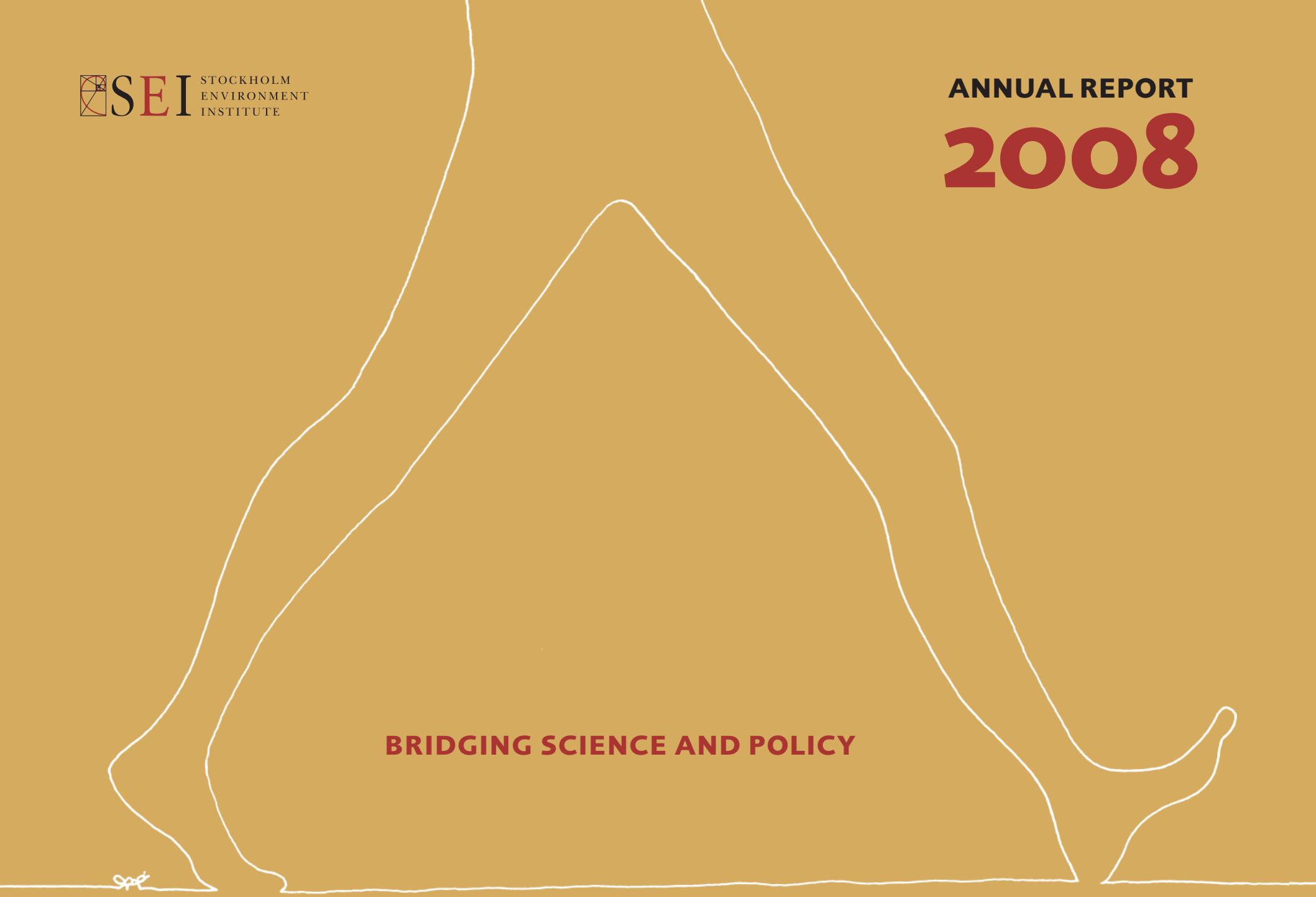
SEI STOCKHOLM ENVIRONMENT INSTITUTE

ANNUAL REPORT 2008



BRIDGING SCIENCE AND POLICY

WELCOME

STATEMENT

from the Executive Director and the Chair of the Board

For a long time many assumed that ecological systems change gradually, and also that sustainable development could be achieved through steady, incremental progress. However, recent evidence points to the contrary – that social and ecological systems are characterised by long phases of minor change followed by sudden, non-linear upheavals. We saw this play out in the financial crisis that hit the world in 2008. A long period of unsustainable and cumulative financial behaviour eroded resilience to the point where a small trigger – the collapse of a couple of banks – pushed the whole financial sector over a dramatic threshold.

THE FINANCIAL crisis is closely intertwined with our exploitation of the planet's natural capital. Financial mechanisms were created to allow excessive consumption. Sub-prime loans and sophisticated financial castles in the air propelled the economy to new insupportable heights. Wealth today was created at the expense of tomorrow, and we have now received the bill for this in the form of an imminent global economic recession. And there is another bill in the post: the planet will demand payment for our unsustainable use of ecosystem functions and services, and we are already seeing indications of the costs. The abrupt – and unexpected – collapse of the Arctic summer ice in 2007 and 2008 is analogous to the tipping point that led to the financial crisis, and is at least as alarming and costly for humanity in the long run. The sad fact is that we are taking out sub-prime loans from the Planet, and this cannot last forever. There is one fundamental difference between the Arctic and Wall Street, though: it doesn't matter how much money we throw at the Arctic, we still don't know how to refreeze it.

The challenge we face is to prevent and solve these large scale non-linear changes, and this requires a deep understanding of how complex social and environmental systems interact from local to global levels. Furthermore, it requires the ability to innovate and create new approaches to business, governance and practice. And it requires us to recognise that environmental issues are, in fact, inseparable from questions of development.

THIS IS AT THE HEART of the SEI mandate: to provide integrated, policy-relevant insights and solutions for the social-ecological challenges that face humanity and, by doing so, support transitions toward sustainable development. As an independent international research organisation, our work – the efforts of 180 staff in seven research centres around the world – is devoted to turning this mandate into tangible achievements through research, capacity building, communication, and by bridging science and policy.

SEI's credibility relies on the quality of its research and its engagement on the ground in real-world issues. This work gives SEI a coherent and distinctive profile – one that builds on the vision of SEI's founding director Gordon Goodman, who sadly passed away in 2008. Gordon not only successfully established SEI as an internationally recognised research organisation, he was also deeply involved in setting up the Intergovernmental Panel on Climate Change. Furthermore, he pioneered the crucial understanding that environment and development issues are tightly intertwined, particularly for poor communities in the world. Gordon's influence certainly lives on within SEI, and we are now

broadening his legacy by establishing the Goodman Lectures, the first of which will be held in 2009. The Goodman Lectures will be hosted by SEI and the Royal Swedish Academy of Sciences, Gordon's two institutional homes in Sweden.

FOR SEI, 2008 was an intensive year of continued growth and consolidation of strategic research initiatives. A milestone for us was the formal establishment of the SEI Africa Centre, which is hosted at the University of Dar es Salaam in Tanzania (see page 10). The Centre will operate across the entire continent through its extensive knowledge network. In partnership with African institutions, SEI Africa will advance knowledge for policy and development in areas where it can fill critical gaps. Initially, the Centre will focus on the key issues of climate change (policy and adaptation) and bio-resources (bio-energy, water and land management).

In 2008 SEI succeeded in connecting its research even more closely to policy. We have, for example, made important contributions to Tony Blair's climate initiative, the Swedish Prime Minister's Commission on Sustainable Development and the Swedish Commission on Climate Change and Development (the secretariat of which was hosted by SEI in Stockholm), as well as to the European Union's biofuels legislation. SEI also hosted the Nordic Council of Ministers COP 15 group, established to provide the Nordic countries with policy advice in preparation for the UN climate change negotiations in Copenhagen (COP 15).

SEI also helped to broaden policy discussions on climate change. Our research on Greenhouse Development Rights (GDRs) has highlighted that a burden sharing regime in line with the UNFCCC – one which takes both climate science and climate justice seriously – will unavoidably result in mitigation requirements on developed countries that exceed 100% by 2025. Our research on embedded carbon in consumption has also received much attention: we revealed that what appear to be net reductions in emissions for countries such as the UK or Sweden are in fact significant net increases – because rich nations increasingly import consumer goods, effectively exporting emissions to other countries.

Alongside our broad network of stakeholders in the South we continued to advance dialogue on climate and development with, among others, representatives for the Group of 77 developing nations in collaboration with the UN. Together with partners in China, SEI initiated strategic research on the economics of climate change in China as a support to the international climate negotiations. We launched a new scientific journal, *Climate and Development* (based at SEI and published by Earthscan), at the UN climate change negotiations in Poznań (COP 14). SEI and the UN Environment Programme (UNEP) also held a workshop of the Global Atmospheric Pollution Forum on the links between mitigating climate change and reducing air pollution.

Furthermore, through our broad systems approach to global environmental change, we helped to communicate to the policy arena the latest science on climate change and the risk of positive feedbacks from the Earth system. On the basis of this science, the European Commission tightened its climate stabilisation target.

OVER THE PAST YEAR SEI's association with the Stockholm Resilience Centre went from strength to strength. In April 2008 the Centre, together with the International Council for Science (ICSU) and the Resilience Alliance, hosted the first international resilience science conference. An amazing 700 researchers from around the world gathered in Stockholm, firmly establishing the Resilience Centre as a vital global nexus for trans-disciplinary resilience research.

Together, SEI and the Stockholm Resilience Centre form an extraordinary, complementary partnership, strengthening the research profile of SEI and the science-policy interface of the Resilience Centre. Gordon Goodman loved the fact that the Centre was a collaboration between SEI, Stockholm University, and the Beijer Institute at the Royal Swedish Academy of Sciences. After all, The Beijer Institute was the predecessor of SEI in the 1980s, an institute that Gordon headed before establishing SEI. Now, 20 years later, we have joined forces in our common cause to contribute new knowledge for a sustainable world.

Johan Rockström – Executive Director
Lars Anell – Chair of the Board

Johan Rockström – Executive Director of SEI

Lars Anell– Chair of the SEI Board

GORDON GOODMAN

(1926–2008)

Founding Director of the Stockholm Environment Institute

GORDON GOODMAN, who died in May, 2008 at the age of 82, although Director of the Stockholm Environment Institute for less than two years, is still for many the essential embodiment of the Institute. This is not due only to the innovative ideas he promoted and the Institute's thrust and direction, for which he laid the foundation, but also to the working approach he pioneered and established. To engage with SEI's mission statement is to be back with Gordon, planning and pushing forward work on an important development or environment issue. Long before 'evidence based' policy formulation and decision making became the fashion, for Gordon, engagement with an issue, the collection of relevant data followed by analysis, assessment and investigation, and then a period of synthesis of all relevant facets was the natural way to approach a problem. For him policy was never primarily determined in the light of political expediency.

A notable example of Gordon's approach was his engagement with the climate change issue, something for which he never received adequate recognition. Early on, after absorbing the accumulating evidence that, for example, the Scientific Committee on Problems of the Environment (SCOPE) assembled in its book *The Greenhouse Effect, Climate Change and Ecosystems*, Gordon appreciated that some ongoing, concerted, multi-disciplinary effort had to be organised. Effective policies needed to be agreed to address the major development and environmental issues of climate change on a global scale. Working with the Advisory Group on Greenhouse Gases (AGGG) he organised two seminal meetings, one in Bellagio and the other in Villach, and from these evolved further documentation of the scientific basis of climate change phenomena, the range of responses and effects by natural and man-managed ecosystems and, thirdly, the socio-economic context within which all of this would play out. The structure of this approach is easily recognisable in the present Intergovernmental Panel on Climate Change, which eventually eclipsed the work of the AGGG.

Of course, these accomplishments were not achieved single-handed. Gordon was able to interest, motivate and weld into a single, focused group a whole range of experts, visionaries and experienced practitioners. Actually, they ended up wanting to work with him! Some even felt slighted if they had not been invited to do so.

Gordon appreciated the complexity of the interdependent relationships involved with natural and man-made systems, within societies, institutions and communities. To deal with such systems one needed the input of a variety of actors at local, national, regional and global levels. These, Gordon knew, had to be knowledgeable and perceptive, appreciating the depth of knowledge against which action was planned. Above all they needed to be open-minded and innovative to work with Gordon. They needed to appreciate the complexities that ranged across natural and applied science, social and political science, and economics. The focus often had to be local but with a realistic appreciation of the global context. All of this needed to be brought to bear on the task of policy formulation, adoption, implementation and monitoring – still the mission of the Institute today

This annual report displays the truth that policymaking, global and local partnerships, complexity and innovation are still the hallmarks of the Stockholm Environment Institute as it seeks to contribute to equitable development and environmental health and sustainability across the world.

M.J. Chadwick

'His advice was always soundly based on scientific evidence, practical, and given in such a way that the receivers came away with a spirit of determination and a vision of possibilities for the future. All this was done with an engaging sense of humour.'

Obituary, *The Guardian (UK)*, 26 June 2008

SEI AT A GLANCE

Our goal is to bring about change for sustainable development by bridging science and policy. We do this by providing integrated analysis that supports decision makers.

WHO WE ARE

SEI is an independent international research institute. We have been engaged in environment and development issues at local, national, regional and global policy levels for more than a quarter of a century.

The Institute was formally established in 1989 by the Swedish Government. Since then SEI has established a reputation for rigorous and objective scientific analysis in the field of environment and development.

Our goal is to bring about change for sustainable development by bridging science and policy. We do this by providing integrated analysis that supports decision makers.

HOW WE WORK

We believe that scientific insights can guide us through change and should inform decision making and public policy. We also believe that local knowledge and values are crucial in building sustainable lives. Our approach is often highly collaborative, and stakeholder involvement has always been at the heart of SEI's work. Our projects help to build capacity and strengthen institutions to equip our partners for the long-term.

Our researchers are gathered into six thematic teams that tackle overarching issues like climate change, energy systems, vulnerability and governance, as well as specific problems such as water resources and air pollution. Our work on scenarios, sustainability modelling and vulnerability assessments has gained particular recognition.

SEI is an innovator, and has consistently shown the vision to confront issues before they enter the mainstream: our pioneering work on renewable energy and sustainable sanitation has its roots in the early days of the Institute.

WHAT MAKES US DIFFERENT

We combine the qualities of:

- a non-profit and non-partisan research institute
- an honest broker in handling complex environmental, developmental and social issues
- a research institute committed to rigorous and objective scientific analysis to support improved policymaking
- an agent for change that promotes transitions to a more sustainable world.

Achievements in 2008

From SEI's innovative events at the UN climate change negotiations in Poznań (COP 14) to its contribution at the Tällberg Forum, in 2008 we have continued to shape the agenda on environment and development at conferences and policy forums throughout the world. As our research base continues to grow, our work on communications and publishing is helping it to find an even wider audience. Here are a few highlights of our work in 2008.

SEI's China specialists have been working with the Stern Review and the Chinese Economists 50 Forum to report on the economics of climate change in China. The report will be launched in early 2009.
➔ page 14

Our work on the links between ground level ozone, climate and food production revealed that ground level ozone could pose a greater threat to food security in Southeast Asia than the changing climate. This research was published in a Royal Society report.
➔ page 15

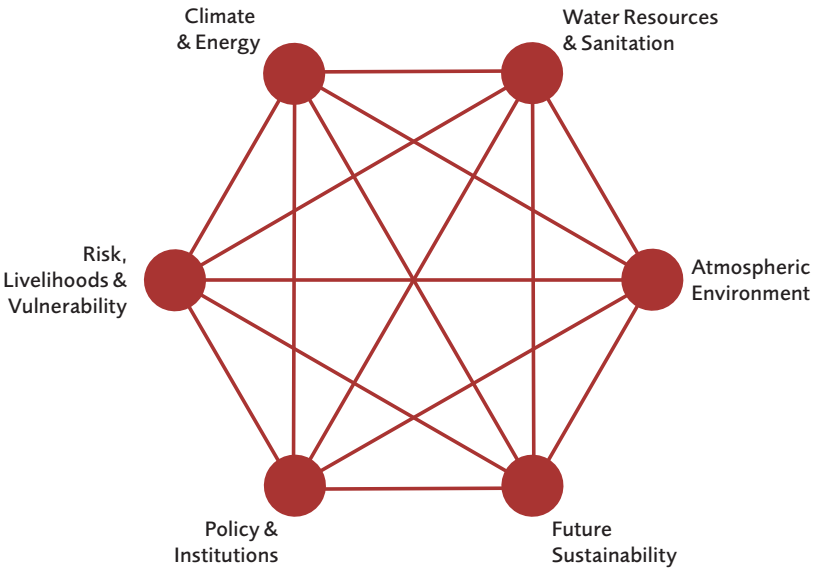
Our Future Sustainability programme has further developed our software tool (REAP) that tracks the ecological footprint of the UK economy by industrial sector, region and socio-economic group. Twenty UK local authorities are using this software in their policy processes, and more than two-thirds of all local authorities use the footprint data that REAP provides.
➔ page 20

For the European Parliament SEI published reports on climate adaptation and biofuels, and with partners in Norway we are running a project to enable the energy industry and policymakers to make more sustainable investment decisions.
➔ page 25

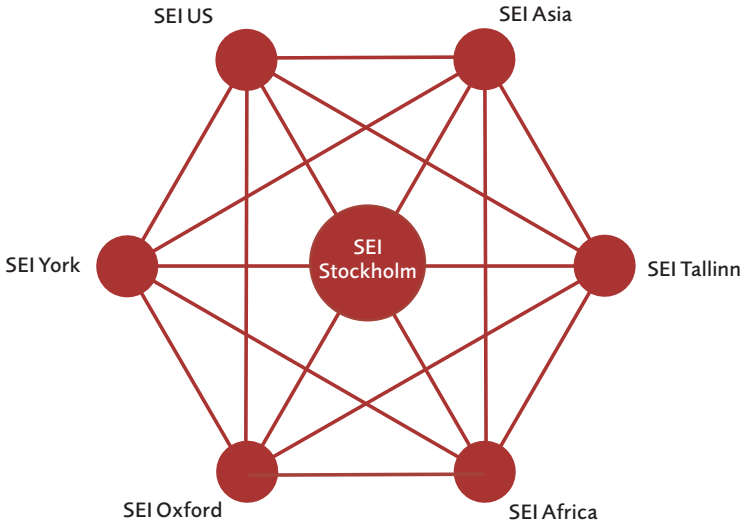
The Greenhouse Development Rights framework (GDRs) provides tools to calculate a climate change agreement that has sustainable development in its DNA. Since its launch at the Bali climate summit the GDRs approach has been championed by development organisations such as Oxfam, and governments in the developed world and the G77.
➔ page 29

The OECD identified the weADAPT platform as one of the three best web resources for knowledge sharing on adaptation. With the addition of the Adaptation Layer the platform is now even better placed to support development practitioners and decision makers.
➔ page 31

Our research programme on ecological sanitation (EcoSanRes) has been exploring and delivering sustainable sanitation in Africa and Asia for the past six years. In 2008 the group published an analysis of progress towards the Millennium Development Goal for sanitation.
➔ page 34



PROGRAMMES AND OFFICES
Our people work from seven locations and project teams generally span these offices.



SEI AFRICA

SEI's new base in Africa at the University of Dar es Salaam, Tanzania, will provide targeted knowledge to decision makers across the continent to strengthen institutions and build capacity.

AFRICA IS FACING many environmental and developmental challenges. Sustainable development can only be achieved by sound management of environmental resources and improvements to infrastructure. To meet these challenges, it is essential to strengthen institutional frameworks and enable public and private actors to organise more effectively.

With the founding of SEI Africa, we can help to make substantial contributions to this goal. The African base also confirms SEI's long-term strategy to integrate more directly with local partners. Over the coming three years, SEI plans to expand across Africa and operate as a network from three main locations, coordinated from the office in Tanzania.

Demand-driven research

A physical presence in Africa helps us to focus on research and analysis that is relevant to and in demand from decision makers in the region. SEI Africa will help to build capacity over the long-term, both with partners in Africa as well as within SEI.

Dialogue

A regional presence enables a continuous dialogue on sustainable development policy with public and private clients active in Africa. We will be able to respond more effectively to demands for policy analysis, develop new approaches and methodologies in development cooperation and guide the private sector to make ecologically and socially responsible investments.

Key issues – climate and bioresources

At the outset, SEI Africa will focus on two priority areas: bioresources and climate issues. Taking a strategic approach, SEI Africa will analyse key environmental and developmental drivers and promote innovative interdisciplinary research.

Bridging science and policy

The emerging SEI Africa network will engage in and promote links between science and policy to support regional decision making. By doing this, SEI will help tackle many of the complex environmental and developmental concerns facing Africa.

The SEED programme – growing access to modern energy

The SEED programme (Strengthening Energy-Environment-Development Processes) supports energy policies and practices that expand access to modern energy services, and the pragmatic use of bio-energy resources for sustainable development. The Sida-funded programme will now move to SEI Africa. Because of SEED's Africa focus, this move will bring greater credibility to the research and ensure close partnership with regional stakeholders.

A shift to cleaner fuels and technologies for basic energy needs is essential to meet the Millennium Development Goals (MDGs). Today, around 2.4 billion people rely on traditional biomass – such as wood, charcoal or dung – to meet their basic energy needs. In sub-Saharan Africa alone, where traditional biomass supplies more than 70% of the region's energy mix, approximately 500,000 people per year die from diseases caused by exposure to indoor air pollution. Traditional biomass use also contributes to climate change and environmental degradation.

A key focus of the programme is household energy access. In July 2008, SEI worked with the Gaia Association, an Ethiopian NGO, to assess an ethanol stove programme in Addis Ababa. It is anticipated that the model developed in Ethiopia will be applied in other sub-Saharan African countries in 2009.

As well as changing lives on the ground, SEED also works with governments to support policy processes in the East African Community (EAC) and to help reach a common energy access strategy.

IN BRIEF

'Any policy on the environment is a policy only on the basis of effective forms of international cooperation which take into account both ecological relationships on regional and global scales, and the interdependence of the world economy. [...] Since SEI initiates, carries out and disseminates research in the environmental field, the physical presence of SEI in Africa, particularly in Tanzania is of paramount importance.'
(Dr. Batilda Salha Burian, Minister of State for Environment, United Republic Of Tanzania)

WHAT WE DO

To give a flavour of SEI's work, we've grouped a selection of our research into four themes that embody the work of the Institute.

COMPLEXITY

We break down barriers between development and environment issues and expose the complex relationships between people, nature and social systems. The result is integrated research that crosses disciplines to fully evaluate challenges and provide solutions.

INNOVATION

Often our work is about asking people to look at things in a different way. We confront issues before they enter the mainstream, and strive for a complete picture rather than looking at aspects of a problem in isolation.

GUIDING POLICYMAKERS

We believe the best way to help decision makers is to provide them with rigorous and objective analysis.

GLOBAL ISSUES, LOCAL PARTNERSHIPS

It is never enough just to theorise about policies. We test what works in practice so our research can be trusted. And we can't achieve this on our own: real change requires input from people who know what's really going on in their region.

COMPLEXITY

Ever since the smogs of 19th Century London we've known that burning fossil fuels to heat homes, generate energy and power transport causes air pollution. New research shows that air pollutants, such as black carbon and ground-level ozone, also have a major impact on our climate.

The atmosphere unmasked

SCIENTISTS, INCLUDING a team from SEI, are developing recommendations for more cost-effective integrated policies to tackle air pollution and climate change in developing countries. This will address both the immediate costs of air pollution and the even bigger bill that comes with the long-term impact of climate change. The World Health Organization says that air pollution accounts for an estimated 500,000 premature deaths in Asia each year, and the World Bank estimates that the cost of air pollution for China's economy is at least USD 23 billion per year.

Hidden impact

2008 has been the year in which the impact on global climate change from substances traditionally considered as 'air pollutants' was highlighted to the global community. At a conference hosted by SEI, IUAPPA (the International Union of Air Pollution Prevention and Environmental Protection Associations) and the Global Atmospheric Pollution Forum in Stockholm, researchers presented evidence that suggests that there are sufficient greenhouse gases (GHGs) already in the atmosphere to warm the planet by over 2˚C. However, air pollution, in the form of aerosols such as sulphate, is reflecting enough sunlight to mask this global warming by about 40%, according to the IPCC.

Black carbon

As some aerosols 'cool' our climate, so deposits of black carbon in the Himalayas and the Arctic cause regional warming by increasing the amount of sunlight that is absorbed by areas of snow and ice. This has the potential to change the flow of water to a region in which 500 million people depend on the Himalayan water resources and contribute to the melting of snow and ice in the Arctic.

The potential for accelerated warming as we clean up our skies and remove the 'cooling' effect of aerosols increases the pressure to reduce both GHG emissions of long- (e.g. CO_2) and short-lived substances (e.g. black carbon and ground-level ozone and methane). It also means making adaptation to climate change an urgent priority (see page 26).

Modelling policy

To support the development of integrated international air pollution and climate change policies, SEI and its partners are using our modelling tools, such as LEAP, to provide long-term energy scenarios (see page 19). These help us to understand the implications of different policy interventions at urban, regional and national scales. Strategies to reduce the relatively short-lived black carbon, ozone and methane emissions will have immediate climate benefits, potentially avoiding key 'tipping points' in the earth system (see page 22), and providing significant benefits to human health and crop yields.

IN BRIEF

- Air pollution is hiding the true impact of GHGs in the atmosphere.
- SEI is also researching carbon sequestration in soils (see page 21) and the influence of ozone and climate change on crops (see page 15).

SUPERKIMBO IN BKK

Smog in Bangkok. Air pollution accounts for 500,000 premature deaths in Asia each year.

The Parliament in London by Claude Monet (1904). Monet painted several views of London showing the sun struggling to shine through the city's polluted air.

The Beijing Olympics brought to the world's attention both China's dynamic economic growth and its environmental problems.

Shopping mall – Dalian, China. Economic development comes with a high price tag.

Thirty years of economic growth in China has come at a price. The same growth that has lifted millions of Chinese out of poverty – and contributed to global economic growth – has come at ever escalating environmental costs, for the country itself and for the global community.

Low carbon China

WITH ITS ASTONISHING economic track record, many developing economies look to China as a development role model. But following the Chinese path to a stronger economy comes with the price tag of rapidly increasing carbon footprints.

The Beijing Olympics brought the severe pollution from China's energy and transport system to global attention. China overtook the USA to become the world's largest greenhouse gas (GHG) emitter in 2007, and the country already faces the impacts of a changing climate, such as the drought in northern China. This combination of factors has led Chinese leaders to consider seriously how the country could achieve a low carbon economy. As the eyes of the developed and developing worlds focus on China, SEI researchers are discovering what a low carbon China would look like.

Searching for answers

For China the key questions are how and at what pace a low carbon economy supports economic and social development. And researchers and policymakers are curious to know what types of international cooperation best support the emergence of a low carbon economy and whether China could take a lead on climate mitigation and adaptation.

SEI and the Chinese Economists 50 Forum (CE50) launched a research project in early 2008 that will answer these questions and provide evidence-based analysis in support of policies for a low carbon economy. The working hypothesis for the project is that a shift to a low carbon economy can generate political and economic benefits, as well as increase global security. Moreover, the transition to a global low carbon economy will depend on sharing out the responsibility for cutting carbon emissions (see page 29).

Cooperation on climate mitigation

At its mid-point, three themes are emerging from the research: fair emission and mitigation targets, policy and institutional change to achieve co-benefits, and sharing the global responsibilities through international cooperation. The findings demonstrate the importance of macroeconomic and trade policies as drivers of climate mitigation.

The project has brought about informal dialogue between mainstream and environmental economists, environmental experts, scientists and policymakers on the economics of climate change. In the longer term we hope to establish a global platform for collaboration between developing and developed countries on low carbon economic development.

IN BRIEF

'A large nation like China (20% of mankind) should have high standards for the global public good, no matter whether others do their part or not... We will look at policy and institutional issues, for example energy and resource pricing systems, and how to eliminate price distortions which cause high emissions.' (Economist Dr Fan Gang of the Chinese Economists 50 Forum)

During the first three months of 2008, international prices of all major food commodities reached their highest levels in nearly 30 years. This price spike, which led to hunger and protests, put food security on the global agenda. But what of the threats to food security in a decade or three?

Sowing seeds of food security

WAS IT DOWN to the longest Australian drought in living memory? Or the increased demand for meat in parts of Asia? Or biofuels? Or the failure to agree trade tariffs? Food security seems dependent on complex interactions between policy, prices and production.

SEI's research has been looking into future food security. In particular, we wanted to know how climate change and ground level ozone (O_3) complicate the picture.

Ozone and climate

O_3 is toxic to plants and humans. Evidence from Asia suggests that current-day yield losses from O_3 exposure are in the order of 10 to 30% for sensitive varieties of staple crops such as wheat, rice and a variety of pulses. And all projections show that O_3 emissions are increasing rapidly in Asia.

Comparing crop yield losses now with those forecast to occur by the end of this century due to climate change (up to 30%) has revealed that O_3 may be a more immediate threat to agricultural productivity than climate change in South Asia. It is also likely that the CO_2 fertilisation effect, that was hoped might partly offset reductions in agro-ecosystem productivity, may well be limited by the impacts of O_3.

SEI researchers have also found that drought, humidity and temperature influence the extent to which O_3 affects crop yield. They have concluded that as changes in our climate combine with increased O_3, future crop yield losses could get even worse.

Economic impacts

For countries with an economy largely based on agricultural production, O_3 induced damage is estimated to offset a significant portion of annual GDP growth. We assessed the economic impacts of O_3 on four staple crops in South Asia, and estimated annual losses in the region of USD 4 billion.

Mitigation or adaptation?

As for climate change, dealing with O_3 requires mitigation and adaptation policies. The transboundary nature of O_3 pollution requires international efforts to effectively reduce emissions of nitrogen oxides and volatile organic compounds and hence O_3 impacts on agricultural productivity. Such emission reductions would have co-benefits for climate change and human health. However, evidence shows that recently bred cultivars of some important crops are actually more sensitive to O_3. We are strengthening links with international crop breeders to investigate adaptation options, such as the breeding of O_3 resistant varieties.

IN BRIEF

- Global economic losses in crop production due to O_3 are estimated to be in the range of USD 14 to 26 billion with about 40% of this damage occurring in China and India.
- There are substantial side benefits from reducing O_3 as ground level ozone is an important greenhouse gas and can have adverse effects on human health.
- SEI was a main contributor to the Royal Society report *Ground Level O_3 in the 21st Century*.

A farmer planting rice in the Philippines. O_3 could be a bigger threat to agriculture in South Asia than climate change.

Farmers in Tanzania show off their Jatropha curcas crop. Jatropha curcas has great potential as a biofuel, and is a highly productive crop for local farmers.

Developing the next generation of biofuels.

Sorghum (pictured right) is not only a vital cereal crop in arid regions of the world, it can also be used to make ethanol for fuel.

Claims and counterclaims about bioenergy have dogged the issue in 2008. Some hail it as an ecological panacea while others insist it is bad medicine. SEI works towards a better understanding of its benefits and drawbacks, with an emphasis on the developing world.

Bioenergy: sorting the wheat from the chaff

RECENTLY THERE has been unprecedented controversy and media alarm around bioenergy, and biofuels in particular. Supporters tout biofuels as an all-in-one solution to address climate change, rural development and agricultural reform. Critics claim that biofuels raise food prices, destroy rainforests and forcibly displace rural populations. Why is it that an industry that previously attracted so little attention is suddenly having so many different impacts?

Fuel for thought

The short answer is that biofuels can have all these impacts and more. The transition away from the fossil economy in the coming century will create many different pressures and the cultivation of certain kinds of biofuel on a large scale can have undesirable impacts. But it is the type of crop and how it is produced and used that determines the outcome, and bioenergy can have substantial economic and environmental benefits.

The fossil fuels that the world has burned in just one hundred years took millions of years to create, and it is no surprise that land resources will come under strain when we are forced to use resources sustainably at the same time that world population and consumption are increasing.

Biofuels are only one part of the global transition towards a *bioeconomy* and to the improved use of biomass resources for food, feed, fuel, and fibre. The fact that the transition is tightly bound to the changing climate magnifies the interdependence of the social, economic, and ecological processes that are shaping it.

A balanced approach

We look at bioenergy in the round, placing international policy-oriented partnerships at the centre of our work. The breadth and depth of these partnerships leads to innovative ways of evaluating problems and implementing solutions.

In 2008 SEI led a study of the interactions between food, feed and fuels in the developing world, and published research on the role of sugarcane as a renewable resource, and a report on biofuels for the European Parliament.

SEI is also helping to speed the transition away from the use of traditional biomass to cleaner forms of energy in the developing world (see page 10).

Steps forward

Historically, SEI has placed special emphasis on the least developed countries, whose interests tend to be under-represented in world policy forums. For this reason, sub-Saharan Africa is a major focus – and one that has been reinvigorated by the opening of SEI Africa (see page 10).

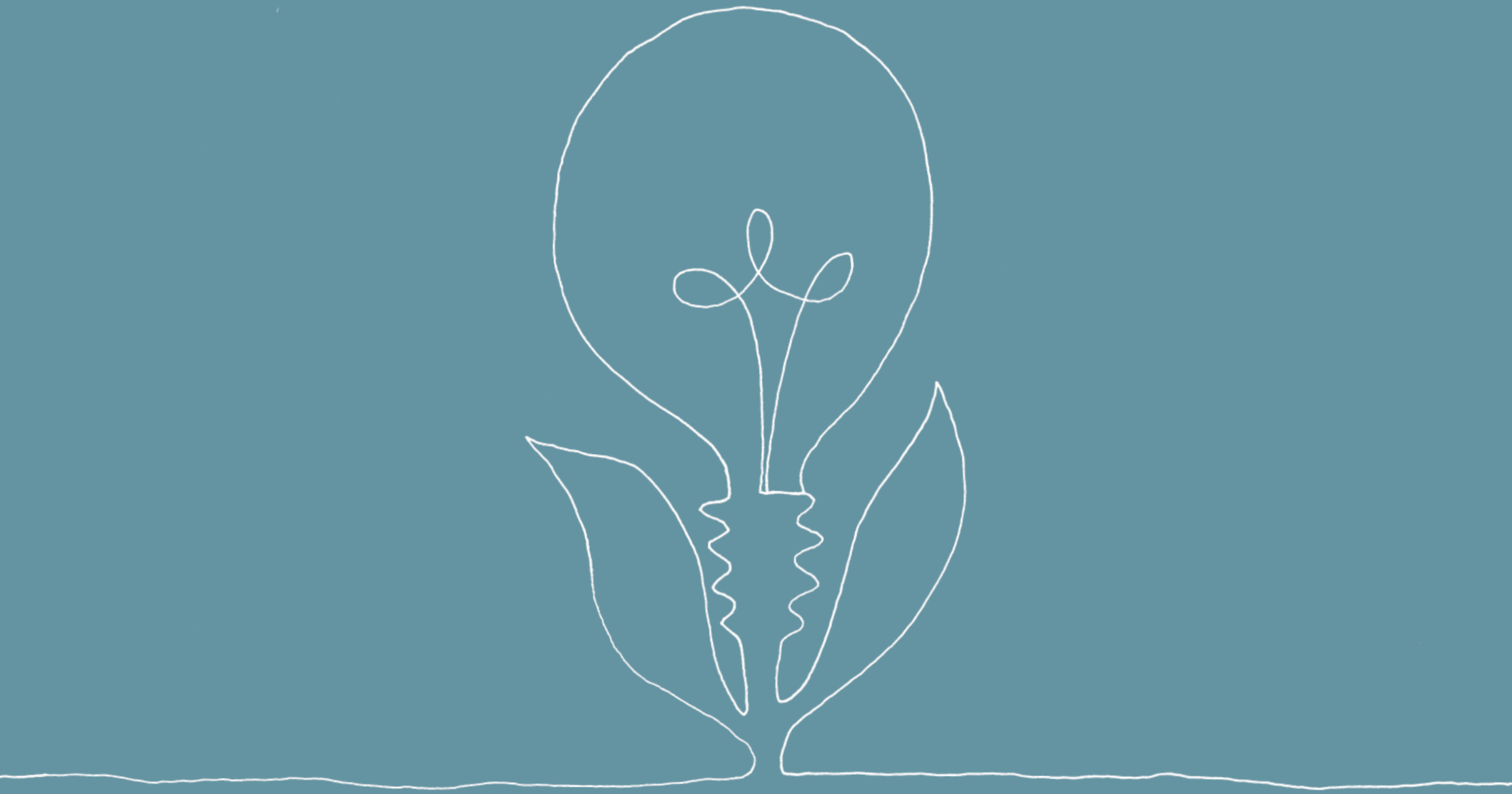
At the same time, policies in Asia, Europe and elsewhere can have major impacts globally and deserve attention. For example, EU energy policy will affect developing countries that aspire to build biofuel industries and export to the EU (see page 25).

Bioenergy is no silver bullet, but it can bring real benefits. The key is to take the right steps forward alongside our partners in developing countries.

IN BRIEF

Our predecessor – The Beijer Institute – got its start over thirty years ago analysing the transition away from fossil fuels and the policies and institutions that were shaping that transition.

INNOVATION



The world's most populous country now emits more greenhouse gas than any other. It is clear that China has a decisive role in meeting global emissions targets. But how? SEI is challenging conventional wisdom to create ambitious scenarios for deep cuts in China's emissions.

Deep and rapid cuts in China's emissions

IT IS IMPROBABLE that China can achieve deep and rapid emissions cuts using only currently available technologies. This fact places limits on conventional ways of forecasting, which tend to say that if a target cannot be achieved using available technology, the target must be revised.

SEI's approach turns this convention on its head: we first map out reduction targets and work backwards to identify the gaps in technology that must be bridged if the target is to be achieved. We believe that this will enable policymakers to be pro-active and bridge technology gaps by targeting funds for research and development.

This work is part of a broader project on the economics of climate change in China, and also draws on SEI's Greenhouse Development Rights framework (see page 29).

What's the scenario?

Our 'deep carbon reduction scenario' (DCRS) begins with the assumption that dramatic cuts are attainable without affecting demographic and macroeconomic indicators. The scenario examines the potential for energy efficiency and fuel switching across all major sectors of the economy, including industry, transport, households, services, and electricity generation.

We used our LEAP software tool to explore the DCRS and examine the implications of a 56% cut in China's emissions by 2050 against 2006 levels. We use a baseline scenario that takes in historical trends in China's emissions and projects forward to 2050. Up to 2030 this baseline closely matches trends published in the 2008 International Energy Agency *World Energy Outlook*. In contrast, the DCRS predicts cuts of 85% up to 2050 compared with the baseline.

Ambitious, yet realistic

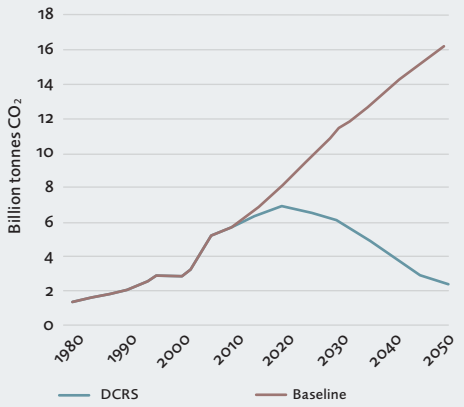
The next stage of the work is to consult with our partners in China on whether our draft assumptions are both plausible and desirable. Their feedback will be used to design a second, improved version of the scenario. This will provide more refined information on the measures that are needed to put China on an ambitious but realistic path to deep cuts in GHG emissions.

IN BRIEF

To achieve deep emissions cuts in China, our scenario looks at the potential to:

- make big improvements in energy efficiency
- shift to electricity, heat and (where possible) low carbon fuels
- increase public transport and introduce high efficiency freight transport
- retire inefficient coal fired power stations
- replace 'dirty' coal with efficient coal with carbon capture and storage (CCS) and renewable energy
- introduce large scale combined heat and power and redesign industry to use process heat efficiently, and
- dematerialise the economy to some extent (i.e. do more with less).

Deep carbon reduction scenario for China compared with current projected trends



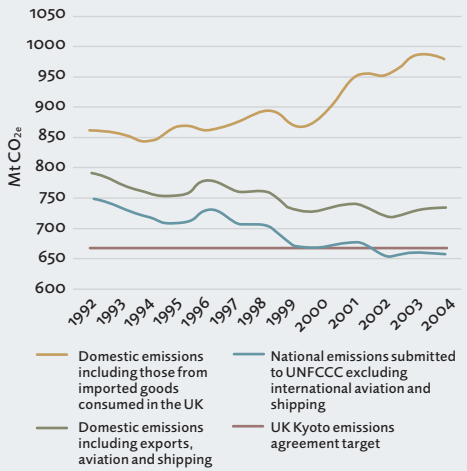
The Shanghai maglev train. To help make deep and rapid cuts in emissions, China needs more investment in public transport infrastructure.

The Kyoto Protocol has barely affected global greenhouse gas emissions. They are rising faster today than they did 10 years ago. What is driving this trend?

Consumption counts

'The scientists should be congratulated... [the report] will help us to get a global agreement'. Phil Woolas (UK Environment Minister), 1 August 2008, speaking on the BBC Radio 4 Today Programme.

CO_2 emissions in the UK



BETWEEN 1992 AND 2004 UK territorial emissions decreased by 12% compared with 1990 levels. However, in the same period the global climate impacts from UK consumption rose continuously. When emissions from consumption are included in the calculations the figure actually increases by 18%.

These results are the product of a ground-breaking new modelling approach, pioneered by SEI, called multi-region input-output analysis. The research lifts the veil on the impacts of all the goods and services consumed by British households wherever they may have been produced. Unlike standard emissions analyses it includes emissions from countries exporting to the UK.

Where did all the emissions get to?

Our research traces the GHG emissions of all goods and services through the global supply chain and assigns them to the country where they're finally consumed. In the UK, the emissions embedded in imports went up from 35% of UK emissions in 1992 to 67% in 2004, while those embedded in exports increased from 31 to 45% of emissions over the same period. This suggests that the reduction in the UK's own carbon dioxide emissions has been more than cancelled out by increased emissions in other countries caused by UK consumption of imported goods and services. Trade data indicates that these emissions are coming from newly emerging economies such as China, India and Russia

Practical solutions

SEI's Resources and Energy Analysis Programme (REAP) provides decision makers with the tools to identify and evaluate the changes necessary in production systems and consumption patterns to move to a more sustainable society.

In each of the nine English regions, and Wales, Scotland and Northern Ireland, emissions from consumption have mirrored UK trends for the last 12 years. We've seen that promoting a low carbon model requires a greater focus on the way people live as well as the way business operates. Steps are already being taken to support this by building zero carbon homes. More needs to be done to improve existing homes and transport infrastructure.

Policy impact

The research SEI has carried out during 2008 provides a deeper understanding of the drivers of emissions and shows the global costs of consumption that must be factored in to the climate negotiations. Counting consumer emissions will ultimately assist in the design of an international climate regime that reduces carbon leakage and is acceptable to developing countries.

A comparison of carbon footprints shows that developed countries rely on worldwide inequalities in consumption when communicating the challenge of, and calculating responsibility for, climate change. After all, if everyone consumed like the average UK person, dangerous climate change would be unavoidable.

IN BRIEF

- 60% of the growth in the carbon footprint of UK households is driven by increased travel demands.
- Meat and dairy products make up more than 50% of the GHG emissions associated with food consumption in the UK.
- 90% of houses in the Leeds city region need to increase their energy efficiency in order for the UK government to meet its emission targets.

Soil can absorb and release huge quantities of carbon from the atmosphere and have a decisive impact on our changing climate, but its role in the carbon cycle is still neglected by scientists. SEI is using the latest technology to understand and protect this elemental resource.

How the earth breathes

SCIENTISTS KNOW MUCH more about ecology above the soil than in it. This 'hidden half' of the biosphere not only feeds us by maintaining the plants we eat and use, but also stores twice as much carbon as there is in the atmosphere. Carbon in the soil is produced by vegetation, through root and leaf litter, and decomposed by organisms such as fungi, bacteria and earthworms. It is changes to these two processes that determine the levels of carbon stocks in the soil.

A warming planet will not only damage the earth through desertification and erosion; many predict that it will create negative feedbacks by stimulating decomposition, releasing huge quantities of sequestered carbon from the soil – especially from peatlands. We believe that soil science deserves serious attention.

Vital work

SEI is doing the vital work of creating models to accurately predict the effects of climate change on soil carbon cycling. Our research provides a better understanding of plant-soil carbon allocation, how fast decomposition occurs, and which organisms are key to this process.

Rethinking the sink

It is a commonplace belief that forests mitigate climate change by absorbing a large part of the increased level of human-induced atmospheric carbon dioxide. However, our research reveals that what is crucial to carbon storage is the increased flow of carbon through trees into soil, not only into tree biomass.

We have pioneered powerful tools that enable us to trace carbon through trees and plants, into their roots, to the attached mycorrhizal fungi and soil organisms that feed on them, and even into their DNA.

Soil, fungus and forests

Our research also shows how various parts of the soil breathe out carbon and how they respond in different ways to environmental factors. Our new soil carbon models represent these major components that affect the flow of carbon dioxide and show how these components respond in different ways to environmental change.

SEI is investigating the symbioses between root systems and mycorrhizal fungi – well known for their edible boletes but also vital for plant growth and survival. We are now working with the English Forestry Commission to establish links between tree carbon input and soil respiration to understand how forests breathe carbon dioxide. With this new knowledge we can help to understand how climate change might be affecting future forest carbon stocks.

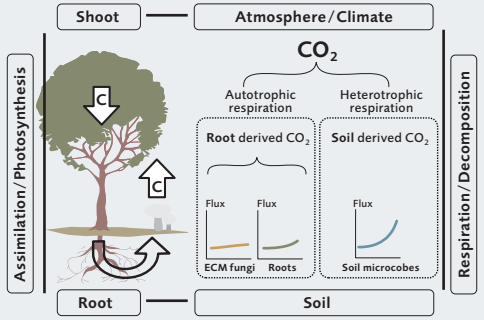
IN BRIEF

A healthy level of carbon in soils is central to livelihoods and wellbeing. Not only can soil help mitigate climate change, it also:

- reduces erosion
- stores nutrients and soil water
- boosts agricultural productivity
- keeps waterways clean, and
- sustains biodiversity.

Equipment for monitoring carbon in soils in use in northern Sweden.

The carbon cycle



SEI is working to identify the boundaries that we must live within if we are to safeguard humanity and the global environment.

In 1998 an intense El Niño event caused unusually high temperatures and very dry conditions in Southeast Asia. As fires raged through the region releasing massive amounts of carbon dioxide, scientists began to ask themselves whether climate variability was the only factor at work.

Living within safe boundaries

FOR MORE than 30 years, swathes of Southeast Asia's forests have been cut down to make way for palm oil plantations. Researchers recognise that this new pattern of land-use distorts natural climate variability; for example, Monsoon rains that would normally extinguish fires before they get out of control are arriving later and later. After the 1998 blazes, researchers concluded that the compound effects of local decisions on regional weather patterns led to forest fires and emissions of carbon dioxide that were globally significant.

What happened in Southeast Asia is a microcosm of the problems facing the planet. Seemingly minor changes can escalate to major impacts due to the complex, non-linear interactions of humans with nature. Scientists term these sudden and unexpected changes 'tipping points'.

Knowing our limits

In June 2008 SEI, the Stockholm Resilience Centre and the Tällberg Foundation gathered 20 of the world's leading Earth system scientists to identify planetary boundaries – limits that we must live within to safeguard human well-being and the global environment.

Whether it's climate change, the extinction of species or ocean acidity, scientific evidence demonstrates that human pressures are significant – perhaps the most significant – influences on planetary systems. Knowing where the boundaries lie is necessary so we do not cross tipping points and put current and future generations at risk.

Rather than looking at one issue in isolation, such as climate change, we analyse the interactions and feedback loops between systems. In the case of climate change, the ultimate impact of changing temperatures and sea levels on human societies and ecosystems will also depend on atmospheric pollution, freshwater consumption, land use and levels of biodiversity. As the Southeast Asian experience shows, planetary boundaries are closely interdependent – if one is tipped, others may follow. Knowing where the boundaries lie provides a framework for technological development and effective governance strategies.

The message and the means

Vital new knowledge on planetary systems must also be communicated to policymakers. We know much more about how ocean acidification interacts with global warming, and the importance of land-use patterns for albedo effects, biodiversity and carbon sequestration (see page 21). Greater awareness of such issues will mean more effective environmental policy.

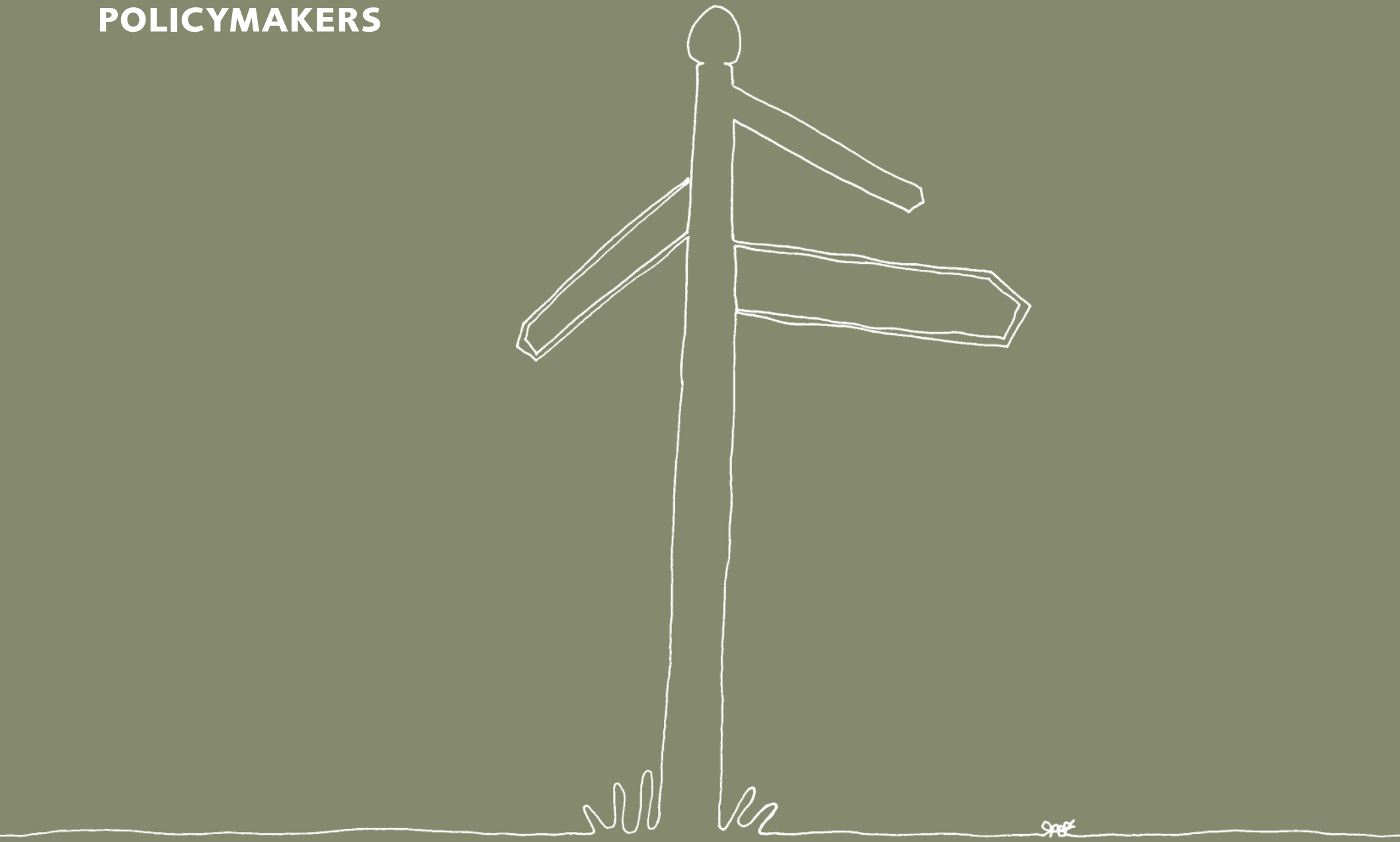
Though simple to articulate, the societal and economic transformations required to meet these interconnected problems are profound in nature and difficult to implement. We need to change the way we produce energy, goods and food, and how we transport ourselves and our commodities. These changes will require innovation from all corners of the globe and from all parts of society.

IN BRIEF

- The project has developed a preliminary set of nine Planetary Boundaries, which will be described in a report in 2009.
- Among the 20 scientists that launched the project were Jim Hansen from NASA, Bob Corell from the American Meterological Society and Diana Liverman from Oxford University.

MAGALIE L'ABBÉ

GUIDING POLICYMAKERS



How do we achieve a sustainable and secure energy supply? Climate, politics, complexity and national interest all play a role, and there is no crystal ball for decision makers. But authoritative information can help. SEI is enabling the Nordic energy sector to make informed policy decisions.

Power in the north

IN DECEMBER 2008 the EU finalised its plans on climate change and energy security. The package includes ambitious targets to cut GHG emissions by 20%, establish a 20% share for renewable energy, and improve energy efficiency by 20%, all by 2020. However, big questions remain over how these targets will be met and the future shape of EU climate and energy policy.

SEI, together with the Fridtjof Nansen Institute and leading players in the Nordic energy sector, has launched the CANES project to help industry and policymakers respond to political uncertainty with greater assurance. The aim is to understand how EU climate and energy politics will affect the development of Nordic energy markets and infrastructure.

Will Europe lead?

It is a complex task for industry and government to develop energy policy and make crucial investment decisions. Will Europe continue to be a first-mover and follow up on its pledge to be a global leader? How will this affect EU policy? What markets and investment opportunities will emerge? These questions are high on the energy industry's strategic agenda, and affect heavy industrial users and infrastructure providers as well as electricity producers.

The CANES project is split into four parts. First, using a range of methodologies it undertakes rigorous analysis of EU bureaucratic and political processes, and explores how they are influenced by different interest groups and member state governments, particularly in relation to renewable energy.

Shifting sands

Expert analysis can help to predict surprising outcomes. Throughout the 2000s, the European Commission has championed the labelling of electricity to verify its source (the Guarantee of Origin system) – as an instrument to achieve its targets on renewable energy. The fact that this system was ultimately defeated by a coalition of groups that normally have different goals (renewable energy industries, environmental NGOs and governments) reveals the often shifting sands of EU politics.

The second and third parts of the project examine what such developments mean for Nordic energy producers, infrastructure providers and energy-intensive users. Finally, we ask how these insights can help to improve energy forecasting and, as a result, decision making.

Indispensable

The CANES project brings a fresh perspective to the usual methods of energy forecasting: political science is not normally concerned with predicting events. But we believe that for those that must take difficult decisions about the future, such perspectives are indispensable.

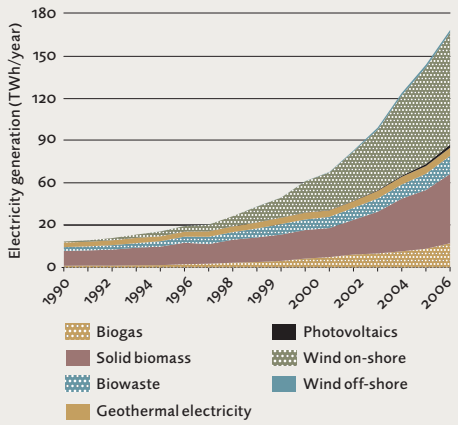
IN BRIEF

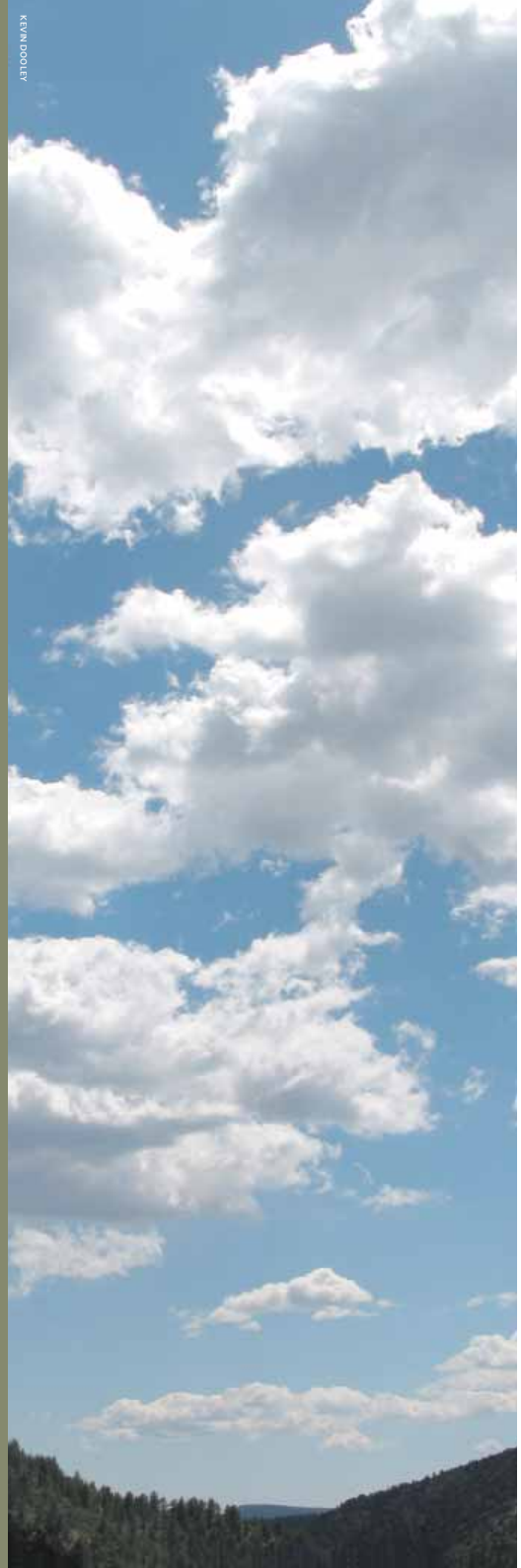
The CANES (Climate Change Altering Nordic Energy Systems) project is funded by the Norwegian Research Council and co-funded by Swedish and Norwegian bodies, including: Vattenfall, Statkraft, Statnett, Norwegian Electricity Industry Association, Federation of Norwegian Industries, and Svenska Kraftnät.

JEPPE VIK STRØM/SCANPIX

SEI and its partners are providing advice on how EU energy and climate policy will affect the development of Nordic energy markets.

Historical development of electricity generation from 'new' renewable electricity in the European Union
(EU-27) from 1990–2006




KEVIN DOOLEY

Climate change is now upon us, and the world must adapt to its impacts. But disputes over how to pay for adaptation could scupper a future climate deal. SEI is working to solve the political impasse.

Adaptation added up

PEOPLE, THE ECONOMY and ecosystems are experiencing the first impacts of climate change. In 2007 the Intergovernmental Panel on Climate Change (IPCC), which shared the Nobel Peace Prize with Al Gore, stated that 'Warming of the climate system is unequivocal'. According to the IPCC, even the most stringent mitigation efforts to minimise emissions will not avoid further impacts of climate change in the next few decades.

Prevention and cure

This means that cure is as important as prevention. 'Adaptation' is the term used to describe all efforts to prepare for or deal with the impacts of climate change, ranging from individual households, communities and firms, to entire sectors and countries. Adaptation reduces the damage from climate change, but it has limits. Mitigation remains crucial – to rely on adaptation alone would lead to a level of climate change that is unmanageable and therefore catastrophic for future generations.

Money trouble

The UN Bali Action Plan, agreed in late 2007, attaches equal weight to mitigation and adaptation. It identifies technology and finance as the key ways to enable developing countries to deal with climate change.

The UN, Oxfam and the World Bank differ over how much money is needed to help developing countries do this: estimates range from USD 10 billion to more than USD 100 billion per year. There are also disputes over where this money will come from and how it will be managed. The politics of adaptation are a potential pitfall for a climate-policy deal in Copenhagen in December 2009.

Politics and theory

Our research makes crucial contributions to breaking this political impasse. In 2008, our work on adaptation funding has helped to move the negotiations forward.

SEI prepared a briefing paper for Tony Blair's report to the G8+5 meeting in Japan in July 2008. The paper emphasised the importance of reaching agreement on adaptation funding and underlined the need for synergies between adaptation and development policy. An SEI white paper for the Government of Switzerland served to facilitate discussion and, hopefully, agreement on the operational guidelines and principles of the UNFCCC's Adaptation Fund.

As well as influencing the politics of adaptation SEI is fulfilling the growing demand for policy analysis. We have developed conceptual groundwork for emerging research and policy on 'mainstreaming' (combining adaptation into development efforts), which is essential to effectively compare mainstreaming approaches and to evaluate policy experiences. The first results are forthcoming in a book chapter and a journal article.

The long view

SEI's work on adaptation will branch out beyond 2009. Getting an agreement in Copenhagen is vital, but we must also take the long view: the need for adaptation funding will not disappear in 2010, and SEI is well placed to meet the challenges ahead.

IN BRIEF

Adaptation is the term used to describe all activities aimed at preparing for or dealing with the consequences of climate change. Such activities can be in response to a wide array of impacts (like drought or floods) and undertaken at the level of individual households and firms, or of entire sectors and communities.

Coastal and marine environments worldwide are in serious decline because of development, overfishing, pollution, disease and climate change. Asian coastlines have experienced especially severe socio-economic and environmental upheavals. How should policymakers reconcile development with environmental protection?

Navigating the demands on our coasts

THE 3000 KM coastline of Myanmar was once carpeted in mangrove forests. But since the Irrawaddy Delta was developed for rice and agricultural production, large areas of mangroves have been lost, leaving only patchy outcrops. As coastal land has been reclaimed for housing, agriculture and ports, the threat of pollution has risen and is now matched by damage caused by shrimp ponds, deforestation, and changes to water flows.

Migration from inland rural areas to the coast means that the delta is now home to 6.5 million people. Their livelihoods depend on rice production, fishing, livestock and aquaculture. The delta has become crucial to the food security of the region and is known as the 'rice bowl' of Myanmar.

Since 2005, SEI has been studying how a legacy of conflicting interests has affected the management, governance and use of coastal resources. We are investigating ways to help policymakers reconcile the many demands on mangrove ecosystems and to integrate mangrove replantation into coastal management plans.

Lessons of the cyclone

The importance of this research was highlighted by Cyclone Nargis, which struck the coast of Myanmar on 2 May 2008. It caused catastrophic damage to the Irrawaddy Delta: almost 100,000 people were killed and over 1 million were left homeless.

The scale of the impacts of Cyclone Nargis led to calls from governments and NGOs for mangrove replantation to reduce the effects of natural hazards. The challenge for SEI was to convince policymakers to reflect on the wider purpose of replanting mangroves: not only to reduce vulnerability to hazards but also to secure development and livelihoods.

The many uses of mangroves

Healthy mangroves provide important ecosytem services such as breeding grounds for fish and crab species, as well as products that support local livelihoods. Their unique root system captures sediment and prevents erosion. Against a cyclone like Nargis, they also act as a natural protective barrier by dissipating the force of water driven by storms, tides and winds.

But more than that, in areas where mangroves are maintained, people live further inland and are naturally less vulnerable than those living by the shore.

Based on evidence from stakeholders at the three project sites, it is clear that serious conflicts of interest underlie the restoration and replanting of mangroves. Finding a balance between, for example, aquaculture and the restoration of biodiversity, requires negotiation with different interest groups to agree appropriate trade offs. Institutions and policies need to include mechanisms to ensure that user rights are upheld and management regimes are feasible and efficient.

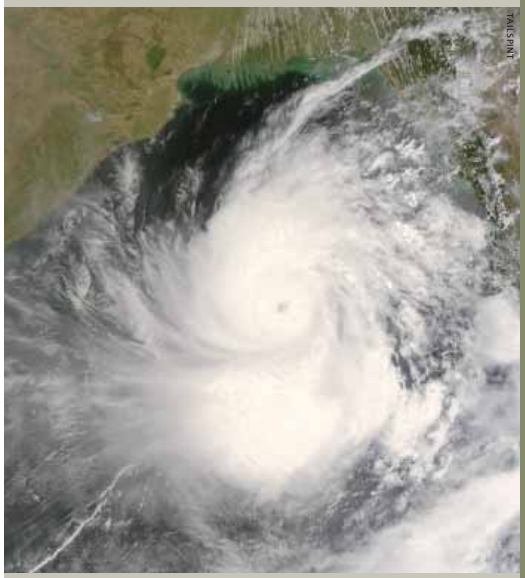
We conclude that by taking account of social and economic development in the replantation efforts, the results are more likely to be sustainable, have long-term local buy-in, and provide multiple benefits.

IN BRIEF

- Asian cities took 15 of the top 20 places in an OECD report ranking the cities most likely to be affected by climate extremes.
- The mangrove ecosystems of Southeast Asia are the most abundant (50,000 km^2) and diverse (40+ tree species) in the world. They support many hundreds of animal species.
- In Thailand 50% of the mangrove forests have been degraded since the 1960s.

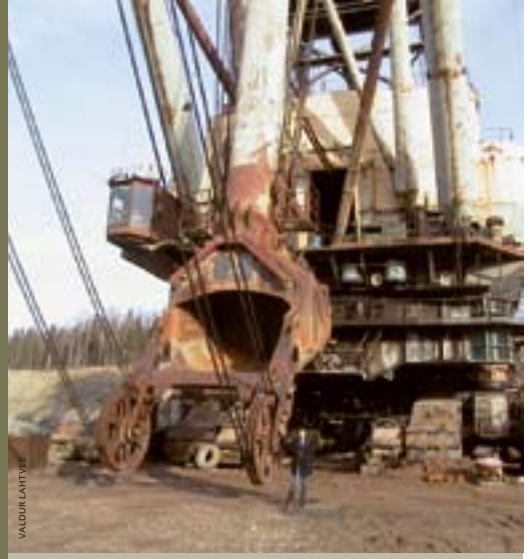
RENÉ EHRHARDT

According to some estimates a quarter of the destruction of mangroves is caused by shrimp farming.



TAILSPINT

NASA satellite shows Cyclone Nargis above Myanmar, May 2008.



VALDUR LAHTVEE

A 'walking excavator' at Narva, Estonia. The Narva complex consists of the world's two largest oil shale-fired thermal power plants.

MARCUS VEGAS

A new windmill in Estonia. SEI recommended that Estonia should produce 40% of its power from wind.

With rapid economic growth and increasing demand for energy, the Baltic states are looking at new energy strategies that make better use of the region's natural resources. SEI is advising Estonia on how to wean itself from oil shale, preserve energy security and meet EU targets.

Shale shift

SINCE 2000, the Baltic states' rapid economic growth has been stoked by fossil fuels: in 2007, 93.6% of Estonia's energy came from one source – oil shale – and just 1.2% from renewable sources. All three Baltic countries face a similar predicament: how to continue to develop and achieve energy security while reducing carbon output and shifting to renewable sources of energy.

In Estonia, between 2000 and 2007 GDP rose by 71% and energy consumption went up by 28%, the bulk of it from fossil fuels. If these trends continue it is clear that Estonia will not achieve the EU's target to produce 20% of its energy from renewables by 2020.

The route to 2020

As with all EU member states, Estonia must review its energy policy in the light of these targets. In January 2008, the Estonian Government published a revised national energy development plan leading up to 2020. Its main objective is to ensure a continuous, sustainable and affordable energy supply for the country.

SEI carried out a strategic environmental assessment (SEA) of the plan. We developed and refined a set of energy scenarios provided by the government using our LEAP energy planning tool. And by applying LEAP and the EcoSenseWeb assessment model, we predicted potential trends in greenhouse gas and sulphur dioxide emissions and calculated the external costs of energy production.

Which road to take?

Our analysis showed that the scenario for electricity production with the lowest costs, as well as the smallest overall impact on the environment, society and the economy, was an energy mix of 39% oil shale, 22% wind, 30% gas and 9% heat and power co-generation.

This scenario provided the best balance between reduction of carbon and sulphur dioxide emissions and socio-economic targets. The scenario would set Estonia on the clearest path towards the EU energy and environment targets. It is also likely that this choice would bring benefits over the longer term.

Following this path would demand a steep increase in wind energy production (capacity growth from 80 to 500 MW) requiring massive infrastructural investments, while an equal effort is needed to make existing energy production facilities (e.g. oil shale combustion and gas turbines) more efficient.

In 2009, the Estonian Parliament will decide which road to take. All require tough choices, but whatever Estonia favours, the country will make real strides on its journey towards a clean energy future.

IN BRIEF

Oil shale produces more greenhouse gases than conventional fossil fuels. In 2006, about 81% of CO_2 emissions in Estonia came from its energy sector, fuelled mainly by oil shale.

Despite the need for immediate action to halt rising temperatures, many people are losing confidence in today's climate negotiations. The wrangling between developed and developing countries, rich and poor, continues amid the twin crises of climate and development. How can we break with politics as usual?

Climate and development: necessary justice

THE ONLY PROVEN routes to development – to water and food security, improved health care and education – involve expanding access to energy services. Given the limited access to low-carbon energy technology in developing countries, this means an increase in fossil fuel use and carbon emissions. For the world's poor, this pits development squarely against climate protection.

The Greenhouse Development Rights framework, created by SEI and Ecoequity, describes a climate agreement that has development woven into its DNA. The framework faces up to the big question: what kind of climate regime brings global emissions rapidly under control, even while the developing world scales up energy services to fight endemic poverty and support human development? The answer – the scale of the break from the usual – is alarming.

The emergency pathway

Following the latest science, the framework apportions responsibility for reducing emissions among the rich and poor, and proposes strategies to meet the challenge. Allocating responsibility for such rapid emission reductions among countries is the biggest challenge. The fundamental problem is that the vast majority of reductions must be in the developing world, where most emissions now occur and where they are growing most rapidly, but the capacity to make reductions lies mainly in the developed world.

Common but differentiated

The framework proposes a legally binding, two-fold obligation. First, the developed world must commit to deep reductions in domestic emissions. The depth of these cuts is based on the science, on the silent fact that our climate system does not negotiate. Second, the rich must support, through finance and technology, a rapid transition to clean energy in the developing world, and the adaptation needed to cope with already inevitable warming (see page 26).

Self interest or self destruction

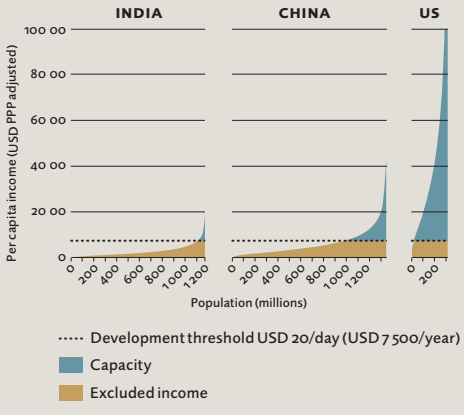
Such obligations may seem implausible to some. But for rich countries, facilitating the low-carbon development of the poor is a matter of self-interest. Withhold this assistance and developing countries will exploit fossil-based technologies to generate energy and poor communities will continue to burn the wood and charcoal that creates black carbon emissions (see page 13).

The bottom line is that climate negotiations will not succeed until they address the fundamental challenge of human development for the world's poorest people. Greenhouse Development Rights shows that we cannot choose between climate protection and human development. We shall have both, or we shall have neither.

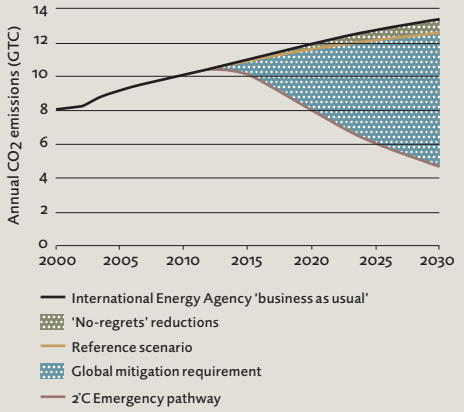
IN BRIEF

In 2008 SEI launched a report at the Swedish parliament that describes Sweden's responsibility for tackling climate change. The report reveals the hidden emissions of Sweden's consumers and suggests a path to reduce emissions to 2020 and beyond. The report harnessed SEI's research into carbon footprinting (see page 20) and the GDRs framework.

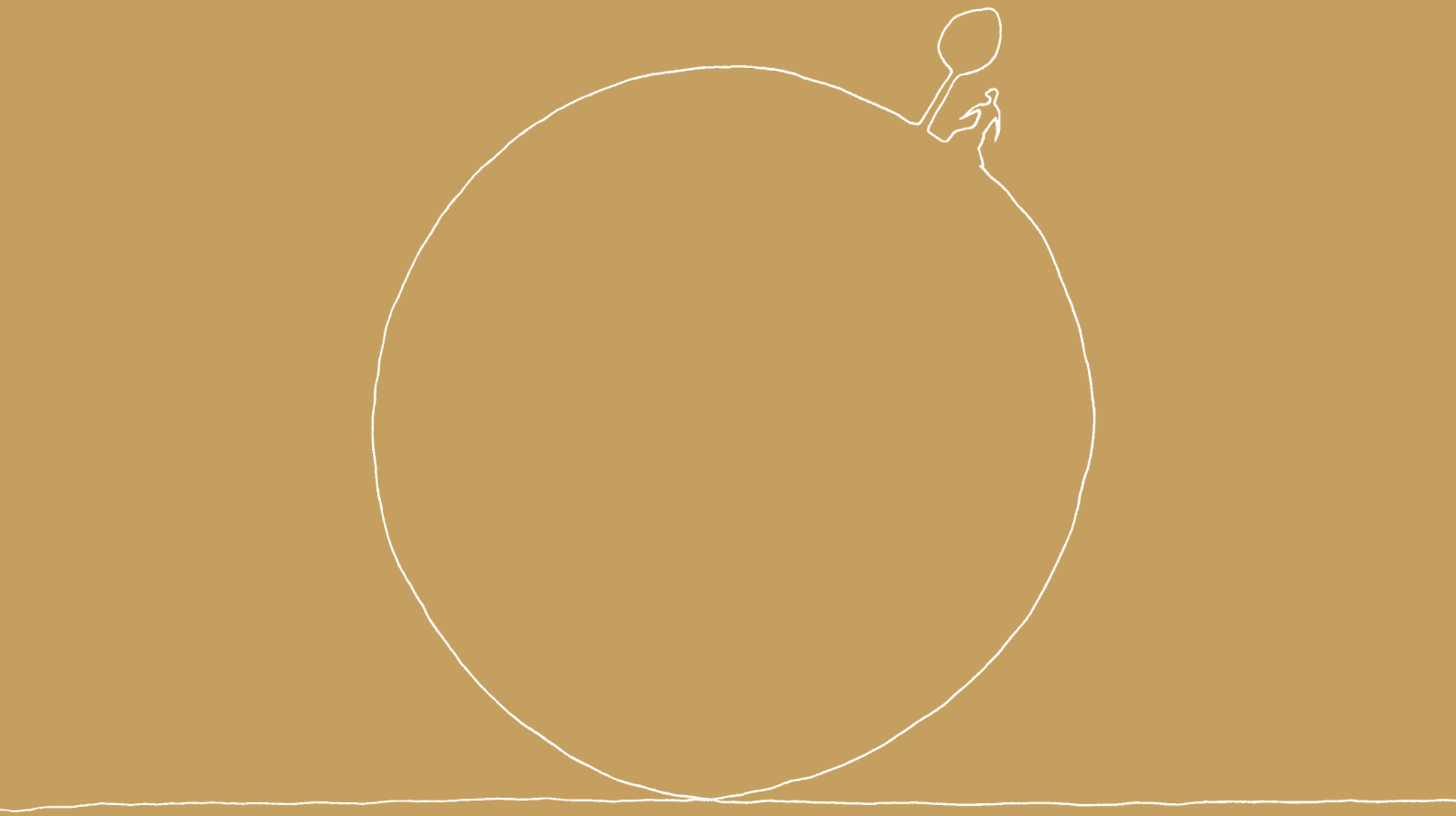
The GDRs framework exempts those living on less than USD 20 per day from paying for climate change. The poor, wherever they are located, prioritise development.



Global mitigation requirement, following the GDRs framework



GLOBAL ISSUES
LOCAL PARTNERSHIPS



From the vulnerable farmers of the semi-arid Sahel to the plans for major dams and roads, how will Africa adapt to climate change?

We must adapt

AFRICA HAS ALWAYS adjusted to climatic shifts, but the current rate of change is on a scale not seen before. Greater support for adaptation must get under way now, as delays will only increase the costs. The more we do, the more we recognise the need for effective processes to support adaptation.

The challenges are clear and solutions can be found, but questions remain. What are the prospects for effective on-the-ground reductions in vulnerability? How can we engage across wide social scales, from individuals to government and the private sector? How do we recruit and train a global team of adaptation practitioners?

Money and know-how

SEI is working to build capacity and bridge the knowledge gap on adaptation in Africa. We are represented in most adaptation funding programmes, and new projects on costing adaptation are taking off, globally and in Africa – but political obstacles block the effective deployment of money. Our researchers are working to address this bottleneck (see page 26).

Building capacity begins with people, but needs sound organisations. We are working alongside UNEP and have seen their adaptation team take shape and set challenging objectives. Over the past 18 months, SEI has renewed its effort in Africa (see page 10), working closely with the University of Cape Town to establish a world-leading knowledge resource on climate adaptation – weADAPT.org.

Visualising change

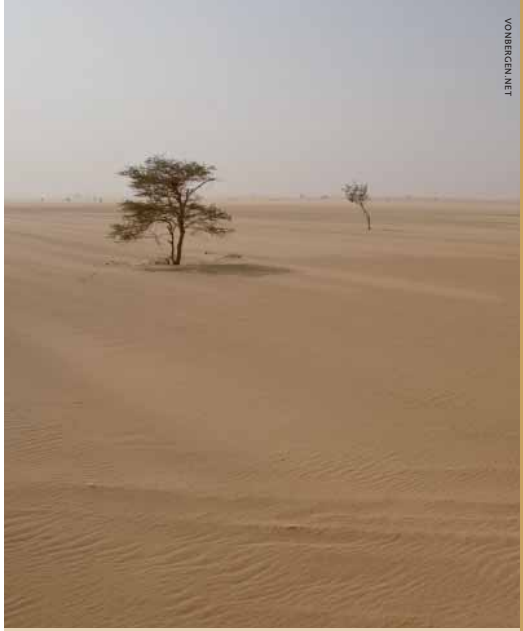
In 2008 we added the Climate Change Explorer tool to the weADAPT platform. Climate Change Explorer enables users to quickly access climate change data tailored to their region of interest. This kind of 'downscaled' weather projection can help people prepare and plan for coming climate events. The tool has evolved from, and contributed to, a dialogue across disciplines and continents on risk communication, scientific uncertainty and decision-making. Climate scenarios are now available for Africa and Asia, and more are being processed.

Interactive adaptation

The weADAPT Adaptation Layer uses Google Earth technology to allow users to explore adaptation projects around the world. The Adaptation Layer, a collaboration of the weADAPT group (including BCAS, ICCAS, IIED, OSS and START) contains studies, videos, projects, workshop reports and downscaled climate data. The adaptation layer is in prototype phase but turned heads at the UN climate change negotiations in Poznań (COP 14). The aim is for as many organisations as possible to add adaptation information to make it simple to interact with adaptation projects around the world, and to learn from the experience of others.

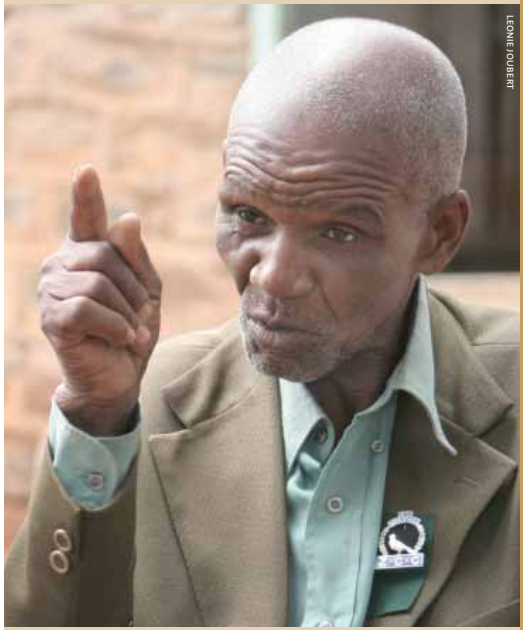
IN BRIEF

The OECD recently selected weADAPT as one of three adaptation platforms to receive further support.



VONBERGEN.NET

The Sahel meets the Sahara.

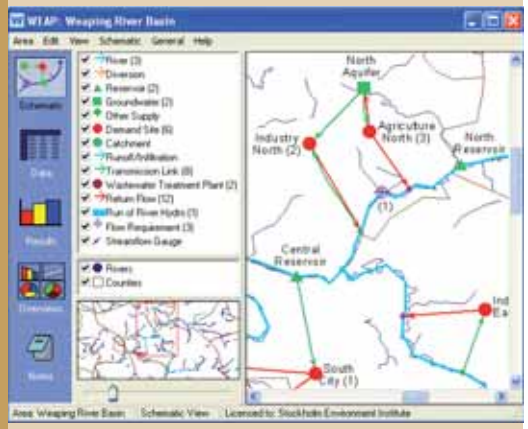


LEONIE JOUBERT

A South African in conversation with an SEI researcher.

www.weadapt.org

The Jordan River region. Along with its partners, SEI is working to build cooperation over water resources between Israeli, Palestinian and Jordanian scientists.



Our WEAP (Water Evaluation and Planning system) tool promotes an integrated approach to water resources planning. WEAP is helping to solve problems of water management in the Jordan River region.

In a region where water is scarce, demand increasing and conflict only a step away, SEI researchers are improving water productivity and cooperation over water resources.

Future water constraints

SEI IS PART of an international project that brings together Jordanian, Palestinian, and Israeli scientists and water managers to examine the bio-physical and socio-economic aspects of climate change in the Jordan river basin. The GLOWA Jordan River project is organized around the 'green-blue water' concept, an integrated approach to the management of water from precipitation, lakes, rivers, groundwater and soil water.

Testing scenarios

We have used our water modelling software (WEAP) to test scenarios on global change and water management. SEI is using this approach to investigate alternatives to the planned mega-project to provide desalinated water by linking the Red Sea and the Dead Sea.

Regional climate scenarios are used to simulate future water-related constraints for development and security. In some parts of the basin, water is already so scarce that even drinking water can't always be obtained. In other parts of the basin the effects of water scarcity are still limited to commercial sectors such as agriculture.

The volatile political situation in the basin affects who has access to water and for what purpose, thereby aggravating the underlying problems. As for future climate change, GLOWA models show that surface and groundwater availability will decrease even more rapidly than precipitation.

Focus on the small scale

Initial findings show that large scale infrastructure projects may not be flexible enough to adapt to the effects of climate change (and in fact are so energy-intensive that they make a significant contribution to climate change). Smaller, integrated green and blue water management options can provide a more sustainable water supply by tapping unused potential.

These small scale projects are also better suited to the local needs of different areas and communities and thereby reduce vulnerability. Based on the green-blue water concept, they can also cope better with the uncertainties of climate change, such as heavy rainfall or dry spells.

Cooperation is possible

The new concepts of integrating water and land management, and treating ecosystems as a natural water infrastructure, have triggered a dialogue between traditionally separate institutions, such as ministries of water, environment and planning.

The Jordan River region is one of the 'cradles of agriculture', with experience of adaptation gathered over millennia. From water harvesting to waste water reuse, SEI researchers have developed a knowledge base that spans both traditional and recent adaptation options, and can be applied in other drylands.

By identifying options for enhanced overall water productivity and cooperation over water resources, SEI helps solve the water crisis, and supports conflict resolution in the region.

IN BRIEF

People have been adapting to water scarcity and climate variability for millennia. A blend of both old and new adaptation options is needed to confront the serious challenges that we face over water supply in the 21st Century.

www.glowa-jordan-river.de

In some parts of the Jordan River basin even drinking water is often in short supply.

NELSON EKANE

SEI outlined the crucial link between sustainable development and sanitation in its 2008 publication Pathways for Sustainable Sanitation.

ARNO ROSEMARIN

The urban onsite organic fertiliser plant at our project in China produces 1.5 tonnes of fertiliser a day from human manure.

Poor sanitation and hunger have disastrous effects in the developing world. SEI's work on ecological sustainable sanitation links these issues and provides solutions.

Sanitation and survival

IN 2007 FERTILISER prices rose dramatically, driving up the cost of food production – around two billion rural smallholders in developing countries cannot afford chemical fertilisers (see box). This has sharpened the global crisis in which more than 40,000 people die every day of hunger and related diseases. Sustainable agricultural practices are key to tackling this problem.

Sanitation and agriculture – a vital connection

The harm caused by poor sanitation is well known: water-borne diseases cut short countless lives, and 700 million people eat food from crops irrigated with untreated sewage. Meeting the MDG target to increase sanitation coverage for 1.75 billion people will bring many social benefits, improving lives and productivity.

SEI calculations show that sub-Saharan Africa could become self-sufficient in fertiliser supply if it were to adopt productive or ecological sanitation practices. Some 75–80% of Africa's farmland is degraded, and more sustainable agricultural practices – like more efficient use of fertilisers, water harvesting and recycling of nutrients from various organic sources, including manure and human waste – can help solve this problem.

Efficient processing and reuse of waste water, excreta, sludge, and solid organic waste can close the loop on nutrients, bringing food security, reducing water-borne disease and providing new livelihood opportunities.

Making it real

To show how this can be done, in 2008 we built China's first urban onsite organic fertiliser plant, specialised for human manure, in a new town in Dongsheng municipality. The town consists of four and five storey buildings, and has a nursery school and commercial centre. Residents began moving into their new homes in 2006. This eco-town represents the first major attempt in China – and the world – to build an entire town that uses on-site ecological sanitation.

To be effective and hygienic, organic material, urine, faeces and greywater must be separated at source and contained. They can then be treated and reused as fertiliser. The potential benefits are clear: for example, one person's yearly output of treated urine can support 300–400 m^2 of cropland for each growing period.

Hearts and minds

As fertiliser prices continue to fluctuate ecological sanitation can bring great gains. But ignorance and cultural taboos are preventing its widespread development. We recently published an in-depth assessment of why the world is so slow in making the vital changes to link sanitation and agriculture.

SEI's practical work on the ground coupled with our outreach efforts are changing minds and showing that waste products are a valuable (perhaps essential) resource.

IN BRIEF

The cost of fertiliser is decided for the most part by a small group of nations. China, Morocco and the US set phosphate prices, while Canada, Belarus, Germany and Russia control the value of potassium.

Southeast Asia's vibrant and dynamic economic growth brings pressures as well as benefits. SEI is working with Vietnamese partners to tackle the risks of rapidly growing energy demand.

Future generation

LIKE MANY COUNTRIES in the Mekong region and Southeast Asia, Vietnam faces an increasing demand for power to fuel industrial and human development. And the Vietnamese Government has ambitious plans to generate it from fossil sources and hydropower. However, these can damage both the environment and the resources on which the Vietnamese people depend for their subsistence. Depleted water resources, degraded agricultural land, air and water pollution and population displacement are just some of the potential risks.

To show how these risks can be handled effectively, we are piloting a strategic environmental assessment (SEA) of the national hydropower plan in the Greater Mekong subregion. The SEA is tailored to the institutional context of the planning process and will give planners the tools to integrate sustainability into strategic decision making. SEI's long experience of research and policy advice in Vietnam, and our network of partners, ensure our assessments are strongly grounded within national capabilities.

A new approach

Our decision-oriented model addresses the shortcomings of traditional methods of assessment: it recommends short-term policy reform and also looks at how institutions can learn from and use environmental knowledge when making long-term decisions. The model has been identified by the World Bank as a real step forward.

SEI promotes joined-up planning. In the past, hydropower projects have been built with little awareness of social and environmental costs. Alongside our partners, we advise on how to strengthen mechanisms to link energy schemes to local development processes, like water management, agriculture and poverty reduction.

To ensure projects are sustainable, the assessment also encourages the introduction of effective mitigation and compensation measures before development starts.

Looking forward

Despite its success, greater capacity is needed to fully realise the potential of the SEA as a strategic planning tool. We are working to fill gaps in knowledge so that social and environmental issues are integrated effectively into power-sector planning.

Our study demonstrated the SEA's potential for enhancing national development policy and planning in Vietnam. The Government is now pursuing a range of projects to lock-in the SEA procedure into power-development planning and in other sectors like heavy industry and mining.

IN BRIEF

Electricity consumption in Vietnam has grown by about 15% per year for the last decade, and this rate is expected to continue.

Power lines in Vietnam. SEI's long experience of research and policy advice in the region ensures successful cooperation with our partners for joined-up planning.

We are working with the Vietnamese government to risk assess hydropower plans to safely meet the energy needs of future generations.


SUKAINA BHARWANI

Despite agreements that services such as running water would be provided when the Mohale dam was built, they are often faulty or poorly maintained.

A woman from Lesotho tells the story of how her life has been transformed by climate change and the new Mohale dam. An SEI researcher on vulnerability interprets her predicament.

Notebook on change in Lesotho

MY NAME IS 'M'a Letsema. I live in the village near the Mohale Dam in Lesotho. My village has about 200 families and is overseen by our chief. She decides how we use the land surrounding the village and promotes social welfare and development as much as she can.

The mountainous region here has a lot of rainfall, very cold winters and heavy snowfall. But we have all noticed that rainfall is later than it used to be and over a shorter period. Recently there's been less snowmelt – very worrying as it is so good for the soil. Droughts also last longer than they used to.
RESEARCHER: *Variable precipitation threatens region. Climate stresses and extremes. Gradual change.*

The development of the Mohale Dam, which was built to supply water to South Africa, has affected us in good and bad ways.
RESEARCHER: *Sudden shock. Rapid change.*

Our main livelihoods are raising cattle, sheep and goats, growing maize and other crops, and growing potatoes, cabbage or other vegetables. For everything else we rely on what we can find locally.
RESEARCHER: *Vulnerable ecosystems make for vulnerable communities.*

Some people move to towns, or to South Africa, in search of work, while others own or manage small shops, make and sell handicrafts, work as drivers, teach at the primary school, and work in the fields.

The changes in our weather patterns affect how many crops we produce, the availability of food, our health and physical safety. We've had to find ways to cope with these problems. For example, when water is scarce we go back to using wells and collecting surface water at local wetlands.
RESEARCHER: *Multiple impacts → coping and adaptation.*

When it gets very difficult to find food, the government gives us aid, such as grain or seed. But sometimes the government gets the timing wrong (like when seeds arrive after the end of the planting season) and the aid often fails to reach the people that need it most, like the sick, disabled and elderly.
RESEARCHER: *Ineffective institutional support.*

Basic services in our area are limited, despite the agreement to provide services that was part of the deal behind the building of the dam. They set up new services in all the villages around here but some are much better than others.

My village, and many others, have had what they call gravity-fed taps installed. Some never work, others dry up and many pipes burst in the winter. We have to fix them out of our own pockets. Even when the taps are working, we are only allowed to collect water between 6am and 10am, otherwise it runs out.
RESEARCHER: *Coping mechanism → further health impacts.*

Most of us still go to the traditional healer, but we also know that there are some illnesses that the healer just can't help with. More and more young people are getting sick. Health workers visit us once a month but this often isn't enough. Some of us have set up a support group to try to help the families in the village when people get sick.
RESEARCHER: *HIV/AIDS related health stress.*

The nearest doctor is in the bigger village. Although they built a good main road after the dam was built, it doesn't reach the village. And there's no way that most of us can pay for the communal taxis.
RESEARCHER: *Poor mobility and access.*

The land round the village has changed from what I remember as a child. Wood for burning, grasses for roofing and plants for healing are much more difficult to find and we have to go further from the village to collect them. The places where we used to collect them are now flooded by the dam.
RESEARCHER: *Impacts over time. Ecological stress.*

Our life is our cattle. But the condition of the rangelands is getting worse and theft is increasing. With livestock at home, I am no different from a person with money saved in the bank.

The lack of electricity puts real limits on what we can do. We need an energy supply at home, as wood is scarcer now and paraffin and diesel are expensive. We would like electricity to replace the diesel flour mill. We'd also like to start farming poultry but we need electricity for that.

We are trying different things – people told us to grow new crops like apples and garlic. Our main problem is that there are just not enough jobs about. Jobs in mining and textiles have suddenly disappeared and now we have no alternatives.
RESEARCHER: *Macro-level ecomonic trends – regional impacts felt locally.*

Our farming is sometimes affected by delayed rainfall, or a lack of snow, or droughts. If there are enough crops left over from selling, they help to feed the family. But there are not enough jobs or ways to earn cash. Some people who are working in the town, can help their family by sending money home.
RESEARCHER: *Micro-level climate trends interacting with macro-economic realities = dynamic vulnerability.*

Our main wishes are for more jobs, clinics and doctors that are easier to get to when we need care, and training in growing new crops, or making handicrafts to sell.


SUKAINA BHANWANI


ANNA TAYLOR

RESEARCHER'S CONCLUSIONS

The multiple stresses affecting these communities cannot be underestimated. Vulnerability analysis must not take a sectoral, single stressor approach but needs to address the multiple and complex changing stresses that are faced in many different areas.

Where they have the knowledge, technology or resources to do so, people try to adapt to their situation. These responses to multiple stresses and dynamic vulnerability (gradual and sudden impacts at different scales) may not provide adequate systemic resilience.

Institutional support
These communities need greater institutional support to help them work towards a long-term sustainable future. Resilient local livelihoods are more likely to flourish if local adaptive capacity is supported by institutional structures. These structures must recognise:

- the various aspects of vulnerability (such as declining grazing areas or lack of fuel)
- the diverse groups at risk (herders, households, women, sick, elderly etc.), and
- the changes in current practice and traditional adaptation methods (such as the extended rotational grazing period or 'closing off' wood sites).

Resilience thresholds
It is vital that the climatic, social, and economic thresholds of resilience are explored before interventions are made. Otherwise there is a risk that interventions will exacerbate existing vulnerabilities or even create new ones. Where resilience analysis is done adequately, the community's own adaptive capacity will be 'refined' through the institutional support – identified, supported and reinforced.

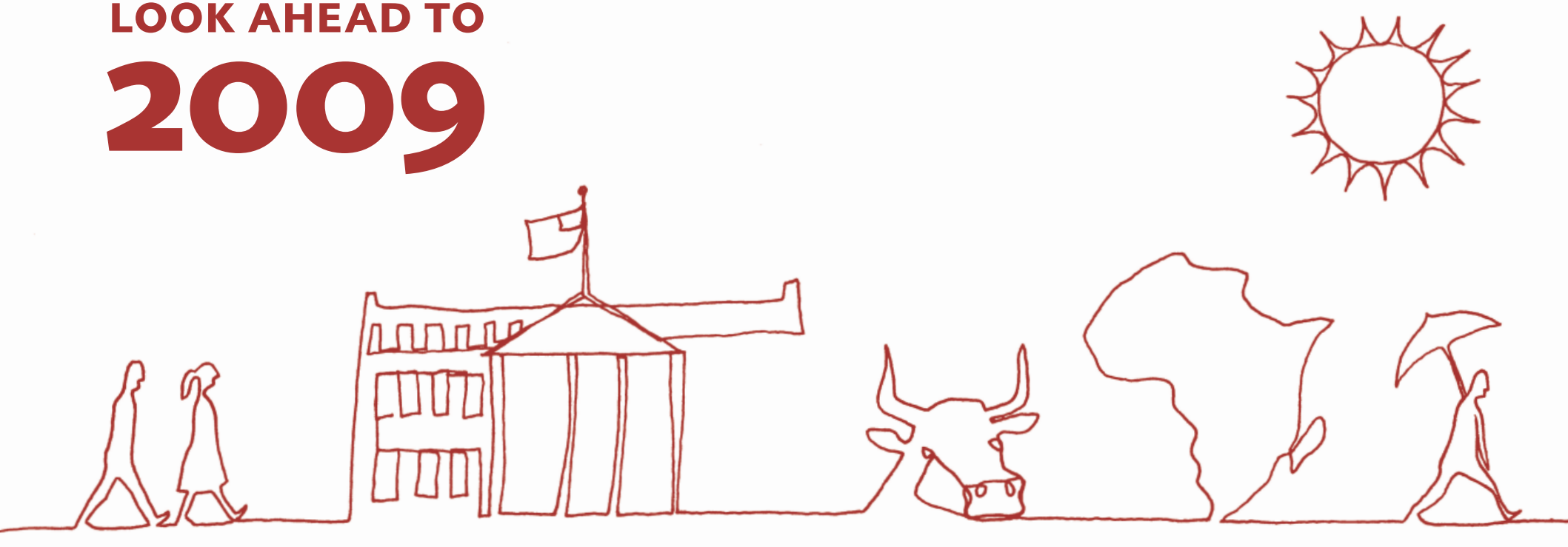
From 'M'a Letsema and her community there is resignation to delayed support and limited assistance, but also hope for the future. As she says: 'muso ha o tate' – government rushes for no-one. But we hope that change will come eventually.


MAURITZV

‘The land around the village has changed from when I was a child. We have all noticed that the rains come later and for a shorter period, and droughts last longer than they used to.'

‘M'a Letsema, Lesotho

LOOK AHEAD TO 2009



The year of the Ox, of a new President in the White House and of climate change negotiations.

And it's our 20th anniversary too. 2009 is undeniably a big year.

Our research will play an important role in Sweden's Presidency of the European Union. And we will continue to strengthen our international research network, not least through our new Africa Centre.

On climate change, forthcoming research publications and events for policymakers will focus on the crucial roles of China, the US, and the EU in the UN negotiations.

● **New President, new climate?** The domestic challenges facing President Obama are enormous: two wars, an economy in tatters, soaring unemployment rates, and a failing health system. Added to this gloomy picture is the growing urgency of global warming. The President has already signalled that his administration will take a decidedly different stance than his predecessor. SEI is asking: what does this mean in practice?

The answer is that the US sees climate change policies as part of a larger strategy for sustained national development. Our ambition is to identify those factors with real positive climate impact. These insights will ultimately generate a set of recommendations for the UN climate change negotiations in Copenhagen (COP 15).

● In the Chinese year of the ox, research across SEI will look at the dilemmas posed by **China's huge demand for energy.**

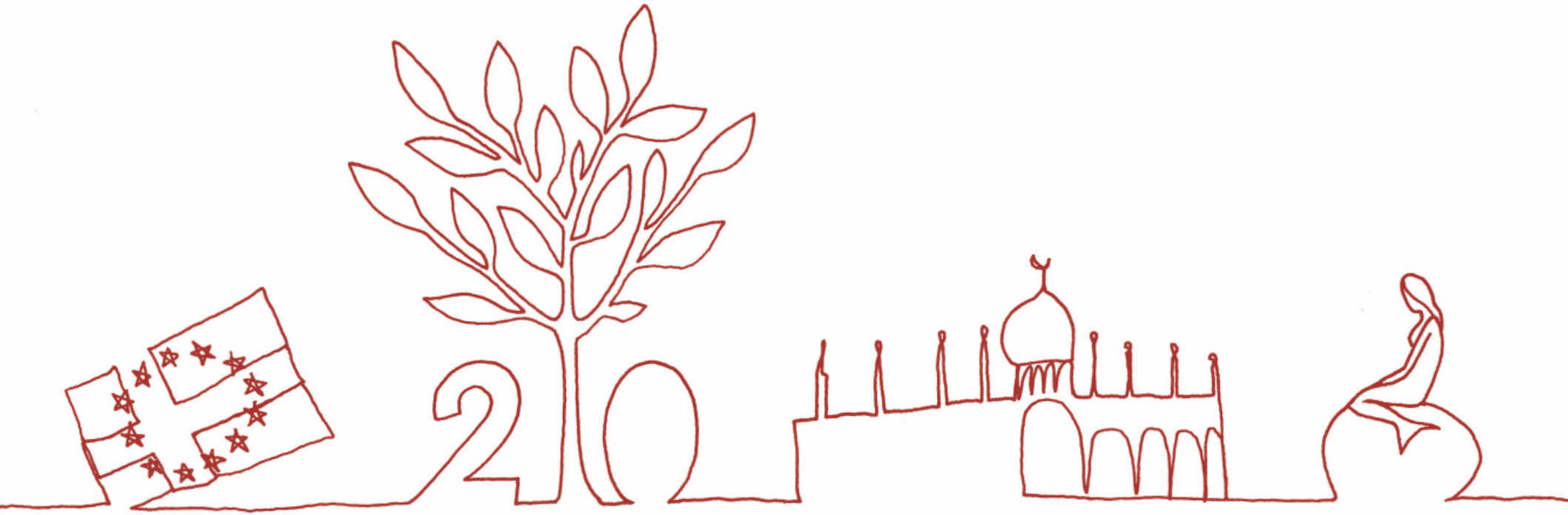
Our China specialists will also look into urbanisation and the social dimensions of environmental issues in relation to China's development

Among other things, they will continue to work with the Chinese 50 Economists Forum, present a report comparing climate and energy policy in China and the US, and carry out a study of cooperation between China and Africa.

● The official opening of the **SEI Africa Centre** takes place in June.

Meanwhile, SEI will lead a study on the **economic impact of climate change in Kenya**. The study is funded by the UK Department for International Development (DFID) and the Danish International development Agency (DANIDA).

The SEI **sustainable sanitation** programme (EcoSanRes) is setting up 10 knowledge nodes around the world. The node in Burkina Faso will spread practical information among municipalities and local councils in order to reduce ill health, increase food security, and generate income for both rural and urban communities. The nodes also feed local experiences into national and international networks.



● During the Swedish EU presidency, an SEI study on **eco-efficient Europe** will stimulate discussions at three informal ministerial meetings on energy, environment and competitiveness. An eco-efficient economy should simultaneously address climate change mitigation, energy efficiency, resource policy, economic growth, industrial renewal and innovation, and competitiveness, by exploiting the synergies and minimising the trade-offs involved. The study introduces a range of policy and governance approaches that promote an eco-efficient economy, and presents examples from new sectors such as biotechnology and renewable electricity as well as from eco-efficiency in traditional sectors.

● In the autumn SEI celebrates its **20th anniversary** and looks ahead to the next challenges for environment and development.

In the past 20 years the Institute has tackled immediate problems and set the agenda in areas such as GHGs, biotechnology, agro-forestry, energy analysis and global acid rain mapping.

The Institute has grown, too, from a staff of 31 in three countries in 1989 to a global organisation of over 170 staff in seven research centres on four continents.

Our 20th anniversary is the moment to ask: what bridges between science and policy must be built in the next 20 years? And how and where will they be built?

● The year will culminate in the UN climate change negotiations in Copenhagen (COP 15). SEI will be there, supporting delegations and presenting findings from a year of intense climate research.

During 2009 we will launch a project that looks at **liability and compensation** for damage caused by climate change. We'll be collaborating with Sweden's Anna Lindh Foundation to break new ground in a field that is only just beginning to be studied in any detail.

We'll continue to develop **energy and environment scenarios and analysis**. And we'll apply our scenarios to examine global, regional and national sustainability trends. We also plan to broaden the scope of these scenarios and introduce new issues that go beyond energy policy and GHG mitigation assessment.

By the end of the year, the **footprinting and Greenhouse Development Rights** teams will have linked their research, creating a tool that allows for transparent comparisons between different burden-sharing proposals for addressing climate change. More country studies (e.g. Denmark) will appear to help policymakers understand the concept and scale of the challenge. And we'll continue to work with delegations to the UN negotiations, particularly on technology funding.

COMMUNICATIONS AND MEDIA

From research to knowledge to sustainable lives: the challenge is getting our research to the right people, in the right way, at the right time.

2008 MARKED a watershed for our communications activities. A more strategic approach, including targeted events, a streamlined publications portfolio and use of new technologies has raised the profile of the institute and increased the impact of our research.

Publications portfolio

In 2008 the SEI communications team assessed how best to reach our target audiences, whether they're local politicians or acclaimed academics. The result is a refreshed publications portfolio that introduces, for the first time, factsheets and policy briefs for policymakers and journalists. In addition the portfolio includes a flagship, peer-reviewed, research publication. In the last quarter of 2008 we produced 24 factsheets and seven policy briefs, many prepared to coincide with the UN climate change conference in Poznań.

Building capacity

SEI researchers are much sought after by conference organisers and journalists. To help them develop the skills to get their messages across we held our first communications workshop in September 2008. But we don't just build capacity in-house: last year SEI provided training for Swedish journalists (on climate science) and for the Swedish Environment Ministry (on European policymaking).

Newsletters

October saw the launch of the West African version of the magazine *Tiempo*, the climate change bulletin for developing countries. Targeted to the French-speaking audience of West Africa, *Tiempo Afrique* provides a channel for to debate on climate change vulnerability in the world's least developed countries. Tiempo has global circulation of around 10 000.

2008 also marked the twentieth year of Renewable Energy for Development (RED), SEI's newsletter on renewable energy in developing countries. Around 50% of the RED audience are from developing countries.

More than www.sei.se

From webcasting to online courses, SEI became more of an online experience in 2008. In October 2008 we launched an on-line Foundation Course on Air Quality Management in Asia. In the same month we doubled our website visitors by webcasting a high-level seminar on climate change held at the Swedish Parliament.

Media

International media frequently contacts SEI for comment on questions of environment and development. During the second half of 2008 the Institute, on average, appeared in the media more than once a day. Newspaper articles from every corner of the globe quoted SEI researchers, from the Sydney Morning Herald to the Jakarta Post, from the Guardian to the Financial Times. We gave interviews to BBC radio and made regular appearances on Swedish radio and television.

Selected conferences

SEI has always been an influential presence at conferences and forums throughout the world, and 2008 was no exception. The list on the right shows just a sample of some of the events where SEI was an active participant over the past year.

Particular highlights included the Resilience 2008 conference (see page 5). This conference was the first of its kind, and was hosted by the Stockholm Resilience Centre, of which SEI is an integral part. We also held an open house at our Asia office where we hosted key partners and stakeholders, establishing SEI as an important policy and research partner in the region. And at the UN climate change negotiations in Poznań (COP 14), we broke with tradition by leading a participatory side event on adaptation.

FEBRUARY
- London: presentation at Community Based Adaptation to Climate Change, Third International Conference
- Berlin: Conference on the Human Dimensions of Global Environmental Change

MARCH
- Vienna: EASY ECO Conference. Presented paper on sustainability evaluation in strategic assessment

APRIL
- Stockholm: Resilience 2008 conference
- Hanoi: Global Oceans Conference. Chaired session on the UNEP/GPA mainstreaming programme on water resources

MAY
- Bangkok: Regional Training Courses on Climate Risk Management and Early Warning Systems, organised by the Asian Disaster Preparedness Center (ADPC). Led sessions

JUNE
- Tällberg: Tällberg Forum. Organised pre-forum workshops on Planetary Boundaries and Moral Imperatives
- Johannesburg: African Ministerial Conference on the Environment (AMCEN)

JULY
- Munich: UN University, Re Foundation, Third Summer Academy Environment-related migration

AUGUST
- Stockholm: World Water Week
- Colombo: 10th session of Malé Declaration Intergovernmental meeting

SEPTEMBER
- Stockholm: Global Atmospheric Policy Forum conference
- Bangkok: SEI Asia open house

OCTOBER
- Changwon: UNEP Global Climate Change Adaptation Network meeting

NOVEMBER
- Macau: World Toilet Summit & Expo. Presented EcoSanRes report
- Bangkok: Better Air Quality (BAQ) conference

DECEMBER
- Poznań: The United Nations Climate Change Conference (COP 14)
- Boston: SEI US symposium, Taking Climate Change Seriously: Research and Policy Directions for the Next US Administration

PUBLICATIONS

In 2008 we wrote:

- **75 peer-reviewed articles, books and book chapters**
- **104 other scientific articles and reports, and**
- **11 popular science publications.**

A Review of Offset Programs: Trading Systems, Funds, Protocols, Standards and Retailers
Kollmuss, A., Lazarus, M., Lee, C., and Polycarp, C.

This review provides an up-to-date analysis and synthesis of the most influential offset programs and activities. The review reflects on lessons learned, and so informs participants and designers of current and future offset programmes. The authors' intention is to periodically update this review, and to develop a website portal to make this information more accessible. This version includes programmes that meet one or more of the following criteria:

- a significant volume of credit transactions occurring or anticipated
- an established set of rules or protocols
- path-breaking, novel or otherwise notable initiatives, or
- important lessons learned.

SELECTED PUBLISHED WORK

Articles in journals

Ackerman, F. (2008). Climate economics in four easy pieces. *Development*, 51(3): 325–331.

Cinderby, S., Snell, C. and Forrester, J. (2008). Participatory GIS and its application in governance: the example of air quality and the implications for noise pollution. *Local Environment*, 13 (4): 309–320.

Haq, G., Whitelegg, J., Cinderby, S. and Owen, A. (2008). The use of personalised social marketing to foster voluntary behavioural change for sustainable travel and lifestyles. *Local Environment*, 13 (7): 549–569.

Hicks, W. K., Kuylenstierna, J.C.I., Owen, A., Dentener, F., Seip, H-M. and Rodhe, H. (2008).Soil sensitivity to acidification in Asia: status and prospects. *Ambio*, 37 (4): 295–303.

Kemp-Benedict, E. and Agyemang-Bonsu, W.K. (2008). The Akropong approach to multi-sector project planning. *Futures*, 40 (9): 834–840.

Laur, A. and Kallaste, T. (2008) COFITECK – project for developing biomass co-firing technologies and biomass market in Central and Eastern Europe (in Estonian). *Keskkonnatehnika* (Environmental Technology), no. 1: 28–29.

Nilsson, M., Jordan, A., Turnpenny, J., Hertin, J., Nykvist, B. and Russel, D. (2008). The use and non-use of policy appraisal tools in public policy making: an analysis of three European countries and the European Union. *Policy Sciences*, 41 (4): 335–355.

Smakhtin, V. and Schipper, E.L.F. (2008) Droughts: the impact of semantics and perceptions. *Water Policy*, 10 (2): 131–143.

Tol, R.S.J., Klein, R.J.T. and Nicholls, R.J. (2008). Towards successful adaptation to sea-level rise along Europe's coasts. *Journal of Coastal Research*, 24 (2): 432–442.

Watkiss, P. and Downing, T. (2008). The social cost of carbon: valuation estimates and their use in UK policy. *Integrated Assessment Journal*, 8 (1): 85–105.

Ziervogel, G. and Taylor, A. (2008). Feeling stressed: integrating climate adaptation with other priorities in South Africa. *Environment*, 50(2): 32–41.

Books

Ackerman, F. (2008). *Can We Afford the Future? Economics for a Warming World*. London: Zed Books. ISBN 97818481303 88.

Baker, S. and Eckerberg, K. (eds.) (2008). *In Pursuit of Sustainable Development: New Governance Practices at the Sub-national Level in Europe*. London: Routledge. ISBN 9780415419109.

Patt, A.G., Schröter, D., Klein, R.J.T. and de la Vega-Leinert, A.C. (eds.) (2008). *Assessing Vulnerability to Global Environmental Change: Making Research Useful for Adaptation Decision Making and Policy*. London: Earthscan. ISBN 9781844076970.

Schipper, E.L.F. and Burton, I. (eds.) (2008). *The Earthscan Reader on Adaptation to Climate Change*. London: Earthscan. ISBN 9781844075317.

Book chapters

Chen, Y. and Johnson, F.X. (2008). Sweden: greening the power market in a context of liberalization and nuclear ambivalence. In: W.M. Lafferty and A. Ruud (eds) *Promoting Sustainable Electricity in Europe*. Cheltenham, UK: Edward Elgar. P. 219–250. ISBN 978184720807.

Hoff, H. (2008). Challenges in upland watershed management: the green-blue water approach. In: A. Dinar and A. Garrido (eds) *Managing Water Resources in a Time of Global Change: Mountains, Valleys and Flood Plains.* Oxford: Routledge. ISBN 97804157777780

Karlberg, L., Barron, J. and Rockström, J. (2008). Water productivity and green water management in agro-ecosystems. In: J. Förare (ed.) *Water for Food*. Stockholm: Formas.ISBN 9789154060191

Li, L. (2008). Putting the assessment into action: six steps for governments. In: J. Ranganathan, M. Munasinghe and F. Irwin (eds) *Policies for Sustainable Governance of Global Ecosystem Services*. Cheltenham, UK: Edward Elgar. ISBN 9781847202444.

Morone, P. and Taylor, R. (2008). Knowledge architecture and knowledge flows. In: M. Khosrow-Pour (ed.) *Encyclopedia of Information Science and Technology* (2. ed.). Hershey, PA.: Information Science Reference. P. 2319-2324. ISBN 9781605660264.

Nilsson, M. and Persson, Å. (2008). Sweden. In: A.J. Jordan and A. Lenschow (eds.) *Innovation in Environmental Policy?: Integrating the Environment for Sustainability*. Cheltenham, UK: Edward Elgar. P. 224–246. ISBN 9781847204905

Ziervogel, G., Nyong, A., Osman-Elasha, B., Conde, C., Cortés, S. and Downing, T. (2008). Household food security and climate change: comparisons from Nigeria, Sudan, South Africa and Mexico. In: N. Leary, et. al. (eds.) *Climate Change and Vulnerability*. London: Earthscan. ISBN 9781844074693

Reports

Baer, P., Athanasiou, T., Kartha, S. and Kemp-Benedict, E. (2008). *The Greenhouse Development Rights Framework: the Right to Development in a Climate Constrained World* (2., rev.ed.). Berlin: Heinrich Böll Foundation. Publication Series on Ecology, vol. 1. ISBN 9783927760714. http://www.ecoequity.org/docs/TheGDRsFramework.pdf

Klein, R.J.T., Kartha, S., Persson, Å., Watkiss, P., Ackerman, F., Downing, T.E., Kjellén, B. and Schipper, L. (2008). *Adaptation: Needs, Financing and Institutions*. London: Office of Tony Blair and the Climate Group. 23 pp. (Briefing paper to the report *Breaking the Climate Deadlock*). http://www.theclimategroup.org/assets/resources/Adaptation_-_Needs,_Financing _and_Institutions.pdf

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Madeleine Fogde
Benita Forsman
Åsa Gerger Swartling
Tom Gill
Karl Hallding
Guoyi Han
Sturle Hauge Simonsen
Holger Hoff
Francis Johnson
Håkan Jönsson
Louise Karlberg
Clarisse Kehler Siebert
Bo Kjellén
Marianne Kjellén
Richard Klein
Rasmus Klocker Larsen
Elisabeth Kvarnström
Fiona Lambe
Lailai Li – *Deputy Director*
Maria Morales
Stina Nieminen
Göran Nilsson Axberg
Annika Nilsson
Måns Nilsson – *Programme Director*
Björn Nykvist
Teresa Ogenstad
Gunnel Olofsson
Linn Persson
Simon Persson
Åsa Persson
Neil Powell
Johan Rockström – *Executive Director*
Felicity Rolf
Mikael Román
Arno Rosemarin
Cecilia Ruben
Karin Schéle – *Head of Human Resources*
Thor-Axel Stenström
Bohumil Stetina – *Head of Finance*
Patricia Vilchis Tella
Ivar Virgin
Annika Värnas
Oskar Wallgren
Robert Watt – *Head of Communications*
Fiona Zuzarte
Agneta Åkesson

SEI AFRICA

SC Anders Arvidson – *Centre Director*
YC Stacey Noel

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Elnora de la Rosa
Muanpong Juntopas
Dusita Krawanchid
Chayanis Krittasudthacheewa
Noraset Kunjara Na Ayudhya
Sommai Liengwattanakul
SC Eva Lindskog
Wenman Liu
SC Vikrom Mathur
Sopon Naruchaikusol
SC Maria Osbeck
Papassarah Pimanmas
SC Lisa Schipper
YC John Soussan – *Acting Centre Director & Programme Director*
SC Frank Thomalla
Tatirose Vijitpan
Darawat Weerapong

SEI OXFORD

Carol Benzie
Sukaina Bharwani
Ruth Butterfield
Anton Cartwright
Tahia Devissher
Thomas Downing – *Centre Director & Programme Director*
Jillian Dyszynski
Mohamed Hamza
Izabela Juszko
Mark Kelleher
Kate Lonsdale
Patrick O'Donohoe
Matthew Savage
Moliehi Shale
Ben Smith
Linda Stephen
Takeshi Takama
Adriaan Tas
Anna Taylor
Richard Taylor
Ian Tellam (*Associate*)
Paul Watkiss (*Associate*)
Fernanda Zermoglio
Gina Ziervogel

SEI TALLINN

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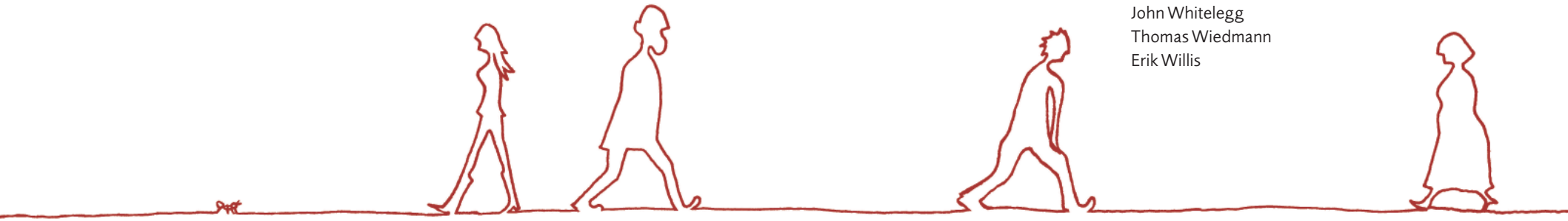
Peep Jürmann
Vivika Jürna
Mari Jüssi
Tiit Kallaste
Enn Kareda
Karin Kilk
Veljo Kimmel
Piret Kuldna
Anton Laur
Anne Menert
Harri Moora
Tea Nõmmann – *Centre Director*
Ahto Oja
Maaja Orasson
Kaja Peterson
Helen Poltimäe
Heidi Tuhkanen
Evelin Urbel-Piirsalu
Meelis Uustal
Viire Viss

SEI US

Frank Ackerman
Tariq Banuri – *Programme Director*
Ramon Bueno
Victoria Clark
William Dougherty
Peter Erickson
Marisa Escobar
Amanda Fencl
Roel Hammerschlag
Charles Heaps – *Centre Director*
Cornelia Herzfeld
Brian Joyce
Sivan Kartha – *Programme Director*
Eric Kemp-Benedict
Anja Kollmuss
Michael Lazarus
Carrie Lee
Vishal Mehta
David Purkey
Linda Rhines
Kim Shaknis
Jack Sieber – *Centre Deputy Director*
Liz Stanton
Christopher Swartz
Sebastian Vicuna (*Associate*)
David Von Hippel (*Associate*)
Charles Young

SEI YORK

Mike Ashmore
John Barrett
Jennie Barron
Julian Briggs
Patrick Büker
Howard Cambridge
Matthew Chadwick
Michael J. Chadwick (*Associate*)
Steve Cinderby – *Centre Deputy Director*
Richard Clay
Ellie Dawkins
Jenny Duckmanton
Lisa Emberson – *Programme Director*
John Forrester
Gary Haq
Andreas Heinemeyer
Kevin Hicks
Phil Ineson
Johan Kuylenstierna – *Centre Director*
Neela Matin
Jan Minx
Tim Morrissey
Anne Owen
Alistair Paul
Adam Regis
Dieter Schwela
Kate Scott
Carolyn Snell Pomfret
Jens-Arne Subke
Harry Vallack
Sarah West
John Whitelegg
Thomas Wiedmann
Erik Willis



BOARD

Lars Anell (Chair)
Sweden
Former Senior Vice-president at AB Volvo, involved in policy and environment

Sukaina Bharawani
UK
SEI Staff Representative. Her research includes modelling of poverty and vulnerability scenarios.

Lidia Brito
Mozambique
Assistant Professor in Wood Science and Technology at Eduardo Mondlane University.

Patrick Büker
UK
SEI Staff Representative. His research focuses on the impacts of air pollution.

Matthew Chadwick
UK
SEI Staff Representative. His research focuses on natural resources management issues.

Angela Cropper
Trinidad and Tobago
Co-founder and President of the Cropper Foundation and Deputy Director of UNEP

Birgitta Dahl
Sweden
Former Swedish Minister of Environment and Speaker of the Parliament

Lena Ek
Sweden
Member of the European Parliament

Carl Folke
Sweden
Director, The Beijer Institute of Ecological Economics.
Science Director, Stockholm Resilience Centre

Eva Lindskog
Sweden
SEI Staff Representative. Her area of expertise is social impact assessment.

Giuseppe Locati
Italy
Vice-president, Corporate Health and Environment, Pirelli

Johan Rockström
Sweden
Executive Director, SEI

John Schellnhuber
Germany
Director, Potsdam Institute for Climate Impact Research (PIK)

Jim Skea
UK
Research Director, UK Energy Research Centre

Youba Sokona
Mali
Executive Secretary, Sahara and Sahel Observatory (OSS)

Monthip S. Tabucanon
Thailand
Inspector General, Thai Ministry of Natural Resources and Environment

DONORS AND PARTNERS

A selection of organisations that supported us in 2008

Bilateral agencies

Australian Agency for International Development (AusAID)
Government of Germany, GTZ, BGR, GLOWA
Swedish International Development Cooperation Agency (Sida)
UK Department for International Development (DFID)

Multilateral agencies

European Commission
Nordic Council of Ministers
United Nations Economic Commission for Europe International Cooperative Programme (UNECE ICP) on Vegetation
United Nations Development Programme (UNDP)
United Nations Environment Programme (UNEP)
United Nations Framework Convention on Climate Change (UNFCCC)
United Nations Institute for Training and Research (UNITAR)
United Nations Office for Project Services (UNOPS)

Government

City Government of Seattle, Washington, US
City Government of Sharon, Massachusetts, US
Department of Environment, Food and Rural Affairs (DEFRA), UK
East Bay Municipal Water District, US
El Dorado Irrigation District, US
Government of Estonia
Ministry for Foreign Affairs, Sweden
Ministry of the Environment, Sweden
National Oceanic and Atmospheric Administration (NOAA), US
National Renewable Energy Laboratory (NREL), US Department of Environment
Natural England, UK
South Africa National Energy Research Institute (SANERI)
Swedish Energy Agency
Swedish Environmental Protection Agency
Swedish Meteorological and Hydrological Institute (SMHI)
US Environmental Protection Agency (EPA)
US State Department

Research institutes and NGOs

Center for International Forestry Research (CIFOR)
Australian Commonwealth Scientific and Industrial Research Organisation (CSIRO)
The Climate Group
Christian Aid
Ecotrust
Engineering and Physical Sciences Research Council (EPSRC)
Environmental and Energy Study Institute (EESI)
Friends of the Earth
Fridtjof Nansen Institute (FNI)
Humanist Institute for Development Cooperation (HIVOS)
International START Secretariat
Institute for International and European Environmental Policy (Ecologic)
International Energy Agency (IEA)
International Centre for Integrated Mountain Development (ICIMOD)
International Union for Conservation of Nature (IUCN)
International Water Management Institute (IWMI)
National Environment Research Council (NERC)
Natural Resources Defense Council
The Nature Conservancy
South Pacific Regional Environment Programme (SPREP)
Stockholm International Water Institute (SIWI)
Stockholm Resilience Centre
Swedish Environmental Research Institute (IVL)
Tellus Institute
Tällberg Foundation
Vetenskapsrådet (Swedish Research Council)
World Wildlife Fund (WWF)

Universities

Lund University
University of California, Davis
University of California, San Diego
University of Tübingen
Swedish University of Agricultural Sciences (SLU)

Foundations

Environmental Investment Centre (EIC)
Estonian Association for Environmental Management
Latvian Green Movement
The Swedish Foundation for Strategic Environmental Research (MISTRA)
The Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (FORMAS)
Winrock International Institute for Agricultural Development

Private sector

Cipax Estonia
Estonian Energy
ETC International Group
ENVECO Miljöekonomi AB
Ramboll Natura AB
Rolls Royce
Shell China
Unilever

Banks

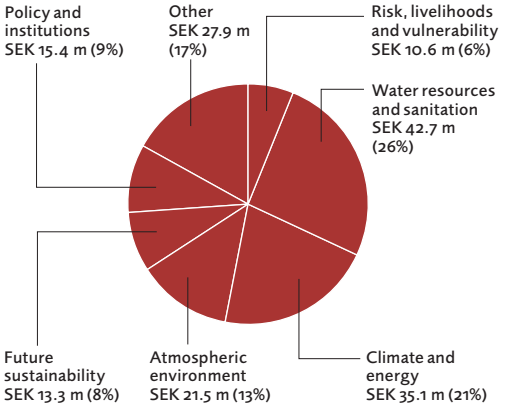
Asian Development Bank
World Bank Group

FINANCE

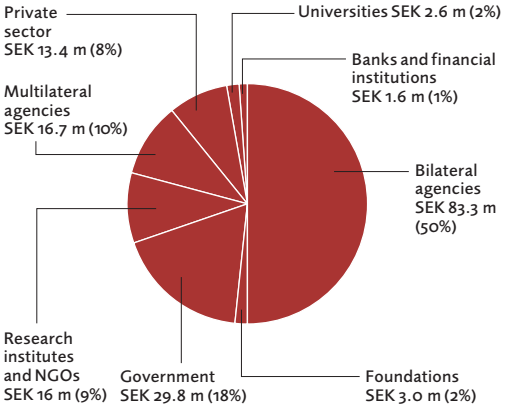
SEI generated approximately SEK 167 million in research funding in 2008 – an increase from SEK 130 million in 2007.

2008

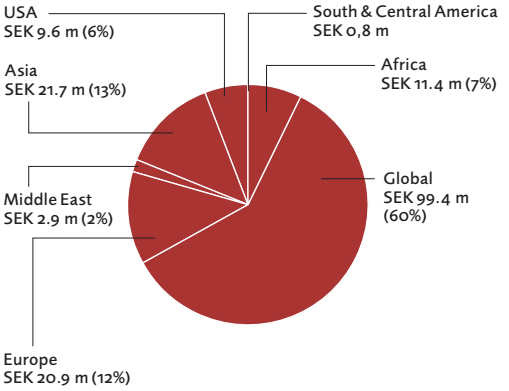
RESEARCH AREA



FUNDING SOURCES BY SECTOR

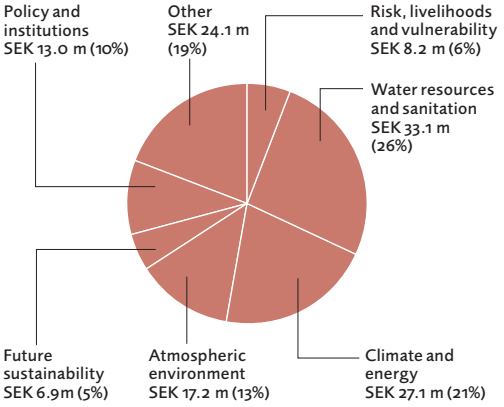


GEOGRAPHIC FOCUS

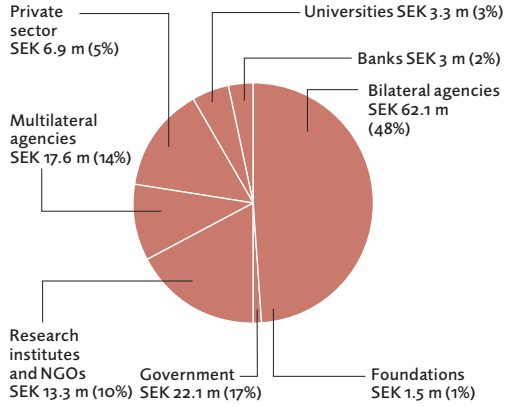


2007

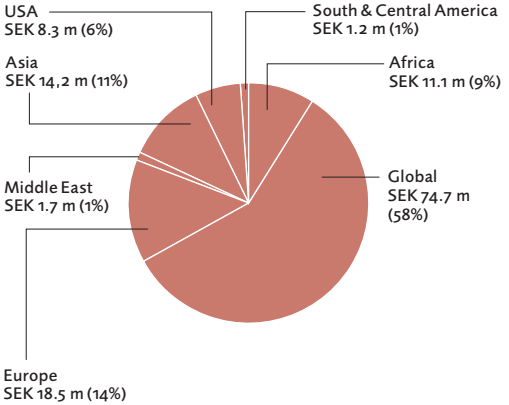
RESEARCH AREA



FUNDING SOURCES BY SECTOR



GEOGRAPHIC FOCUS



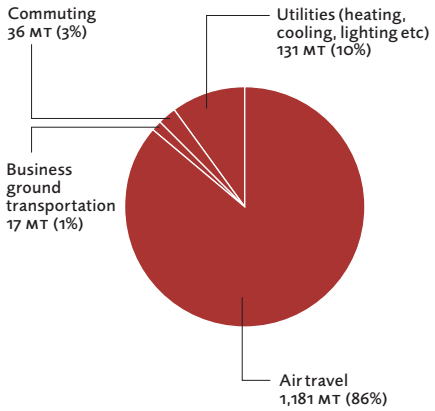
ENVIRONMENTAL POLICY

WALKING THE TALK

The aim of our environmental policy is to 'walk our talk' and to carry out our work as sustainably as possible, aiming to minimise our own negative impact on the environment.

2008–2009 is our pilot phase, with reports from these years providing a baseline for subsequent targets. Estimates show that our total carbon footprint in 2008 was 1,366 MT. Not all of SEI's centres have been able to measure every emission source this year. During 2009 we will further harmonise our environmental monitoring so that by the 2010 report we will have the full picture of our carbon emissions.

Monitoring so far shows that emission levels vary between the centres due to different climates, different energy sources, and the different levels of long-distance travel connected to each centre's research portfolio. It is clear that reducing our air travel will be the most significant factor in reducing our footprint. We will continue our efforts to consolidate our air travel and improve our video conferencing equipment during the next few years.



SEI total CO_2 emissions in 2008: 1,366 MT

MINIMISING OUR CARBON FOOTPRINT

1. Reducing our carbon emissions from travel by doing less of it and switching to more environmentally friendly modes of travel.
2. Using video conferencing and other communication technologies wherever possible.

MONITORING OUR CARBON FOOTPRINT

3. Annually reporting our environmental impacts and setting targets for further emission reductions.
4. Offsetting our carbon emissions.

REDUCING WASTE

5. Reducing energy and water consumption in our office buildings.
6. Reducing our paper consumption.
7. Using recycled paper or paper from sustainably harvested forests.
8. Using environmentally friendly office supplies wherever possible.
9. Recycling paper, metals, plastics, glass and electrical equipment in all offices.
10. Reducing the amount of non-recyclable material used.
11. Including a component on our environmental management system in staff training.

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Project co-ordination: Jane Webb
Print: Danagårds Grafiska, Ödeshög

This annual report has been produced using environmentally-certified printing processes and printed on paper with the environmental standards Swan and FSC.

FSC, the Forest Stewardship Council, is an international organisation that promotes the responsible management of the world's forests, assuring that products come from forests that are managed to meet the social, economic and ecological needs of present and future generations.

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