RESEARCH THEME

Managing Environmental Systems

Key objective: To provide new insights on how to manage environmental systems to protect human health, food security, biodiversity and guard against climate change.

SEI research themes

The Stockholm Environment Institute is an independent, international research institute with a reputation for rigorous and objective scientific analysis on environment and development issues. SEI aims to bring about change for sustainable development by bridging science and policy. The institute has organised its research into four themes:

- Managing Environmental Systems
- Reducing Climate Risk
- Transforming Governance
- Rethinking Development

Overall goal

The overall goal of the theme Managing Environmental Systems is to ensure sustainable human development by enhancing food security for an expected global population of nine billion people by 2050, reducing the health impacts caused by atmospheric pollution and lack of sustainable sanitation, and promoting air, land and water resource management to protect ecosystem services and climate.

To achieve our goal we focus on understanding the biophysical processes that affect our resource use. Knowledge of the interactions between land, air and water resources is central to achieving a range of outcomes, which include identifying and promoting viable food and fibre production systems, increasing food security, improving the resilience of rural livelihoods, reducing poverty, and managing local climatic systems. These are all areas in which SEI has developed important expertise in past decades.

Importantly, we recognise that these local interactions are not isolated, but nest within larger interacting systems. These include: (i) atmosphere, where pollution affects both ecosystems and vulnerable human communities and creates feedbacks with the global climate system; (ii) watersheds, which are embedded within global climate/hydrological cycles that support human activities through capture, storage and distribution of surface and ground water for multiple benefits and; (iii) the terrestrial biosphere, which often connects atmospheric and water processes in such a way as to provide biomass resources essential for sustaining human activity. We recognise that all these processes are embedded within economic and social systems that require appropriate governance from the local to the global scale if they are to be managed sustainably.

SEI is active at all these spatial scales, placing us in a unique position to understand complex biogeochemical cycles within which system changes at the local scale can accumulate sufficiently to influence global dynamics. Defining the safe operating limits for these systems is a key scientific challenge, and SEI research suggests that some of these boundaries may be planetary in scale and hence require international cooperation in their management. Other more local scale ecosystems and resources may require different management mechanisms to ensure their resilience to change and continued ability to support livelihoods. The research carried out within this theme will endeavour to define appropriate boundaries to inform policymaking at a range of scales of resource management.

Strategic objectives

To achieve our goals we have a number of strategic objectives, targeted at the scales where managers seek to protect and improve the provision of ecosystem services. They are designed to support policy change for improved food security, human health, biodiversity and climate. We aim to:

- Support sustainable urbanisation through holistic analyses of urban infrastructure and its capacity for service delivery, and the consequences for communities of changes in land-
use, air quality, water resources, sanitation and solid waste.

- Support the development of sustainable bioresource and bioenergy strategies and their governance processes in Asia, Latin America, Africa, Europe and North America, securing both food and energy access.

- Support the implementation of good governance and management in the fields of sustainable agriculture, water security and sanitation in the face of increased water scarcity, land-use pressures and environmental degradation, especially in sub-Saharan Africa, North Africa, the Middle East, Latin America and Asia.

- Develop and analyse scenarios to integrate energy and land-use planning to identify co-benefits that can be realised by addressing both climate change and air pollution mitigation. Focus is placed on ecosystem services, human health, food security and biodiversity.

- Develop our understanding of biogeochemical cycling, particularly water, carbon and nutrient cycles to advise policymakers at global to regional scales on the role the terrestrial biosphere plays in controlling climate feedbacks.

- Turn our experience of building natural resource management models that can deal with land, air and water resources into the next generation of integrated assessment tools. These tools will support decision-makers in the management of scarce natural resources for the strengthening of livelihoods and the sustainable management of ecosystem services.

Our work
SEI researchers are involved in a number of initiatives and projects that aim to improve the management of our environmental systems. Examples of key initiatives and projects are listed below.

The triple green project
This integrated project is being undertaken in Niger, West Africa, to understand the biophysical relationships between carbon, water and nutrient cycling for improved management of arable agricultural systems. Scaling methods are used to assess the viability of extending these methods to the regional level, and whether they can help us remain within planetary scale boundaries related to water, nutrient cycling and climate change.

Removing barriers to effective integrated water resources management
WEAP is a user-friendly software tool for water resources planning, developed by SEI. Over 4,000 people in 150 countries use WEAP as an environmental planning tool. The majority of WEAP users are based in developing countries. However, their success in applying WEAP as a decision support tool could be improved with greater capacity and access to data. This project will develop this capacity by providing universal access to data, improving decision support tools, and fostering collaboration in the expanding WEAP community.

The integrated sustainable sanitation initiative
This initiative will develop a large, SEI-integrated sanitation work programme, in cooperation with EcoSanRes worldwide ‘knowledge node’ network, the Sustainable Sanitation Alliance and the Swedish resource base. Each project planned under this initiative would include four components: knowledge management, training and capacity development, communications and networking, as well as management support.

The green-blue water initiative
Currently in its pilot phase, the Green-Blue Water Initiative (GBI) is a regional knowledge base, and will also develop a set of tools through dialogue with project partners and stakeholders. A full-scale programme will be developed, in which local and basin-wide effects of interventions (in terms of costs, benefits and trade-offs) will be determined for various planning scenarios. Key tools for the initiative include WEAP at the management level, and SWAT for research and capacity development. Visit www.weap21.org and swatmodel.tamu.edu for more information.

Summary
Growing populations, rapid urbanisation and increased consumption put unprecedented pressure on land, water and air resources. Our research addresses how to manage these resources to enhance food security for our planet’s six billion people.

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