Climate change – what next?

IIASA research shows how to address and adapt to a new climate reality

also in this issue

An elemental balancing act: What happens as we drastically change natural element cycles in the environment?

Know your planet: IIASA’s Geo-Wiki team shows how crowdsourcing and gaming could help global food security research

A blueprint for clean air: IIASA research underlies new European policies for reducing air pollution
What next?

The quote, “Prediction is very difficult, especially if it is about the future”—often attributed to Nobel Prize Winning physicist Niels Bohr—is especially applicable to the uncertainty about the future that we face today as part of the global transitions.

Since the Institute’s beginnings, IIASA researchers have not shied away from this complex task. They aim not to magically predict the future, but to build models that can help us understand the possible and plausible trajectories that our world might take. Only with such research—with a view into possible futures and how they might be reached—can governments and policymakers make sound decisions for the future of their nations and for the planet.

The progress of such research is clear when you look at IIASA’s contributions to the Intergovernmental Panel on Climate Change Fifth Assessment Report (AR5). Nineteen IIASA researchers contributed as authors or reviewers, and countless IIASA publications were cited in AR5, particularly in the areas of climate mitigation, impacts, and adaptation (page 14). Of particular note is IIASA’s fundamental contribution to the development of the Representative Concentration Pathways (RCPs), which provided the climate forcing trajectories for AR5, and the Shared Socioeconomic Pathways (SSPs) which will serve as a set of consistent scenarios for the next era of climate research.

Of course, IIASA research goes far beyond the realms of climate change. IIASA scientists are central advisors to the many debates on global change—from environment, energy, and population, to human development and disaster risk. Also in this issue you will read about new research on the growing imbalance in food and water; and the Shared Socioeconomic Pathways (SSPs) which will serve as a set of consistent scenarios for the next era of climate research.

The views and opinions expressed herein do not necessarily represent the positions of IIASA or its supporting organizations.

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EU flood risk could double by 2050

Current flood losses in Europe are likely to double by 2050, according to IIASA research published in the journal Nature Climate Change. Socioeconomic growth accounts for about two-thirds of the increased risk, as development leads to more buildings and infrastructure that could be damaged in a flood. The other third of the increase comes from climate change, which is projected to change rainfall patterns in Europe.

The study, which was conducted in collaboration with other research centers including the Institute for Environmental Studies in Amsterdam, estimated that floods in the European Union averaged €4.9 billion a year from 2000 to 2012. These average losses could increase to €23.5 billion by 2050. In addition, large events such as the 2013 European floods are likely to increase in frequency from an average of once every 16 years to a probability of once every 10 years by 2050.

The analysis combined models of climate change and socioeconomic development to build a better estimate of flood risk for the region. IIASA researcher Stefan Hochrainer-Stigler led the modeling work on the study.

He says, “The new study for the first time accounts for the correlation between floods in different countries. Current risk-assessment models assume that each river basin is independent. But in actuality, river flows across Europe are closely correlated, rising and falling in response to large-scale atmospheric patterns that bring rains and dry spells to large regions.”

“But if rivers are flooding in Central Europe, they are likely to also be flooding Eastern European regions,” says Hochrainer-Stigler. “We need to be prepared for larger stress on risk financing mechanisms, such as the pan-European Solidarity Fund (EUSF), a financial tool for financing disaster recovery in the European Union.”

In February, Hochrainer-Stigler presented the research in a public hearing on the EUSF.

Read more on the group’s research in a recent commentary in Nature Climate Change.

Further information


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To insure against financial crisis, tax banks

During the 2007–2008 international financial crisis, a string of bank failures rippled around the world, threatening the total collapse of many large financial institutions. The crisis illustrated the sometimes dangerous interconnection of the global banking system: when one institution fails, the entire system is at risk of collapse.

A new study from IIASA researcher Stefan Thurner provides a possible solution for this systemic risk. The study, published in the open access academic journal arXiv, examines the idea of systemic risk, the risk that a large system could stop functioning and collapse, using a financial model and data from the Austrian banking system.

The researchers find that by taxing banks on their risky transactions, countries could insure against such a crisis. The proposed tax would charge financial institutions greater taxes for transactions that carry greater risks, thereby also discouraging risky behavior. At the same time, the funds raised could be used to bolster financial institutions in times of crisis, so that the banks in effect bail themselves out when needed, rather than the general taxpaying public.


Stefan Thurner thurner@iiasa.ac.at
EU could lead on climate action
A new study from IIASA and the Potsdam Institute for Climate Impacts Research (PIK) shows that early action by the European Union on climate change could reduce future warming by more than 1 degree, even if other countries join later. The study investigated EU frontrunner action in line with its roadmap for moving to a low carbon economy, including an emissions reduction of 40% in 2030 compared to 1990.

Crowdsourcing game brings a flood of data
IIASA’s Cropland Capture game ended its six-month trial period on 9 May, with over 4.5 million square kilometers of land cover validated. The crowdsourcing game for mobile phone, tablet, and desktop computer involved players around the world in research to identify global land cover images as cropland or not. The data will be used to improve global cropland maps, which are currently lacking in accuracy. Read more about citizen science initiatives from IIASA’s Geo-Wiki team on page 12.

Brazilian agriculture policy could aid climate
Brazil may be able to curb up to 26% of global greenhouse gas emissions from deforestation by encouraging the intensification of its cattle production, according to a new study led by a former IIASA Young Scientists Summer Program participant. The study in PNAS showed that by subsidizing semi-intensive pasture-based cattle production or taxing conventional pastures Brazil may be able to deliver a substantial cut in global greenhouse gas emissions, even in the absence of a global agreement to prevent deforestation.

ERC grants
The European Research Council (ERC) has awarded IIASA researchers with two major new grants. The first, to Ecosystems Services and Management Program Director Michael Obersteiner, will support an international research project to examine the impacts of fertilizer pollution. The second, to IIASA’s Steffen Fritz, will support expanded work in IIASA’s crowdsourcing efforts such as the Geo-Wiki project.

Overcoming the volunteer’s dilemma
In the office kitchen, we have run out of coffee beans for the shared coffee machine. If someone does not step up and buy more, we will all have to go without coffee—a hardship for all.

In game theory, the volunteer’s dilemma describes situations such as this, where preserving or protecting a public good depends on individuals making a sacrifice. The dilemma applies also to human societies, as well as to collections of nations. Sometimes a single volunteer suffices (as when buying coffee), whereas in other situations a minimal number of volunteers must join forces (as when safeguarding a community). Now, game theory researchers in IIASA’s Evolution and Ecology Program have shown that providing small rewards to all volunteers, their numbers in a group can be drastically increased.

The researchers use a model to simulate the individual actions of players in the volunteer’s dilemma game. By adjusting reward levels and considering different group sizes, they can determine how individuals will respond, and what conditions will push them to volunteer or not.

The study finds that remarkably small rewards suffice to stabilize the coexistence of non-volunteers and volunteers, providing enough incentives for volunteers to step up and take one for the team, so to speak.

When group size is increased, at intermediate reward levels, the fraction of volunteers also increases—first gradually, before jumping up abruptly. When group size is then decreased again, the fraction of volunteers not only remains high, but even increases further.

“What was surprising was that even small rewards had such a large effect,” says researcher Xiaojie Chen, who led the study while working at IIASA.

So what are the implications for our coffee-less kitchen? IIASA Evolution and Ecology Program Director Ulf Dieckmann says, “It might be as simple as offering a small reward. Why don’t you try it and tell us what happens?”


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Hand grip reveals the speed of aging

A strong handshake can say a lot about a person—it can indicate power, confidence, health, or aggression. Now IIASA demographers say that the strength of a person’s grasp may also be one of the most useful ways to measure people’s true age.

In a study published in the journal *PLoS ONE*, IIASA researchers Serguei Scherbov and Warren Sanderson (also at Stony Brook University) show that hand grip corresponds to other markers of aging such as people’s future mortality, disability, cognitive decline, and ability to recover from hospital stays.

For their new research, Sanderson and Scherbov reviewed findings from over 50 published studies that focus on people of all ages around the world. Since the measure is already commonly used, data are readily available. “Hand-grip strength is easily measured and data on hand-grip strength now can be found in many of the most important surveys on aging worldwide,” says Sanderson.

The study also demonstrates how such a test could be used to compare the speed of aging in different population groups, using data from one such survey, the United States Health and Retirement Survey (HRS), to show how this could be done.

In a growing body of research funded in part by a new grant from the European Research Council (ERC), Scherbov and Sanderson have begun to define new measures of aging based on people’s characteristics, such as their longevity, health, disability status and other important demographic factors.

Scherbov says, “Our goal in this paper was to measure how fast different groups in a society age applying our characteristics approach to the measurement of population aging. If some group is getting older faster than another, we can ask why that might be and see whether there are any policies that could help the faster aging group.”

Further information


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A forest model for Bolivia

A new study by Wageningen University researcher Christian Seiler provides a far better understanding of Bolivian forest dynamics. The carbon cycling of forests, particularly in tropical regions, is one of the key uncertainties in global climate models. The new study combines a regional vegetation model with data from on-the-ground measurements and remote sensing, to build a comprehensive climate impact assessment for the forests of Bolivia. Seiler recently completed his PhD under the advisement of IIASA Director General and CEO Prof. Dr. Pavel Kabat.

Education and disaster

A growing body of research led by IIASA’s World Population Program is showing that education is a key factor in people’s ability to survive and prepare for natural disasters, as well as to adapt to climate change. A recent conference on the topic, co-hosted by IIASA and the International Union for the Study of Population, brought together demographers and social scientists working on vulnerability and adaptation to take stock of the current scientific understanding, and determine what research needs to be done. The conference followed the publication of a special issue on the topic in the journal *Ecology and Society*.

Evolution of cooperation

A conference in April brought together international experts in the evolutionary theory of cooperation, a field of research that connects evolution and ecology with social sciences, and sheds light on environmental dilemmas. The conference, hosted by IIASA’s National Member Organization in China, the National Science Foundation of China, featured about 30 speakers presenting new research on topics from climate change, migration, biodiversity, public goods, and corruption.

European Geophysical Union

Eleven IIASA researchers presented new work at the EGU conference in Vienna in April, the second-largest geophysical research meeting in the world. Topics included analysis of recent disasters and disaster management, land use and deforestation, and renewable energy production for climate mitigation.
What is the optimal fertility rate?

What is the ideal fertility rate for a society? A new study from IIASA population researchers Erich Striessnig and Wolfgang Lutz provides an empirical analysis to explore this tricky question.

Their results, published in the journal *Demographic Research*, suggest that the ideal future fertility rate for Europe and China is actually far below the supposedly optimal replacement level of two children per woman. By factoring in education as well as age and sex into demographic projections for the two regions, the researchers found that in the longer run low fertility rates would lead to lower dependency burden and thus better socioeconomic prospects.

The researchers used the concept of “education-weighted dependency burden”—the education-specific ratio of people who are dependent on society’s support, such as the very young and the very old, to those active in the labor force, to determine an optimal fertility rate.

In addition the study finds that to mitigate climate change, an even lower fertility rate would be optimal. Higher fertility rates lead to faster population growth, and more emissions of greenhouse gases.


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How much food will we need for the future?

Food demand could increase by more than 59% by the year 2050, according to new scenarios published in the journal *Agricultural Economics*. The study, which compared food demand projections for 2050 using 10 different agricultural models, finds that demand is likely to increase by 59–98% between 2005 and 2050, more than the 54% projected by the FAO’s most recent analysis.

IIASA researcher Hugo Valin led the study, which was conducted as part of an unprecedented comparison of agricultural economic models, the Agricultural Model Intercomparison and Improvement Project (AgMIP).

The study compared food demand projections for 2050, based on different population and wealth projections, as well as for different regions and products. It found that uncertainties related to population, income, and consumption—often factors which are set as assumptions in agricultural models—are even greater than uncertainties related to climate change.

“Population and wealth have a strong influence on how much food we need to produce, which foods, and how much we waste,” says IIASA researcher Hugo Valin, who led the study. “The study shows that climate change will be a challenge for future food availability, but our future consumption patterns are an even greater challenge.”

By harmonizing the set of assumptions that fed into the models, the researchers were able to compare the technical functions of the models and better quantify the uncertainties.

“You don’t want to compare apples with pears,” says Valin. “When you make projections about the future with different models, you need similar assumptions about future possible population, how income will develop, and how agriculture will change technologically. Otherwise it is very difficult to compare other model responses, such as the impacts of climate change.”


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Elena Rovenskaya, Evgeny Vinokurov, Peter Havlik, Michael Emerson, and Pavel Kabat describe their new IIASA flagship project exploring economic cooperation between Europe and countries of the former USSR

Last year IIASA launched an international interdisciplinary project, “Challenges and Opportunities of Economic Integration within wider European and Eurasian Space.” This project focuses on trade, energy, infrastructure, institutions, and demographic aspects of economic integration in the EU and RBK-CU “from Lisbon to Vladivostok,” and may also explore a truly trans-continental dimension extending cooperation to key Asian players, such as China, South Korea, and Japan, usually referred to as “from Lisbon to Shanghai.”

Since the collapse of the USSR, the former Soviet republics have been integrating into the global economy, mostly as exporters of commodities and importers of machinery, equipment and consumer goods. Having left the initial transition shocks behind, based on a myriad of economic, infrastructural, social, and cultural ties, some of these countries have now been moving towards re-integration, notably on the basis of the Customs Union of Russia, Belarus, and Kazakhstan (RBK-CU) established in 2010 and the Single Economic Space (SES) deepening RBK-CU from 2012. The CU secured the free movement of goods and common import tariffs and the SES ensures free movement of services, labor, and capital, boosting trade between its members. The next step in integration is envisaged to be the establishment of a Eurasian Economic Union (EEU), likely including Armenia and Kyrgyzstan, which would ultimately conduct coordinated economic policy. The EU is by far the most important trading partner of Russia, Belarus, and Kazakhstan and of the RBK-CU/SES as a whole. Belarus trades about 40% of its exports with the EU, and Russia and Kazakhstan more than 50%.

The current situation around the case of Ukraine has and will continue to have implications on both current economic relations and future cooperation. However, once the current crisis passes, it will be time to make longer term strategic decisions based on rational economic reasoning. The EU, Russia, and their common neighbors are bound to cooperate: they are tied together by territorial proximity, trade of strategically important goods such as energy, and many other factors. Countries in the common neighborhood, such as Ukraine, should be able to benefit from the deep and high-quality economic relations with both the EU and Russia.

Ultimate decisions will be made by authorities: the challenge to the science and expert community is to provide holistic and comprehensive analysis that explores country- and region-specific integration scenarios in economic and social dimensions. The next and key challenge is to make scientific information available for policymakers and the public through a fully participatory interactive approach. The project, in addition to its scientific methodological contributions and due to its international multidisciplinary and independent nature, is well positioned to provide scientific substantiation in support of possible solutions for the current crisis and across all major parties involved.

Previous research on economic integration on the region has already evaluated the impact of some integration scenarios for some countries and regions. These studies relied on qualitative and quantitative methods, such as computational general equilibrium modeling, statistical and econometric analysis, and surveys. But because these individual studies use different assumptions, different countries and regions, different data, and different approaches, they produced sometimes contradictory results. To date, there has been no single study that evaluated a sufficiently broad portfolio of integration scenarios.

Our new project will carry out a meta-analysis of the alternative results obtained by different studies. We aim to draw a road map for further, more comprehensive research on plausible futures of the economic relations between the EU, the RBK-CU/SES/EEU, and their neighbors.
Going Dutch—on climate

In the Netherlands a “top-down” climate impact assessment approach is increasingly being combined with a “bottom-up” practice and policy approach—a method that could provide insight to other countries aiming to address climate change impacts. This observation is a major conclusion of 6 years of research by two Dutch national research programs, “Climate change spatial planning” and “Knowledge for Climate.” Fifteen papers, stemming from the research, have been made available in a special issue of Springer’s Regional Environmental Change journal.

IIASA Director General and CEO Professor Dr. Pavel Kabat, who was a founding Science Director of these programs—which attracted close to €200 million in funding from the government and from public–private partnerships—co-edited the special issue, entitled: “From climate research to climate compatible development: Experiences and progress in the Netherlands.”

The editors of the special issue, Jeroen Veraart, Peter Driessen, Kim van Nieuwaal, and Pavel Kabat, conclude that this dual trend—namely “top-down climate impact assessment” plus “bottom-up practice and policy”—is contributing to a climate-compatible development of the Dutch economy and natural environment. This development, they argue, has enriched both fundamental and applied research on climate adaptation within the Netherlands.

Though offering a predominantly Dutch-oriented perspective of climate research, the work is expected to be of interest to all countries developing national climate adaptation strategies. To adapt to climate change, say the editors, countries should involve not just policymakers and governments, but also businesses, urban planners, and individuals in their planning processes.

The papers are available on the Internet through open access. A hard copy book is expected to be released in summer 2014.


IIASA Director General and CEO Professor Dr. Pavel Kabat kaban@iiasa.ac.at
Every day, I face complex problems as head of the President’s Delivery Unit, which monitors and facilitates government progress on achieving Indonesia’s national priorities. These problems are diverse, ranging from economic competitiveness to food security. They are also immensely complex, interconnected, and international in nature. In my fast-paced role in the Indonesian government’s cabinet, I have found systems science to be a key approach to identifying the best policies for my country.

Forests, for example, being the main provider of resources for the economy, are crucial to Indonesia. To protect these resources we need to better tackle deforestation. As our oil and gas production declines, we are increasing our focus on bioenergy as a key energy resource. This leads us back to forests and to a key policy question: how to deal with the competing uses of forests?

The answer can only be found through integrated analysis of multiple sectors and objectives—social, economic, and environmental. However, such expertise in Indonesia is still weak. We have yet to witness scientifically robust policy formulation even at the highest level, namely, in terms of policy recommendations to the President. Indonesia’s membership of IIASA aims to help fill this gap through direct scientific support, as we deal with the pressing issues the country faces. For example, Indonesia is working with IIASA and its member countries, particularly Brazil, on the new IIASA Tropical Flagship Initiative, which will advance research into tropical deforestation and the development of sustainable land use options.

Equally important is improving the capacity of Indonesian researchers to conduct systems analysis by taking advantage of the academic training opportunities provided by IIASA. I’d also like to encourage global researchers to come to Indonesia; our country provides a fascinating and sophisticated laboratory for systems analysts. Social diversity, tropical rain forest biodiversity, archipelagic geography, and economic development challenges provide an abundance of issues that call out for analysis at a systems level. For instance, Indonesia is implementing many new strategies to reduce emissions from deforestation and forest degradation (REDD+), and we welcome experts from institutions like IIASA to help us evaluate and improve these strategies.

We also need to take systems analysis to the next level by bridging the gap between academic research and government/business decision making. For Indonesia, or indeed any country, to realize the full benefits of applying systems analysis to real world problems, this is vital. Having started as a campus decision scientist, I was tasked from 1989 to 1993 to turn around Timah, an ailing tin mining corporation in Indonesia. This led to my appointment as Minister of Mining and Energy in 1998. From 2005 to 2009 I led the US$8 billion reconstruction effort in Aceh-Nias following the Indian Ocean earthquake and tsunami.

Conflicting objectives are the key feature of the gap between academic research and policymaking. Academic research strives for the optimum solution regardless of the time it takes. Governments, however, need to deliver results in often very short timeframes. I believe that we can bridge this gap by embedding systems thinking in every scientific branch that supports government policymaking. But because of time pressures, we must realize that we will not find perfect solutions. Instead, scientists and policymakers can identify good solutions that will require refinement over time. The key is then for the government to establish flexible mechanisms to regularly refine policies using input from academic researchers and from evidence that arises from implementation of current policies. It is only in this way that we can make sure our actions are efficient, effective, and sustainable for the long term.
The age of sustainable development

An interview with world renowned economist Jeffrey D. Sachs, who was recently named IIASA’s first Distinguished Visiting Fellow

Q Your work spans a large area of research: from economics, to Earth science, to sustainable development. What is the common thread that ties all this together?
A The common thread is the challenge that we face on the planet. We can no longer separate economic, environment, and social challenges because we find that if we try to pursue any one of those alone, we end up jeopardizing the others. For too long, economists have focused simply on economic growth, and clearly that strategy has put Earth and humanity at great peril. There’s no shortcut anymore. We have to be able to combine a vision that includes all the major dimensions of the complicated global reality that we face. Economics, divided societies, environmental crises, and rapidly changing geopolitics. It’s not simple to integrate all of these different areas. Our traditional intellectual disciplines do not accomplish that.
IIASA has been one of the world’s leading champions of this kind of integrated vision: Systems thinking applied to massive human problems, bringing together very diverse areas of natural science, social science, and I would say ethical considerations as well. This kind of holistic approach is central to IIASA’s whole strategy. That’s one of the reasons I’m so proud of my connection to the Institute.

Q What do you see as the biggest problems facing our planet?
A We have become an enormously crowded and interconnected global society overnight, because of the technological reach of our economies and because of the remarkable growth of the world’s population during the last century. With 7.2 billion people on the planet now, we are putting vast parts of the biosphere and human well-being at dire risk. We are only slowly waking up to this reality. All of history, humans have faced local challenges, but we have never faced such a confluence of massive global challenges at the same time. We don’t yet have the institutions, the insight, or the moral outlook to handle this set of challenges, and yet they are bearing down on us very fast.

Q What do you see as the role for researchers and for institutions like IIASA in solving these global challenges?
A I believe that these problems are inherently complex because they are about managing interconnected complex systems. There’s nothing simple about the world economy, nothing simple about global social dynamics, and nothing simple about interconnected Earth systems. And yet we have to master the risks that attend to each of those and the interconnections among them. It’s quite obvious in that regard that IIASA has a unique role to play. IIASA has been in the forefront of climate modeling, demographic modeling, and agricultural modeling for many years. I’ve been a huge admirer of the Institute’s work, and I look forward to working more closely with IIASA in the future, through our new efforts such as the Alpbach–Laxenburg Group, my appointment as IIASA Distinguished Visiting Fellow, and the UN Sustainable Development Solutions Network, of which IIASA is also an important player.

Read a full version of this interview at blog.iiasa.ac.at
The Geo-Wiki project’s growing efforts in crowdsourcing land-cover data could help end “satellite squabbles” in Kenya.
At the time of writing, the chances of finding the missing Malaysian Airlines flight MH370 in the southern Indian Ocean seem to be contracting. Time magazine writes that spotting a downed jetliner under these circumstances is “like locating one toothpick in more than 800 Olympic swimming pools.”

Since the airplane disappeared, experts and literally millions of amateurs have been sitting on their computers scanning satellite images of vast tracts of Thai jungle and tropical ocean for objects of interest.

Virtual volunteers, logged on to crowdsourcing sites like Tomnod, have reported numerous pieces of possible airplane debris floating everywhere from the Andaman Sea south to the Indian Ocean.

But the satellite images have been too blurry to make a clear identification, so ships and aircraft have been sent to search.

Clearly, one thing the world has learned in 2014 is that satellites don’t have an all-seeing visual acuity. Human overview is still needed.

**A birds-eye view of cropland**

Such problems with satellite imaging are faced daily by scientists around the world, who rely on satellite data to make maps of what grows where on Earth.

Land for growing crops is under severe pressure. By 2050 ten billion people will need to be fed. But it’s not just about what we grow and getting optimum yields. In the next 20 years, an area the size of South Africa will disappear beneath concrete or asphalt, much of it land that could grow food and animal feed crops.

Developing countries will be the most affected, with a tripling of the area of sealed urban land area in the period between 2000 and 2030.

Steffen Fritz and his team of researchers in the Earth Observation Systems (EOS) group of IASAS’s Ecosystems Services and Management (ESM) Program are responding to these challenges in creative ways, using satellite imaging to understand what’s growing or not growing on Earth’s surface so as to manage global land resources better. But just like finding an airplane in an ocean, identifying cropland in global satellite data is not that easy.

Take, for instance, point #190450 on Geo-Wiki, near Kanunga Village on the northern outskirts of Nairobi, Kenya.

The location is in richly fertile Kiambu County, where pineapple, tea, coffee, wheat, and macadamia cultivation flourishes alongside poultry and dairy farming.

The MODIS, Globcover, and GLC2000 satellite data sources for the site don’t agree on whether the land—crossed by a section of the Boma Road running from Kanunga to the tea plantations at Limuru—comprises: (i) closed deciduous broadleaf tree cover, (ii) open broadleaf deciduous forest, or (iii) grasslands.

This isn’t an isolated case of satellite squabbles. Hundreds of polygons have been identified in Kenya—and thousands worldwide—where our eyes in the sky have proved myopic.

The three data sources deliver medium-resolution spatial images of the ground, designed to capture global dynamic processes like cloud cover and leaf area. However, other data sources such as Google Earth Maps, capture the same area at 50 centimeter resolution, fine enough to spot structures such as houses and the telltale squares and rectangles of cropland—if you have someone to look at the millions of data points. That’s where Geo-Wiki brings in the volunteers.

You can check the Kanunga polygons online at Geo-Wiki point #190450 on Google Earth and, just like data validator “Davey Boy,” decide that the MODIS description of closed deciduous broadleaf tree cover for the relevant polygon is “bad” or that the Globcover description of grasslands is “not sure.”

Or, you can download the new Geo-Wiki Pictures app to your mobile phone, get down to Boma Road in person, take geo-referenced photos from the four cardinal points (automatically tagged with camera angle-of-tilt information), tag the photographs with additional comments, including land cover type, and email them to Geo-Wiki. The app even gives you the correct route to #190450 on your mobile phone.

In a new project funded by a European Research Council grant, Steffen Fritz will also ask participating photographers to find the farmer or land owner to ask what crops are grown and how/if they are irrigated. Such contributions to Geo-Wiki Kenya project could be remunerated, perhaps even in cash.

Such information is vital for policy and planning as well as science—a new bypass is under construction from Nairobi that will provide quicker access to Kiambu, and already the green setting of former banana plantations is giving way to the red rooftops of burgeoning urbanization. As Kenyans become suburban commuters, the fertile land within their boundaries will decrease, with impacts on people and food production.

Geo-Wiki has a catch phrase: “You’ve got to know a planet to save a planet.” For the sake of the hungry, Steffen Fritz and team are hoping to get much closer to the Earth’s surface than even Google Earth can, through real people on the ground.

Further information Geo-Wiki Pictures is currently available for Android 2.3.3+, iPhone/iPad, and Windows Phone. Cropland Capture, a crowdsourcing game, is available for tablet, mobile phone, and desktop.

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When negotiators sit down at the United Nations Climate Change meeting in Paris in December 2015 to hash out a new climate agreement, they will be under greater pressure than ever before.

The 2015 date has been set as the deadline for a binding agreement for countries to limit their carbon emissions, and many experts see Paris as the last chance to limit climate change to the 2°C target set under the 2009 Copenhagen Accord. A growing body of research, including IIASA studies published in the journals Nature and Nature Climate Change, shows that delaying policy action beyond 2015 would make climate mitigation more expensive, and less likely to succeed as well as make climate adaptation more challenging.
How IIASA research and the IPCC’s Fifth Assessment Report are changing the narrative on climate change mitigation, impacts, and adaptation

Whatever happens in Paris and other current policy processes, negotiators will base much of their talks on the new IPCC Fifth Assessment Report (AR5) released in 2013 and 2014. The report provides a wealth of information, not only on the physical science of climate change, but also on the benefits that climate policy could have for the environment, human health, and economic development, as well as the potential impacts and risks of climate change.

IIASA research played an important role in the new report, particularly in Working Groups II and III, which focus respectively on climate change impacts and mitigation. Nineteen IIASA researchers contributed to the AR5 as authors or reviewers. Countless IIASA publications were also cited in the report.

IIASA Director General and CEO Professor Dr. Pavel Kabat says, “IIASA’s systems analysis approach is key for addressing global problems such as climate change. The IPCC’s Fifth Assessment Report incorporates this viewpoint even more than previous reports.”

“The IPCC AR5 clearly demonstrates that adaptation and mitigation are becoming more urgent. Any further delays in avoiding dangerous climate change render our actions more difficult and costlier,” says IIASA Deputy Director General and Deputy CEO Professor Dr. Nebojsa Nakicenovic, a lead author on the new report. “Stabilization of climate change at two degrees will bring huge potential co-benefits for human development and well-being. It will also avoid exceeding planetary boundaries, such as ocean acidification and biodiversity loss,” he adds.
IIASA—Ahead of the times

“Mankind is slowly realizing that it faces at least three major interrelated problems—food, energy, and population—and all are related to climate.”

These were the words of Rumen D. Bojkov, then Secretary General of the World Meteorological Organization, at a 1978 meeting at IIASA entitled Carbon Dioxide, Climate, and Society. At the time, researchers had recognized the increase in carbon dioxide in the atmosphere from fossil fuel burning, and were beginning to develop models to assess how this increase would affect the climate and environment. As an international institute with a mandate to solve interdisciplinary problems across national borders, IIASA was a natural starting point for research into the changing climate.

In 1979 IIASA researchers projected temperature rise of between 1°C and 4°C by 2050—a projection that has remained remarkably constant even as the science has advanced in the last 25 years. The researchers also projected consequences of climate change for food production, the environment, and the world’s energy system, which remain major concerns today.

For more on IIASA’s history in climate change and the IPCC, read the 2006 article, “40 Years’ Research into Climate Change.” And see IIASA’s contributions to IPCC assessment reports and special reports since 1995: www.iiasa.ac.at/ipcc

Climate change affects us all

“Nobody on this planet is going to be untouched by the impacts of climate change,” IPCC chair Rajendra Pachauri said at the launch of the IPCC WGII report in March 2014.

One big question is where and how climate change will affect human beings. IIASA research with the Potsdam Institute for Climate Impacts Research has brought a new clarity to that question, in part through a unique model intercomparison project, ISI-MIP. The project results, published in a special issue of the journal Proceedings of the National Academy of Sciences, showing that the impacts of climate change could be greater than expected in areas ranging from water availability, health, and agriculture, provided important evidence for the new IPCC report.

A shift towards climate risk management

The AR5 also brings a change in thinking on adaptation strategies, reflecting new evidence on climate-related impacts and strategies for risk management.

“The fifth assessment report essentially takes a risk-management approach, which lays out potential risks from a warming climate across natural and social systems, the potential for adaptation, as well as the limits to adaptation,” says Reinhard Mechler, a lead author on Working Group II report’s technical summary and Chapter 17, which focuses on the economics of climate adaptation.

“This focus on risk represents a fundamental shift in thinking, which should lead to better informing decisions on mitigation as well as adaptation,” says Mechler.

“Mechler and researchers in IIASA’s Risk, Policy, and Vulnerability program were authors on the IPCC’s 2012 special report, “Managing the Risks of Extreme Disaster,” which provided a new focus on risk management that fed into the AR5. The report showed that climate change will not only lead to rising sea levels and temperature, but also increases the risks from extreme weather. It also identified a need for increased efforts to help communities and countries adapt to the growing risks of extreme weather, linked to human-caused climate change. Mechler says, “The thinking developed in that report was crucial for AR5. It gave scientists a much better understanding of risk and risk management.”

“We are not doomed”

While much of the IPCC report focuses on better cataloging the potential dangers of climate change, the Working Group III report on climate change mitigation brought a much more expansive view of the possibilities for action.

“We are not doomed,” says IIASA researcher Volker Krey, a lead author of the report. “If we want to limit climate change, there are a number of possible ways to do this.”

The IIASA-led 2012 Global Energy Assessment (GEA), for example, provided 41 pathways for energy systems transitions that would allow the world to limit climate change to the 2°C target, while also bringing energy to people currently living without access to clean modern energy, and cutting air pollution worldwide. The GEA also provided the groundwork for research on the multiple co-benefits of climate action, showing that climate policies would also improve energy security and reduce the health burden of air pollution. The GEA was a key input into AR5, with 40 GEA authors contributing as lead authors to the IPCC report.

But even with all these possibilities and benefits of climate action, in the real world, climate agreements have proven difficult to conclude. So IIASA researchers have also begun to examine in detail what could happen without a climate deal.

Recent research from the IIASA Energy program shows that in the absence of such a global agreement, voluntary pledges for emissions reductions to 2030 are far below what they need to be in order to meet climate targets. While it could still be possible to reduce emissions starting from a higher level in 2030, it would become far more difficult and expensive, and the options for mitigation decrease.
“There is not much time to fundamentally change the system,” says IIASA Energy Program Director Keywan Riahi. “Delays will not only increase the cost significantly, but would also require a global energy transformation at a pace that will be historically unprecedented.”

Another study showed that technologies for removing carbon from the atmosphere may become necessary. For example, bioenergy with Carbon Capture and Storage (CCS) could be used to limit climate change in the future. However, relying on CCS is a risky choice, the researchers say, because it has not been proven to work at large scale, and it may prove politically unpopular in some countries or regions.

“CCS could buy us time,” says Krey. “But what if it doesn’t work? It’s a risky strategy.”

With the new report in hand, negotiators in Paris will have thousands of pages of evidence pushing them toward action, as well as clear guidance about potential outcomes of their action. What happens will ultimately depend on politics, and on public opinion in the IPCC member countries. But the links between climate, policy, and socioeconomics are becoming ever clearer.

A look ahead
The research in the Fifth Assessment Report is already old news to the researchers who worked on it. They are already well into work on a new framework that will streamline the IPCC reporting process and better integrate the work between different disciplines, which began with the Representative Concentration Pathways used in AR5, and is continuing with the development of the Shared Socioeconomic Pathways (SSPs).

The SSPs are five scenarios that provide different explanations of how the future will develop. But unlike previous scenarios used by the IPCC, the SSPs provide a consistent set of assumptions, across academic fields, which researchers can use to provide input to their models, whether they are examining wheat yield in Africa or the future availability of drinking water in Africa.

Three different research communities are working together to develop the SSPs: climate modelers, who focus on physical science, integrated assessment modelers, who examine the connections between economics and policy, and experts in impacts, adaptation, and vulnerability, all of which are represented in IIASA research programs.

Further information  IIASA and the IPCC: www.iiasa.ac.at/ipcc

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In December 2013, the European Commission proposed a new air pollution control policy—the most stringent ever. Over the next two to three years, the European Parliament and member states will negotiate the details and come to consensus, eventually ratifying it into law.

While Europe’s air is cleaner than in the past—and far cleaner than many other regions of the world—air pollutants such as fine particles, soot, and ozone still cause major damage to health, infrastructure, and the environment. Particulate air pollution and ozone cause cardiac and lung disease and contribute to an estimated 420,000 premature deaths each year in the European Union. And excess nitrogen constitutes a widespread threat to biodiversity, especially in nature protection areas, by influencing plant species composition.

The new proposal calls for new air quality measures for the period up to 2030, with stricter national emissions ceilings for six pollutants. The measures will avoid an estimated 58,000 premature deaths, save 123,000 square kilometers of land area from nitrogen pollution, and protect 19,000 square kilometers of forest from acidification.

European Commission Environment Commissioner Janez Potočnik lauded the new proposal, saying, “The actions we are proposing will halve the number of premature deaths from air pollution, increase protection for the vulnerable groups who need it most, and improve quality of life for all. It’s also good news for nature and fragile ecosystems, and it will boost the clean technology industry—an important growth sector for Europe.”

“What’s new about this policy is the integrated view it takes,” says IIASA Mitigation of Air Pollution and Greenhouse Gases Program Director Markus Amann. “It is really a systems perspective that capitalizes on the connections to other policy areas.”

To support the policy development process which ran over the last five years under IIASA leadership, institutions around Europe combined their research models of sectors including agriculture, energy, transport, and more. The project, called the European Consortium for Modelling of Air Pollution and Climate Strategies (EC4MACS), worked sort of like a policy-assessment factory, where each model was connected to the others so that all the important linkages between sectors could be accurately assessed. IIASA’s GAINS model was the framework that tied everything together.

The result is that the new proposal focuses greater attention on pollution from agriculture and small woodstoves. Amann explains, “It draws attention to sectors which have been overlooked in the past,
where measures are now much more cost-effective than further emission reductions from sectors which have contributed a lot in the past in terms of emissions reductions, such as power plants and transportation."

The new air policy proposal also for the first time includes methane, to limit its contribution to hemispheric background of ground-level ozone. As methane also constitutes an important greenhouse gas, the proposed measures would deliver clear co-benefits for both air and climate policies.

SPEAKING THE LANGUAGE

The policy assessment process included consultations with policymakers at every step. IIASA researchers met with government representatives to assess their emissions data. They talked to policymakers to determine what information was needed, and they shared draft assessments for comments and feedback, running further analyses based on questions that came back from the policymakers.

That back-and-forth has led to an evolution in the way IIASA researchers communicate their results to policymakers—one reason that the scientific reasoning has been taken up by policymakers to a large degree, says Amann.

The societal costs of air pollution—and benefits of control measures—have long been left out of assessments for air pollution policy, leaving governments and stakeholders with a lopsided view of the costs and benefits of measures to control pollution.

"In the past when we quantified the costs of policy action, we could not really compare these on a solid basis with the benefits. And if you’re just looking at costs there’s not strong criteria to argue for more stringent measures," says Amann.

"Here we managed to make a strong case about the health benefits. These couldn’t be discounted. By assessing health and other benefits from an economic standpoint, the researchers could show much more concrete benefits to reducing air pollution—the evidence that policymakers needed to support action.

"Science really came in and changed the outcome. What was proposed in the end was not much different than what the scientific analysis suggested," says Amann.

As the EU parliament and member states now work towards a consensus, the consultations will continue. Over the next six months, 22 countries will send representatives to IIASA to consult on emissions data and ask questions about the analysis. Amann says, “This means that the discussion will not be derailed by technical details, but can focus on ambition levels, willingness to pay, and the value of clean air.”

Further information
IIASA and the EU climate proposal: www.iiasa.ac.at/news/eu-climate
IIASA and the European Clean Air Policy Package: www.iiasa.ac.at/news/clean-air

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Elements such as carbon, nitrogen, and phosphorus move through the Earth’s atmosphere, water, living creatures, and soil in natural cycles. All three elements are vital to life, and serve as fertilizer to help plants grow. But what happens as the balance of these key nutrients changes?

“The general ratios of carbon, phosphorus, and nitrogen have been in balance for millions of years, more or less,” says Michael Obersteiner, who leads IIASA’s Ecosystems Services and Management Program.

But today, humans are pumping carbon dioxide into the atmosphere, dumping increasing amounts of nitrogen and phosphorus into the soil, and at the same time rapidly exhausting the world’s limited phosphorus reserves. Carbon and nitrogen are abundantly available, and becoming more so. But the relative amount of phosphorus is declining. That means that in many places, the relative amounts of these three nutrients may change drastically. “The Earth’s plant life evolved with these stoichiometric ratios. If we change them, especially in natural ecosystems, we might get some unexpected results,” says Obersteiner.

What those results might be is the subject of a new international research project sponsored by the European Research Council (ERC), to explore the impacts of this growing imbalance on the climate, the environment, and food security.

NUTRIENT BALANCE & THE CLIMATE

While human beings released over nine billion metric tons of carbon dioxide into the air last year, only about half of that remained in the atmosphere. The rest was pulled into natural carbon sinks including oceans and forests. Earth’s forests are one of the largest carbon sinks, but it is still unclear how much carbon they absorb and under what conditions. A growing body of research suggests that the availability of nitrogen and phosphorus in the soil is one condition that makes a huge difference in that balance.

In a new paper published in the journal Nature Climate Change, Obersteiner and the ERC research team show that the nutrient availability in forest soils is a key factor regulating how much carbon forests can take up from the atmosphere.

“When plants are in nutrient poor conditions, they send out more roots and produce chemicals that can help dissolve nutrients from the soil,” says Obersteiner, “This takes energy, though, and so the plants produce less biomass.” The study, which relied on experimental data from 92 forests around the world, showed that in nutrient-rich conditions, forests accumulated four times as much carbon as in nutrient-poor conditions.

In another recent study, 2013 IIASA Post-Doc Christina Kaiser, IIASA Researcher Oskar Franklin, and colleagues took the question of soil nutrient balance to an even more detailed level, examining how nutrient availability affects the function of microbes that break down forest litter—a process that releases approximately six times more greenhouse gases than humans do.

While trees and plants take up carbon dioxide through photosynthesis, the tiny creatures that live in forest soils break
“The Earth’s plant life evolved with these stoichiometric ratios. If we change them, especially in natural ecosystems, we might get some unexpected results.”
— Michael Obersteiner

down old leaves, branches, and dead animals, releasing greenhouse gases such as carbon dioxide and methane back into the atmosphere. Previous research had suggested that nutrient imbalances could lead to even greater emissions, as the microbes worked less efficiently. But the new study shows that as nutrient conditions change, the microbes adjust to the new conditions and continue to operate smoothly and emit about the same amount of carbon dioxide. Franklin plans to continue the work as part of the ERC grant.

IMPROVING CLIMATE MODELS
To project future climate change, Earth system models have to project how much carbon dioxide will stay in the atmosphere. To do that, they have generally looked at forests as one unified photosynthetic organism—essentially a big leaf—without considering factors such as nutrients or soil quality. However, as Obersteiner says, “We now have evidence that this is not enough. How CO₂ is taken up and then transformed into biomass also crucially depends on soil nutrients.” With a better understanding of forest carbon processes, Obersteiner hopes that the models can also be improved, providing more clarity for policymakers.

“There are so many uncertainties about climate change. Improving our models of the carbon cycle is vital for understanding what might happen in the future,” says Obersteiner. “It’s a big problem, and we know very little about it.”


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FROM PROBLEMS TO SOLUTIONS

Food security
Nutrient imbalances are also a growing concern for food production worldwide. While rich countries deal with phosphorus and nitrogen pollution, farmers in poor countries struggle to buy phosphorus-based fertilizer. And global phosphorus supplies are projected to run out within the next 40 to 400 years. In a recent commentary, in the journal Nature Geoscience and a recent study in Global Change Biology, Obersteiner and Marijn van der Velde, a former IIASA researcher, point out that simple solutions such as more efficient fertilizer application could help improve crop yields while wasting less of the element and leading to less pollution. Read more at blog.iiasa.ac.at.

Fertilizer pollution
Research by IIASA’s Wilfried Winiwarter shows that more efficient fertilizer application could make a big difference in the amount of nitrogen and phosphorus pollution. Nitrogen and phosphorus both enter waterways when used excessively as fertilizer, finding their way into natural ecosystems and causing overgrowth of algae and other aquatic plants.
Governance risks to solar energy investment in the Mediterranean

While solar power in North Africa could provide a valuable source of renewable energy for both Africa and Europe, to date, investors have been cautious about implementation, especially of large-scale projects, because of governance issues in the region.

To investigate the governance framework for investment and doing business in North Africa, IIASA’s Nadejda Komendantova led a multi-institute study on the perceptions of stakeholders involved in financing and deploying solar projects in the region. The scientists conducted their research from 2010 to 2013 via interviews and surveys and, due to the time span of the research, they were able to follow how perceptions of risks changed with the Arab spring.

The results showed that respondents perceived complex legislation and bureaucratic procedures as the most serious and likely risks during the construction phase of solar projects. Operation and management issues proved less problematic.

Surprisingly, the researchers found that large-scale foreign direct investment in solar energy could possibly increase governance risks. The study also found that the recent political changes meant that the framework and conditions for doing business in some of the countries had become even more complex after the political changes.

“This means that even if political change happened quickly, it could take an entire generation for institutional structures and bureaucratic practices to also change,” says Komendantova.

“To improve the prospects of exploiting solar potential in the region, policymakers need to deal urgently with the current institutional structures and bureaucratic framework,” Komendantova adds.


Household accidents arising from residential energy use

Although many South Africans have access to electricity, 3.5 million households in the country still rely on inefficient energy and risky technologies for cooking and lighting. These can cause environmental pollution and accidents such as burns, scalding, and poisoning.

To analyze the health risks posed by household fuels in the region, David Kimemia, a participant in the 2013 Southern African Young Scientists Summer Program, partnered with Shonali Pachauri and other IIASA scientists to conduct a study of how such risks are related to household income and energy poverty. For their assessment, the researchers used two national household energy consumption survey datasets plus treatment data on energy-use related injuries from a sample of 17 hospitals in South Africa.

The researchers found that in South Africa the risks of burn incidents and fires initially rise with income only to decrease at higher income levels. Moreover, for households below a defined energy poverty threshold, the risks of energy-related accidents rise with an increase in household energy use, but fall once that energy poverty threshold is crossed.

“This shows that marginal increases in income only enable the poor to afford riskier transitional fuels,” says Kimemia. “Thus a pro-poor approach that aims to raise per capita household incomes to above US$50 per month is needed.”

Energy access programs should be geared toward substituting liquefied petroleum gas and electricity or solar power for paraffin and candles in order to minimize the adverse health and safety consequences of fuel-based cooking and lighting, say the researchers.


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Fishing practices lead to smaller wild Alaskan salmon

Since the late 1800s gillnet fishing has removed the larger fish from wild Alaskan salmon populations, allowing the smaller fish to escape and continue to breed. Could these fishing practices have given smaller fish an evolutionary advantage, causing a trend toward smaller adult fish in wild populations?

To find out, IIASA researchers examined an exceptional 50-year dataset covering nine wild Alaskan salmon populations across two lake systems of Bristol Bay, Alaska. The scientists analyzed this data in conjunction with long-term information regarding fishing practices in the area that details the intensity of fishing in each population as well as the size of the targeted fish.

The researchers found that fish length at maturation had decreased in six of the populations studied, while the time taken by the salmon to reach maturity had not changed. These results, together with the historical record of fishing in the region, imply that industry practices have indeed led to the projected evolutionary trends toward smaller adult fish.

“Our findings demonstrate the influence of size-selective fishing on wild salmon populations. Fishery managers should be aware that such evolutionary pressures tend to influence yield and could jeopardize the ability of the exploited fish populations to respond to future environmental or management changes,” says study author and IIASA Program Director Ulf Dieckmann.

To reduce size selectivity, fishery managers could reduce fishing intensity or adjust regulations limiting the mesh size of nets. Such modifications would ensure that fish populations stay healthy and the fishing industry in the region remains robust.

Assessing the climate change and flooding connection

In the last year, heavy rainfall and floods have devastated parts of northern India, central Europe, and North America. Globally, there is evidence that climate change has contributed to more intense and frequent rainfall, and climate models project increased heavy rainfall in the future. Does this mean that flooding has also increased, or will do so in the future?

To answer this complex question, a team of researchers including IIASA’s Reinhard Mechler, performed a comprehensive investigation into rainfall patterns and the link to flooding from the late 20th century up to 2011, a period during which climate has changed significantly.

The scientists examined data assessing changes in flood risk globally included in the IPCC Special Report on “Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation” (SREX) and also data from more recently published literature.

The data analysis gave the scientists medium confidence that climate change has caused more intense rainfall globally. Based on peak flow measurements, they found no evidence for climate-driven changes in the magnitude or frequency of riverine floods in the last decades.

However, based on an understanding of the physical processes associated with flooding, the study found that projected increases in heavy rainfall would contribute to increases in rain-generated local flooding in some areas.

The scientists emphasize that their findings corroborate the need for societies to better prepare for floods to minimize future damage and losses and to increase their understanding of the role played by precautionary measures in shaping flood risk.

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Further information

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Benefits of cleaner air in India outweigh costs

The high costs of protecting the environment are often seen as impediments to economic development. However, the economic and social benefits of investing in air pollution control measures in India far outweigh the costs. New IIASA research reveals that even advanced and costly measures to reduce atmospheric fine particulate matter (PM$_{2.5}$), found in smoke and haze, would benefit development, improving air quality, human health, and longevity in India, and would pay for themselves in a few years through increasing productivity.

India’s present PM$_{2.5}$ levels (which contribute to lung and cardiovascular disease) exceed the World Health Organization (WHO) guideline by over a factor of four. Under Indian air pollution legislation current PM$_{2.5}$ are set to increase by another 50%. “Only implementing advanced controls could cut pollution and bring PM$_{2.5}$ levels closer to the WHO guidelines,” says IIASA’s Markus Amann.

The direct costs of implementing advanced control measures would amount to about 0.5% of GDP initially, and then fall to about 0.3% of GDP by 2030. However, investments in cleaner air would reduce employee sick leave, increasing productivity. Extended life expectancy (an estimated 2.8 years) resulting from lower pollution could allow people to accumulate more economic assets, like savings, in their working years, increasing capital formation for productive investment.

Researchers conclude that from the perspective of development and well-being, improved longevity resulting from cleaner air more than compensates for the loss of per capita GDP, if measured by the UN’s Human Development Index.

Coal power plants may prove a costly investment

Some 37% of global investment in coal power plants over the next 40 years could be unprofitable—with China and India bearing most of the costs—if stringent action on climate policy is delayed, according to new IIASA research.

Coal power plants are recognized as a major source of greenhouse gas emissions, and new plants are still planned globally, particularly in India and China. However, new power plants have a long payback period. Moreover, stringent climate policies could make emissions costs too high for coal to be competitive, leaving new power plants idle. This problem is known as stranded capacity.

The new study suggests that delaying climate action will only increase the problem. “Delaying action encourages utilities to build more coal-fired power plants” says IIASA’s Nils Johnson, who led the work. “When climate-sparing policies are introduced, we’ll have to phase out coal even more quickly, meaning wasted investment.”

Researchers examined strategies to reduce stranded capacity in coal plants, while limiting the increase in mean global temperature to 2°C by century’s end, a level that would avoid the worst consequences of climate change. Findings suggest that the best strategy is not to construct new coal plants unless they incorporate carbon capture and storage (CCS). This as yet unproven technology would see emissions captured at the source and stored underground—normally in a geological formation—to keep them from the atmosphere.

The authors also examined two additional strategies: providing emission exemptions for existing coal plants, and retrofitting plants with CCS. However, neither strategy would increase the likelihood of achieving the 2°C target, the report found.
Regional Focus

Chinese agriculture faces regional wins and losses

Regions of China will be impacted differently by climate change, with some areas benefiting and other regions facing increasing challenges, according to new joint IIASA projections of the regional impact of climate change on Chinese agriculture.

Global climate change is expected to have a significant impact on food production through changes in agroclimatic conditions which will affect crops suitability and soil moisture conditions. As recent warming trends are higher in China than the global average, concerns are rising on how changing climate is altering agroclimatic conditions in China and the potential impact of these changes on crop production in the future.

Based on a range of scenarios projected from regional climate models, findings suggest a significant extension of the crop-growing period which may lead to an increase in multi-cropping opportunities particularly in high latitudes. “This could advance the total potential output per unit of cropland,” IIASA’s Laixiang Sun points out. On the other hand, results show that Southwest China could experience drier conditions which could create severe challenges for future agricultural development in the region.

Studying agroclimatic conditions adds, researchers believe, to existing studies that simply examine how crops respond to climate and how this response affects yield. “Assessing agroclimatic conditions provides more general information about which crops, cropping rotation schemes, and/or farming technologies can be applied to specific areas,” says Sun. Knowing this can be beneficial for policymakers and farming communities in adjusting cropping structures, adopting suitable technologies, and designing adaptation and mitigation measures.

Further information

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Better livestock diets bring all-round benefits

Changing livestock diets could cut greenhouse gas (GHG) emissions from land use change globally by 23% over the next two decades, new IIASA research suggests. Altering livestock diets from pure grazing to diets supplemented by higher quality feeds would also improve food availability.

Livestock production is responsible for 12% of human-related GHG emissions, primarily from land use change and deforestation caused by the expansion of agriculture plus methane released by the animals themselves. Other emissions come from manure management and feed production.

Cows, sheep, and goats grow more quickly and produce more milk when they eat energy-rich diets that include grain supplements or improved forages in addition to traditional grass. “More livestock can be raised on less land, and with fewer emissions per pound of meat or milk produced,” explains IIASA’s Petr Havlík, who led the study, in collaboration with researcher Mario Herrero at the Commonwealth Scientific and Industrial Research Organisation (CSIRO), IIASA’s Australian National Member Organization.

The study projects that the increasing cost of land and continued crop yield increases will lead to richer animal diets in the future. These are efficient in terms of greenhouse gas reduction, while providing the livestock products at lower cost.

“There’s a lot of discussion about reducing meat in the diet as to reduce emissions,” says Havlík. “But our results show that targeting the production side of agriculture is a much more efficient way to reduce GHGs.”

But changing livestock production systems is a challenge. Safeguards would be needed to ensure that intensified animal production does not lead to environmental damage or reduced animal well-being, say the researchers.

Further information

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Tradeoffs between retirement age and labor force participation

Population expert Serguei Scherbov, deputy director of the IIASA World Population Program, says, “Coping with aging populations is a challenge for most developed countries.”

In Europe and many other areas of the developed world, birth rates have dropped while life expectancies have increased, leading to a larger number of older people. When a greater proportion of the population is older, they rely more heavily on the younger working population to finance their pensions and healthcare. One way to fix the problem is to raise the retirement age, but this has proven unpopular.

In a new study with Warren Sanderson, a researcher at IIASA and Stony Brook University, the researchers for the first time estimated the trade-off between pension age and labor force participation policies. They show that if labor force participation rates remain at current levels, by 2050 it would be necessary to raise pension ages above age 68.

The study, published in the journal Demographic Research, also showed that increasing labor force participation by as little as 1 or 2 percentage points could allow pension ages to be reduced by one year without increasing the burden on the working population.

Says Scherbov, “In many European countries, without new policies to increase labor force participation rates, normal pension ages would have to be raised well above 68 by 2050 to keep the burden on those working similar to the current burden.”

Further information

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Boreal benefits

A new book, co-edited by Florian Kraxner, deputy director of IIASA’s Ecosystems Services and Management (ESM) Program, focuses on global trends likely to affect the future use of Nordic forests. The book aims to engage forest sector professionals, civil society organizations, and decision makers in a broad debate about future Nordic forest management, its opportunities and challenges, plus the trade-offs associated with future forest use.

IIASA is an official research partner with the Swedish funded “Future Forests Program” under which this book project has been carried out. Although the empirical work in the book focused on Sweden, the research questions relate to the boreal forests of the Scandinavian countries in general and to the political space of the Nordic welfare model, which apply similarly to Norway, Finland, and Sweden.

Two main concerns are raised by the book. The first relates to global challenges to land-based resources, namely the demographic and economic outlooks and the pressures that these are expected to create. The second relates to the consequences of those pressures for Nordic forest resources. The chapters of the book all respond in their own specific ways to these concerns.

Former IIASA Acting Director, Professor Sten Nilsson, contributed two chapters. One, which examines how Canada is trying to transform the current structure of its forests, provides potential “lessons learned” for the Swedish context, as the Canadian transition is somewhat similar to that of Sweden.

Further information

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Alpbach–Laxenburg Group
A new global think tank led by IIASA and the European Forum Alpbach argues that tackling inequality is key to sustainable development

Last August, as part of their new partnership, IIASA and European Forum Alpbach (EFA) announced the launch of a new global think tank. In March a core group of board members of the group—the Alpbach–Laxenburg Group—met to discuss how the group can aid in the creation of sustainable development paths to address issues caused by the global transformation.

Albert van Jaarsveld—President of National Research Foundation (NRF), South Africa and Co-Chair, Belmont Forum, International Group of Funding Agencies for Global Change Research—observed the meeting. He says, “One of the first topics to be tackled by the group is inequality, as it is a burning issue across all societies, and is a major issue as far as sustainable development is concerned.”

“The impact of inequality affects all areas of the ongoing global transformations that we are facing,” says Prof. Dr. Pavel Kabat, Director General and CEO of IIASA. “At IIASA we are currently investigating the drivers of poverty and inequality, their impacts on human well-being and the environment, and the impacts of policies and general development on the poor and most vulnerable. The think tank will focus in its first year specifically on inequality in education, energy access, and inequality in financial systems, and by doing so will address critical issues and forge a new path for a sustainable future.”

Jeffrey D. Sachs, Director of the Earth Institute at Columbia University and a core member of the Alpbach–Laxenburg Group, says, “We have a chance, and we have to take it, to understand the whole chain from science to policy, and not be driven by short term considerations. We have the space and freedom of thought to take a longer term view. IIASA can play a special role, based on their excellence and the partnership with European Forum Alpbach. This is a great and exciting venture and I think we will make a difference.”

As part of the two day meetings, IIASA, in collaboration with EFA and Austrian Academy of Sciences, organized a public lecture by Jeffrey Sachs, titled “The age of sustainable development.” Sachs discussed the need to address the intertwined challenges of economic development, social inclusion and environmental sustainability. Following the lecture, Sachs accepted an appointment of Distinguished Visiting Fellow from Kabat. This is a new category of scholars associated with IIASA, which will bring leading scientists from around the world to collaborate with IIASA researchers in order to enrich the research programs’ efforts to address complex problems related to global development, new technologies, and population growth.

The core group of the Alpbach–Laxenburg Group consists of: Jeffrey D. Sachs, Director, The Earth Institute at Columbia University; Petr Aven, Chairman of the Supervisory Board, Alfa Bank; Fahad Bin Mohammed Al-Attiya, Chairman, Qatar National Food Security Programme; Franz Fischler, President, European Forum Alpbach; Pavel Kabat, Director General and Chief Executive Officer, IIASA. They were joined by: Special Guest Albert van Jaarsveld, President, National Research Foundation (NRF), South Africa, and Co-Chair, Belmont Forum, International Group of Funding Agencies for Global Change Research; Nebojsa Nakicenovic, Deputy Director General of IIASA; Chin-Min Lee, Special Advisor to the IIASA Director General; Philippe Narval, Managing Director of EFA.

The Sachs lecture is available online at www.iiasa.ac.at/sachs
IIASA Alumni Day 2014

On 29 April, IIASA welcomed alumni from around the world to an Alumni Day in Laxenburg. Over 60 attendees met with former colleagues and shared memories, experiences, and stories of success. They also connected with current IIASA researchers and staff. After a welcome by IIASA Director General and CEO Professor Dr. Pavel Kabat, speakers included IIASA Alumni Martin Parry and Sabine Fuss and current IIASA Research Scholars Shonali Pachauri and David McCollum.

Introduced by Susan Riley with an historical overview of IIASA’s work on climate change and collaboration with the IPCC, presentations focused on IIASA’s past and current contributions to climate change research and the recent IPCC 5th Assessment report, as well as the assessment of the impact of climate change in over 30 years of research at IIASA and elsewhere.

During the afternoon session Susan Riley and Fredy Jäger addressed the audience on behalf of the Alumni Advisory Board, to introduce the IIASA Alumni Association and the multiple ways that IIASA alumni can connect with the Institute and each other, for example through the IIASA Alumni Facebook group and LinkedIn group. They also presented plans for future actions: getting in contact with more alumni, developing local alumni chapters, organizing alumni days in other countries, and other activities to be driven by alumni desires. The session also included vivid dialogue filled with lively narrations from IIASA alumni, moderated by Jill Jäger, former IIASA Deputy Director and researcher.

Following the day of lectures and discussion, current IIASA staff and alumni got together for IIASA’s annual International Dinner. IIASA would like to thank all alumni who contributed with their memories, anecdotes and photos. For those who missed the event, a video is available online.

Friends of IIASA begin fundraising partnership

IIASA’s network in the United States has formed a new organization to help promote the Institute’s research and training activities. Friends of IIASA (FoI) is a tax-exempt organization incorporated in the US for the purpose of activating IIASA’s US community for fundraising and outreach efforts.

In late 2013, the FoI worked closely with IIASA to launch a fundraising campaign for the Peter E. de Jánosi Postdoctoral Fellowship to honor the legacy of IIASA’s sixth Director. This first campaign raised over $80,000 (=€60,000) in only a few months; the campaign goal of $1,000,000 would support the de Jánosi Fellowship for ten years. In March, the FoI Board of Directors met with IIASA Director General and CEO Prof. Dr. Pavel Kabat and the US National Member Organization to develop plans for alumni activities and fundraising in the US.

FoI Board of Directors President Roger Levien, who served as IIASA’s second Director, is enthusiastic about the new organization. He says, “IIASA has many alumni, collaborators and supporters in the US who believe in IIASA’s mission and will welcome the opportunity to contribute.”

The FoI allows US taxpayers to make donations tax free. The organization provides grants to IIASA for the purposes designated by the donors, such as the de Jánosi Fellowship or the IIASA Annual Fund for support of YSSP Fellowships.
The future of the Arctic

IIASA has announced a new flagship initiative which will provide an independent, holistic assessment exploring the potential futures of the Arctic, the fastest warming region on Earth. The Arctic Futures Initiative will be developed in collaboration with a variety of stakeholders. It will bring together scientists from economic, environmental, and social sciences to take an interdisciplinary perspective and produce the first systems analytical view of the region’s possible futures, complexly intertwined with the futures of the Earth.

An important conclusion from several successful recent events organized in Finland and the USA was the need for a holistic, integrative assessment of plausible futures of the Arctic, cutting across different disciplines and individual countries’ strategic interests. As an international, independent, non-governmental institute, IIASA is in the process of initiating an Arctic Futures Initiative as an IIASA flagship initiative, integrating academia, policy, business and media for a holistic understanding of the Arctic.

As part of the new initiative, in collaboration with the Arctic Monitoring and Assessment Programme (AMAP) of the Arctic Council, IIASA hosted a workshop in Laxenburg in May. Participants included scenario experts, Arctic experts, IIASA researchers, and selected stakeholders who met to begin work to develop and test a generalized scenario framework that can be customized and applied for pan-Arctic and regional Arctic scenarios.

The workshop built on synergies between the Arctic Council Adaptation Actions in the Changing Arctic (AACA) project, the Arctic Futures Initiative and related Arctic projects, such as the Pan Eurasian Experiment (PEEX), the Alaskan North Slope Arctic Scenarios Project (NASP) and the new MISTRA project on Arctic Sustainable Development in the European Arctic.

A Special Session was organized in connection with the Arctic Scenarios Workshop for high-level policy stakeholders from Finland, Sweden, Norway, USA and Russia. In cooperation with stakeholders, IIASA will lay out the goals and agenda for the initiative’s work on the Arctic and also bring together national approaches to the holistic Arctic view. A variety of IIASA researchers will provide expertise on complex systems analysis, scenarios, modeling and integrative techniques.

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Tropical Flagship Initiative news

IIASA’s Tropical Flagship Initiative was launched in Jakarta, Indonesia, in February with a kick-off meeting attended by project partners and high-level stakeholders. The new initiative aims to address tropical deforestation by developing sustainable land use options. As part of the meeting, IIASA signed a memorandum of understanding with the Indonesian Delivery Unit to the President (UKP4), and the recently created National REDD+ Agency for Indonesia—the first such agency in the world—to formally agree on collaborating on the initiative.

A new role for science advisors

On 14–15 April IIASA’s Science Advisory Committee (SAC) met for the first time under the leadership of Professor Mary Scholes of Witwatersrand University in Pretoria. Scholes is the third chair of the committee, which was founded in 2002 by the IIASA Council. The SAC advises the IIASA Council and the Director General on the scientific strategy for IIASA to fulfill its mission and goals, with a focus on how the Institute’s science program should evolve to meet emerging global challenges.

Young scientists summer programs

IIASA’s 2014 Young Scientists Summer Program (YSSP) is hosting 48 elite young scientists from around the world who are working on or recently completed their PhD. The current program received a record number of applications, 332 from over 60 different countries. In February 2014, 34 young researchers completed the 3-month Southern African Young Scientists Summer Program (SA-YSSP), now in its second year.

Mexico joins IIASA

On 16 June, as Options goes to press, IIASA announced that the newly formed Mexican National Committee for IIASA will join twenty-one other National Member Organizations (NMOs) that fund and govern the Institute. The new committee includes the Mexican National Council for Science and Technology (CONACYT) and the National Institute of Statistics and Geography (INEGI), bringing together some of Mexico’s leading scientists.
Could solar go viral?

A 2013 YSSP participant and Peccei award winner finds a novel way to explain how energy technologies spread

Why do some technologies spread seemingly overnight, while others never get off the ground? If we could answer this question, the challenge of transitioning from fossil fuels to renewable energy might not seem so daunting.

Benjamin Leibowicz, a participant in last year’s Young Scientists Summer Program (YSSP), spent his summer at IIASA developing a new method for understanding how new technologies spread from place to place, and incorporating this method into IIASA’s MESSAGE Model, an integrated assessment model for energy and climate policy analysis.

The work is important for understanding how renewable energy technologies, such as solar, wind, and bioenergy will spread, particularly in developing countries, which stand to drastically increase their energy use in the future as they expand energy access to underserved populations.

“The impact that emerging low-carbon electricity technologies will have on climate change depends critically upon how quickly they will be transferred from the advanced economies that pioneer them to the developing economies where opportunities to reduce emissions abound,” says Leibowicz.

Leibowicz received IIASA’s annual Peccei award for his study. It will fund him to return to IIASA to continue and deepen his work. He says, “I plan to combine my representation of spatial technology diffusion with a number of other ideas in development at IIASA to develop a comprehensive formulation of technology diffusion for MESSAGE.”

Growing new leaders for Africa

Lanoi Maloiy, participant in the 2013/14 Southern African Young Scientists Summer Program, explores the challenges and strategies of assisting African women to become leaders

Lanoi Maloiy grew up in Nairobi, Kenya. As a child, her parents encouraged her to pursue education to the highest level—encouragement not often provided to young women like Maloiy from the Maasai tribe. The Maasai are a group of semi-nomadic people living in Kenya and Tanzania, many of whom adhere to a very traditional lifestyle.

“I saw very clearly how having access to education makes a difference, and how it presents a limitation for those who don’t have access to education. Especially for girls, not having that education really limits their options,” says Maloiy, now a PhD student at the University of South Australia in Adelaide. In her PhD research, Maloiy is exploring the experiences of women political leaders in Kenya, and particularly, how education influences leadership.

During the 2013/14 Southern African Young Scientists Summer Program (SA-YSSP), Maloiy expanded her research from an education point of view to an interdisciplinary project connecting demography and social science, advised by IIASA researcher Anne Goujon and Petronella Jonck of the Central University of Technology, Free State in South Africa.

During the SA-YSSP, Maloiy analyzed interviews which she had conducted with 18 female political leaders in Kenya, aiming to identify factors and experiences which contributed to their success or held them back. She is currently working on her analysis and plans to submit the work for publication in an academic journal.

“I have a strong desire to be part of research that transforms the lives of Africans,” says Maloiy, “in particular through education and leadership development projects.”

I believe that attending the SA-YSSP has proved an important step towards that.”

Read more about Maloiy and her research in an interview at blog.iiasa.ac.at
Keeping the lights on

Q&A with IIASA Research Scholar Jessica Jewell

Q What is energy security?
A I think the easiest way to understand energy security is by looking at what it’s not. When you have energy security and things work smoothly, nobody pays attention to it. The most famous example of when something went wrong was in 1973, when major petroleum exporting states imposed a six-month oil embargo on the USA and other Western countries. Over the course of a few months, the oil price quadrupled, which had major economic consequences in the midst of an already weak economy. The embargo disrupted not only transportation but also electricity since a large portion of the electricity system was dependent on oil. Ensuring energy security is about building energy systems which are less exposed to risks and more able to recover from potential disruptions.

Q Your work explores the connections between energy security and climate change. What are the trade-offs between these two goals?
A In some ways the two areas are complementary. In some ways, there are trade-offs between them. From a very practical standpoint, to a politician, energy security is really about keeping everything as stable as possible and making sure nothing goes wrong. On the other hand, if we are going to address climate change we are going to need to change our entire energy system. In the short term, there may be a conflict between the two goals. In the long term there’s probably less conflict because if you decarbonize the energy system—that is, if you replace oil, gas, and coal with renewables such as hydropower, solar, and wind—then you end up with lower energy imports. So you can’t face another oil embargo because there’s no oil in the system, and you also end up with a more diverse energy system. That diversity means that if one source fails, you have other eggs in your basket to replace the source that fails.

Q In a recent study, you explored what would happen to energy security if the world addresses climate change by switching to low-carbon fuels. What did you find?
A We examined the whole system of energy trade based on a number of scenarios for climate action. We found that once you get rid of oil, no single fuel steps up to replace it. In other words, the world won’t replace oil with only biofuels. Instead, you end up replacing oil with different things, depending on where you are and what choices you make. Some countries might not want to go nuclear, whereas other countries might be limited with regard to biofuels. The more you limit energy technologies, the greater the risk is that you’ll end up putting all your “energy eggs” in one basket. For example, if nuclear energy is limited, the energy system is forced to rely on solar energy which could be risky if solar technology does not develop in the way we hope.

Q How did you get interested in this subject?
A My original training is as a geologist. I had worked in energy from the scientific and engineering standpoint of how we get oil and building roads for cars to use that oil. But I found myself working on development projects that seemed unsustainable. I was interested in working in a way where I could combine both my quantitative background of how energy systems work with a qualitative policy understanding of what drives energy choices.
Connect with IIASA

Join the IIASA Alumni network to connect with IIASA’s global network of over 300 researchers, postdoctoral scholars, and young scientists from more than 50 countries, as well as over 300 collaborating institutions and 3475 alumni worldwide.

www.iiasa.ac.at/alumni

Support a Young Scientist from a developing country

“I am more than grateful for my YSSP experience and for that I cannot thank the IIASA Annual Fund donors enough for their generosity. As a student from Cambodia, I do not think it would have been possible for me to be part of this superb program at IIASA without their support.”

—Pheakkdey Nguon
Annual Fund Recipient 2012, IPCC Fellowship winner 2013

For many young researchers, IIASA’s Young Scientists Summer Program (YSSP) is a summer of intellectual development and close friendships with colleagues from around the world. Make a difference to the future of an exceptional young scientist from a developing country by supporting IIASA’s Annual Fund.

www.iiasa.ac.at/donate