Sustainability assessment: overview and introduction to bio-diversity conservation assessment

July 12. 2010 @ U of Tsukuba
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Objectives of my talk

- Through lecture, I provide views that are (perhaps) important in considering global sustainability and assessing sustainability.

- Then, I will talk about recent developments in the field of bio-diversity conservation as an assessment research example.

Things related to (un)sustainability

- Too many issues related to sustainability.

Overview of existing sustainability assessment tools (Barry et al., 2007)

Retrospective

1. **Indicators and Indices assessment**
   Quantitative measures which present state of something related to sustainability, Integrated vs non-integrated

2. **Product-related assessment**
   Resource use and environmental impacts emerged within the production chain

3. **Integrated assessment**
   System analysis based on modeling
   which support decision-makings prospective
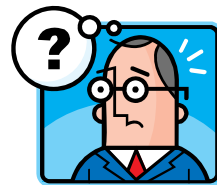
Prospective

The question is then:

Things are complicated.

Many tools already exist, but no one is complete.

How do we approach sustainability?

Important concepts and views for approaching sustainability

Some definitions on "sustainability"

☐ IR3S′ (2006) "**Sustainability Science**"

"*a new academic discipline that seeks to **understand the interactions within and between global, social, and human systems…**"*

☐ Brundtland Report (1987): "**Sustainable development**"

"*development that meets the needs of the present without compromising the ability of future generations to meet their own needs.*"

Too big…

Sustainability assessment

☐ Sustainability for who or what?

☐ What duration you consider?

☐ How you measure what?

☐ How you interpret the results?

☐ How you use the assessment?
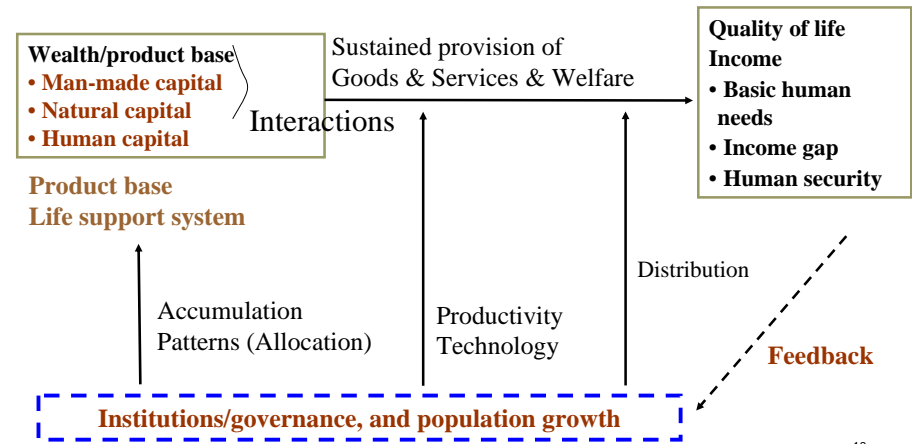
These steps constitute sustainability assessment.

Characteristics of sustainability

- Dynamics (long-term things)
- Uncertainty (many things unknown)
- Complexity (many factors and systems involved and interacted)
- Local vs global (spatially connected)
- And more…

My view in conducting sustainability assessment research

Wealth/product base
- **Man-made capital**
- **Natural capital**
- **Human capital**

Interactions

Product base
Life support system

Sustained provision of Goods & Services & Welfare

Quality of life
Income
- **Basic human needs**
- **Income gap**
- **Human security**

Accumulation Patterns (Allocation)

Productivity Technology

Distribution

Feedback

Institutions/governance, and population growth

Two fundamental ideas

- **Strong sustainability**

  Natural materials and services cannot be duplicated by man-made capital. The state of the environment must be maintained and enhanced.
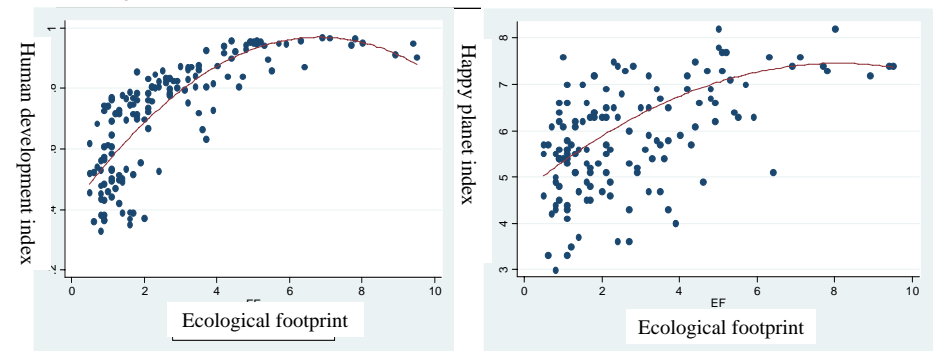
- **Weak sustainability**

  Man made capital can be replaced by the environment.

Which one you think should be taken?

Interesting observations: Physical achievement vs QOL

Human development index — Ecological footprint

Happy planet index — Ecological footprint

Implications are (my opinion):
Strong sustainability → developing countries
Weak sustainability → developing countries
Should put value on QOL instead of GDP・Physical Consumption

Recent developments in Sustainability Assessment: Biodiversity-conservation and Eco-system services

Two major global environmental issues

- The Earth Summit (1992)
  - *Convention on Biological Diversity*
  - *Framework Convention on Climate change*
- Bio-diversity conservation is as important as climate change.
- Yet, huge gap exists in progress between the two.
- Specifically, IPCC has triggered major policy changes and actions around the world.

Reasons why gap exists

- Lack of knowledge through (academic) assessment studies
- Climate changes → getting to know what the consequences of climate change are.
- Biodiversity conservation: lots of literature on the impact of human actions on ecosystems (rather clear) but little knowledge about the link b/w bio-diversity loss and its negative impacts on human welfare: how do you measure bio-diversity? What services and how much do human being receive?

Some basics

- Biodiversity measures: it barely has operational definition (like "sustainability")
- One candidate: species richness (the number of species): Why is it important?
  - B/c of their existing values (it has some bottle necks)? Or b/c "diversity" yields high productivity of ecosystem services?
- How do you measure "diversity"?:
  - E.g., Phylogenetic trees (in ecology) and more sophisticated methods by Weitzman, Polasky, and among others.
- It is yet hard to connects diversity measures to human welfare.
- So, many researchers have begun to focus directly on ecosystem services rather than biodiversity as the way to define the objective function for policy.

Emerging integrated studies (of high quality)

- □ (Limited) budget allocation for biological conservation: Integration of cost-minimizing scheme into eco-service production (Ando et al 1998 in *Science*)
- □ Inclusion of scope (number of services) and spatial effects (geographical and temporal): Nelson et al. (2009) in *Front Ecol Env*.
- □ Incorporating non-linearity between eco-system services and habitat size into the study of Mangrove conservation (Barbie et al. 2008 in *Science*): This allows us to provide partial development strategies for a specific site (not like a development-or-conservation solution)
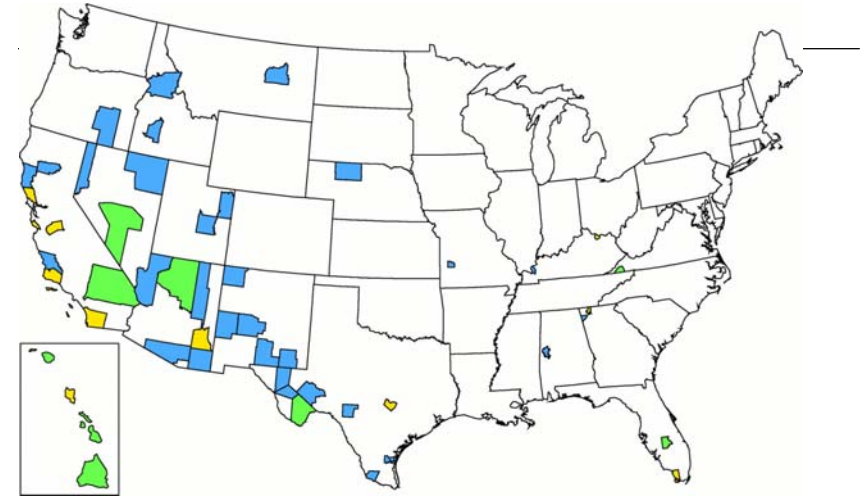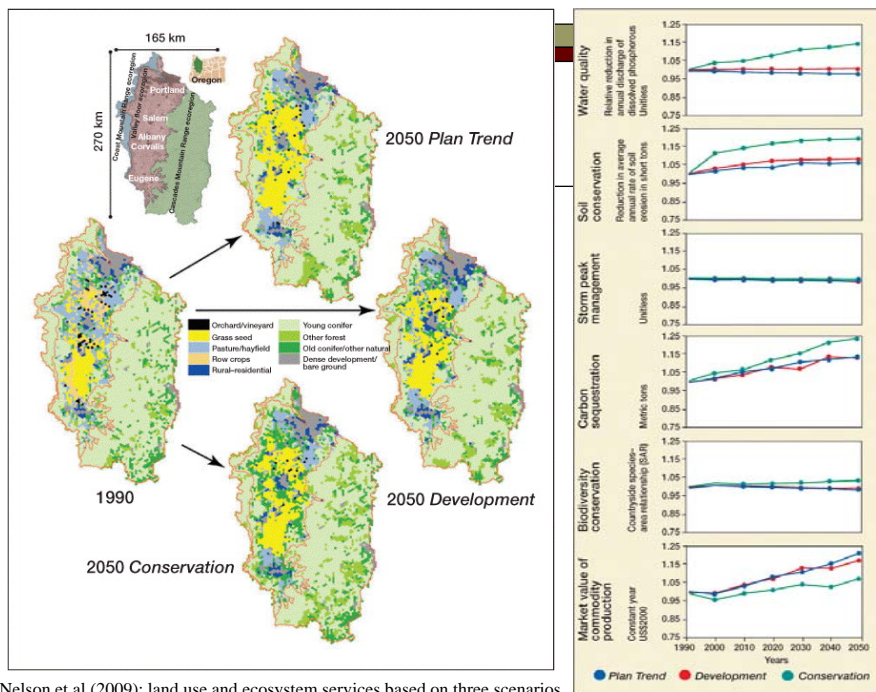
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Ando et al. (1998)

Figure 2. Selected sites for coverage of 453 species in the United States. Sites in the site-minimizing solution only are shown in yellow, sites in the cost minimizing solution only are shown in blue, and sites in both solutions are shown in green.

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Nelson et al (2009): land use and ecosystem services based on three scenarios

Summary

- □ Sustainability is a concept that has barely operational definition.
- □ Also, sustainability issues by nature have complex characteristics.
- □ I overviewed ideas and approaches important for approaching sustainability (both research and practices).
- □ (As for research) To accumulate research outcomes dealing with a specific case while taking an integrated approach is essential.
- □ I believe every academic field is able to contribute to the research field of sustainability assessment (sustainability science).

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