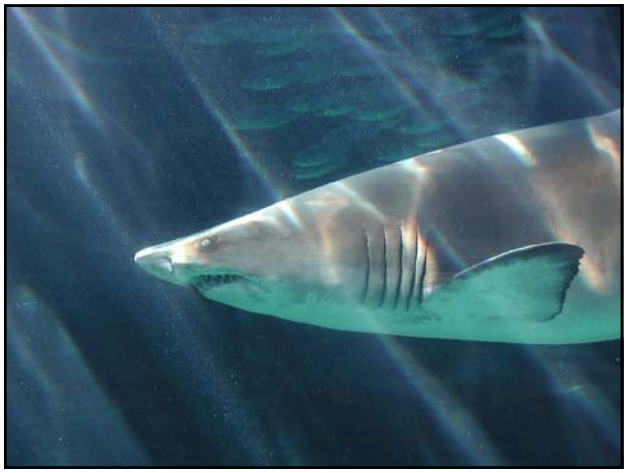
Economics of Conflict, War, and Peace

Prof. Dr. Jurgen Brauer; Summer 2009
Chulalongkorn University; Bangkok, Thailand

Session 2.4
Environmental effects



Environmental effects

- **War and Nature: The Environmental Consequences of War in a Globalized World**
  - Genesis of the book
    - Request for an encyclopedia article
  - Outline of the book

Environmental effects

- Outline of the book
  - Chapter 1: Globalization, nature, and war
  - Chapter 2: The Vietnam war
    - Long, major, international, forest environment
  - Chapter 3: The Persian Gulf war
    - Short, major, international, marine environment
  - Chapter 4: Civil war and borderland effects
    - Often long, "minor," national environments?
  - Chapter 5: War and nature in a globalized world

Environmental effects

- Chapter 1: Globalization, nature, and war
  - 1.1 Natural resource consumption by armed forces
  - 1.2 Nuclear war and nuclear weapons testing
  - 1.3 Need and greed as causes of war
  - 1.4 Measuring the environmental consequences of war
    - 1.4.1 Classifying war-related environmental damage
    - 1.4.2 The data – finding out what really happened
  - 1.5 The environment in international law of war
  - Appendix: Why nuclear weapons?
- Chapter 2: The Vietnam war
  - 2.1 Bombing, bulldozing, and other nonherbicidal destruction
    - 2.1.1 Bombing
    - 2.1.2 Bulldozing
    - 2.1.3 Other nonherbicidal destruction
  - 2.2 Herbicide attacks
    - 2.2.1 Background
    - 2.2.2 Inland forests: terrestrial plant ecology and forestry
    - 2.2.3 Forest fauna: animal ecology
    - 2.2.4 Herbicide persistence, mobility, and soil ecology
    - 2.2.5 Coastal, marine, and aquatic ecology
    - 2.2.6 Long-term effects
  - 2.3 In sum

Environmental effects

- Chapter 3: The Persian Gulf war
  - 3.1 The Persian Gulf
    - 3.1.1 Scientific missions and data gathering
    - 3.1.2 Geography and oceanography of the western Persian Gulf
  - 3.2 Marine environments
    - 3.2.1 Supratidal and intertidal areas
    - 3.2.2 Benthic communities, fish, shrimp, coral reefs, and islands
    - 3.2.3 Marine mammals and turtles
  - 3.3 Birds
    - 3.3.1 Shorebirds
    - 3.3.2 Seabirds
  - 3.4 In sum
  - 3.5 Bibliographic note [on soil and air resources]
- Chapter 4: Civil war and borderland effects
  - 4.1 Rwanda and the eastern Congo
    - 4.1.1 Rwanda
    - 4.1.2 The eastern Congo
  - 4.2 Afghanistan and Pakistan
    - 4.2.1 Afghanistan
    - 4.2.2 The effects of the Afghan wars on Pakistan
  - 4.3 In sum
  - 4.4 Bibliographic note [on other civil wars]

Environmental effects

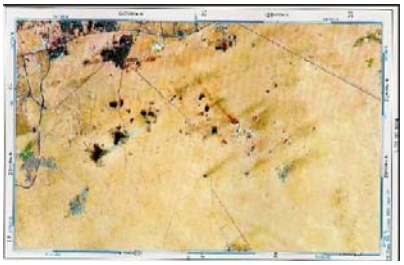
- Chapter 5: War and nature in a globalized world
  - 5.1 Findings
    - 5.1.1 Big wars, small effects? Small wars, big effects?
    - 5.1.2 Firepower and mobility
    - 5.1.3 Refugees and returnees
    - 5.1.4 Conservation by default
    - 5.1.5 Benefits of war, costs of peace
  - 5.2 A way forward
    - 5.2.1 Perspectives and standards matter
    - 5.2.2 Continuous biomonitoring and rapid assessment matter
    - 5.2.3 Preparation and communication matter
    - 5.2.4 Incentives in a globalized world matter
  - 5.3 In sum: preventing war, preserving nature

Environmental effects

- No econ chapter!
  - Economic valuation [later today]
- Let's start with more pictures …

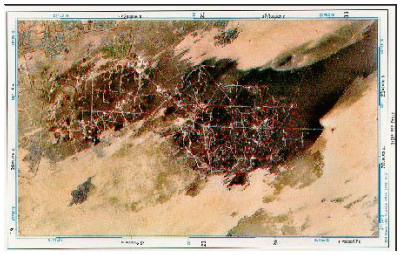
Environmental effects

- 17 February 1987



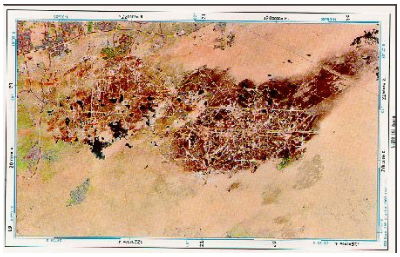
Environmental effects

- 14 November 1991



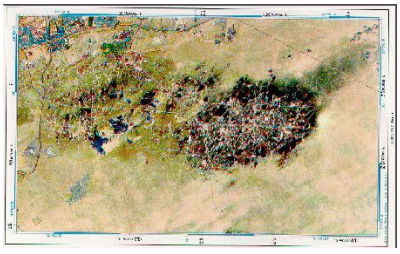
Environmental effects

- 28 February 1993



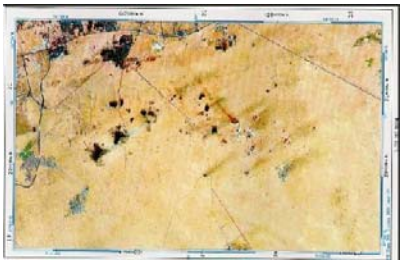
Environmental effects

- 30 March 1995



Environmental effects

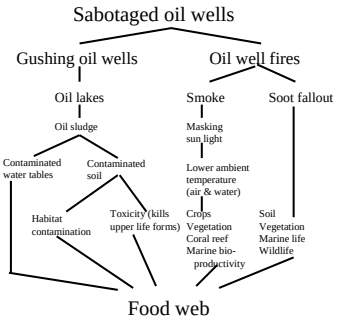
- 17 February 1987



Environmental effects

- Two sets of findings
  - Methodological findings
  - Substantive findings
- One set of constructive comments
  - What can de done?

Environmental effects



Methodological findings:

Finding out what really happened is, if credible, usually

- dangerous,
- complex, and
- costly

Examples …

Environmental effects

- (1) Environmental difference (no damage)
- (2) Environmental disruption (gradations of damage)
  - (2a) Environmental disturbance
    - (transitory damage)
  - (2b) Environmental degradation
    - (ecosystems of comparable richness will emerge)
  - (2c) Environmental depletion
    - (ecosystems of comparable richness will not emerge)
  - (2d) Environmental destruction
    - (complete devastation)

Environmental effects

- Missions
  - Three Birdlife International missions (March 1991; April/May 1991; Nov/Dec 1991)
  - *MS Greenpeace* mission (8 Aug to 1 Oct 1991)
  - *Mt. Mitchell* NOAA mission (Feb to June 1991; >140 scientists from 15 nations)
  - Several NCAR missions
  - Three IUCN missions (Aug 1991, 1992, 1993)
  - Two *Umitaka* missions (Dec 1993, 1994)
  - Senckenberg Institute (EU; 40 scientists; 6 countries; 2 volumes of studies)
  - And many more …

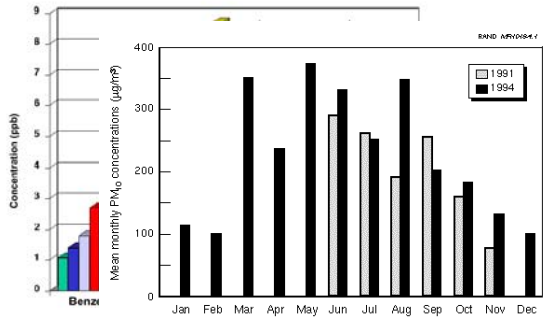
Environmental effects

- Finding out what really happened
  - If credible, is dangerous, complex, and costly
  - Is uninformative if not classified by ecological categories
  - Is usually incomplete
  - Is often grossly unreliable, even wrong
  - Findings can surprise
  - Is frequently anecdotal, mediated, and biased
- Recent improvements
  - Conservation community (since mid-1990s)
  - UN Environment Program (since 1999)

Environmental effects

- Substantive findings
  - Big wars, small effects? Small wars, big effects?

Environmental effects



Environmental effects

Environmental effects

- Substantive findings
  - Big wars, small effects? Small wars, big effects?
  - Firepower and mobility
  - Refugees, returnees, and opportunists
  - Conservation by default
  - Benefits of war, costs of peace

Environmental effects

- A way forward
  - Perspectives and standards matter
    - Evidence, perspectives, standards
    - Beyond detection, toward ecological assessment
  - Continuous biomonitoring and rapid assessment matter
    - Rapid assessment techniques

Environmental effects

Table 5.1: Rapid survey technique results, Persian Gulf war, August 1991

	Coastal ecosystems						Pollution/Impacts		
	Halophytes	Algae	Sea grasses	Birds	Invertebr.	Fish	Oil	Wood	Other
1986									
All sites	2.47	3.33	1.77	1.06	5.31	0.63	1.77	2.11	2.29
N sites	3.23	3.69	2.06	0.65	5.53	0.33	2.24	2.65	2.65
S sites	1.71	3.00	1.47	1.44	5.11	0.93	1.33	1.61	1.94
N vs S sites	p<0.05	NS	NS	p<0.01	NS	NS	NS	NS	NS
1991									
All sites	2.54	4.97	2.06	1.46	5.45	3.63	3.20	2.15	2.68
N sites	2.65	5.29	1.82	1.12	5.12	3.65	5.00	2.50	2.69
S sites	2.44	4.67	2.28	1.78	5.78	3.61	1.50	1.83	2.67
N vs S sites	NS	NS	NS	p<0.05	NS	NS	p<0.01	NS	NS
Heavily oiled sites	3.33	5.58	1.75	0.75	5.17	3.08			
Other sites	2.13	4.65	2.22	1.83	5.61	3.91			
Heavily oiled vs. other sites	NS	NS	NS	p<0.01	NS	NS			
1986 vs 1991									
All sites	NS	p<0.01	NS	p<0.05	NS	p<0.01	p<0.01	NS	NS
N sites	NS	p<0.01	NS	NS	NS	p<0.01	p<0.01	NS	NS
S sites	NS	p<0.01	NS	NS	NS	p<0.01	NS	NS	NS

Notes: Other: metal, plastics, etc.; N, S are sites north and south of Abu Ali, respectively; NS (not statistically significant). *Source*: Adapted from Price, Wrathall, Medley, and Al-Moamens (1993, pp. 145, 147).

Environmental effects

- A way forward
  - Perspectives and standards matter
    - Evidence, perspectives, standards
    - Beyond detection, toward ecological assessment
  - Continuous biomonitoring and rapid assessment matter
    - Rapid assessment techniques
    - Ecological scaling
    - Pre/post bio-monitoring techniques
  - Preparation and communication matter
    - Politics, money, and media
  - Incentives in a globalized world matter
    - Actors and actions in war
    - Business in conflict zones

Environmental effects

- Science => economics => law
  - Scientific assessment of damage
  - Economic valuation of damage
  - Liability under international law
- Environmental economics applied to conflict, war, and peace

Environmental effects

Table 7.1: Valuation of environmental costs and benefits

Benefits

1. [redacted]
2. [redacted]
   a. [redacted]
   b. Local flood reduction
   c. [redacted]
3. [redacted]
   a. Fixing and cycling of nutrients
   b. Soil formation
   c. Circulation/cleansing of air and water
   d. Global life support
4. [redacted]
   a. Gene resources
   b. Species protection
   c. Ecosystem diversity
   d. Evolutionary processes
5. Education and research
6. [redacted]
7. Nonconsumptive benefits
   a. Aesthetic
   b. Spiritual
   c. Cultural/historical
   d. Existence value
8. Future values
   a. Option value
   b. Quasi-option value

Costs

1. Direct costs
2. Indirect costs
3. Opportunity costs

Source: Dixon and Sherman (1990, pp. 15-20).

- Discounting
  - Future value (single period)
    - FV = PV + (PV x i)
    - $1,000 + ($1,000 x 0.04) = $1,040
    - FV = PV (1 + i)
  - Present value (single period)
    - PV = FV/(1 + i)
    - $1,040 / (1.04) = $1,000
  - Multiperiod discounting
    - $FV = PV (1+i)^n$
    - $FV = PV (1 + 0.04)^{10} = \$1,480.24$
    - $PV = FV / (1+i)^n$
    - $PV = FV / (1 + 0.04)^{10} = \$1,000$

Environmental effects

- Changes in discount (interest) rate
  - $1,000: FV = PV $(1 + 0.04)^{10}$ = $1,480.24
  - Converted to: PV = FV/$(1 + 0.04)^{10}$ = $1,000.00
  - But: PV = FV/$(1 + 0.05)^{10}$ = $ 908.74
- Practical problems with discounting
  - (1) how to arrive at a proper discount rate
    - $1,000/$e^{rt}$, where r is the discount rate, t is the number of years, and e is Euler's number
    - At r=0.04, t=200, a FV of $1,000 becomes $0.34 (34 cents)
    - At r=0.05, t=200, a FV of $1,000 becomes $0.045 (4.5 cents)
    - So something discounted from far into the future (as is almost always the case with environmental goods) appears to be worth almost nothing today; this strikes most people as wrong

Environmental effects

- Practical problems with discounting
  - (2) use average or weighted expected rates?
    - If r=0.04 continuously, we get $e^{(0.04)(200)}$ => $0.34
    - But if r=0.01 for 100 years and r=0.07 for another 100 years, we get the *same average* of r=0.04, yet a different outcome, namely

      ½[$1,000 x $e^{(0.01)(200)}$] + ½[$1,000 x $e^{(0.07)(200)}$] => $67.67
    - This is 200 times larger than the first estimate
  - (3) need to include inflation rate (p); now *two* sources of uncertainty and instability in the estimates
  - (4) how to estimate FV to begin with?
    - Criterium of safe minimum standard: "minimize the maximum possible loss ... from making the wrong decision"

Environmental effects

Opportunity cost

- What is "value" to begin with?
  - "The value of one thing is always phrased in terms of how many units of another a person would be willing to give up for it. Now it's true that economists often discuss values in terms of monetary units (prices), but to say that the value of an apple is fifty cents and that of an orange a dollar is just another way of saying that one orange is worth two apples" (Simpson, 2000, p. 91).
  - "How can we compare the value of the better housing people will enjoy as a result of lower timber prices with the value of the amenities preserved when a forest is left standing, without placing some kind of dollar value on the latter as well as the former? ... Grocers can decide much more easily what to stock, for example, and customers can decide what to buy, by comparing price tags which enables them to cooperate very effectively. When prices are *not* attached to alternatives, cooperation becomes more difficult" (Heyne, 1998).

Environmental effects

- Valuation techniques
- (1) Market-priced based techniques [when market values are available]
  - Opportunity cost
    - Direct (explicit) cost
    - Indirect (implicit) cost
  - Benefits gained/losses measured approach [when only benefit values or only cost values are available]
    - Change in productivity approach
    - Loss (or gain) of earnings approach
    - Costs incurred (or avoided) approach
    - Cost-effectiveness analysis
    - Expenditure-based approaches
      - Permissive or preventive expenditure | potential or prospective expenditure
        - Mitigation or resource-replacement | shadow projects | relocation
    - Cost-of-illness approach

Environmental effects

- (2) Surrogate market techniques [when unambiguous market values are not available]
  - Hedonic valuation
    - Property-value or land-value approach
    - Wage-differential approach
  - Travel-cost approach
- (3) Contingency-based techniques [based on hypothetical behavior]
  - Contingent valuation
    - Willingness-to-pay (WTP) or revealed preference method
    - Willingness-to-accept (WTA) or stated preference method
      - Open-ended
      - Bidding game
      - Take-it-or-leave-it | referendum
      - Trade-off | conjoint
    - Cost-less choice (service-to-service | in-kind trading) approach
    - Delphi method

Environmental effects

- Plenty of methodological problems with all of these approaches
  - E.g., stating of protest responses, punitive responses, infinite values, deterrence values, …
  - People may not know their preferences or not know how to value them
  - Data collection/analysis problems
- Other problems
  - Scale of war damage may be overwhelmingly large
  - Computation of isolated effects when the whole should be considered
  - Ecosystem interdependencies may only become known much later on
  - FV, discount rates (as discussed before)
- And yet more problems …
  - Ecological or natural resource values?
  - Permanent or temporary losses?
  - Compensation for or restoration of values?
  - Is the objective "to reinstate (1) the precise physical, chemical, and biological state of the affected environment; (2) the significant ecological functions; or (3) the human resource service." Would substitute resources, if available, suffice, or does one need to restore the original resource?
- As a result of these difficulties … I know of only a SINGLE economic valuation study of environmental damage in war ever done (and it's unpublished)


See you next week