• DeLong et al. 1981
• Regan 1981
• Baram 1980
• Pearce 1976

C. Policy

1. Overview: instrument choice and design

• Hahn and Stavins 1992
• OECD 1991
• Hahn and Noll 1990
• Tietenberg 1990
• Oates, Portney, and McGartland 1989
• Opschoor and Vos 1989
• Bohm and Russell 1985
• Dewees 1983
• Smith and Vaughan 1980
• Rose-Ackerman 1973
• Baumol and Oates 1971
• Crocker 1966

2. Individual Instruments

a. Regulation

(1) Standards

(a) General Theory
• Espey 1997
• Helfand 1991
• Besanko 1987
• Baumol and Oates 1971, Ch. 10

(b) Uncertainty
• Dasgupta 1982, Ch. 4, pp. 68-99
• Weitzman 1974

(c) Underestimation of Benefits
• Oates et al. 1989

(d) Applied Studies
• Godek 1997
• Henderson 1996
• Kahn 1996
• Crandall 1992
• Zilberman 1991
• McGartland 1988
• Atkinson and Tietenberg 1982
• White 1982
• Atkinson and Lewis 1974

(2) Other Regulations
• Viscusi 1996
• Pollak 1995
• Segal 1995
• Applegate 1992
• Swallow, Oplauch, and Weaver 1992

b. Tradeable Permit Systems

(1) Overview
• Montgomery 1972
• Hahn 1989
• Tietenberg 1980
• Axtell and Hahn 1990
(2) **Design and Implementation**

- Hahn and Noll 1982
- Noll 1982
- Downing 1981
- Fullerton *et al.* 1997
- Bohm 1997

(3) **Market Structure and Strategic Issues**

- Hahn 1984
- Pashigan 1984
- Misolek and Elder 1989
- Malueg 1990
- Stavins 1995
- Kerr and Mare 1997

(4) **Uncertainty**

- Hahn and Noll 1990
- Opaluch and Kashmanian 1985

(5) **Applied Studies**

- Cansier and Krumm 1997
- Johnson and Pekelney 1996
- Foster and Hahn 1995
- Cason 1995
- Bohm and Larsen 1994
- Atkinson 1983
- Seskin *et al.* 1983
- Krupnick *et al.* 1983

c. **Pigouvian Taxes/Subsidies**

(1) **Overview**

- Fullerton and Wolverton 1999
- Fullerton 1997
- Fullerton 1996
- Palmquist 1990
- Carlton and Loury 1986
- Lee and Misolek 1986
- Sadka 1978
- Green and Sheshinkski 1976
- Holtermann 1976
- Baumol 1972

(2) **Market Structure/Imperfection**

- Berg *et al.* 1997
- Tschirhart 1994
- Newbery 1992
- Oates and Strassmann 1984
- Barnett 1980
- Blackman and Baumol 1980
(3) Imperfect Information

• Dasgupta et al. 1980
• Kwerel 1977

(4) Depletable Externalities

• Freeman 1984a

(5) Applied Studies

• Peszko and Zylicz 1998
• Fullerton and Kinnaman 1996
• Sigman 1996
• Palmer et al. 1995a
• Sigman 1995
• Hahn 1995b
• Alberini et al. 1995
• Poterba 1994
• Miranda et al. 1994
• Nordhaus 1992
• Jorgenson and Wilcoxen 1992
• Nordhaus 1982

d. Deposit/Refund Systems

• Palmer et al. 1997
• Fullerton and Kinnaman 1995
• Bohm 1981

e. Liability

• Larson 1996
• Pitchford 1995
• Zweifel and Tyran 1994
• Kornhauser and Revesz 1994
• Strasser and Rodosevich 1993
• Segerson 1993
• Segerson and Tietenberg 1992
• Shavell 1980

f. Environmental Bonds

• Cornwell and Costanza 1994
• Shogren et al. 1993

g. Information Provision

• Kiker and Putz 1997
• Pargal and Wheeler 1996
• Arora and Cason 1996
• Grodsky 1993
3. Issues

a. Pollution Technologies

• van der Voet et al. 1995
• Eiswerth 1993

(1) Spatial Differentiation

• Mendelsohn 1986
• Tietenberg 1978
• Hochman et al. 1977

(2) Temporal Accumulation

• Toman and Palmer 1997

b. Dynamic Issues

(1) Dynamic Efficiency/Effectiveness

(2) Discounting The Future

• Cropper et al. 1992

(3) Technological Change

• Milliman and Prince 1989
• Magat 1978
• Downing and White 1986
• Malueg 1989
• Berndt et al. 1993
• Jaffe and Stavins 1994
• Jaffe and Stavins 1995
• Hassett and Metcalf 1995
• Juising, Krutilla, and Boyd 1996
• Newell et al. 1999

c. Private Avoidance

(1) Defensive Expenditures

(2) Firm and Private Locational Decisions

• McConnell and Schwab 1990

d. Second-Best: Instruments in Presence of Distortionary Taxes

(1) Green Tax Shifts and the “Double Dividend”

• Sandmo 1975
• Bovenberg and de Mooij 1994
• Van der Ploeg and Bovenberg 1994
• Oates 1995
• Parry 1995
• Goulder 1995a
(2) Instrument Choice

- Goulder, Parry, and Burtraw 1997
- Fullerton and Metcalf 1997
- Goulder 1998
- Parry et al. 1999
- Goulder et al. 1999

e. Monitoring and Enforcement

(1) Monitoring

- Russell 1990
- Beavis and Walker 1983

(2) Enforcement

(a) General Theory

- Swierzbinksi 1994
- Kaplow and Shavell 1994
- Burby and Paterson 1993
- Naysnerski and Tietenberg 1992
- Harford 1987
- Russell et al. 1986 1986
- Shibata and Winrich 1983
- Harford 1978
- Viscusi and Zeckhauser 1979

(b) Noncompliance

- Stranlund 1995
- Malik 1990
- Gray and Deily 1996

(c) Fines: Probability vs. Magnitude

- Friedman 1993
- Polinsky and Shavell 1992
- Polinsky and Shavell 1979

f. Trade

- Barrett 1997
- Bhagwati and Srinivasan 1996
- Hoel 1996
- Copeland and Taylor 1995
- Hecht 1995
- Barrett 1994b
- Chichilniskly 1994
g. **Growth**

(1) **Abatement Costs and Competitiveness**

- Palmer *et al.* 1995b
- Porter 1995
- Jaffe *et al.* 1995
- Robinson 1995
- O'Reilly 1994
- Azzoni and Isai 1994
- Walker and Gover 1993
- Goto and Sawa 1993
- Blitzer *et al.* 1993
- Gaskins and Weyant 1993
- Hazilla and Kopp 1990
- Jorgenson and Wilcoxen 1990
- Ascher and Healy 1990
- Gray 1987
- Christiansen and Haveman 1981
- Peskin *et al.* 1981

(2) **Economic Development**

- Agras and Chapman 1999
- Rothman and de Bruyn 1998
- Barbier 1997
- Dasgupta 1996C
- Dasgupta 1995
- Selden and Song 1995
- Grossman and Krueger 1995
- Selden and Song 1994
- Gruver 1976
- d'Arge and Kogiku 1973

h. **Distribution**

(1) **Effects On Distribution**

(a) **Cross-Sectional Distribution**

- Jacoby *et al.* 1997
- Resosudarmo and Thorbecke 1996
- Hamilton 1995b
- Coates *et al.* 1994
- Hird 1993
- Bingham *et al.* 1987
- De Meza and Gould 1987
- Robison 1985
- Pearce 1985
- Christiansen and Tietenberg 1985
- Gianessi and Peskin 1980
• Gianessi et al. 1979

(b) Temporal Distribution and Sustainability

• Toman 1994

(2) Effects Of Distribution

• Boyce 1994

4. Policy Formulation

a. General

• Earnhart 1997
• Finkelshtain and Kislev 1997
• Gupta et al. 1996
• Simon et al. 1995
• Rabe 1995
• Kahn and Matsusaka 1995
• Rhodes and Wilson 1995
• Barthold 1994
• Sunstein 1993
• Hornstein 1993
• Gersbach 1993
• O'Hare and Sanderson 1993
• Cropper et al. 1992
• Hausker 1992
• Hahn and Stavins 1991
• Hahn 1990
• Nelson 1987
• Baumol and Oates 1988, Ch. 13-14, 16-17
• Tietenberg 1985

b. Environmental Federalism

• Peltzman and Tideman 1972
• Wheeler 1994
• Revesz 1996
• Levinson 1997

c. Coordination/Treaties

• Barrett 1999
• Markowska and Zylicz 1999
• Murdoch and Sandler 1997
• Jehiel and Moldovanu 1995
• Barrett 1994a
• Mohr 1994
• Chander and Tulkens 1994
• Carraro and Siniscalco 1993
• Hamilton 1993
• Parkash and Tulkens 1992
• Hoel 1992
d. **Conflict**

- Hurley and Shogren 1997
- Baik and Shogren 1994

e. **Positive Political Economy**

- Buchanan and Tullock 1975
- Maloney and McCormick 1982
- Keohane, Revesz, and Stavins 1998
- Joskow and Bailey 1998
- Shogren 1998b
- Boyer and Laffont 1999

5. **Specific Environmental Studies**

a. **Waste**

(1) **Municipal Solid Waste**

- Dinan 1993
- Opaluch *et al.* 1993
- Miranda *et al.* 1994
- Strathman *et al.* 1995
- Fullerton and Kinnaman 1996
- Palmer, Sigman, and Walls 1997

(2) **Hazardous Waste**

- Peretz *et al.* 1997
- Sigman 1998

b. **Water Pollution**

- Weinberg and Kling 1996
- Carson and Mitchell 1993
- O’Neil, David, Moore, and Joeres 1983

c. **Air Pollution**

(1) **Local Air Pollution**

- Henderson 1996
- Innes 1996
- Alberini and McConnell 1995
- Zylicz 1995
- Krupnick and Walls 1992
- Hahn 1995a

(2) **Transboundary Air Pollution: Acid Rain**

- Maler 1989
- Cason 1993
- Burtraw 1996
- Coggins and Swinton 1996
• Burtraw et al. 1997
• Fullerton et al. 1997
• Schmalensee et al. 1998
• Stavins 1998
• Joskow, Schmalensee, and Bailey 1998
• Ellerman and Montero 1998
• Montero 1999

(3) Global Air Pollution: Greenhouse Gases and Climate Change

• Nordhaus 1993a
• Nordhaus 1993b
• Falk and Mendelsohn 1993
• Weyant 1993
• Bohm 1993
• Nordhaus 1994
• Mendelsohn et al. 1994
• Kosobud 1994
• Kolstad 1996b
• Schmalensee 1997
• Barrett 1998a
• Barrett 1998b
• Schelling 1998
• Jacoby et al. 1998
• Stavins 1999
REFERENCES


Pezzey, John. (1989). "Definition of Sustainability". *Centre for Economic and Environmental Development, United Kingdom, Paper no. 9*.


