Between the lines
Finding solutions through crosscutting research

2-DEGREES
IIASA research shows the way towards limiting climate change

THE FUTURE OF WATER
The world’s water challenges finally get a systems view

CLEARING THE AIR
Research for the European Union is a model for science to policy
Between the lines

There is a growing recognition of the value of systems thinking, among not only researchers, but also business leaders, policymakers, and educators. It is this integrated and interdisciplinary approach to research that IIASA has been leading for over four decades. And this approach is key to finding optimum solutions to global challenges, like meeting our needs for water, food, and energy.

Today, two-thirds of the water we take from nature goes for irrigation. We are reaching the limits of this resource, as rivers run dry and underground reserves empty. In February IIASA and partners launched a new research project that will investigate how best to protect the world’s increasingly scarce water reserves from human use and nature’s cycle. In February IIASA and partners launched a new research project that will investigate how best to protect the world’s increasingly scarce water reserves from human use and nature’s cycle.

In our Global Energy Assessment (page 8), published in 2012, we linked three pressing issues: bringing electricity to the 1.6 billion who lack it, preventing the millions of deaths every year from inhaling smoke from indoor cooking stoves. We found that an integrated approach could achieve all three goals at 40 percent less cost than doing each separately.

This issue’s cover feature examines what needs to be done to slow climate change and limit global temperature rise to 2°C (page 14), based on three new studies published recently in Nature and Nature Climate Change. The researchers warn that “the next eight years really determines the feasibility and choices that we have in the long term (to limit climate change).”

Other articles in this issue show how IIASA brings systems analysis to the next generation—the Young Scientists Summer Program (page 20) and the first Southern African Young Scientists Summer Program (page 22). Business, too, wishes to better understand the nexus issues and systems analysis which IIASA specializes in. “How do we (businesses) deal with the nexus between energy, food, water, land use and similar issues?” asks Björn Stigson, IIASA’s new special advisor to develop collaborations with business (page 10).

Only integrated thinking can penetrate these complex topics and come up with realistic policy options. The articles in this issue show the value of looking across disciplines and national boundaries—of looking between the lines—to find integrated and long-lasting solutions to the major challenges facing our globe.

I hope you enjoy reading this selection of IIASA’s recent research in this issue of Options.
This issue of Options highlights the impact of research that crosses disciplinary boundaries. Cover design by IIASA using images © Revensis | Dreamstime.com © Stajduhar | Dreamstime.com
Smarter use of nutrients will help clean up the planet
Humans have massively altered the natural flows of nitrogen, phosphorus and other nutrients, according to a new United Nations Environment Program report. IIASA’s Wilfried Winiwarter and Zbigniew Klimont contributed to the report, which focuses on solutions for reducing pollution from fertilizers.

The report suggests that a 20 percent improvement in nutrient use efficiency by 2020 would reduce the annual use of nitrogen fertilizer by 20 million tons, and provide a net saving of billions of dollars per year. The report proposes ten key actions to reduce pollution, and makes recommendations for governments, businesses, and citizens. These actions include eating less meat, improving agricultural practices, and taking action to reduce nutrient losses from agriculture, industry, and waste water treatment plants.

Land-use choices for climate
Europe could potentially reduce greenhouse gas emissions from land use by more than 60 percent by 2050, according to new estimates presented by IIASA researcher Hannes Böttcher at the European Geophysical Union General Assembly in April. But those gains would be partially offset by changes in land-use outside of Europe, to compensate for less food and fuel production within the region.

“The land use sector can be both a sink and a source of greenhouse gases,” says Böttcher. “How we manage land can switch areas between taking up carbon and releasing it into the atmosphere.”

The study estimated future land-use emissions based on an integrated modeling framework that combines information about population, economics, and land use and land productivity. It found that the biggest mitigation potential lies in cutting emissions from agriculture such as livestock production, as well as in managing forests effectively to increase their role as a carbon sink.

New research links education and disaster survival
Education is the single most important socioeconomic factor affecting people’s vulnerability to natural disasters, according to three recent studies from IIASA scientists published in a special issue of the journal Ecology and Society. One global study found that education was linked to a greater chance of surviving natural extreme events such as floods, storms, droughts and landslides. The study combined IIASA population projections that include education levels with a wealth of data on disaster response in countries around the world.

The two other studies focused on specific disasters and regions. One, in Nepal, found the same link as the global study, but at a village level. A second study found that in Haiti, Cuba, and the Dominican Republic, three countries with equal exposure to hurricanes, the more educated people of Cuba were far less likely to die because of a hurricane than people in the other two island nations. In both of these regional studies, the researchers interviewed local residents to explore the possible causal links that might explain the correlation.

In all three studies, the effect was strongest when women were educated—an effect that the researchers say may be tied to the role of women in educating children.
Negative emissions and the carbon cycle

Can humanity switch from emitting massive amounts of climate-warming gases, to instead removing them from the atmosphere? Researchers from the Global Carbon Project, IIASA, and other institutions discussed this question at a meeting in Laxenburg in April. More and more, researchers say that targets for climate change may be slipping out of reach. In order to limit climate change to 2°C above pre-industrial levels, many scenarios suggest that emissions will not only need to drop to zero, but eventually to become negative—that is, human beings will need to begin removing greenhouse gases from the atmosphere. But the technologies required to transition to negative emissions remain a big question mark.

“What we’re exploring here are new mitigation technologies to bring emissions to stabilization,” says Pep Canadell, Executive Director of the Global Carbon Project (GCP), who led the meeting along with IIASA Deputy Director Nebojsa Nakicenovic. Canadell says, “We need to not just decarbonize fossil fuels and introduce other emissions free options but in addition take carbon out of the atmosphere through negative emissions and sequester it underground.”

During the two-day workshop, researchers presented relevant findings and participated in discussions, including how much negative carbon emissions are required and how long we can wait to act and still meet the 2°C target. They also discussed details and uncertainties in the carbon cycle, the biogeochemical system by which carbon flows in and out of the atmosphere, vegetation, and associated land, water, nutrient requirements, and the flow of the ocean. Other questions included how much biofuel could be produced sustainably, while also maintaining adequate food production for the world’s population.

Connecting Africa to a global data network

A new IIASA initiative, FarmSupport, brings smartphones to African farmers, involving them in data collection for global land-use models and at the same time connecting them to weather and agricultural data that can help improve crop yields. In February, IIASA researcher Steffen Fritz traveled to Kenya to launch the project, which is a collaboration with the Austrian Central Institute for Weather and Geodynamics (ZAMG).

During his travels, Fritz distributed smartphones to farmers in 4 regions of the country. Each phone came equipped with an application that works in two directions, providing the farmers with weather information that could help them to improve yields, while also improving global land-use information. The application provides weather data and requests crop and farming information from farmers. It also allows farmers to take geo- and orientation-tagged pictures of their crops and to document the crop development over the season and upload them into IIASA’s Geo-Wiki database. “These data are essential for global land cover models,” says Fritz.

Does disaster risk management pay?

The toll from natural disasters, such as floods, landslides, cyclones, earthquakes, and tsunamis is increasing, as populations rise and more assets are at risk. At the same time climate change is changing the frequency and intensity of climate-related events. While researchers cannot predict the precise location and timing of disastrous events, they can estimate the risk of such events. Researchers in IIASA’s Risk, Policy, and Vulnerability program are working to determine actions pay off, and how countries and local governments can make smart investment decisions that lead to fewer deaths and less destruction.

At the European Geophysical Union General Assembly in April, IIASA researchers Reinhard Mechler, Stefan Hochrainer-Stigler, and Nadejda Komendantova presented findings from new studies examining the economics of disaster risk management, as well as the ways that people’s biases influence their preparedness and response to disasters.

www.iiasa.ac.at
IIASA researchers win two new grants from the European Research Council

Research to develop a suite of new measures and methods for the analysis of aging, and research to investigate the implications of producing energy from solar and wind farms in the Sahara have won two major new grants. The funding of almost €4 million was awarded to IIASA demographer Sergei Scherbov and IIASA policy researcher Tony Patt by the European Research Council (ERC).

The ERC funds the brightest ideas on the frontiers of knowledge through Europe-wide, peer-reviewed competitions with excellence as the sole selection criterion. Patt won a €1.5 million ERC Starting Grant for emerging research leaders, and Scherbov won a €2.25 million ERC Advanced Grant for established researchers. The two new awards are the third and fourth ERC grants at IIASA.

Today people are living longer and they are also staying healthier longer. But traditional measures of age have not changed, and therefore a growing section of the population gets categorized as old just because they have hit the magic age of 65. This somewhat arbitrary measure has major implications for pensions, for health care systems, and for the labor force. Scherbov and colleagues will develop new ways to measure aging that include factors like life expectancy, health, disability, cognition, and ability to work—measures that explain how people live and what they need, not just the number of years they have lived.

Patt’s research will also look to the future, but in the Middle East and North Africa region which could generate significant quantities of renewable energy from solar and wind farms. The ERC grant enables Patt and colleagues to explore the economic, social, and development implications of such a huge investment in renewable energy.

Further information
European Research Council:  erc.europa.eu

Anthony Patt (patt@iiasa.ac.at)
Sergei Scherbov (scherbov@iiasa.ac.at)

UN Human Development Report relies on IIASA projections

IIASA population and education projections underlie the United Nations Human Development Report 2013, which shows development gains in the Southern Hemisphere during the last several years.

The new report, which was launched in Vienna on 9 April by UN officials and IIASA’s Wolfgang Lutz, shows a continued rise in living conditions in Africa, Asia, and Latin America. It also examines the factors that have driven those changes and could lead to future improvements.

IIASA contributed population and human capital data and projections which are used throughout the report, as well as background research. World Population Program Leader Wolfgang Lutz and IIASA researcher Samir KC wrote a background paper for Chapter 4 of the report, which focused on policies and projections for sustaining the improvements.

Lutz says, “This series of Human Development Reports has become the most influential publication series in global development. We are very happy to see that our multi-dimensional approach to quantitatively describing population dynamics by age, gender, health, and education has gained such a prominent place. With UNDP we fully share the focus on developing the human resource base for sustainable development.”

The demographic projections produced by IIASA in collaboration with the other partners in the Wittgenstein Centre for Demography and Global Human Capital (the Austrian Academy of Sciences and the WU-Vienna) are unique in that they not only project the number of people in different countries, but also education levels—essential as research shows education, especially of women, is vital for reducing poverty and increasing well-being around the world.

Further information
The Human Development Report: hdr.undp.org

Wolfgang Lutz (lutz@iiasa.ac.at)
Black carbon larger cause of climate change than previously assessed

Black carbon is the second largest man-made contributor to global warming and its influence on climate has been greatly underestimated, according to the first quantitative and comprehensive analysis of this issue. IIASA researcher Zbigniew Klimont contributed estimates from IIASA’s GAINS model of emissions and mitigation potentials of black carbon and co-emitted species to the study, which was a collaborative effort between international researchers.

The landmark study published in the Journal of Geophysical Research: Atmospheres in January 2013 finds that the direct influence of black carbon, or soot, on climate warming could be about twice previous estimates. Accounting for all of the ways it can affect climate, black carbon is believed to have a warming effect of about 1.1 watts per square meter (W/m²), approximately two thirds of the effect of the largest man made contributor to global warming, carbon dioxide. This makes black carbon the second most important individual climate-warming agent after carbon dioxide, according the report. The study also shows that cleaning up diesel engines and some wood and coal combustion could slow the warming immediately.

IIASA research using the GAINS model provides key data on air pollution and greenhouse gas emissions, as well as mitigation measures and their costs, at global and regional scales.


Zbigniew Klimont (klimont@iiasa.ac.at)

Why free riders and blackmailers are a minority

Two recent studies by IIASA researchers have shed light on the evolution of cooperation. One study published in the Proceedings of the Royal Society B may help explain how social exclusion arose in evolution. Another study shows how larger populations naturally encourage cooperation at the expense of extortion.

The first study by postdoctoral fellow Tatsuya Sasaki uses evolutionary game theory to show that punishing people by excluding them from a group indirectly provides rewards for the punisher, thus encouraging them to exclude those they have reason to punish.

“Imagine a pie,” says Sasaki. The fewer people sharing that pie, the more pie everyone gets. But you can’t deny people pie for no reason. There needs to be a justification, for example, that someone did not contribute to baking the pie—a free rider, in game theory parlance. Sasaki says, “If you punish free riders with social exclusion, it increases the payoff for the punishers.”

The second study, published in the Proceedings of the National Academy of Sciences, uses a repeated version of the “prisoner’s dilemma” from game theory to investigate the evolution of extortion. The research by IIASA’s Karl Sigmund, along with Christian Hilbe of the Max Planck Institute for Evolutionary Biology and Martin Nowak of Harvard University, shows that in large populations blackmailers act as catalysts for their own demise. “In very small populations, however, extorters hold their ground,” write the researchers in the article. “Extortion strategies do particularly well in co-evolutionary arms races between two distinct populations. Significantly, they benefit the population that evolves at a slower rate.”


Tatsuya Sasaki (sasakit@iiasa.ac.at)
Karl Sigmund (ksigmund@iiasa.ac.at)
A model tool for science to policy

This year, the European Union plans to complete a two-year review of air quality policy, assessing the impact of current policies and determining the region’s future goals and policies. IIASA research is an essential element in this process, providing the underlying data on emissions, emission control strategies, costs, and impact assessments.

Unlike many policy processes, the EU’s air pollution control measures are regarded worldwide as a shining example of effective science-policy cooperation—a process that provides science-based policies that lead to effective and affordable outcomes. What makes this process so successful?

IIASA researcher Fabian Wagner works with IIASA’s GAINS model, which is the underlying scientific tool used to assess the candidate strategies of emission reduction for their costs and effectiveness. He says, “We are not just providing a report for someone to read and put on a shelf. We work closely with the European Commission and the member states together in an iterative process, and we provide whatever information on options that is deemed relevant to the structured decision making process.”

Key to that information, says Wagner, is that scientific information is incorporated at “the right time,” which means during the whole preparatory period leading up to negotiations. The EU process brings scientific information in throughout the policy cycle in an iterative process that goes back and forth between scientists, stakeholders, and policymakers.

What makes this unique process possible, says Wagner, is the transparent nature of the GAINS platform, which allows stakeholders to track model inputs, methodologies and outputs, but also to retain ownership of data. These stakeholders, and policymakers, NGOs, scientists, and students. Every month since the launch over 400 users have used the FAO and IIASA GAEZ Data Portals to download approximately 3GB of data. For example, a consortium led by the Australian International Food Security Centre in Canberra has used GAEZ data to update and characterize farming systems in sub-Saharan Africa, to define priorities for science and policy. Another recent assessment used GAEZ data to assess land use options and associated water use requirements on the island of Mauritius.

Further information

The Global Agro-ecological Zones portal: www.iiasa.ac.at/GAEZ

Günther Fischer (fisher@iiasa.ac.at)
GEA authors take energy findings to the world

The Global Energy Assessment (GEA) has gone on tour. The 12-pound book, containing 5 years of research from 300 authors around the world, shows that a global energy transformation that could provide multiple benefits for society and the environment is both necessary and attainable. Over the past six months, GEA authors have taken their findings to policymakers and energy experts in Europe, the US, Asia, and Africa.

“The Global Energy Assessment is about the grand transformation toward a sustainable future,” said IIASA Deputy Director and GEA Director Nebojsa Nakicenovic in November at Chatham House in London. Nakicenovic joined other GEA co-authors and UK energy experts there to discuss GEA findings and how they apply to UK energy challenges.

In April, GEA authors, including GEA co-chair and University of Maryland professor Anand Patwardhan, presented the report at the Clean Energy Ministerial (CEM) in Delhi, India at a side event co-organized by IIASA and its Indian National Member Organization (NMO), the Technology Information, Forecasting and Assessment Council (TIFAC). The presentations focused on energy access and the adoption of sustainable energy technologies. Afterwards, panels of policymakers from India and elsewhere discussed how best to put GEA to use in advancing sustainable energy policies.

GEA events have so far taken place in Germany, Sweden, Norway, Japan, China, Russia, India, the Nethelands, the UK, and the USA. At these regional events, presentations focused on GEA analyses relevant to local and national priorities such as energy efficiency, climate change mitigation, and environment, as well as energy access and sustainable development.

Further information www.globalenergyassessment.org

Nebojsa Nakicenovic (naki@iiasa.ac.at)
Margaret Goud Collins (collins@iiasa.ac.at)

The post-2015 development agenda

The UN Millennium Development Goals, established in 2000, set goals for poverty, education, and health issues to be reached by 2015. What happens after that? IIASA is helping to set the new agenda, providing direct input at high-level meetings taking place around the world. In March, IIASA’s Nebojsa Nakicenovic, Michael Obersteiner, and Samir KC participated in a consultative meeting in Bali, co-organized by the Indonesian National Committee for Applied Systems Analysis. IIASA’s Narasimha Rao presented findings on global energy access, human development, and climate change at an April meeting organized by the Norwegian government.

Further information www.iiasa.ac.at/Post-2015

Nebojsa Nakicenovic (naki@iiasa.ac.at)
Michael Obersteiner (oberstei@iiasa.ac.at)
By Bjorn Stigson

There is both a need for and an interest in cooperation between science and the global business community. There are many options that we can consider on how IIASA can interact more with the private sector, creating a special business advisory panel or via cooperation agreements with companies or the World Business Council.

In October 2012, I participated in IIASA’s 40th Anniversary Conference. We discussed the need for new partnerships between the science community, academia, business, and governments. If science and business communities stand together, then policymakers will be forced to listen. The science community has developed a lot of knowledge, and can put this knowledge to better use in global policymaking. Part of this will be in cooperation with the business community.

The business community is way ahead of governments in terms of understanding challenges such as climate change and the environment. We are also way ahead of governments in taking action. But what we struggle with is understanding the nexus issues and systems analysis, which IIASA specializes in. How do we deal with the nexus between energy, food, water, land use, and similar issues? These are the areas where we need more engagement between business and the scientific community—and IIASA can provide that key focal point. But the cooperation between science, business, and governments has to overcome some challenges.

One major issue is the disconnect in the timeframes that different sectors focus on. Scientists work with a long time frame, and so do businesses—investing for up to 50 years into the future. However the financial community is very short-term oriented and often focuses on the next quarter or year at most. The political system works with the syndrome “my term in office,” which normally is three to four years. This is a major disconnect when looking at long-term investments for sustainability.

Another challenge is that the scientific community often does not see business knowledge as real knowledge because it is not published and reviewed in the same way. If we can improve communication between science and business, we can join hands and go to the politicians together to say this is what is really needed and we will have a much bigger impact than we have today.

Global business has come to engage in policy issues because we depend on them. If scientists really want to influence policy then they cannot sit on the sidelines, but should be suggesting possible solutions. Both science and business must do a better job of explaining to the politicians what the solutions are—not only the problems. I am looking forward to working closely with IIASA to see how we can address many of these issues as a partnership between science and the private sector.
Angling for sustainability

New research analyzes harvest control rules

The Arctic waters north of Scandinavia and Russia are home to one of the largest commercial fisheries in the world. In 2004, Russia and Norway agreed on a new system, known as a harvest control rule (HCR), to keep the Northeast Arctic cod stocks in those waters healthy and sustainable. But how well do HCRs work?

In this interview with Options, IIASA’s Ulf Dieckmann describes the latest research on the topic.

Q How do harvest control rules differ from traditional fisheries management?
A In the old system, fishery managers and politicians met every year to negotiate how many fish they were allowed to catch in the next season. These annual negotiations fostered a myopic perspective on the considered stock, making it more susceptible to overexploitation through the so-called “tragedy of the commons”—a standard problem in the management of natural resources resulting when actions benefiting a subset of stakeholders jeopardize the common good.

HCRs take as input current estimates of a stock’s size and status, and yield as output the next season’s allowed catch. Unlike the old system, HCRs remain in operation until further notice: once such a rule has been negotiated, its subsequent annual output is respected by the negotiators. This lets politicians agree on more foresighted and more prudent harvesting strategies.

Q Your group has recently developed a new method for producing HCRs. What is different about your method?
A While the design of most HCRs uses quantitative data, the design process itself typically is not fully quantitative: this allows opinions and guesswork to enter the design in an uncontrolled manner, undermining its transparency and accountability. What we have done is to develop a procedure for the design of an HCR based on comprehensive quantitative evaluation and alternative socio-economic management objectives. Our approach is general and can be applied to all fisheries for which sufficient data are available.

We considered three alternative management objectives: maximizing the yield, maximizing the profit, and maximizing the total welfare. For each of these objectives, we derived the optimal HCR, which we compared with the one that is in operation. This is the first time that an analysis of this kind has been done.

Q In your study you analyzed the 2004 rule negotiated between Russia and Norway. What did you find?
A We found that the current rule is indistinguishable from the one that maximizes profit. This is surprising because the current rule has not been quantitatively derived, even though it is based on solid expert knowledge.

But even though this finding might sound encouraging, it’s not a foregone conclusion that politicians should, or would want to, arrive at profit-maximizing HCRs. This is because such HCRs maximally favor the fishing industry’s interests, whereas politicians are also charged with protecting interests of other stakeholders, such as processors, retailers, consumers, and conservationists.

Q In your analysis, how did the rules that maximized welfare or yield compare to the current one, which maximizes profit?
A We found that the rule most beneficial for the national economy is slightly more aggressive than the profit-maximizing one—it would harvest more fish, but only when the stock is healthy and large. Relative to this, the current rule reduces supply and thus drives up the price of cod, which serves the fishing industry, but not the consumers.

The yield-maximizing HCR was even more aggressive. It is so aggressive, in fact, that stock biomass would drop below what is considered by fisheries scientists a safe threshold. This is worrying because the concept of maximum sustainable yield is nowadays becoming internationally accepted as a political goal. Our results highlight that maximizing sustainable yield is too simplistic for optimizing harvest.


Ulf Dieckmann (dieckmann@iiasa.ac.at)
On 4–5 February 2012, a diverse group of high-level representatives from all stakeholder groups gathered at IIASA to discuss a new initiative which aims to produce a systematic worldwide analysis of water issues. The Water Futures and Solutions: World Water Scenarios initiative will forge a broad institutional partnership bringing together the scientific community, governments, decision makers, as well as civil society, non-governmental organizations, and the private sector. Started by a partnership of IIASA, UNESCO, the Ministry of Land, Transport and Maritime Affairs of the Republic of Korea, the World Water Council, and the International Water Association, the initiative will test a range of solutions against scenarios for socio-economic change, and bring together decision makers to discuss a common vision for the future of water on our planet.

Water is a resource at the epicenter of sustainable development and peace and is vital for life, human health, food and nutrition, energy, biodiversity, and ecosystems. It has social, cultural, economic and environmental values that are interconnected and mutually supportive, especially in the quest for building sustainable green societies.

“If the wars of this century were fought over oil, the wars of the next century will be fought over water—unless we change our approach to managing this precious and vital resource,” said Ismail Serageldin, then Vice President of the World Bank, in 1995.

Since then water has climbed the global agenda, with the creation of global bodies such as the World Water Council and Global Water Partnership, the World Commission on Water, and the Water Vision Scenarios.

But water experts say much more needs to be done.

As IIASA Director and Chief Executive Officer Professor Dr. Pavel Kabat told Nature this winter: “Actually, water is much more valuable than oil. There are alternatives to oil, but there are no alternatives to water.”

“Currently approximately 3 billion people live without water at home or in their vicinity; 4 billion lack continuous access to water, 4.5 billion have no sewage system, and 5.5 billion have no water treatment,” says Glen Daigger, president of the International Water Association. With world population expected to reach 9 billion
Assessing the future of water in 2050, demand for water will dramatically increase. Population growth is just one of many factors that will influence water needs; climate change and erratic weather events, including floods, droughts, and storms all add to the vulnerability and uncertainty of global water resources.

Current projections say that by 2025 an estimated 60 percent of world population will live in water stressed conditions and a similar proportion will be without adequate sanitation. Water scarcity is closely associated with poverty, food and security and malnutrition.

“One of the big things that is needed in water research is a greater integration of the social sciences with the physical sciences and hydrological sciences, in particular I think we need to have a much better handle on the economic costs and benefits of different courses of action,” says Anthony Cox, head of Economy and Environment Integration Division of the Organization for Economic Cooperation and Development (OECD).

Fritz Holzwarth, federal minister for the environment, nature conservation and nuclear safety of Germany, says, “I think that the Water Scenarios and Water Futures initiative could become a real basis for the next 10–15 years in water because the scenario approach would overcome the very traditional and classical approach which follows a business as usual line. Water scenarios are able to set new options, new possibilities, new foundations also for political decisions, and they can also review the business as usual approach. However, it is very important to make clear that the business as usual approach is not valid any longer.”

Managing water resources both at the national and international levels has grown more complex because of the unique physical, geographic, and political characteristics of water. Water affects the entire spectrum of socio-economic development.

“There is an urgent need to develop appropriate water management frameworks, infrastructure, and knowledge sharing that works for sound and sustainable corporation between people whose lives depend upon shared water resources,” says UNESCO’s Hans D’Orville. “The provision and sharing of data and information as well as the support for water resource assessment frameworks at global, regional, national and basin scales are essential elements for sound water resources management.”

In addition to the consensus among participants during the launch meeting that the project was important there was also strong interest in participation and agreement on steps moving forward. The initial governing board met prior to the kick-off meeting of the 7th World Water Forum in May, and the board will be established by the Budapest World Water Summit in October. The initiative will include two stakeholder groups to ensure the usefulness and feasibility of the process and outcomes; The Scenario Focus Group and the Sector Actors group, who will hold their first meetings in June.

Further information Water Futures and Solutions: World Water Scenarios, a new initiative coordinated by IIASA, aims to provide a scientific basis for responding to worldwide water challenges • www.iiasa.ac.at/wws

Bill Cosgrove (cosgrove@iiasa.ac.at) • David Wiberg (wiberg@iiasa.ac.at)
IIASA research examines what needs to be done to limit climate change.

Crops in Africa will wither during long hot spells and droughts, leading to food shortages. In delicate alpine meadows, animals and plants already stressed by changes in their environment will succumb to extinction. Off the coast of Australia, vulnerable coral reefs will bleach and die off. Coastlines around the world become inundated as sea level rises. This is a vision of a future in which climate change continues unabated—and just a few of the impacts that climate researchers expect to see as global temperatures rise because of human emissions.
To limit those impacts and avoid the most dangerous outcomes, more than 190 countries agreed in 2010 to take steps to limit global temperature rise to 2°C above pre-industrial levels. But since that global agreement, set in UN-sponsored climate discussions, many people have questioned the feasibility of that goal. Already the planet has warmed by 0.8°C (1.4°F) over pre-industrial times. Is it still possible to reach the 2°C target? If so, how much will it cost? How soon must action occur? And what policies and measures will be most effective?

“For any given greenhouse gas emissions trajectory, there is uncertainty in the climate system about what that means for temperature increase in the future,” says IIASA energy researcher David McCollum. “But there are also many uncertainties that feed into those emission pathways, including a variety of technological, social, and political factors.”
Researchers in IIASA’s Energy program have been looking into those uncertainties, as well as the potential costs and side benefits of addressing climate change. In a series of three new studies recently published in the journals *Nature* and *Nature Climate Change*, McCollum, IIASA Energy Program Leader Keywan Riahi, and ETH Zurich researcher Joeri Rogelj, a participant in IIASA’s 2011 YSSP, provide new insight into the big questions about climate change—including how climate mitigation interlinks with other global issues such as energy access and poverty, technology, and the environment.

**Windows of opportunity for climate action**

The first in the series of studies, published in December in the journal *Nature Climate Change*, showed where emissions would need to be in the year 2020 in order to have a good chance of limiting global temperature rise to 2°C in the long term. The study quantified those thresholds as an emissions window, which was calculated to be between 41 and 47 gigatons of carbon dioxide equivalent (CO₂e) per year by 2020. Currently, global CO₂e emissions are about 50Gt per year, and projections suggest that they will reach 55Gt per year by 2020. The study showed that while it would still be possible to reach climate targets if emissions are not within the target window in 2020, it would become much more difficult and expensive.

**INSIDE THE BLACK BOX**

Much of the work described in this article relied on IIASA’s well-known MESSAGE model, a tool that includes insights from economics, biology, social science, geophysics, and engineering. Work using the MESSAGE model feeds into policy-relevant scientific reports such as the Intergovernmental Panel on Climate Change (IPCC) and the recent Global Energy Assessment. MESSAGE is a type of model known as a scenario analysis or integrated assessment model (IAM). Unlike other models, which produce projections or predictions about what might happen under certain circumstances, IAMs produce a range of pathways or scenarios that give specific details about how a given objective might be achieved, how much it will cost, and what technologies might be needed. For example, a climate model can predict how much global temperatures will rise, given different levels of greenhouse gas emissions. In contrast, the MESSAGE model might tell you how likely a certain investment or mix of technologies and policies would be to limit temperature rise to a specific level.

Rogelj explains, “IAM scenarios are not predictions, and they are not forecasts. They are more like stories about the future, based on facts that we know about how things have been in the past, how they are now, and how researchers imagine them for the future.” These scenarios, the researchers say, can lend insight into the paths and circumstances that might lead us to specific objectives.
“What we do over the next eight years really determines the feasibility and choices that we have in the long term,” says Riahi. “Some of these options for policies and technological change are still choices, such as phasing out nuclear power. We lose these choices if we overshoot certain thresholds.”

All is political

In a second study published in January in the journal *Nature* the researchers found that the most important factor uncertainty in limiting climate change is political—that is, the question of when countries will begin to take serious action to reduce greenhouse gas emissions and implement other policies that could help mitigate climate change.

Using a range of scenarios developed with IIASA’s MESSAGE integrated assessment modeling framework, the researchers examined the probability of keeping global temperature rise under 2°C, and ranked the uncertainties associated with efforts to mitigate climate change.

Riahi says, “While there are still a number of things we don’t fully understand about the global climate system, one thing we now know is that with a twenty-year delay in controlling greenhouse gas emissions, you can throw as much money as you have at the problem, and the best outcome you can get is a fifty–fifty chance of keeping temperature rise below two degrees.”

Social uncertainties, which influence consumer energy demand, were second-most important, the study found. Social uncertainties refer to things like people’s awareness and choices with respect to energy and to the adoption of efficient technologies. Next on the list were geophysical and technological uncertainties, including the uncertainties in the climate system as well as what technologies will become available in the future, and how quickly they will be developed and adopted.

Solutions for a warming planet

In order to reach climate targets, the researchers say, the world will ultimately need to reduce emissions of greenhouse gases to zero. And since 80 percent of emissions come from energy production and use, that means fundamental changes to how we use and produce energy for the world.

In a third recent paper published in February in *Nature Climate Change*, Rogelj, McCollum, and Riahi examined the potential climate impacts of the United Nations Sustainable Energy for All (SE4All) Initiative, which was launched in 2012 to address three objectives related to energy: providing universal access to modern energy, doubling the share of renewable energy globally, and doubling the rate of improvement in energy efficiency—all by 2030.

By analyzing over 500 scenarios in which some or all of the SE4All goals were met, the researchers found that the effort could be a good start towards slowing down climate change. “Doing energy right will promote the Millennium Development Goals, such as poverty eradication, and at the same time kick-start the transition to a lower-carbon economy,” says McCollum.

The researchers examined the probabilities of meeting the 2°C target, showing that both the efficiency and renewable goals contributed substantially towards reducing emissions. They also found that bringing energy access to many more people around the world—which one might initially expect to lead to increased greenhouse gas emissions—was also consistent with reducing emissions because energy efficiency would also likely improve with better access to modern energy technologies and fuels. Rogelj says, “Sustainable development and poverty eradication can go hand in hand with mitigating climate risks.”

These three recent studies are part of a larger body of ongoing IIASA research, which explores the interplay between objectives such as climate protection, poverty reduction, environment, and public health. Exploring the tradeoffs, costs, and co-benefits of addressing these problems can provide clear insight for policymakers and world leaders who are trying to make good decisions. Rogelj says, “Although we will never know everything, we already know enough to make robust decisions for the future to limit potential risks and impacts of our activities.”

Further Information

Rogelj J, McCollum DL, Riahi K (2013). The UN’s ‘Sustainable Energy for All’ initiative is compatible with a warming limit of 2°C. *Nature Climate Change* [doi:10.1038/nclimate1806].


Keywan Riahi (riahi@iiasa.ac.at)
David McCollum (mccollum@iiasa.ac.at)
Joeri Rogelj (joeri.rogelj@ethz.ch)
EC4MACS
REDUCING
AIR POLLUTION,
MINIMIZING
CLIMATE CHANGE
While connections between air pollution, climate change, and human and environmental health are intuitive, what has been missing is a systematic way of linking together all aspects of the environment and society to anticipate the impact that policies in one area may have on another region or sector.

A host of complex and well-documented facts make decisions in the field of climate and air quality extremely difficult for policymakers. Unless these interactions are put into the right context, they could not only prevent a cost-effective solution being found to both problems, but might also lead to trade-offs that unnecessarily waste Europe’s important economic resources.

Earth’s atmosphere is a complex and continually changing composition of gas, moisture, and particles. A growing proportion of these—greenhouse gases (GHGs), polluted/acidic cloud water, and solids like soot and dust—are anthropogenically produced and have adverse effects on the climate, on human and environmental health, as well as on food production and water availability. While greenhouse gases and air pollution were once distinct research areas, the boundaries between them are blurring, as more is discovered about their interconnected sources and effects, as well as the co-benefits and trade-offs of tackling them simultaneously.

In 2006 the European Consortium for Modelling of Air Pollution and Climate Strategies (EC4MACS) was established to develop tools to help European policymakers managing climate change and air pollution to tackle those challenges in a coordinated way. Funded by the EU LIFE Program, it brought together leading research institutions from across Europe. EC4MACS developed the first-ever fully integrated modeling tool to assess and define the actions that EU governments could take to reduce air pollution and greenhouse gas emissions in a synergistic way.

IIASA is leading the Consortium which will run through 2013. Each member of the project contributes sophisticated and well-established economic and environmental modeling tools for different project sectors. The IIASA GAINS model integrates the information across all sectors, models, and regions, assessing the effectiveness and costs of more than 1,000 alternative emission control measures used across all 43 European countries in the study. The results from the GAINS model feed directly into the GEM-E3 general equilibrium model, which estimates the macro-economic impacts of mitigation strategies, and into the BENEFIT model, which assesses the impacts of pollution on human health.

In fact, it was the EC4MACS modeling collaboration that first pointed up the significant interactions and potentially large economic synergies between air pollution control and greenhouse gas mitigation. This meant, essentially, that policies and management strategies could be chosen that tackle air pollution and reduce greenhouse gases, while at the same time contributing to other policy objectives, for example, economic growth, competitiveness, resource efficiency, and import dependency.

The findings of EC4MACS are not too optimistic. There have been improvements in pollution levels in Europe, but serious threats remain to human and environmental health. The current stringent policies in place should bring about a decline in emissions, but they are not sufficient to achieve a sustainable environment in Europe.

The bright note is that cost-effective options had been found to improve air quality and reduce greenhouse gas emissions, and that the benefits of implementing these would outweigh their cost.

The project research was completed in 2012, and now provides the analytical framework for the review of the entire EU air policy in 2013, and the development of the European Commission’s forthcoming climate policy proposals.

As with many IIASA products, the modeling toolkit is adaptable to national and regional conditions so that the EC4MACS work can be applied to other regions of the world. This should help other countries to distill specific policy interventions to address their immediate policy priorities, while the toolkit contributes to meaningful and effective international pathways toward challenges of a global nature.

Further information European Consortium for Modelling Air Pollution and Climate Strategies: www.ec4macs.eu

Markus Amann (amann@iiasa.ac.at)
From June through August 2012, 49 young scientists from 24 countries took part in the 35th annual Young Scientists Summer Program (YSSP). The YSSP is IIASA’s three-month summer program for advanced PhD students in the natural and social sciences, offering them the opportunity to conduct independent research under the direct supervision of an experienced IIASA scientist.
Forty-nine young scientists spent the summer of 2012 in “Schloss Laxenburg,” the Austrian palace near Vienna that is home to IIASA. YSSPers, as the participants in the YSSP program are known, work alongside IIASA researchers on projects related to both their doctoral research and IIASA’s research areas. A high level of supervision—one research supervisor for almost every YSSPer—helps equip participants with new insight into conducting research.

During their stay, YSSPers enjoy a range of cultural and recreational activities in addition to their academic work. This combination of scientific and social elements helps YSSPers forge strong bonds with each other and their IIASA supervisors.

Individual mentoring is complemented by a scientific program that includes lectures, seminars, and workshops to broaden participants’ research perspectives and skills in areas such as research methods, GIS models, and policy-relevant research.

An awards ceremony marks the end of the summer’s YSSP program and welcomes the participants into IIASA’s worldwide network of over 1500 former YSSPers from 80 countries. The ceremony is also an opportunity to celebrate the research progress of the YSSPers.

YSSA’s YSSP Program  www.iiasa.ac.at/yssp  • Tanja Huber (huber@iiasa.ac.at)
Better soil degradation assessments required

Overgrazing, deforestation, and inappropriate agriculture can leech the nutrients out of soil and make it unusable for growing crops or forests. This problem, known as soil degradation, is a serious threat to food production and future food security, threatening the livelihood of millions of households worldwide, and the problem is growing. To tackle the issue, IIASA researchers say that better approaches to assessing both the extent and impact of soil degradation are now needed.

“Several methods have been used over the past decades to assess soil degradation and the associated impact on ecosystem productivity, yet the lack of consistency between methods has led to uncertainty,” IIASA’s Marijn van der Velde says. While the uncertainty in assessments is large, they show that the problem is serious—about one quarter of global land area is currently considered to be degraded.

Recent research in China and Sub-Saharan Africa showed not only the impact of degradation on crop production but also the need to tailor solutions specifically to local agro-ecological conditions and farming systems. Ideally, lessons learned from what works in specific locations can form a common knowledge base of successful location-specific interventions. A shared catalogue of interventions, says van der Velde, is essential for successfully preventing or mitigating degradation.

As computer power increases and more satellite data become available, researchers are working to develop a more comprehensive and consistent approach to assessing soil degradation. The researchers say that reducing land degradation and sustaining agricultural productivity is vital to alleviating poverty.

Further information


Marijn van der Velde (velde@iiasa.ac.at)
Sulfur dioxide on the decline

Human emissions of major air pollutant sulfur dioxide have declined globally since 2006, according to a new IIASA study. But while emissions from North America and Europe have declined, emissions from Asia and from international shipping have increased.

Sulfur dioxide contributes to particulate pollution (associated with negative impacts on human health) and to acid rain—which leads to ecosystem damage. Emissions of this common air pollutant have generally declined since the mid 1970s. The new study showed that a worrying upturn in emissions from 2000 to 2005 proved short-lived. By 2006 the upward trend halted following the implementation of sulfur emission controls in China and further large reductions in more affluent regions, particularly the United States and Europe (see figure).

Emissions from international shipping continue to increase, but are expected to start declining soon following an international agreement to reduce the sulfur content of fuel oil. Declining emissions from both China, still the world’s largest source of sulfur dioxide, the planned decreased in shipping emissions, and continued decreases from industrialized countries are likely to lead to a further net decrease in global sulfur dioxide emissions in the future.

“This will have both regional and global consequences, decreasing the net negative radiative forcing from sulfur dioxide emissions that has been masking some of the impact of increasing greenhouse gases,” says IIASA’s Zbigniew Klimont. “A continued decline in global sulfur dioxide emissions is likely to result in an increase in the rate of future climate change.”


Sulfur dioxide on the decline

Energy supplies vulnerable to climate change

In recent years higher water temperatures and reduced river flows in Europe and the United States have resulted in reduced production or temporary shutdown of several thermoelectric power plants. Thermoelectric (nuclear or fossil-fuelled) power plants supply 91% and 78% of total electricity in the US and Europe respectively. “Disruption to the operation of thermoelectric power plants is a significant concern for the energy sector,” says IIASA’s Michelle van Vliet.

Compared to other water use sectors (e.g. industry, agriculture, domestic use), the thermoelectric power sector is one of the largest water users in the US (at 40%) and in Europe (43% of total surface water withdrawals). Reduced water availability and higher water temperatures—caused by increasing ambient air temperatures associated with climate change—are therefore significant issues for electricity supply.

The researchers forecast that lack of cooling water is likely to reduce thermoelectric power generating capacity by between 6–19% in Europe and 4–16% in the US for the period 2031–2060. In addition to power supply disruption and higher electricity prices, researchers note that increasing water temperatures could have a serious environmental impact on river ecosystems.

One adaptation strategy is to reduce reliance on freshwater sources and replace with saltwater, van Vliet says. “However given the life expectancy of power plants and the inability to relocate them to an alternative water source, this is not an immediate solution but should be factored into infrastructure planning. Another option is to replace cooling systems or to switch to new gas-fired power plants that are both more efficient than nuclear or coal-fuelled power plants and use less water.”

Further information van Vliet MTH et al. (2012). Vulnerability of US and European electricity supply to climate change. Nature Climate Change 2(9):676–681 [doi:10.1038/nclimate1546]. Michelle van Vliet (vanvlie@iiasa.ac.at)
Kerosene subsidies benefit urban, but not rural, poor

Critics of energy subsidies in developing countries argue they cost too much, encourage wasteful consumption, and increase greenhouse gas emissions without providing intended benefits to the poor. Recent research by IIASA’s Narasimha Rao suggests that calls to phase out kerosene subsidies may be premature.

Rao’s study explored how the kerosene subsidy performs in the Indian state of Maharashtra. In the western Indian state, 70 percent of households (68 million people) use kerosene. Of these, about 50 million users (91 percent of the rural population) live in rural areas and 18 million (49 percent of the urban population) in towns. The study showed that only 26 percent of the kerosene subsidy value in Maharashtra directly reaches households, the rest is diverted to distributors and retailers on the supply chain.

In rural areas, the research suggests that kerosene subsidies are of minimal financial value to poor households. However, in urban areas where kerosene is largely used for cooking rather than lighting, the subsidies may provide benefits of up to 5–10 percent of household expenditure among poorer households that lack affordable access to liquid petroleum gas (LPG) and biomass.

“By focusing on eliminating rural kerosene use for lighting, current policy analysis neglects important distributional benefits of the subsidy in urban areas,” Rao points out. “In the short term, the efficacy of the subsidy can be improved by redesigning households’ quota of subsidized kerosene to better reflect households’ needs—cooking in urban areas and lighting in rural areas. In short, analysis suggests that subsidies targeted only to kerosene-dependent urban areas would have a higher efficacy than broad-based subsidies.”


Narasimha D. Rao (raonar@iiasa.ac.at)

New wetland map for China

During the last century about half of the global wetlands area has been lost. Providing accurate wetland maps is essential in order to protect and manage these vulnerable ecosystems, which play important ecological, economic and cultural roles in societies around the world, says IIASA’s Junguo Liu.

Wetlands provide such diverse ecosystem services as water supply, pollution control, nutrient recycling, groundwater recharge, soil formation, climate and flood regulation, and coastal protection. They also provide recreation and tourism opportunities. Current estimates place the total value of global wetland ecosystems to be around US$15.5 trillion a year.

To provide better information about this valuable resource, Liu and colleagues set out to create a more accurate hybrid wetland map for China by combining five existing wetlands datasets, including four spatially explicit wetland distribution data and one wetland census. The resulting map, say researchers, despite some limitations is reliable and by far the first wetland mapping that is consistent with the statistical data at national and provincial levels in China.

“This provides a benchmark map for research on wetland protection and management,” Liu says. Moreover, the method can be applied not only to wetland mapping but also to other thematic mapping in China and beyond.


Junguo Liu (liujung@iiasa.ac.at)
Landslide risks may benefit from decentralized approach

Landslides represent a major threat to human life, property, and the environment. By undertaking landslide hazard and risk assessments to, for example, identify high-risk areas, authorities aim to improve the management of landslide hazard risk. But could a decentralized risk assessment system work better than a centralized one?

IIASA researchers examined the impacts and response to two landslides: the first, in May 1998 when 160 people died in five small towns in the Campania region of southern Italy; the second in August 1998 when more than 200 people died in the village of Malpa, India.

Analysis indicates that Italy’s risk assessment regime was more decentralized compared to India—which the findings suggest led to better outcomes.

Results indicate a causal relationship between decentralization and three outcomes, says Upasna Sharma. First, decentralization appears to be more conducive to the more rapid and more complete assessment of risks in specific places. Second, decentralization appears to foster greater and more transparent communication of risk assessment products, such as maps. Third, decentralization appears more suitable for open public discussion of contradictory evidence, and for engaging local stakeholders in the risk assessment process.

At this early stage, researchers stress there is no proof that decentralization leads to improved outcomes such as reduced losses in infrastructure or lives or more cost effective solutions. Rather, Sharma points out, it suggests a direction for institutional change to bring about more effective risk assessments.

Further information


Upasna Sharma (shar mau@iiasa.ac.at) • Anna Scolobig (scolobig@iiasa.ac.at)

Improving air quality assessment

Ensuring that air quality models can provide robust projections of future changes in air quality is vital for anticipating future air quality. But, says IIASA’s Markus Amann, “It’s not yet clear that the robustness of predictions of air quality models has increased in line with their growing complexity.”

To address this issue, a team of researchers engaged in a multi-model exercise aimed at assessing the uncertainties and robustness of current projected changes in air quality in Europe. “Our analysis is based on an ensemble of air quality models covering both regional and global spatial scales,” Amann explains.

Researchers investigated two emission scenarios developed in the framework of the Global Energy Assessment with a focus on 2030. The scenarios include identical measures for air quality legislation but differ in terms of climate policy. One of the scenarios is baseline, while the other aims at limiting global warming to 2°C by the end of the century. “Our focus is on 2030 because of its relevance for short-term policy making,” Amann says.

The new multi-model assessment projects that exposure to ozone levels that are detrimental for health will be reduced down to 45–70 percent (for respective scenarios) of their current levels by 2030. Air pollution mitigation measures (present in both scenarios) are the main factors leading to the improvement, but an additional co-benefit of at least 40 percent is brought about by the climate policy. This study opens the way for more comprehensive assessments of future air quality, researchers conclude.

Further information


Markus Amann (amann@iiasa.ac.at)
In March, a delegation from the Australian National Member Organization (NMO), the Commonwealth Scientific and Industrial Research Organization (CSIRO), visited IIASA in Laxenburg to discuss potential areas of collaboration, both scientifically and geographically. CSIRO is IIASA’s newest NMO, having joined IIASA in October 2012. While CSIRO is a truly Australian organization, it has a global research focus that ties in seamlessly with IIASA’s international research agenda, particularly in areas such as Southeast Asia.

During the visit to IIASA, the delegation met with scientists and institute leaders, discussing opportunities for collaboration primarily in the fields of energy, biodiversity, and environmental management, as well as integrated assessments at global, regional, and local levels.

The delegation was led by CSIRO Environment Group Executive and IIASA Council Member Andrew Johnson. He says, “How does humanity feed, fuel, power, and provide water for 9 billion people over the next hundred years without destroying the environment? In order to answer these questions we need to grow our relationships with organizations like IIASA.”

Alex Wonhas leads CSIRO’s national flagship program on energy—a major focus in the country, which has the potential in the next five years to become the world’s second largest exporter of liquid natural gas in the world. At IIASA Wonhas met with energy program researchers and presented CSIRO’s energy agenda and research focus. In particular, he noted that the IIASA-led Global Energy Assessment (GEA) could provide many insights for Australian energy researchers, policymakers, and industry and that CSIRO researchers could contribute local and regional research to help expand GEA’s findings.

Wonhas says, “This is a strong opportunity to take a global integrated assessment to a local level. Australia could serve as a model for other nations in having a nested approach for integrated assessments.”

Science Director of the CSIRO Water for a Healthy Country Flagship Ian Prosser highlighted water resources as another area of potential collaboration between IIASA and its newest NMO. Water is a particular area of concern in Australia. “Australia lives in the face of extreme hydrological variability, and climate change is already leading to a dryer climate,” says Prosser. “We’re living in a different world now, and we need to come up with different policy options.”

IIASA Director and Chief Executive Officer Professor Dr. Pavel Kabat invited CSIRO to join IIASA’s World Futures and Solutions initiative, a new global assessment aimed at providing a global, integrated assessment of water challenges and solutions.

Mark Lonsdale, Chief of CSIRO’s Ecosystem Sciences and Biodiversity Portfolio, raised a number of other areas of potential collaboration between the Australian NMO and IIASA, including biodiversity, land use change, sustainable agriculture, and biosecurity.

Australia has been dealing with an astonishing loss of biodiversity in recent years, says Lonsdale. But, he says, “As biologists, we need to do more than just say how bad the problem is. We need to try to fix the problem, work at a transformational scale with policymakers and the private sector.” Lonsdale met with researchers in IIASA’s Ecosystems Services and Management program to discuss potential areas of collaboration and synergies.

Further information The Commonwealth Scientific and Industrial Research Organization (CSIRO) became the National Member Organization of IIASA in January 2013. www.csiro.au
Managing fish for the future

A new study published in December in the journal *Fish and Fisheries* provides a suite of methods to quantify and predict evolutionary changes in fish populations related to fishing practices. These methods, collectively known as an Evolutionary Impact Assessment (EvoIA), will allow fisheries managers to include evolutionary changes and influences in their assessments and determine the best ways to manage fisheries.

“Fisheries managers have recognized for a long time that traditional methods of studying fisheries don’t give the whole picture,” says IIASA Evolution and Ecology Program leader Ulf Dieckmann, who co-led the study. Not only do species interact with each other and the environment, he says, but years of research at IIASA and elsewhere have shown that fishing itself shapes evolution in ways that affect a population’s health, productivity, and resilience.

Today, many fishery managers try to look at fish populations from a more holistic ecosystem-based perspective. But while this idea is accepted in theory, in practice managers still have few tools at their disposal, particularly when it comes to understanding the role of adaptation in populations. With EvoIA—a suite of tools developed by an international network of experts—fisheries researchers and managers can feed readily available data, such as fish number, size, sex, age, and maturity, into models that answer key questions: How does fishing affect the animals? How does it affect population dynamics of the stock? How does that affect the utility of the stock to society? Which fishing strategies can thus be recommended?

Further information


Cognitive fitness is key aging challenge

The world population is growing older. To date, most studies of aging have focused on measures of how old people are, such as the old-age dependency ratio, a metric that measured the number of elderly people compared to the number of working-age people in a society. An alternative approach that measures cognitive functioning at older ages would offer a valuable new perspective, say IIASA researchers.

Measures such as the old-age dependency ratio and median age have limited usefulness in terms of the consequences of, and possible responses to, population aging, because they don’t accurately describe people’s capabilities or activities. IIASA researchers have now developed an indicator of seniors’ cognitive abilities for countries from different world regions, based on recently released data that includes education levels. “In several countries with older populations, for example continental Europe, we find better cognitive performance on the part of populations aged 50+ than in countries with chronologically younger populations such as China,” IIASA’s Vegard Skirbekk explains.

This variation in cognitive functioning levels may be explained by the fact that seniors in some regions of the world experienced better conditions during childhood and adult life, including nutrition, duration and quality of schooling and lower exposure to disease.

Studying cognitive fitness is important, say researchers, because normal aging tends to involve a decline in certain cognitive abilities. The degree to which demographic aging translates into societal challenges depends to a considerable extent on the age at which mental functioning becomes significantly impaired. “Nations that are truly challenged by aging may be those where the cognitive performance among their seniors is poor; not those who have chronologically older age structures,” Skirbekk says.

Further information


Vegard Skirbekk (skirbekk@iiasa.ac.at)
A growing network of global collaborations

Over the last few months IIASA has continued to develop its relationships with current and potential new national member organizations (NMOs). IIASA Director and Chief Executive Officer Professor Dr. Pavel Kabat has been traveling extensively to these countries, strengthening and expanding the Institute’s global collaborations. Discussions on IIASA membership are ongoing with Italy, Mexico, the UK, and Vietnam. Below, find highlights of some recent country visits.

United Kingdom
In February, Kabat addressed leading UK scientists, engineers, and decision makers at the Royal Society in London, following a keynote speech at a conference in Chatham House on future competitiveness and resilience of economies. British systems scientists have called for a return of the UK to IIASA membership.

United States
On a recent visit to the USA, Kabat met with John Holdren, President Obama’s senior science and technology advisor and Subra Suresh, director of the National Science Foundation, to discuss U.S. interests and opportunities for cooperation in IIASA’s most recent research and policy initiatives, particularly the World Futures and Solutions Initiative (page 12).

China
Not only does China want to play a greater role at IIASA, but it is also interested in supporting a Young Scientists Summer Program (YSSP) for the Asian region, said Chinese research leaders during a recent visit by Kabat.

Mexico
Meetings in Mexico in April led to the relaunch of the Luis Donaldo Colosio Fellowship, a postdoctoral scholarship open to Mexican citizens, which remembers former IIASA colleague Luis Donaldo Colosio.

IIASA’s Young Scientists Summer Program (YSSP) starts in June, with 51 participants from 23 countries chosen from over 300 applicants. Since 1977, over 1600 participants from 84 countries have benefited from collaborating with IIASA scholars and enhanced their own perspectives and career opportunities.

In cooperation with its South African NMO, the National Research Foundation, IIASA has also just completed the first year of a South African version of the program (see page 22).

Best paper awards
IIASA researchers received two recent awards for their excellent research work. Mitigation of Air Pollution and Greenhouse Gases Program Leader Markus Amann co-authored a paper that was selected as the “Best Science Paper 2012” for the journal Environmental Science and Technology. IIASA Ecosystems Services and Management program researchers received second place in Remote Sensing’s Best Paper Award for 2013, for their study, “Geo-Wiki.Org: The Use of Crowdsourcing to Improve Global Landcover,” published in 2009.

IIASA launches new monthly newsletter
IIASA has just re-launched its electronic newsletter—The Analyst—as a monthly update of all the latest news and activities from the Institute. To make sure you receive the latest on IIASA please subscribe by visiting www.iiasa.ac.at/newsletter or scan the QR code below from any smartphone. Existing subscribers can also update their preferences.
EU ambassadors meet at IIASA

On 11 February the European Union heads of mission accredited to the United Nations and Ambassador Mara Marinaki, Global and Multilateral Issues Department, European External Action Service, visited IIASA to discuss European and international policies and to learn about IIASA’s policy-relevant research in climate, energy, food, water, and the environment.

The European Union Heads of Mission are the ambassadors of the EU countries and Croatia to the International Organizations in Vienna, which include IIASA. Their visit to IIASA served as the group’s annual retreat meeting, in which they discuss EU policy, multilateral cooperation, and challenges that require international cooperation.

During the visit, IIASA Director and Chief Executive Officer Professor Dr. Pavel Kabat provided an overview of IIASA’s research activities, highlighting the Institute’s new focus on cross-cutting research that stretches across disciplines to address interconnected global problems such as climate, energy, and water. IIASA Deputy Director Nebojsa Nakicenovic spoke about IIASA’s history of policy-relevant research in global problem areas, describing IIASA’s major contribution to research that has direct applications to policy. And Ulf Dieckmann, Evolution and Ecology program leader, spoke to the group about how systems analysis research and game theory can help inform policymakers who are working towards preserving common resources such as fisheries and forests.

Kabat receives accolade from Queen of the Netherlands

IIASA Director and Chief Executive Officer Professor Dr. Pavel Kabat has been awarded one of the highest distinctions of the Kingdom of the Netherlands for his longstanding contribution to science and the science policy interface, both in the Netherlands and internationally.

The honor was presented to Kabat by his Excellency Peter van Wulfften, Ambassador of the Kingdom of the Netherlands on behalf of her Majesty Queen Beatrix at a ceremony at IIASA on 29 April 2013, to celebrate Dutch Queens Day. Kabat was named Knight in the Order of the Netherlands Lion, a national order of chivalry founded in 1815 by King William I, which recognizes excellence in the arts, science, sport, and literature. The honor recognizes Kabat’s outstanding interdisciplinary research focusing on the nexus areas of water and climate.

Wolfgang Lutz elected to Leopoldina

Wolfgang Lutz, IIASA World Population program leader, was elected to the Leopoldina German National Academy of Sciences in March 2013. The Leopoldina, a German science organization founded in 1652, was appointed as the German National Academy of Sciences in 2008. The academy—the oldest in the world—serves as a forum to provide advice to policymakers within and outside of Germany. Members of the academy, which include international researchers, are proposed by academy members and elected in a multi-stage selection process. As a member of the Leopoldina, Lutz will take part in advisory boards and scientific events aimed at engaging policymakers and society in science that is relevant for society. In addition, Lutz was one of three candidates for president of the Austrian Academy of Sciences this spring.

EU science advisor looks to IIASA for expertise

On 15 January, Anne Glover, science adviser to the president of the European Commission visited IIASA in order to learn more about the Institute’s research and discuss how IIASA researchers can contribute their knowledge and research to EU policy decisions. As scientific adviser to European Commission President Barroso, Glover is charged with locating scientific information and experts to provide input into European policy. During the meeting, Glover met with IIASA researchers and leadership to learn about the Institute’s policy-relevant research in the areas of climate, energy, food and water, and air pollution.
YSSP’12 award winners

Each year, two participants in the previous summer’s Young Scientist Summer Program are invited to return to IIASA to continue their research. The winners of the Peccei and Mikhalevich Awards are chosen by a selection committee of IIASA scientists, based on the quality, originality, relevance and impact of the research they conducted during the previous summer.

Peccei Award
Stefan Schreier, a PhD student at the University of Bremen in Germany, was awarded the 2012 Peccei award for his research on nitrogen oxide emissions from wildfires in Russia. Forest fires release large amounts of gases such as nitrogen oxide, which impact air quality and climate. Schreier says, “Nitrogen oxides affect atmospheric chemistry, air quality, and climate, and they can react to form ozone, which is toxic to human beings.” But emissions from forest fires are difficult to calculate, particularly over large, remote areas like Russia. Schreier’s study, conducted with IIASA’s Ecosystems Services and Management program, combined satellite data on nitrogen dioxide concentrations in the atmosphere with data from land cover and vegetation maps, to create a new, more accurate estimate of fire emissions.

When Schreier returns to IIASA, he plans to continue his work on improving satellite estimates of nitrogen oxide from fires. Nitrogen oxides released by forest fires are hard to estimate from satellite data because of smoke and other aerosols that can literally cloud the results. With better data on the type and pattern of a forest fire, says Schreier, researchers can hone their satellite measurements to more accurately pick up the amount of nitrogen oxide in the atmosphere. During his return to IIASA, Schreier plans to submit his work for publication.

Mikhalevich Award
Pin Pin Oh, a chemical and environmental engineering PhD student at the University of Nottingham, Malaysia, and Karol Opara, a computer scientist at the Systems Research Institute of the Polish Academy of Sciences, jointly won the Mikhalevich Award for their research on modeling a membrane reactor for producing biodiesel fuel. Oh and Opara say that the study could contribute to more efficient biodiesel production in Malaysia, a major producer of palm oil.

Oh says, “Practically, this research would contribute to the economy of Malaysia and also to climate change mitigation.” During their summer at IIASA, Oh and Opara worked with IIASA’s Advanced Systems Analysis Program to develop new methods needed for building a mathematical model of the reactor, working with a set of experimental data that was scarce and inconsistent with chemical knowledge. The study shows how applying systems analysis approaches can be useful in addressing even practical chemical engineering problems.

The two researchers plan to work together in Oh’s laboratory in Malaysia prior to returning to IIASA to continue their theoretical research and submit several papers for publication.

Further information  YSSP Benefits/Awards: www.iiasa.ac.at/yssp/awards
Tanja Huber (huber@iiasa.ac.at)
The tricky side of biofuels

Q&A with IIASA Research Scholar Aline Mosnier

Biofuels are often touted as a major part of the solution to climate change—if we could grow our energy in fields instead of digging fossil fuels out of the ground, the story goes, we would cut down greenhouse gas emissions and increase fuel security at the same time. The United States government put these ideas into practice in 2007 with a new policy to encourage the production of biofuels. But new research from IIASA’s Aline Mosnier shows that this policy may in fact cause the opposite of the intended effect—a rise in greenhouse gas emissions. She spoke with Options about her research and her work at IIASA.

Q Your study won the Best Poster by an Early Career Scientist Award at the IIASA Conference in October. What did you find?
A Our work looked at the outcomes of a specific biofuel policy. The usual perception is that producing fuel from crops is completely green, because they use sun and water and soil, and so you have no emissions associated with their production. In fact that’s not completely right. What we showed is that the US biofuel policy doesn’t really lead to climate mitigation—in fact it would even increase greenhouse gas emissions.

This is because of what we call indirect land-use effects. All the continents are connected somehow by trade, and the US is the leading producer and exporter of agricultural commodities. So changing their allocation affects exports, and other countries have to adjust their own production to make up for these missing exports. That might lead to deforestation, for example, in Latin America.

Q What’s your next goal in your research?
A I’m now focusing on tropical deforestation in Brazil and the Congo Basin. I’ll be looking at the trade-offs between deforestation and economic development and environmental issues. The big question is, can we save the tropical forests in these areas, without compromising economic development in these countries where it’s really needed? I’ve been working since last year on a new project which deals with these issues (REDD-PAC).

Q How did you get interested in these questions?
A I think it is partly because I come from a rural area where agriculture is quite important. I grew up in a small village about 30 kilometers from Clermont-Ferrand, in the center of France, a cereal and sugar beet-producing region. During my Master’s work, I became very interested in questions about how you can implement policies in developed countries that avoid harm in poorer countries. I’ve always been interested in developing countries, especially Africa. I wanted to know how you could create win-win policies, for example, agricultural policies that improve both food security and environment.

Q What do you like about working at IIASA?
A What I like most is that you have to work with people from different countries and different cultures—in fact I wish there were even more countries represented here, especially developing countries.

I also like that we have to work with people from different disciplines. In our group, for example, we have economists, geographers, remote sensing experts, mathematicians. In the beginning you don’t understand each other at all, but at the end it’s great. You bring your different perspectives together and concentrate on solving a problem.

Aline Mosnier mosnier@iiasa.ac.at
In May 2013 IIASA had 20 National Member Organizations, whose governance and finance of the Institute ensure IIASA delivers research that is independent, international, and interdisciplinary.

**AUSTRALIA**
The Commonwealth Scientific and Industrial Research Organisation (CSIRO)

**AUSTRIA**
The Austrian Academy of Sciences

**BRAZIL**
Center for Strategic Studies and Management in Science, Technology and Innovation (CGEE)

**CHINA**
The National Natural Science Foundation of China

**EGYPT**
The Academy of Scientific Research and Technology (ASRT)

**FINLAND**
The Finnish Committee for IIASA

**GERMANY**
The Association for the Advancement of IIASA

**INDIA**
The Technology Information, Forecasting and Assessment Council (TIFAC)

**INDONESIA**
The Indonesian National Committee for IIASA

**JAPAN**
The Japan Committee for IIASA

**MALAYSIA**
Academy of Sciences Malaysia

**NETHERLANDS**
The Netherlands Organization for Scientific Research (NWO)

**NORWAY**
The Research Council of Norway

**PAKISTAN**
The Pakistan Academy of Sciences

**REPUBLIC OF KOREA**
National Research Foundation of Korea (NRF)

**RUSSIA**
The Russian Academy of Sciences

**SOUTH AFRICA**
The National Research Foundation

**SWEDEN**
The Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (FORMAS)

**UKRAINE**
The Ukrainian Academy of Sciences

**UNITED STATES OF AMERICA**
The National Academy of Sciences