Towards an “Open Source Commons” in Environmental Management and Policy

Charles M. Schweik
Associate Professor
Department of Natural Resources Conservation
Center for Public Policy and Administration
Associate Director, National Center for Digital Government
University of Massachusetts, Amherst, MA, U.S.A.
email: cschweik@pubpol.umass.edu

Environmental management and public sector IT:
We've made progress in...

1. ... the debate over how to effectively manage our environment
2. ... the development of technologies we can use to help us understand our environment
3. ... the interest and abilities to collaborate over the Internet

1. PROGRESS IN THE DEBATE OVER HOW TO EFFECTIVELY MANAGE OUR ENVIRONMENT

- Garrett Hardin (1968) “Tragedy of the Commons”
  - Conclusion: Government control or Privatization required

- Ostrom (1990) “Governing the Commons”
  - Common Property is also a policy option
  - Long enduring CPRs governed by their users
  - Central issue: Collective action
1. PROGRESS IN THE DEBATE OVER HOW TO EFFECTIVELY MANAGE OUR ENVIRONMENT

- Mid 1990s-present:
  - Research showing that no form of governance is uniformly associated with sustainable resource governance (National Research Council, 2002)

- Effort needs to be a deeper understanding what “institutional designs” work and in what contexts

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Conceptualizing environmental institutions

- One approach to Institutional analysis:
  - Focus on “actor” in “action situations”
  - Physical, Community and “Rules in Use”
  - Rule Levels: Operational, Collective-choice, Constitutional
  - Rules can be formal or informal norms

- Rules have spatial and temporal properties, and we don’t map them very well

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Source: Dietz, Ostrom, and Stern, 2003
Important Environmental Management Technologies

- Remote Sensing and Geographic Information Systems (GIS)
- Other GIS data
- Computer-based modeling
- Moving rapidly toward real-time sensor monitoring networks

THREE QUICK REMOTE SENSING/GIS EXAMPLES

- Studying “Institutional Landscapes” in Indiana, USA
- Habitat Conservation Planning in Coachella Valley California
- Identifying “Forest Anomalies” in Nepal

CASE 1: Change in the Hoosier National Forest in Indiana, USA

Figure 4-6:

The Hoosier National Forest Pleasant Run Unit 1985 Institutional Landscape
(Adapted from 1985 Land and Resources Management Plan, Hoosier National Forest)
REMOTE SENSING CASE 2:
Evaluation of the Coachella Valley Fringe Toed Lizard
Habitat Conservation Plan (California, USA)
The sand dunes they are trying to protect

The Institutional Landscape of the Coachella Valley
Fringe Toed Lizard Habitat Conservation Plan

- Preserve areas (white – main; black - backup)
- Mitigation fee areas (White/Gray vertical stripes)
- Public land to be managed (Light gray)
- Private land to be zoned (Dark gray)

As new land is developed in fee area, $600 per acre goes to management of the preserves

Chosen Endmembers

- Packed Silt
- Active Sand
- Poorly Sorted Alluvial Sand, Rock and Gravel
- Development
- Live Vegetation

Landsat TM 06/06/86 Matched Filter Modeling Results

EM1 1986 - Active Sand
EM2 1986 - Packed silt with scattered creasote bushes
EM3 1986 - Unsorted or poorly sorted alluvial sands, gravel and rock
EM4 1986 - Development
EM5 1986 - Bright Live Vegetation
EM1 1998 - Active land
EM2 1998 - Packed silt with scattered creasote bushes
EM3 1998 - Unsorted or poorly sorted alluvial sands, gravel and rock
EM4 1998 - Development
EM5 1998 - Bright Live Vegetation

The Search for “Anomalies” in Community Forest Management
Where do forest stands exist, where theoretically we would not expect them? Why are they there?

Case 3: Locating “Anomalies” in Community Forest Management
Where do forest stands exist, where theoretically we would not expect them? Why are they there?

East Chitwan Nepal – 1/24/1989
STUDY FINDINGS

- Quickly located a local community common property forest
  - Baghmara Community Forest, ecotourism driving the forest regrowth
- Further study in the field to understand their institutional designs
- Demonstrates the power of satellite-based change analysis for possibly locating locally-based forest governance

Progress in GIS Data and Software

- Space Shuttle Topography Mission
- Web-based repositories for open access GIS data (e.g., MassGIS, NSDI Clearinghouse network)
- Development of Free (as in cost) and Open Source software
  - QGIS, GRASS, MapWindow, MapServer
  - OSGEO foundation
  - Google Earth

Computer-based modeling

- An example: USDA Forest Service review of Landuse Change models (2002)
- Interested in modeling broad-scale forest change in eastern US
- Lots of models out there
- Many different approaches (e.g., regression, econometric models, dynamic systems, GIS-based)
- Not building upon each other very well

Moving toward real-time environmental sensors

- Examples:
  - Water temperature and depth levels (USGS)
  - “Smart Garbage” in Massachusetts
  - Monitoring fish “breathing and coughing” to measure water quality in city reservoirs
- XML and web data service technologies allowing data loggers to communicate to other parts of the NET
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UNPRECEDENTED PROGRESS IN INTEREST AND ABILITIES TO COLLABORATE OVER THE INTERNET

- Internet collaboration is not new (e.g., Usenet) but the WWW really led it to take off
- People wanting to meet others with like interests
- Intra-organizational or Inter-organizational collaboration but scattered geographically

THREE INTERNET COLLABORATION PROJECTS RELATED TO ENVIRONMENTAL MANAGEMENT

1. The ACORN Project: Using Internet tools to foster cooperative forest management in Vermont and Massachusetts
2. The “Open-Research” System
3. Free/Libre and Open Source Collaboration Study

PROJECT 1: A COoperative Resource Network (ACORN)

Using Internet tools to foster cooperative forest management in Vermont and Massachusetts
PROJECT 1: ACORN

- The Challenge: Protecting Forests and the "Ecosystem Services" they provide
- Ecosystem services:
  - Drought and flood mitigation
  - Soil preservation and nutrient recycling
  - Air, water purification
  - and many others
- Landscapes in the United States are increasingly parcelized

Example:
Property boundaries in on U.S. country
(brown areas are state forest land)

ACORN

- Public programs to encourage forest management
  - USDA Forest Stewardship Incentive Program
  - Massachusetts Current-Use Forestry Property Tax Program
  - American Forest and Paper Associations Tree Farm System
- Low participation
  - Fear of "loss of control" of their land
  - Value privacy

THE IDEA OF ACORN:

- Majority of landowners with 10 acres of forestland or greater have Internet access in the United States
- Lot’s of forest management information on the web, but most not locally specific
- ACORN Goal: Encourage landowner cooperation through information sharing, rather than management requirements.
- Can we get people thinking about their land in the broader ecological context? Can we get them collaborating?
- Two projects: Southern Vermont and Western Massachusetts
Acorn Major Components

- Home page updated at least monthly with "highlights" - a kind of monthly online magazine
- Online "MapServer" Layers:
  - Aerial photos, Landcover maps, Conserved lands, Elevation, roads, wetland boundaries, "forest health" indicators, likely deer wintering areas, etc.
- Local forestry information provided by local foresters or the state agency
- Ask a forester tool
- Talk to other landowners tool

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ACORN VERMONT RESULTS

- Visitation as of May, 2006: approximately 15 hits/day, 4 page views and lasting 1:38 minutes.
- General increasing trend with spikes after regular postcard mailings
- Online Survey:
  - Reaching new and old landowners
  - Reaching absentee owners
  - 71% of users are > 50 years old
  - Half of users do not currently participate in forest management programs

INTERNET COLLABORATION

PROJECT 2:
The Open Research System
ORS: The problem being addressed

- USDA Forest Service – 1999:
  - "We need a web-based platform to share metadata (data about data) and the datasets/research results"

- Two major Forest Service funded user groups:
  - The Baltimore Ecosystem Study NSF LTER ([www.beslter.org](http://www.beslter.org))
    - Over 50 co-PI's distributed all over eastern USA
  - The Urban Ecology Collaborative ([www.urbanecologycollaborative.org](http://www.urbanecologycollaborative.org))
    - Researchers from at least 9 major US cities represented, including NY City, Boston, Baltimore, Washington D.C., Chicago and others

Early 2000 ORS: A Slightly Naïve Design

- A standalone site
- Supports BES, but also others (e.g., local nonprofits)
- Borrowing the idea of “open source” and applying it to data
- The idea that people/organizations interested in the Baltimore environment could log in and share data with one another

Early 2000 ORS: Functionality

- "Post" metadata to a database
- Optional posting of the actual datasets
  - GIS data
  - Nonspatial data (spreadsheets, word documents, etc.)
  - Publications
- Keyword search function of metadata
- Separate web-based administrator system
- Capacity to handle subgroups
- "Public" and "Private" (Intranet) capabilities
The importance of preserving “identity”: Seamless interface to client websites

Web-services model

Only “key” functions
- Public and Intranet functions
- Post metadata and optional data
- Search metadata
- Administrator functions

Charles Schweik. UNU-IST presentation Oct 9, 2006
**ORS – Lite: Web Services (Search)**

- **HTTP Request**
- **XML**
- **XSLT Template (Process)**
- **ORSLITE File Directory**
- **Baltimore Ecosystem Study Web Site**

**ORS – Lite: Web Services (Submit)**

- **Web-Service API**
- **XML**
- **ORSLITE File Directory**
- **Baltimore Ecosystem Study Web Site**

**Advantages:**
- **Platform independence:** Search and Post can be performed/invoked by any client.
- **Flexibility:** ORS provides search and post results (metadata) in XML format. The module which blends search results in XML can be modified, e.g., to be compliant with EML.
- **Transparency:** Search and post results can be presented with XSLT template to provide "brand identity" for a client.
- **Security:** A client can search only information he/she has access rights.
- **Middleware for future “real-time environmental sensor” data collection networks?**

**INTERNET COLLABORATION PROJECT 3:**
Free/Libre and Open Source (FOSS) Collaboration Study
The urgency for better ways for global collaboration on environmental problems

- Landuse change modeling as an example
- Free/Libre and Open Source collaborations as a model for Internet collaboration in other domains
  - Science?
  - Policy Analysis?
- Emergence of “Open Content” licenses

### Methods

- Literature review – factors thought to contribute to success/failure of these projects; link to environmental commons
- Defining success/failure (longitudinal issues)
- Random sample of initial projects for interviews
  - Stratifying by developer team size
  - Interviews with developers
- Currently building metadatabase of FOSS projects for larger online survey and quantitative analysis
  - Crawling Sourceforge.net; Will be crawling other FOSS hosting sites

Some findings after preliminary interviews

- Commons “tragedies” differ:
  - Environmental commons: Over-appropriation
  - FOSS commons: under-production
- Institutions appear to evolve as one moves from small to large teams (as expected)
  - From norms to more formal rules (but only a few)
  - Many operational rules are driven by collaborative platform
- FOSS projects appear to have extremely lean institutional designs – this differs from environmental commons
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Contact and organizational information

- Email: cschweik@pubpol.umass.edu

- Personal website where some of my papers are available:
  http://people.umass.edu/cschweik

- National Center for Digital Government at Umass Amherst: www.ncdg.org