Facing Our Reality

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Global Environmental Challenges:
Population, land & water use for agriculture
Global status of Ecosystem Services
Impacts of feeding 9 billion people
Environmental Governance: Global
Environmental Governance: Tennessee
A call for Resilience

Challenge II: Feeding 9 Billion

From 7 to 9 Billion by 2050: 50M/Year
### Challenge II: Land Use for Agriculture
- 35%-40% of ice-free land is used for agriculture

### Crop Production to Feed 9 Billion
- Assuming recent growth in developing world economies continues (3% annual), overall food production to increase by 70%
- FAO stats

### Challenge III: Water Use for Agriculture
- 70% of global water use is for agriculture
- Given current water use, agriculture will double water use to feed 9 billion

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**Breakdown of freshwater use**

- 70% agriculture
- 22% industry
- 8% residential
Rivers Running Dry Due to Use (primarily irrigation)
- Amu Darya: Uzbekistan/Aral Sea
- Colorado: U.S.A/Mexico
- Fen: China
- Ganges: India/Bangladesh
- Indus: Pakistan
- Nile: Ethiopia, Sudan, Egypt
- Yellow: China
Source: FAO

Countries Depleting Aquifer Supplies
(Countries have over 5% of world population)
- Mideast: Afghanistan, Iran, Iraq, Israel, Jordan, Lebanon, Pakistan, Saudi Arabia, Syria, Yemen
- Asia: China, India, South Korea
- Africa: Morocco, Tunisia
- Americas: Mexico, United States
- Europe: Spain
Source: Earth Policy Institute
**Challenge IV: Ecosystem Services**

- **SUPPORTING**: Nutrient cycling, Soil Formation, Ecosystem functioning …
- **PROVISIONING**: Food, Freshwater, Wood & fiber, Fuel …
- **REGULATING**: Climate & Flood Regulating, Water Purification, Disease Prevention …
- **CULTURAL**: Aesthetic, Spiritual, Educational, Recreational …

Also called Green Infrastructure Services
2009 Study in Nature Foley et al identified 9 biophysical thresholds, 3 we may have passed:
  - Biodiversity Loss
  - Nitrogen cycle
  - Climate Change

Threshold should not exceed 10X historical long term rate
Scientists estimate current rate is 100 to 1000 times historical rate
Human activity releases 121 M tons of Nitrogen; Scientists suggest 35 M tons is a safe level.

- Corral reefs & Marine ecosystems
- Increases in severe weather
- Changing global weather patterns
- Early springtime snow melt & snowmelt decline (18%/decade vs 11 percent for Arctic sea ice—Derksen & Brown, Geophysical Research Letters, 2012)
- Artic Methane Release
- Human impacts include earth and atmospheric linkages, establishing significant change and uncertainty

Historically, scientists pieced together Earth's history from signals of significant change such as “a supercontinent drifting over the South Pole”

The suggestion: Humans are impacting the earth so much, we are transitioning from Holocene to The “Age of Man” Paul Crutzen Nobel Prize holder Nature, 2002
Change and interconnectedness are on steroids.

Complexity and uncertainty are norms.

Importance of Adaptive capacity and Resilience—What is our ability to respond to shocks? How resilient are we?

Governing Processes

Who should be involved?

What decision process should be used?

Learning: How can policy makers develop & use knowledge?

Public learning: How can relevant publics learn—users, consumers, other citizens?

Improving the system of governing & rule making
Environmental Governance at International Level

I: Global Environmental Facility-GEF
- Independent & largest funder to improve the global environment
- Directly funded $9.2 billion & co-financed $40 Billion
- Has multiple mechanisms including Small Grants Program

GEF Operations

- GEF is financial mechanism for:
  - Convention of Biological Diversity
  - UN Framework on Climate Change-UNFCCC
  - UN Convention to Combat Desertification
  - Convention on Persistent Organic Pollutants
- First international institution to finance conservation trust funds, now in 30 countries
- First to support payment for ecosystem services

GEF Problems

- Cumbersome bureaucracy that works through a network of agencies
- Historically underfunded given task
- Climate money encouraging turf-wars
- Developed (donor) countries support World Bank
- Developing countries support UNFCCC - UN Framework Convention on Climate Change
- Is GEF a compromise?
II: Payments for Ecosystem Services (PES)
Payments to conserve ecosystem services

- China: Largest PES in world, since 1999, $100 Billion (cash & rice) & for 120 million farmers to reforest steep land & encourage new sources of employment (Proc. Nat. Academy Sciences)

PES & Costa Rica

- Since 1997, Payments of $45-$163/hectare for reforestation with funding from W.Bank, Hydro-Company, 15% petrol surcharge

III: REDD—A Climate Change PES

- Reduced Emissions from Deforestation & Forest Degradation: Keeping trees & forests intact to reduce emissions & sequester carbon
Developed nations, corporations, NGOs, & individuals compensate developing countries for forest emissions reduction
Deforestation accounts for nearly 20% of GHGs (UN)
GEF is financial link
Current financial flows/commitments near $4-$5 Billion yearly & projected to $30 Billion by 2020 (UN)

REDD requirements are centralizing tropical forest management after 30 years of efforts of decentralization & community involvement
How to balance local community issues with requirements needed to ensure REDD goals?
Environmental Governance in Tennessee: Habitat Conservation Planning

Issue: How to foster continued economic growth in Crossville & Cumberland County while also conserving threatened and endangered species.

Cumberland HCP: A collaborative agreement between the U.S. Fish & Wildlife Service, Crossville & Cumberland County.

30 year planning period: 1-Projected impact to T&E species and 2-Conservation measures necessary to sustain the species.


Project Facilitating Team: The Nature Conservancy, The University of Tennessee, Tennessee Tech University.

Local Government Implementation: City of Crossville and Cumberland County.

HCPs as a Tool

Primary Partners
Other Involved Partners

- Local conservation groups
- Local development interests
- Other business interests
- Tennessee Department of Environment & Conservation
- TVA
- Corps of Engineers

A Network of Committees, Teams, and Communication Flow

- Steering Committee
  - Steer development of HCP and officially adopt HCP
- Science Advisory Committee
  - Provide scientific guidance and review throughout HCP development
- Project Management Team
  - Supports Steering Committee and Technical Teams:
    1. Facilitation & communication services
    2. Legal & policy information
    3. Education & outreach to stakeholder groups & general public
- Technical Teams
  - Address core technical issues for HCP (e.g., stormwater management)

Primary Activities

- Projecting commercial growth in 30 years
- Identifying what land activities to include (Example: Activities impacting Storm Water Runoff)
- What will be impact of these activities on T&E species?
- What are biological goals needed to sustain species given impacts?
- What conservation strategies and practices are needed to reach biological goals & sustain species?
- What funding & monitoring program will be needed?
Summary: HCP as example of Environmental Governance

- Complex network of involved institutions
- Limited government funding
- Absence of policy to create market based payments for ecosystem services
- Challenge of employing new schemes
- Tension between bureaucratic guidelines & local participation
- Significant learning: decision makers & citizens
- Development of civic capital

Environmental Governance in the Anthropocene

- Collaborative work is necessary but not sufficient
- Seizing the imperative of “co-creating the future”
- Co-creating a fundamentally different relationship with earth’s natural systems
- Beyond environmental governance toward holistic governance at political, economic and social levels
- Aristotle: “How OUGHT we live together?”
- Resiliency of natural systems and our place in those systems