September 2013 ISSN 2070-4593

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Saleemul Huq

"if every country had a robust plan to adapt to climate change ...no amount of adaptation will be enough to protect people and property from some of the more serious impacts of climate change."

pg.12

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EARTH CONSCIOUS
is published by:
Caribbean PR Agency
#268 Harold Fraser Circular, Valsayn, Trinidad and Tobago, W.I.
T/F: (868) 645-0368
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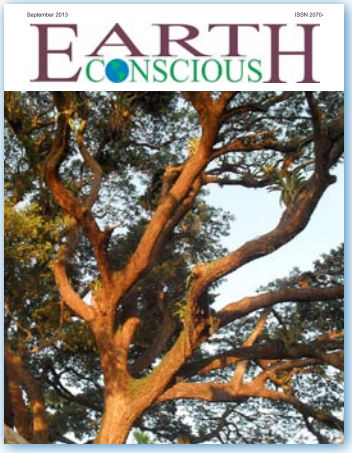
www.earthconsciousmagazine.com



On our Cover

The mighty samaan tree is a legendary member of the tree population in the Caribbean.
Fort King George, Scarborough, Tobago)

Photo: Kathryn Duncan

EARTH CONSCIOUS
September 2013

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From the Editor

In a few months time, countries will gather in Warsaw, Poland to hammer out a global climate change treaty on emissions reduction strategies from 2015-2020.

Poland has set itself a very ambitious and arduous task with a number of set goals to achieve at the end of the global gathering.

At Warsaw, they hope to set the right pace for negotiations under the Ad Hoc Working Group on the Durban Platform for Enhanced Action known as the ADP); clarifying the roadmap to reaching a global agreement at COP 21 and advancing work allowing for fair and global action with respect to closing the emission gap in the years 2015-2020.

It has also committed itself towards ensuring progress in establishing institutional arrangements for addressing loss and damage, addressing the question of climate financing including financing related issues in the period of 2013-2020 and post 2020 and assigning appropriate importance to implementation of the technological and adaptation programs and mechanisms.

On the issue of climate finance, after a long year of exchange and discussion, the UNFCCC's 2013 work programme on long-term climate finance, designed to look into pathways and policy environments to mobilize and deploy scaled-up climate finance to USD 100 billion per year by 2020 from public, private and alternative sources was concluded in the Republic of Korea in mid September.

This process is seen as an important contribution to enhancing the dialogue between contributor and recipient countries as they lay the foundation for shifting to low-carbon, climate-resilient economies.

On a personal note, our magazine, *Earth Conscious*, is beginning its sixth year of publication this month despite battling numerous challenges to remain buoyant. The magazine was created to fill a gap of providing information particularly to the Caribbean and keeping on top of the climate change debate and issues.

Earth Conscious magazine also hosts the Youth Forum on Climate Change in Trinidad and Tobago where hundreds of young delegates participate in debate and discussion on issues.

In November, the third annual Youth Forum will held in Port of Spain with the focus on the impact of climate change on water and food security.

My team and I are looking forward to engaging with the younger generation on how they see these issues should be tackled.

Linda Hutchinson-Jafar

Editor

Caribbean States become Biodiversity Champions

Second phase of Caribbean Challenge Initiative launched

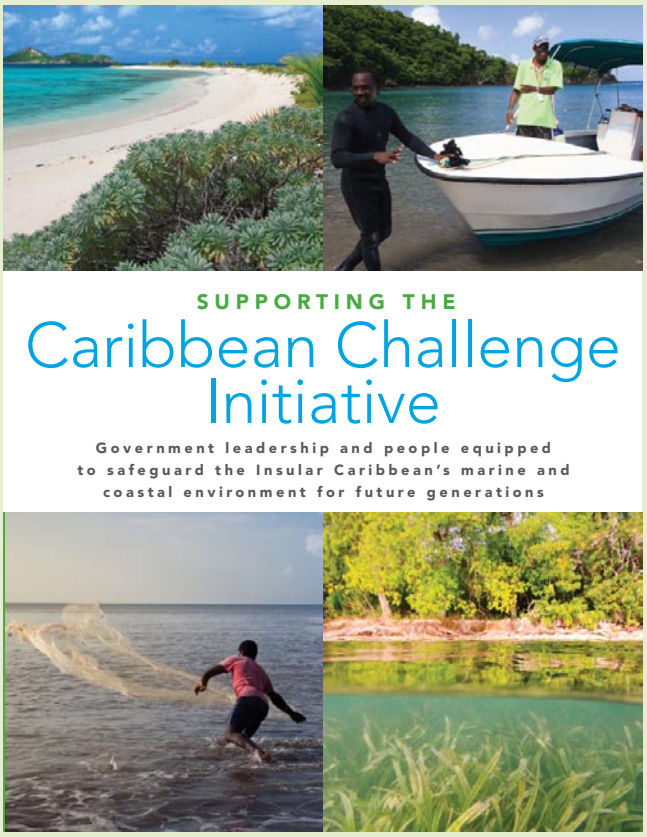
Eight Caribbean governments, in cooperation with business partners, have made significant financial and substantive commitments in support of the Aichi biodiversity targets as part of the second phase of the Caribbean Challenge Initiative, launched at a Summit of Caribbean Political and Business Leaders.

The Bahamas, the British Virgin Islands, the Dominican Republic, Grenada, Jamaica, Saint Kitts and Nevis, Saint Lucia, and Saint Vincent and the Grenadines signed a Leaders Declaration at the Summit of Caribbean Political and Business Leaders (17-18 May 2013, British Virgin Islands) that contains key commitments to marine and coastal conservation including; "in each participating country and territory, to effectively conserve and manage at least 20% of the marine and coastal environment by 2020."

To help progress toward this goal, governments agreed to have in place by 2020, fully functioning sustainable finance mechanisms as a contribution to achieving target 20 of the Strategic Plan for Biodiversity on financial resource mobilization.

Also agreed was a set of seven specific actions covering a broad scope of issues related to the marine environment including marine protected areas, fisheries, tourism, climate change adaptation and marine pollution. The commitments are relevant to the implementation of several Aichi targets, most notably target 11 on marine protected areas, but also support target 14 on ecosystem restoration and safeguarding, and target 15 on resilience and restoration. In addition, fifteen companies signed a corporate compact containing key commitments supporting marine and coastal conservation, including through changes in business practices. The companies formally joined the Caribbean Challenge Initiative.

The Biodiversity Champions campaign, launched at the eleventh meeting of the Conference of the Parties to the Convention on Biological Diversity (CBD) in 2012, allows countries and organizations to make pledges to support one or more of the Aichi biodiversity targets. Relevant commitments announced as part of the second phase of the Caribbean Challenge Initiative amount to US$75 million.



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Small Island States look to 2014 Conference to promote partnerships that advance sustainable development

Practical actions that advance the economic, social, and environmental well-being were at the heart of discussions among government and civil society representatives from island states in Barbados from 28-30 August as they prepare for the global UN Conference on Small Island Developing States that will be held in Apia, Samoa, 1-4 September 2014.

Small island developing states adopted regional positions at meetings that took place this July in Jamaica, Fiji, and the Seychelles that have identified a number of practical and pragmatic actions that could be taken by all countries to accelerate implementation of the outcome of the two previous conference on small island developing states, in Barbados in 1994, and Mauritius in 2005.

The Barbados meeting represented the final opportunity for small island developing states to agree among themselves on common negotiating positions for the conference prior to the start of the formal preparatory process. After January when the global preparatory process is launched, all 193 member states will participate in the preparatory process leading up to the Apia meeting.

"The Barbados meeting will allow small island developing states to chart the way forward," says Conference Secretary-General Wu Hongbo. "Barbados provides an opportunity for the small islands to let the rest of the world know how the world can work together, as partners, to promote sustainable development in the unique circumstances that islanders face."

SIDS delegations during plenary. Photo: iisd.ca

The regional meetings stressed many common issues facing the small island developing states, including climate change, natural disasters, crime and violence, high rates of unemployment—especially among women and youth—and resulting brain drain, the increase in-communicable diseases and other health concerns, and debt sustainability.

Addressing issues related to organized crime and debt sustainability were seen as particularly important for the Caribbean region. All regions felt that the global progress toward implementing the previous agreements on small island developing states was nowhere near what is necessary.

Climate change and ocean related issues figured particularly prominently in the regional meetings, where countries emphasized the concept of the "ocean economy," which encompasses the full range of economic and social development that the ocean can drive.

L-R: Rianna Gonzales, Caribbean Youth Environment Network; Elon McCurdy, Guyana; and Garfield Barnwell, Caribbean Community. Photo: iisd.ca

Countries from varied geographical regions, from the diverse group of Atlantic, Indian Ocean, Mediterranean and South China Seas—known as the AIMS countries—also addressed issues of peace and security, especially in the face of international piracy and organized crime.

Going beyond an elaboration of the problems that the small islands face, countries also looked to possible avenues where forward progress can be made.

The Pacific regional meeting recommended that the theme of the Samoa Conference should be "durable and genuine partnerships". Mr. Wu, in his opening remarks, stated that "the meaningful partnerships, with a focus on institution building and an enhanced support framework for SIDS at the national, regional and international level – must play a central role."

"This inter-regional meeting is the opportunity in the SIDS Conference preparatory process for the island voices to be heard together as one," Mr. Wu stressed, for the SIDS "to make your case for the future you want."

The Caribbean

A vast area, roughly one third the size of the continental United States

10% of the world's coral reefs

10,000 square kilometres of mangrove has as much as 33,000 square kilometres of seagrass beds

12 countries, 17 overseas territories of other countries and a rich mix of cultures

1,400 species of fish and marine animals

11,000 plant species of which 72% are endemics

Many of the species and ecosystems in the Caribbean are **unique and not found elsewhere**

75% of the coral reefs have a threatened status

Source: glispa.org

Youth as UN Partners in Sustainable Small Island Development

Sandwatch students from the Seychelles measure wave height at Beau Vallon Beach. The Sandwatch project seeks to develop awareness of the fragile nature of marine & coastal environments and the need to use them wisely. Photo © Paul Diamond.

On July 2013, UNESCO, UNICEF and UNFPA joined forces to ensure that young people from the 52 Small Island Developing States (SIDS) contribute their vision for the future of small islands to the 2014 Global SIDS Conference which will be held in Apia (Samoa) in September 2014. Three workshops took place in Jamaica, the Fiji Islands and the Seychelles.

In July 2013, 70 young people between the ages of 12 and 30 came together to discuss the future of their small island homes. Representing 30 small island countries and territories in the Caribbean, Pacific and AIMS regions (Atlantic, Indian Ocean, Mediterranean and South China Sea), these young people presented their ideas on the development needs of Small Island Developing States (SIDS) at three regional preparatory meetings for the SIDS 2014 Global United Nations Conference.

The Third International Conference for Small Island Developing States is scheduled to convene during September 2014 in Apia, Samoa. In 1994 Member States of the United Nations came together in Barbados to discuss the special challenges and needs of SIDS. Fourteen key areas were identified covering sustainable environments, energy and communication, tourism and human resource development.

Twenty years later, the United Nations will convene a review and recommitment to development in small islands when the Member States come together in Apia, Samoa. The original Programme of Action and the Implementation Strategy developed in Mauritius during the 10 year review will be examined to determine what progress has been made in 20 years, what challenges still exist and key priorities for internationally agreed development goals in the post 2015 era (linking with the outcomes of the Rio +20 Conference held in 2012 'the Future We Want').

To ensure that young people's voices may be part of this process, UNESCO, UNICEF and UNFPA with support from the regional organisations in SIDS areas (Secretariat of the Pacific Community, Forum Islands Secretariat, the Secretariat for the Pacific Environment Programme and the Indian Ocean Commission) supported three regional youth workshops so that young people from SIDS could share their issues, envision the future young people want, and participate in the process of developing the outcomes of the Apia 2014 Global Conference.

Key issues identified by young people in all three regions were education, health and climate change.

Pacific delegates called for affordable and holistic education, in which young people are provided with the tools to become critical thinkers, active learners, innovators and strong leaders. The AIMS delegates propose that this can be achieved through improving "sustainability literacy" so that every young person from SIDS understands this concept and is empowered to act on it. Building on these concepts in the Caribbean, young people see a future that offers an education, which includes the arts, technical studies, entrepreneurship and community development.

The Caribbean delegates also noted that the provision of quality, accessible and free basic healthcare, including holistic approaches to sexual and health education is required to underpin development in their region.

Sexual and reproductive health and rights (SRHR), mental well-being, and physical health were identified in the Pacific as necessary in building stable and healthy lives to earn a living and contribute to Pacific island development. The AIMS delegates urged that special attention should be paid to the physical, mental and emotional health and safety of youth, through the nurturing of a caring culture in neighborhoods, schools, academic institutions and at the workplace.

Climate change has become a very public concern in many SIDS, which are low lying and are thus particularly exposed to its dangers. . In response to this, delegates in the AIMS region are promoting the reduction of reliance on fossil fuels and developing technology for renewable energy sources such as marine energy as the prime source of energy for SIDS. Caribbean delegates noted the need for this to be grounded on strong awareness raising and capacity development. Pacific delegates also noted the need to promote further alternatives through green jobs.

The role of youth through partnerships, volunteering and activism was noted, along with individual commitments from every delegate to become champions of SIDS in their country and continue to build and develop the concepts from the workshop.

In a final statement, they insisted: "We are the millennial generation, and we stand for action and change. We commit to taking action, doing whatever is within our capacity, to attain a sustainable future. Therefore, we are making the following commitments to make SIDS 2014 a success:

1. Adopting more sustainable lifestyles, educating our local communities and acting as Ambassadors for Change by spreading our message using all available tools.

2. Playing a key role in the post-regional processes for youth nationally.

3. Mobilizing young people for SIDS 2014 and building their capacity as sustainable development advocates."

By Jordan Brandon Jafar

Back to school with a mission

So it's back to school after two months of vacation, particularly for those of us living in the Caribbean.

It was a wonderful carefree vacation which I thoroughly enjoyed. It was a total local vacation, enjoying the beaches, rivers and various sites around Trinidad where I live.

A lot of time was spent outdoors, playing cricket and football with other kids in the neighbourhood. It was simply awesome and kept my carbon footprint to a minimum! And I hope you had a great time as well, whatever you did.

I eagerly anticipated returning to school, especially as I was attending secondary school for the first time. One of the things I discussed with my parents was introducing recycling at the school, if they had not yet implemented such a programme as yet.

I think school is a great place to instil changes among young people and once they get on board, they can do the same at their homes and communities.

I'd like to see paper and bottle bins at special locations at the school to encourage recycling of material.

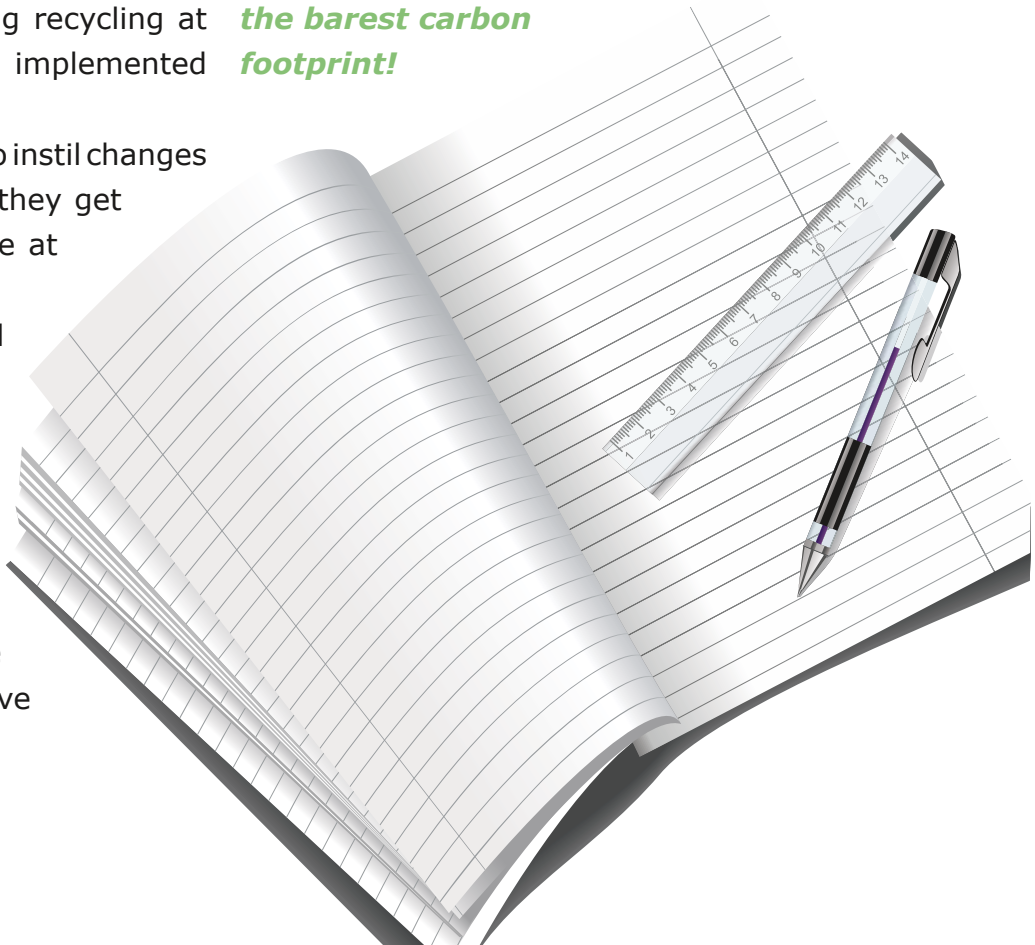
Signs could also be strategically placed in the school about living a green and sustainable life and the simple steps that can be taken to achieve this.

Messages about the environment can also be posted on a school newspaper/bulletin.

So, this is my mission at my new school and of course, doing well in my education and extra-curricular activities.

What about you? What are your own plans for your school?

Jordan dreams of travelling the world one day with the barest carbon footprint!



Trouble for Birds :-(

Climate change does a lot more than just heat up our planet. Climate change can also cause more intense weather. That could mean more hurricanes, floods, heat waves, droughts, and even cold spells.

This extreme weather can be trouble for birds. Scientists have noticed that when extreme weather happens, fewer birds show up in the places they call home. **Why?** One idea is that the birds avoid the extreme weather by moving to a friendlier area.

MAKE YOUR OWN BIRD FEEDER

Want to take a close-up look at the birds in your neighborhood? Follow these simple instructions to make a bird feeder that birds won't be able to resist!

What you will need:
An empty toilet paper roll, some string, peanut butter, bird seed

Step 1: Punch two holes on one end of the toilet paper roll using a pencil. Make sure the holes are across from each other so that you can put a string through it.

Step 2: Put a string through both holes. Tie the loose ends of the string together (so that you can hang it later).

Step 3: Spread peanut butter all around the outside of the toilet paper roll. The peanut butter helps the seeds stick to the feeder.

Step 4: Pour the bird seed onto a plate or other flat surface.

Step 5: Roll the toilet paper roll in the bird seed. Make sure the seeds stick to the outside! This step can be a bit messy!

Step 6: Hang your new bird feeder outside near a window so you can see it from inside.

Step 7: Wait for birds to come and feast on your fancy new bird feeder!

A finished toilet-paper-roll bird feeder.

Source: NASA's Climate Kids http://climatekids.nasa.gov/extreme-weather-birds/

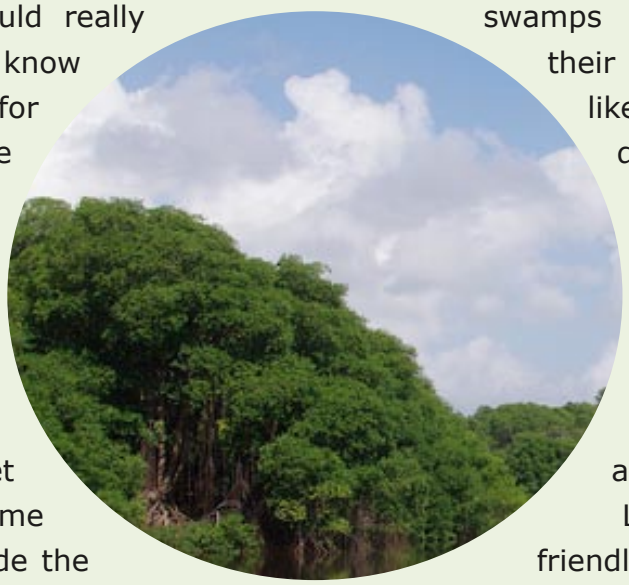
Caring about our environment

By Jo-Anne Nina Sewlal

Attention on environmental problems has increased over the past 50 years or so, even more so in the age of social media like Facebook and Twitter. But does all this attention mean that we really care about our environment. Besides social media, many fields of science have placed much attention on our environment because its resources are running low and if not preserved will run out.

The cause for our declined resources is blamed on our actions. Therefore if our actions are to blame shouldn't we be quite passionate about preserving our home? This article will go through some reasons why we should care about our environment and why people have "stopped" caring.

The question we should really be asking first is do we know why we should care for the environment? One reason is because of the ecosystem services that our environment provides. Without these we would not get the resources or ideal conditions on the planet for our existence. Some ecosystem services include the job done by pollinators like bees, wasps and bats, just to name a few. Bees are documented to be responsible for pollinating over 40 crop plants. So without them our food security will be seriously compromised.



We also cannot underestimate the role that our vegetation plays as well, which is two-fold. The first is that they purify our air. The carbon dioxide in the atmosphere responsible for global warming, a result of climate change, is taken in by plants as part of photosynthesis and oxygen emitted as a by-product.

Our vegetation also provides us with clean water. For example in wetlands plants like Water Hyacinths actually absorb and store heavy metals from the surrounding water. Mangrove swamps trap sediment between their roots and toxic chemical like excess nutrients from dissolved fertilizers and heavy metals preventing them from reaching our groundwater. Forests absorb excess nutrients in water preventing it from entering our rivers and streams.

Leading an environmentally friendly lifestyle does not only benefit the environment but the individual in many aspects of their life. For instance, if we do not protect and preserve it, what will be left for future generation to enjoy?

Unfortunately it is human nature to put a price tag on almost everything and our environment is no exception. The good news is that this lifestyle is also good for our wallet.

Technology and environmentally-friendly products are becoming more affordable. What must be also kept in mind is that these technologies aim to save money by reducing energy consumption and reusing existing resources.

Also when something happens in the environment it can literally stop our way of life for example, the ash produced by the eruptions of the volcano Eyjafjallajökull in Iceland in 2010 which crippled air travel in Britain and much of northern Europe with flights being delayed or cancelled. This prevented people, mail and freight for personal or business reasons, from being transported by air not only in Europe but worldwide.

Nature has shown its great power many time throughout history for instance the eruption of Mt Vesuvius in Italy in the year 79 AD leveling the city of Pompeii with the hot gas killing people long before they were engulfed by the hot magma.

The Caribbean is not immune to such violet acts of nature where the active Soufrière Hills volcano on the island of Montserrat, has left approximately two-thirds of the island unsafe for human habitation, with the former capital city of Plymouth being referred to as the Caribbean Pompeii.

But with all these benefits that our environment provides us with and its immense power do we really care about our environment? Surveys in large developed countries like the USA showed that the state of the environment has not lost importance but its priority level on peoples' lists of concern has fluctuated especially after the 2001 attack on the World Trade Centre.

This event caused a shift in thinking towards terrorism, crime, safety and then job security. These surveys also showed that the people with the state of the environment as a top priority were those from urban areas which faced pollution everyday like smog and little natural vegetation. Basically they knew the loss of the natural environment, while those in rural areas where the primary vegetation was still intact did not think much of the environment because they did not know what it was like to lose it.

"Going green" might be seen as trendy, with the health of the environment in the forefront of news today, with many businesses, institutions and individuals choosing to lead a more environmentally friendly lifestyle.

Some businesses may be genuinely concerned and consumers that have limited time or on a tight budget can do very little in terms of volunteering, etc. so buy buying environmentally-friendly products, consumers are doing their passive part to help the environment. However, other consumers may see these companies going "green" as a marketing ploy and fuel their lack of concern.

So we can see that every organisms from tiny insects to mighty trees, play a part in preserving and maintaining our environment and providing the resources necessary for our survival on this planet. I don't know about you but I don't want to leave a habitable planet and take off into space like the homeless species in science fiction series looking for a new place to settle down. Then again our technology has not reached the level of that seen in Star Trek so we could not runaway to a new planet even if we wanted to.

The author works with the Department of Life Sciences, University of the West Indies, Trinidad

Jo-Anne: 'Home sweet home to me means planet Earth."

A house with many rooms:

Addressing loss and damage from climate change

By Saleemul Huq

Cyclone Nargis destroyed this home in Rangoon, Myanmar in 2008
Photo: US Department of State

The global community has been too slow to limit greenhouse gas emissions and too slow to adapt to the impacts that climate change will bring. Loss and damage are now inevitable.

Even if every country had a robust plan to adapt to climate change —which they do not—no amount of adaptation will be enough to protect people and property from some of the more serious impacts of climate change. Think of the vast damage that an extreme such as Superstorm Sandy can cause, or consider the certainty that some low-lying land will be forever submerged beneath rising seas by the end of this century.

In such cases, loss and damage carries both human and economic costs. And while the human costs can never be repaid, the economic ones can. The question then is: who should pay?

Given that many of the economic impacts of climate change will fall upon the countries and communities that have done least to cause the problem, it might seem obvious that those responsible for creating climate change should foot the bill.

While this principle – that victims can seek recompense from those who have harmed them — is central to the law of most countries, it remains a politically contentious topic in the international context of climate change.

Towards international rules

At the international negotiations under the UN Framework Convention on Climate Change, rich countries – led by the United States – have wanted to prevent any discussion of the topic. Meanwhile the developing nations – led by the small island developing states and the least developed countries have argued for an international mechanism that would compensate countries that suffer loss and damage.

After very strongly contested negotiations at the last conference of parties to the UNFCCC in Doha, Qatar, last year, the international community decided at last to examine options for such a mechanism. As the different parties to the convention get ready for the next conference, in Warsaw in November this year, they must get ready to discuss loss and damage again in a more substantive way.

Recent international and regional meetings have explored ways forward. At one such meeting, which the Asia Pacific Adaptation Network held in Bangkok in August,more than one hundred experts met to discuss the scientific aspects of the issue with support from the government of Japan. They identified research questions and areas in which researchers from developed and developing countries could collaborate. But more science is only part of the solution. We also need a political response and a new era in climate change diplomacy, that of global solidarity.

A house with many rooms

In my keynote address to the meeting in Bangkok, I said that in the context of the UNFCCC, the issue of loss and damage is like a house with many rooms. The poor countries want to go in and explore those rooms but the rich countries don't want to enter the house.

This is because the rich countries know that there is a room there called "liability", which leads to another room called "compensation". They are afraid of ending up in that room, and so have tried to prevent anyone from even entering the house.

But the rich should not be scared of this house. It has many other rooms with names like "research to minimise losses", "sharing knowledge", "insurance", "risk retention" and "solidarity payments". Moreover, the rooms called "liability" and "compensation" are behind a big door labelled "attribution", and that door is locked shut.

This is because it is impossible to say yet which floods or hurricanes and other disasters are due to the climate change human activities have created, and which would have happened anyway. The key to that door has not yet been forged. Its blacksmiths are the scientific community, and while they may be able to make that key in the future, it is not available yet.

As the rich nations prepare for the Warsaw negotiations, they should not let their fear of what lies behind that door get in the way of action on loss of damage in the other rooms, which ultimately will diminish that which they fear the most.

The writer is Director of the International Centre for Climate Change and Development at the Independent University, Bangladesh, and a senior fellow in the climate change group at the International Institute for Environment and Development.

UNFCCC establishes collaboration centre with Latin America's development bank

In an effort to bring the benefits of the Kyoto Protocol's clean development mechanism (CDM) to currently underrepresented countries in Latin America, the United Nations Framework Convention on Climate Change (UNFCCC) secretariat has joined with the development bank of Latin America (CAF) to establish a CDM regional collaboration centre (RCC) in Bogotá, Colombia.

This is the fourth CDM RCC established by the UNFCCC and a regional organization with the aim to support development of CDM projects. The first centre opened in Lomé, Togo to increase participation in CDM projects in West and Francophone Africa. The second one was established in Kampala, Uganda to serve the rest of Africa, and the third was established in Saint George's, Grenada to assist in the development of CDM projects in the Caribbean.

Christiana Figueres

"The CDM has demonstrated what can be achieved when we use markets to incentivize action on climate change and development," said UNFCCC Executive Secretary Christiana Figueres. "The RCC in Bogotá will help tap the potential for CDM projects in Latin America and serve as a working example of the kind of inter-agency cooperation necessary to tackle climate change."

The office in Bogotá will become operational on 1 September 2013 and provide support in all countries in Latin America.

Enrique García.

CAF Executive President Enrique García praised the cooperation agreement as an important step for sustainable economic growth.

"Through the development and financing of such innovative projects, we are helping to combat globalwarming and promote the use of clean and renewable energy in the region. We are honored that the UNFCCC has chosen us as the only Latin America centre that can pave the way towards a low carbon economy," said Enrique García.

The RCC in Bogotá, Colombia will:

- Identify priority areas for the development of standardized baselines, which enable registration of increased numbers of projects by decreasing complexity, reducing transaction costs and factoring in local circumstances;
- Identify opportunities for potential projects and programmes of activities eligible under the CDM;
- Provide direct support in the development of project design documents for such projects; and
- Work in collaboration with current and future RCCs, , in Africa, the Caribbean and Asia.

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Rakhi Bond of Protection

By Bogusia Sipiora

There are many important festivals in the Hindu calendar that actually the entire year in India can be taken as a celebration.

Apart from main nationwide festivals, there are regional and local traditions which have great significance for individuals and are passed down eagerly to the younger generations.

One of the festivals celebrated by Hindus in the most auspicious month of Shravan (August) at full moon is raksha bandhan (rakhi).

Originally rakhi, which is also a holy thread, was tied by sisters on their brothers' wrists to symbolize an unbreakable relationship between siblings and to protect against evils.

Today it is popular among all people, regardless of affinity, beliefs, race and nationality. All soul mates tie rakhi as an amulet and symbol of trust, friendship, loyalty and reliability.

Raksha bandhan like most of the festivals in India gathers families for prayers and sweet feasts. All generations listen to legends which let them know and understand the culture they are living in. Usually they lead to gods who passed traditions to humans.

My favorite is about Krishna who happened to hurt himself during a mythological fight. One of his beloved girls, Drupadi seeing a bleeding finger, in a split second tore a piece of her own sari, which happened to be red, and tied it around the wound. It is said to be the first ever rakhi. Krishna in return took care of the girl just like a brother is supposed to protect his sister.

I was advised not to forget that rakhi puts a responsibility on both sides. While a sister promises prayers to the gods for prosperity and good health of the brother, he is taking a solemn promise to take care of her in return.

Bogusia is amazed at the variety of fashionable rakhis people wear on their wrists.

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Which Coastal Cities Are at Highest Risk of Damaging Floods? New Study Crunches the Numbers

Rapid urbanization in Vietnam has brought both opportunities and challenges to Ho Chi Minh City. Photo: Tran Viet Duc / World Bank

STORY HIGHLIGHTS

- Coastal cities face a high risk from increasingly costly flooding as sea levels rise amid climate change. Their current defenses will not be enough as the water level rises.
- A new study pinpoints cities around the world that will be most at risk and finds the costs of global flood damage could rise to $1 trillion a year if cities don't take steps to adapt.
- The authors encourage early action and warn that some of the cities where flood risk will increase the most in the coming years are not the cities where the risk is particularly high today.

Climate change, rapid urbanization, and subsiding land are putting the world's coastal cities at increasing risk of dangerous and costly flooding, a new study calculating future urban losses from flooding shows.

The study, led by World Bank economist Stephane Hallegatte and the OECD, forecasts that average global flood losses will multiply from $6 billion per city in 2005 to $52 billion a year by 2050 with just social-economic factors, such as increasing population and property value, taken into account. Add in the risks from sea-level rise and sinking land, and global flood damage could cost $1 trillion a year if cities don't take steps to adapt.

Most coastal cities' current defences against storm surges and flooding are designed to withstand only current conditions. They aren't prepared for the rising sea levels accompanying climate change that will make future floods more devastating, the authors write. Protecting these cities in the future will take substantial investment in structural defences, as well as better planning, they write.

The findings add to a series of recent studies, led by the World Bank's *Turn Down the Heat* reports, that have looked closely at expected rises in sea level and their impact on vulnerable regions around the world.

Who is most at risk?

The new study, part of an ongoing OECD project, examined maps and databases of population and world assets, flood-prone regions, storm frequency data, and cost of damage models for 136 large coastal cities. For the first time, it took into account existing coastal defenses and their level of protection.

In terms of the overall cost of damage, the cities at the greatest risk are: 1) Guangzhou, 2) Miami, 3) New York, 4) New Orleans, 5) Mumbai, 6) Nagoya, 7) Tampa, 8) Boston, 9) Shenzen, and 10) Osaka. The top four cities alone account for 43% of the forecast total global losses.

However, developing-country cities move up the list when flood costs are measured as a percentage of city gross domestic product (GDP). Many of them are growing rapidly, have large populations, are poor, and are exposed to tropical storms and sinking land.

The study lists the 10 most vulnerable cities when measured as percentage of GDP as: 1) Guangzhou, China 2) New Orleans, United States; 3) Guayaquil, Ecuador; 4) Ho Chi Minh City, Vietnam; 5) Abidjan, Cote d'Ivoire; 6) Zhanjing, China; 7) Mumbai, India; 8) Khulna, Bangladesh; 9) Palembang, Indonesia; and 10) Shenzen, China.

In most of these cities, the poor are most at risk as rapid urbanization has pushed them into the most vulnerable neighborhoods, often in low-lying areas and along waterways prone to flooding.

Taking action now

One warning from the study's findings appearing in the journal Nature Climate Change is that the cities where flood risk will increase most are not the cities where the risk is particularly high today. Port cities that haven't been highly vulnerable in the past are among those facing the greatest increase in risk by 2050. Leading the cities with the greatest increase in risk are Alexandria, Egypt; Barranquilla, Colombia; Naples, Italy; Sapporo, Japan; and Santo Domingo, Dominican Republic.

"Coastal defenses reduce the risk of floods today, but they also attract population and assets in protected areas and thus put them at risk in case of the defense fails, or if an event overwhelms it. If they are not upgraded regularly and proactively as risk increases with climate change and subsidence, defenses can magnify – not reduce – the vulnerability of some cities," Hallegatte said.

With better defenses, more people will be dependent on dikes and sea walls, and losses when those defenses fail to protect the city will get bigger. Along with better structural defenses, cities will need better crisis management and contingency planning, including early warning systems and evacuation plans, Hallegatte said.

In cities where flood damage hasn't been common, spending money on flood defenses can be politically unpopular. The challenge facing government officials today is investing in protection before the damage occurs.

For small countries, protection and preparation are especially important. A devastating flood in a key city can stall the entire economy of a small country, making recovery and reconstruction even more difficult. For all of the cities, the preparation will save lives and money in the future.

Soil biodiversity will be crucial to future land management

Research by scientists at The University of Manchester and Lancaster shows maintaining healthy soil biodiversity can play an important role in optimising land management programmes to reap benefits from the living soil. The findings, published in the latest edition of the journal PNAS, extend the understanding about the factors that regulate soil biodiversity.

The team says more research on soil food webs -- the community of organisms living all or part of their lives in the soil -- and their response to land use and climate change could also improve predictions of climate change impacts on ecosystems.

In one of the largest studies of its kind, a team of researchers from across Europe looked at soil life in 60 sites across four countries, the UK, Sweden, Greece and the Czech Republic, to assess the role of soil food webs in nutrient cycles in agricultural soils.

Soil food webs describe the community of organisms living all or part of their lives in the soil and their complex living system interacting with other substances such as carbon and nitrogen. The study shows for the first time that there is a strong link between soil organisms and the overall functioning of ecosystems.

Until now most studies which have investigated the reduction of soil biodiversity and how this affects carbon and nitrogen cycling have been laboratory-based or focused on one group of organisms in the soil rather than the wider picture. This is the first time researchers have looked at the entire community of organisms. The team explored soil found under land used in various ways including intensive wheat rotation farming and permanent grassland. It found there were consistent links between soil organisms and soil food web properties and ecosystem functioning on a large scale, across European countries.

Dr. Franciska De vries, from The University of Manchester's Faculty of Life Sciences who was lead author of the research, said: "We found that the condition of the soil was less tied to how the land was used and more influenced by the soil food web properties.

"Soils contain a vast diversity of organisms which are crucially important for humans. These organisms help capture carbon dioxide (CO_2) which is crucial for helping to reduce global warming and climate change.

"This research highlights the importance of soil organisms and demonstrates that there is a whole world beneath our feet, inhabited by small creatures that we can't even see most of the time. By liberating nitrogen for plant growth and locking up carbon in the soil they play an important role in supporting life on Earth."

The researchers hope the findings will help in predicting how land use and climate change will impact on ecosystems and looking at ways to minimise negative changes.

"Soil biodiversity is under threat by a range of pressures such as urbanisation, climate change, pollution and expanding production of food, fibre and biofuel but the topic remains severely understudied.

"We hope that this research will in the longer term will help us to devise ways for farmers, landowners and conservation agencies to optimise the way they manage land to reap benefits from the living soil and reduce carbon emissions."

Dr. De vries

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2012 was one of the 10 warmest years on record globally

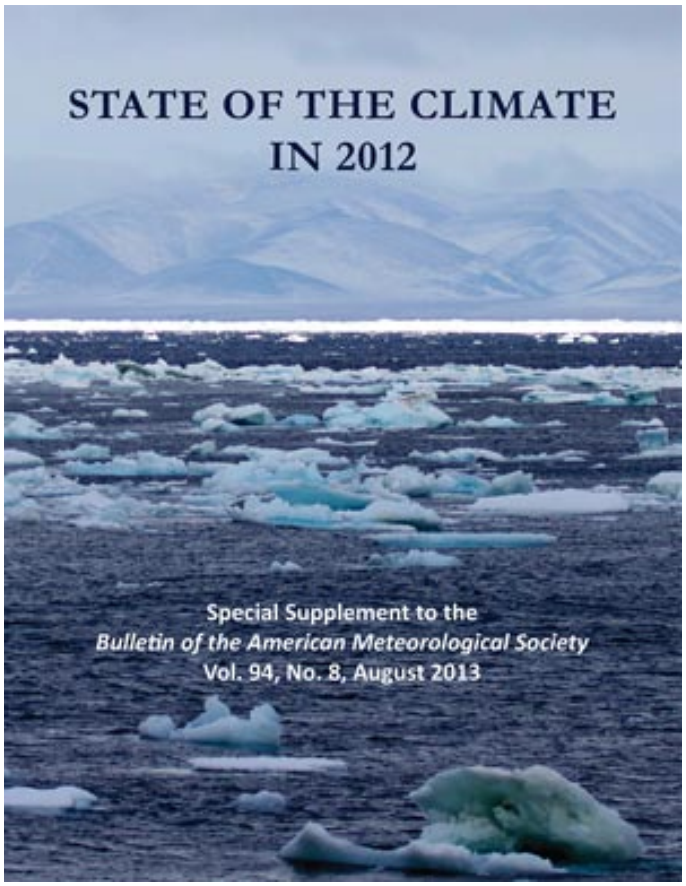
The end of weak La Niña, unprecedented Arctic warmth influenced 2012 climate conditions

Worldwide, 2012 was among the 10 warmest years on record according to the *2012 State of the Climate* report released by the American Meteorological Society (AMS). The peer-reviewed report, with scientists from NOAA's National Climatic Data Center in Asheville, N.C., serving as lead editors, was compiled by 384 scientists from 52 countries.

It provides a detailed update on global climate indicators, notable weather events, and other data collected by environmental monitoring stations and instruments on land, sea, ice, and sky.

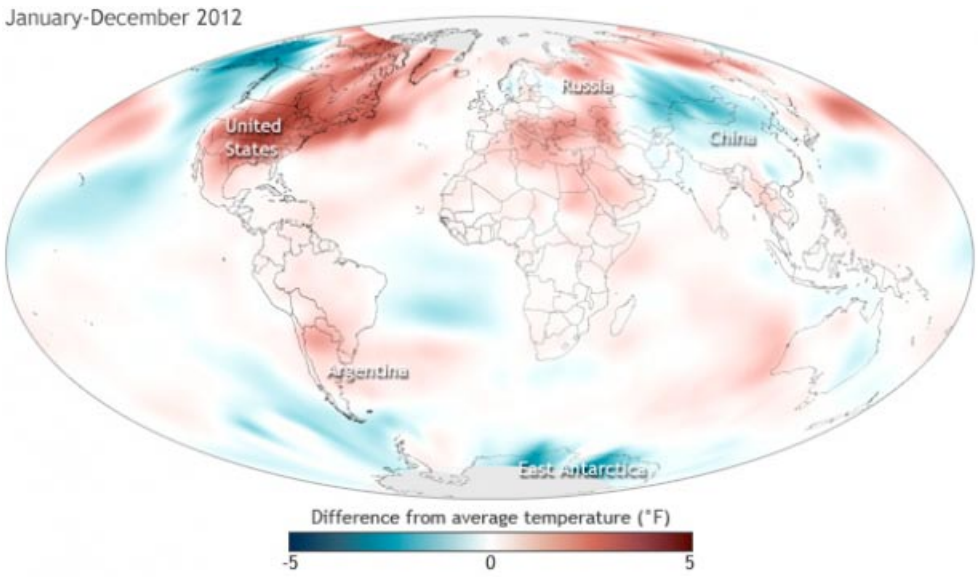
"Many of the events that made 2012 such an interesting year are part of the long-term trends we see in a changing and varying climate — carbon levels are climbing, sea levels are rising, Arctic sea ice is melting, and our planet as a whole is becoming a warmer place," said Acting NOAA Administrator Kathryn D. Sullivan, Ph.D. "This annual report is well-researched, well-respected, and well-used; it is a superb example of the timely, actionable climate information that people need from NOAA to help prepare for extremes in our ever-changing environment."

Conditions in the Arctic were a major story of 2012, with the region experiencing unprecedented change and breaking several records. Sea ice shrank to its smallest "summer minimum" extent since satellite records began 34 years ago. In addition, more than 97 percent of the Greenland ice sheet showed some form of melt during the summer, four times greater than the 1981–2010 average melt extent.



The *2012 State of Climate* report (Credit: NOAA).
Click image to access report online

The report used dozens of climate indicators to track and identify changes and overall trends to the global climate system. These indicators include greenhouse gas concentrations, temperature of the lower and upper atmosphere, cloud cover, sea surface temperature, sea-level rise, ocean salinity, sea ice extent and snow cover. Each indicator includes thousands of measurements from multiple independent datasets.

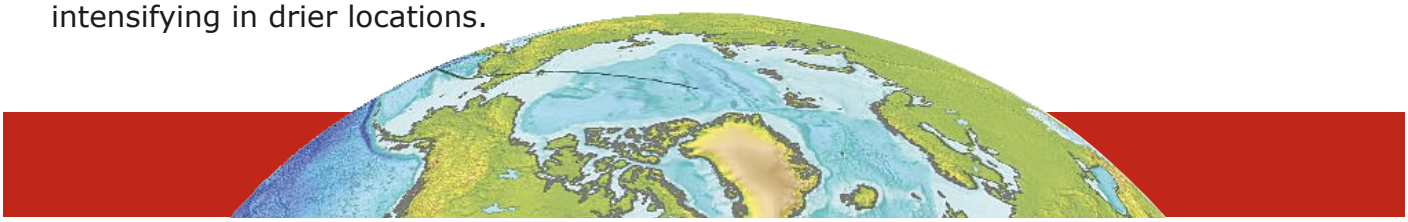


Temperature in 2012 compared to the 1981-2010 average.
Credit: NOAA Climate.gov, based on NCDC data.

Highlights:

- **Warm temperature trends continue near Earth's surface**: Four major independent datasets show 2012 was among the 10 warmest years on record, ranking either 8th or 9th, depending upon the dataset used. The United States and Argentina had their warmest year on record.
- **La Niña dissipates into neutral conditions**: A weak La Niña dissipated during spring 2012 and, for the first time in several years, neither El Niño nor La Niña, which can dominate regional weather and climate conditions around the globe, prevailed for the majority of the year.
- **The Arctic continues to warm; sea ice extent reaches record low**: The Arctic continued to warm at about twice the rate compared with lower latitudes. Minimum Arctic sea ice extent in September and Northern Hemisphere snow cover extent in June each reached new record lows. Arctic sea ice minimum extent (1.32 million square miles, September 16) was the lowest of the satellite era. This is 18 percent lower than the previous record low extent of 1.61 million square miles that occurred in 2007 and 54 percent lower than the record high minimum ice extent of 2.90 million square miles that occurred in 1980. The temperature of permafrost, or permanently frozen land, reached record-high values in northernmost Alaska. A new melt extent record occurred July 11–12 on the Greenland ice sheet when 97 percent of the ice sheet showed some form of melt, four times greater than the average melt this time of year.
- **Antarctica sea ice extent reaches record high**: The Antarctic maximum sea ice extent reached a record high of 7.51 million square miles on September 26. This is 0.5 percent higher than the previous record high extent of 7.47 million square miles that occurred in 2006 and seven percent higher than the record low maximum sea ice extent of 6.96 million square miles that occurred in 1986.

- **Sea surface temperatures increase**: Four independent datasets indicate that the globally averaged sea surface temperature for 2012 was among the 11 warmest on record. After a 30-year period from 1970 to 1999 of rising global sea surface temperatures, the period 2000–2012 exhibited little trend. Part of this difference is linked to the prevalence of La Niña-like conditions during the 21st century, which typically lead to lower global sea surface temperatures.
- **Ocean heat content remains near record levels**: Heat content in the upper 2,300 feet, or a little less than one-half mile, of the ocean remained near record high levels in 2012. Overall increases from 2011 to 2012 occurred between depths of 2,300 to 6,600 feet and even in the deep ocean.
- **Sea level reaches record high**: Following sharp decreases in global sea level in the first half of 2011 that were linked to the effects of La Niña, sea levels rebounded to reach record highs in 2012. Globally, sea level has been increasing at an average rate of 3.2 ± 0.4 mm per year over the past two decades.
- **Ocean salinity trends continue**: Continuing a trend that began in 2004, oceans were saltier than average in areas of high evaporation, including the central tropical North Pacific, and fresher than average in areas of high precipitation, including the north central Indian Ocean, suggesting that precipitation is increasing in already rainy areas and evaporation is intensifying in drier locations.
- **Tropical cyclones near average**: Global tropical cyclone activity during 2012 was near average, with a total of 84 storms, compared with the 1981–2010 average of 89. Similar to 2010 and 2011, the North Atlantic was the only hurricane basin that experienced above-normal activity.
- **Greenhouse gases climb**: Major greenhouse gas concentrations, including carbon dioxide, methane, and nitrous oxide, continued to rise during 2012. Following a slight decline in manmade emissions associated with the global economic downturn, global CO2emissions from fossil fuel combustion and cement production reached a record high in 2011 of 9.5 ± 0.5 petagrams (1,000,000,000,000,000 grams) of carbon , and a new record of 9.7 ± 0.5 petagrams of carbon is estimated for 2012. Atmospheric CO2 concentrations increased by 2.1 ppm in 2012, reaching a global average of 392.6 ppm for the year. In spring 2012, for the first time, the atmospheric CO2concentration exceeded 400 ppm at several Arctic observational sites.
- **Cool temperature trends continue in Earth's lower stratosphere**: The average lower stratospheric temperature, about six to ten miles above the Earth's surface, for 2012 was record to near-record cold, depending on the dataset. Increasing greenhouse gases and decline of stratospheric ozone tend to cool the stratosphere while warming the planet near-surface layers.



CLIMATE CHANGE AND AGRICULTURE IN SOUTHERN AFRICA:

New book helps region understand what might be in store and what to do about

The southern region of Africa could be the hardest hit by rising temperatures from climate change, leaving many to wonder what this means for agriculture. Will some areas become unsuitable for farming? Will farmers face lower yields, or turn to new crops? Will climate change threaten food security? These are challenging questions for policymakers, who must plan for the future without available information and analysis.

A new book, published by the International Food Policy Research Institute (IFPRI), and released today by three research organizations, starts to fill this information gap. Southern African Agriculture and Climate Change offers an analysis of the impact of climate change on the area's agriculture, including full-color maps illustrating a variety of scenarios for eight of the region's countries : Botswana, Lesotho, Malawi, Mozambique, South Africa, Swaziland, Zambia, and Zimbabwe.

"National climate change adaptation policies are not informed by robust research evidence combining socioeconomic and biophysical models," said Sepo Hachingonta, program manager for the Food, Agriculture, and Natural Resources Policy Analysis Network(FANRPAN), a regional agricultural research and development organization. "This book offers that evidence but also urges additional and extensive cost-benefit analysis research on climate change adaptation alternatives."

The book is the result of a collaboration between IFPRI, the CGIAR research program on Climate Change, Agriculture and Food Security (CCAFS), FANRPAN, and scientists from each of the countries. Using sophisticated modeling and available data to develop future scenarios and explore a range of climate change consequences for agriculture, food security, and resource management, the book offers recommendations to national governments and regional agencies.

Some findings from the book:

- Wheat is particularly vulnerable to high temperatures in most of the tropics, but in relatively temperate South Africa, yields could increase.
- Maize and sorghum yields, on average, will decline, yet some areas are bright spots and will see a rise, such as southern Mozambique.
- Crop yields might struggle to keep pace with anticipated population growth, but this could be offset by a projected doubling of incomes across the region.
- Migration patterns could change as people migrate out of areas hard hit by climate change to cities or to areas favored by climate change.
- Successful agricultural adaptation to climate change is not just about better seeds and practices, but building better roads and education systems, which give farmers greater access to markets and the background necessary to make fully informed decisions about new agricultural practices.

Companies see Extreme Weather, Climate Change as Growing Business

Most major companies see extreme weather and other climate change impacts as current or near-term business risks, but lack the data and tools needed to effectively assess and manage these risks, according to a report released by the Center for Climate and Energy Solutions (C2ES).

The report, "Weathering the Storm: Building Business Resilience to Climate Change," provides a detailed snapshot of the state of resilience planning among a cross-section of global companies.

C2ES found that 90 percent of companies in the Standard and Poor's Global 100 Index identify extreme weather and climate change as risks, and most have experienced climate impacts or expect to within 10 years. Top concerns include damage to facilities, loss of water or power supplies, higher costs, and disruption of supply and distribution chains.

Although most companies are well aware of these risks, relatively few are investing in resilience beyond "business as usual" because of a lack of information and tools to help them relate these risks to their specific business operations.

"Companies know how to navigate a changing business environment. Now they face a changing physical environment, as climate change leads to more extreme heat, drought and flooding," said C2ES President Eileen Claussen. "Many companies are asking whether they've entered a 'new normal.' They need help assessing and managing these rising risks to the bottom line."

The report synthesizes the findings from a comprehensive review of public disclosures by S&P Global 100 companies, in-depth case studies of six companies, and a resilience workshop with business leaders from a wide range of industries. It examines how companies perceive their climate-related risks, the steps they are taking or plan to take, emerging best practices in building business resilience, and what's standing in the way.

"Weather-related disasters and other climate change impacts can affect a company's supplies, production, distribution, and property. As extreme weather events become more frequent and intense, it's vital for companies to have the right tools and accurate information so that they can assess and manage their risks," said report co-author Meg Crawford.

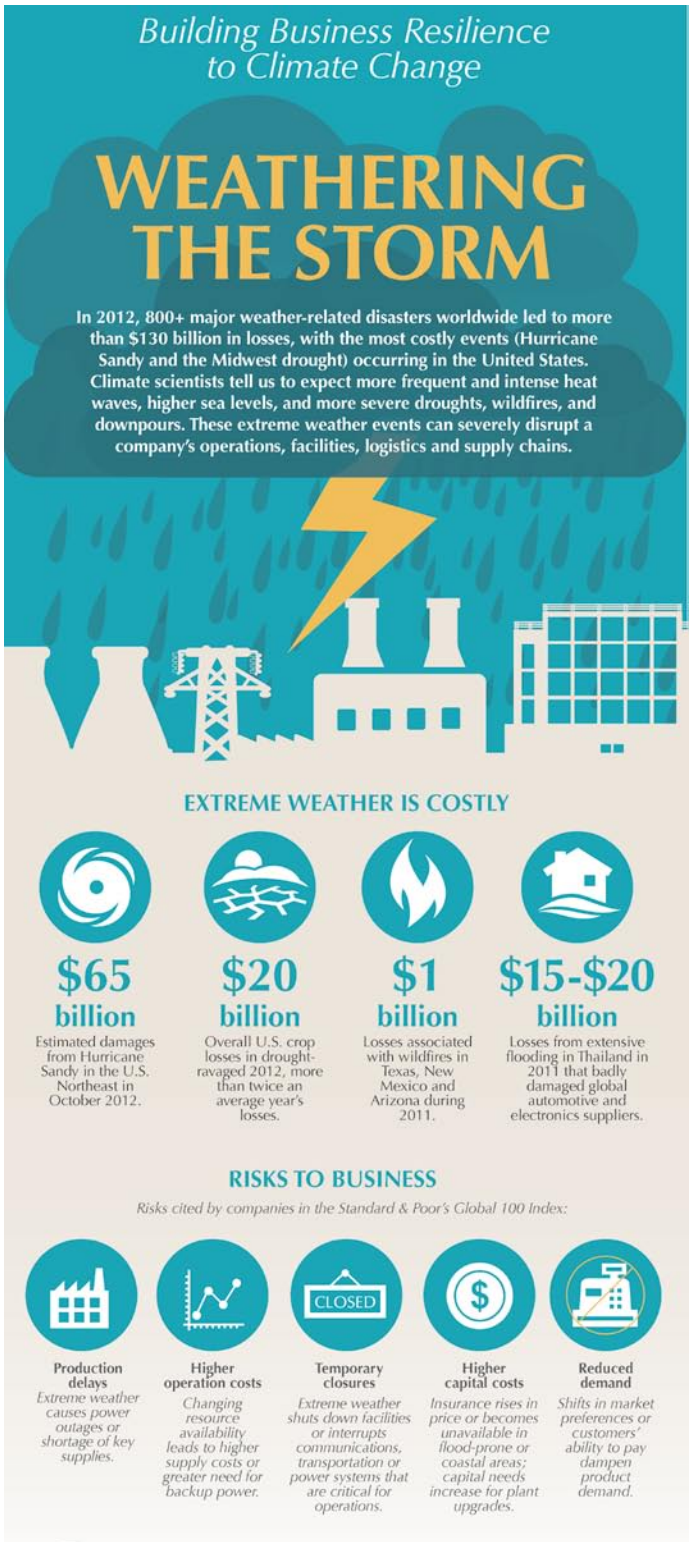
Based on case studies of American Water, Bayer, The Hartford Group, National Grid, Rio Tinto and Weyerhaeuser, C2ES developed a four-step framework for managing climate risks and recommended other actions for overcoming obstacles to building broader business resilience.

Key Findings

- Nearly all — 90 percent — of S&P Global 100 Index companies identify extreme weather and climate change as current or future business risks, across all industry sectors.
- 62 percent say they are experiencing climate change impacts now, or expect to in the coming decade.
- Companies are most concerned about the direct impacts of extreme weather on property, production and supplies, and indirect impacts on operational costs, such as higher prices for commodities or insurance.
- Most companies are managing these risks through existing business continuity and emergency management plans. Only a few have used climate-specific tools to comprehensively assess risks.

Recommendations

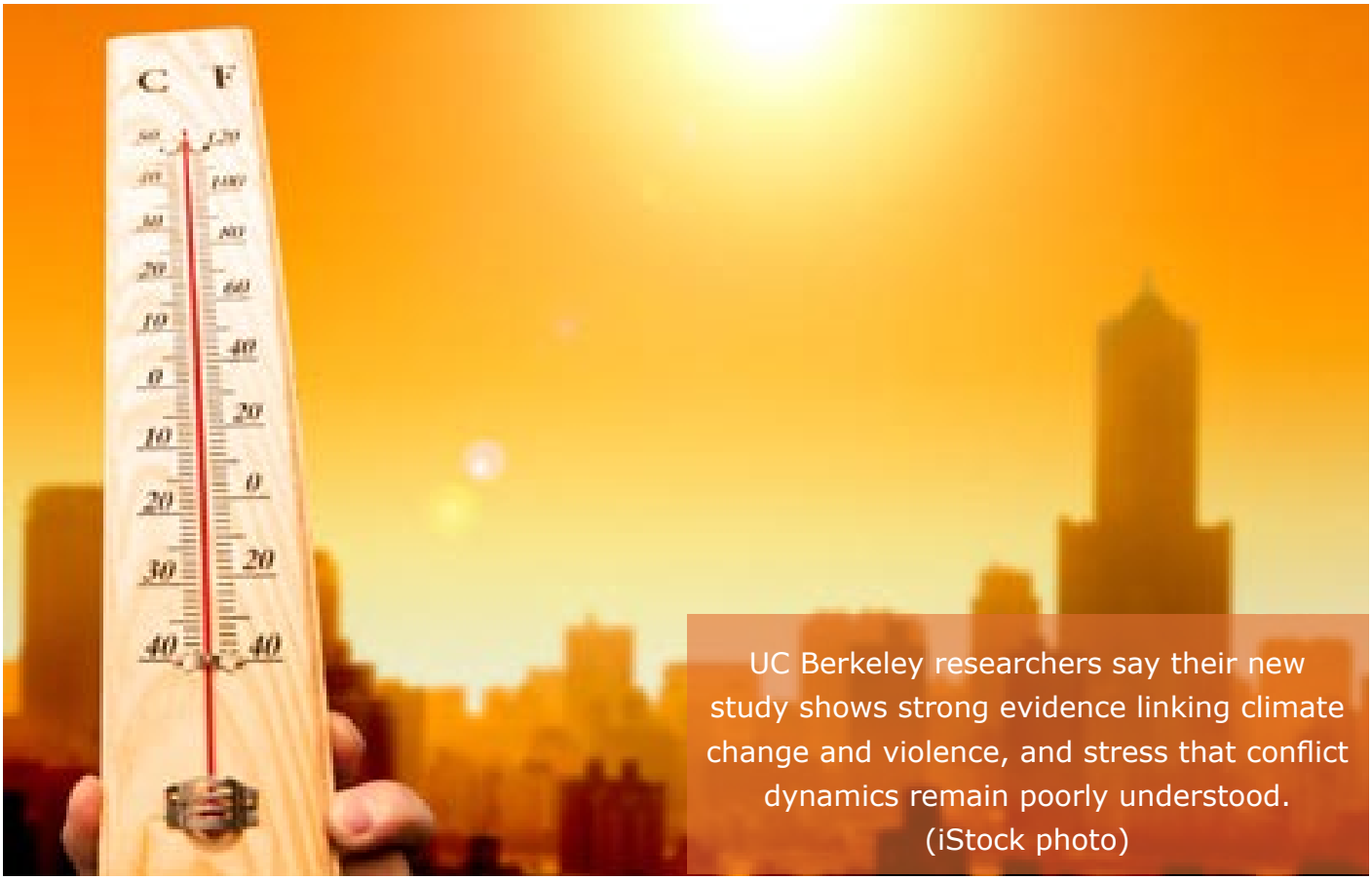
- Create a clearinghouse for reliable, up-to-date data and analytical tools. Companies need user-friendly, localized projections of climate changes and models that link projections to impacts germane to company operations.
- Invest in public infrastructure resilience. Companies rely on public resources, including roads, bridges, and ports, to get their goods and services to market and need these resources to withstand extreme weather and climate impacts.
- Consider resilience needs in regulation. Companies in regulated sectors, such as water, electricity, and insurance, need regulators to be forward-looking and open to companies making the case for more spending on resilience.
- Set up voluntary, public-private partnerships. Bringing together government and business expertise will improve resilience planning.



Click image above, to access full infographic from www.c2es.org

Warmer climate strongly affects human conflict and violence worldwide, says study

Shifts in climate are strongly linked to human violence around the world, and according to a new study by researchers at the University of California, Berkeley and Princeton University, even relatively minor departures from normal temperatures or rainfall can substantially increase the risk of conflict.



UC Berkeley researchers say their new study shows strong evidence linking climate change and violence, and stress that conflict dynamics remain poorly understood. (iStock photo)

The study, which includes more data than prior research in this field and covers all major regions of the globe, shows the Earth's climate plays a more influential role in human affairs than previously thought. The results were published in the journal Science.

The authors found similar patterns of conflict around the world that were linked to changes in climatic, such as increased drought or higher than average annual temperature.

Examples include spikes in domestic violence in India and Australia; increased assaults and murders in the United States and Tanzania; ethnic violence in Europe and South Asia; land invasions in Brazil; police using force in the Netherlands; civil conflicts throughout the tropics; and even the collapse of Mayan and Chinese empires.

The study could have critical implications for understanding the impact of future climate change on human societies, as many climate models project global temperature increases of at least 2 degrees Celsius over the next 50 years.

The study draws on a variety of research fields including climatology, archaeology, economics, political science and psychology to provide a comprehensive look at how climatic changes shape human conflict and violence.

"What was lacking was a clear picture of what this body of research as a whole was telling us," said Solomon Hsiang, the study's lead author, who was a postdoctoral fellow in Science, Technology, and Environmental Policy at Princeton during the research project and is now an assistant professor of public policy at UC Berkeley's Goldman School of Public Policy. "We collected 60 existing studies containing 45 different data sets and we re-analyzed their data and findings using a common statistical framework. The results were striking."

They examined various aspects of climate such as rainfall, drought or temperature, and their associations with various forms of violence within three broad categories of conflict:

- Personal violence and crime such as murder, assault, rape, and domestic violence;
- Intergroup violence and political instability, like civil wars, riots, ethnic violence, and land invasions;
- Institutional breakdowns, such as abrupt and major changes in governing institutions or the collapse of entire civilizations.

The results proved all three types of conflict exhibit systematic and large responses to changes in climate, with the effect on intergroup conflict being the most pronounced. Conflict responded most consistently to temperature, with all 27 out of 27 studies of modern societies finding a positive relationship between high temperatures and greater violence.

A central contribution of the study was to develop a method for comparing results around the world, because the nature of climatic events differs across locations. The authors' new approach was to convert climate changes into location-specific units known to statisticians as standard deviations.

"We found that a 1 standard deviation shift towards hotter conditions causes the likelihood of personal violence to rise 4 percent and intergroup conflict to rise 14 percent," said Marshall Burke, the study's co-lead author and a doctoral candidate at UC Berkeley's Department of Agricultural and Resource Economics.

"We often think of modern society as largely independent of the environment, due to technological advances, but our findings challenge that notion," said study coauthor Edward Miguel, UC Berkeley's Oxfam Professor of Environmental and Resource Economics and director of the Center for Effective Global Action (CEGA) based at UC Berkeley.

"Our results shed new light on how the future climate will shape human societies," said Burke. The findings of the study suggest that a global temperature rise of 2 degrees Celsius could increase the rate of intergroup conflicts, such as civil wars, by over 50 percent in many parts of the world.

The researchers said that exactly why climate affects conflict and violence is the most pressing question for future related research. While the study finds strong evidence that climatic events may be a cause of conflict, the researchers stressed that they are not claiming that climate is the only or primary cause of conflict, cautioning that conflict dynamics are complex and remain poorly understood.

Ocean acidification: Making new discoveries through National Science Foundation research grants

Acidifying marine ecosystems of increasing concern

NSF awardees will study how ocean acidification affects anemones and symbiotic algae. Credit: NOAA

With increasing levels of carbon dioxide accumulating in the atmosphere and moving into marine systems, the world's oceans are becoming more acidic.

The oceans may be acidifying faster today than at any time in the past 300 million years, scientists have found.

To address the concern for acidifying marine ecosystems, the National Science Foundation (NSF) has awarded new grants totaling $12 million in its Ocean Acidification Program. The program is part of NSF's Science, Engineering and Education for Sustainability (SEES) investment.

The awards, the third round in this program, are supported by NSF's Directorates for Geosciences and Biological Sciences.

"These new awards will expand the scope of our knowledge about the types of marine organisms, populations, communities, and ecosystems that may be affected in unique ways by a more acidic ocean," says David Conover, director of NSF's Division of Ocean Sciences.

From tropical oceans to icy seas, the projects will foster research on the nature, extent and effects of ocean acidification on marine environments and organisms in the past, present and future.

"NSF is excited to add these high-quality research projects to our growing ocean acidification award portfolio," says David Garrison, program director in NSF's Directorate for Geosciences and chair of NSF's Ocean Acidification Working Group.

Scientists have discovered that ocean acidification affects marine ecosystems, organisms' life histories, ocean food webs and biogeochemical cycling.

Researchers believe there is a need to understand the chemistry of ocean acidification and its interplay with marine biochemical and physiological processes, before Earth's seas become inhospitable to life as we know it.

Animal species from pteropods--delicate, butterfly-like planktonic drifters--to hard corals are affected by ocean acidification. So, too, are the unseen microbes that fuel ocean productivity and influence the chemistry of ocean waters.

As the oceans become more acidic, the balance of molecules needed for shell-bearing organisms to manufacture shells and skeletons is altered.

The physiology of many marine species, from microbes to fish, may be affected. Myriad chemical reactions and cycles are influenced by the pH, or acidity, of the oceans.

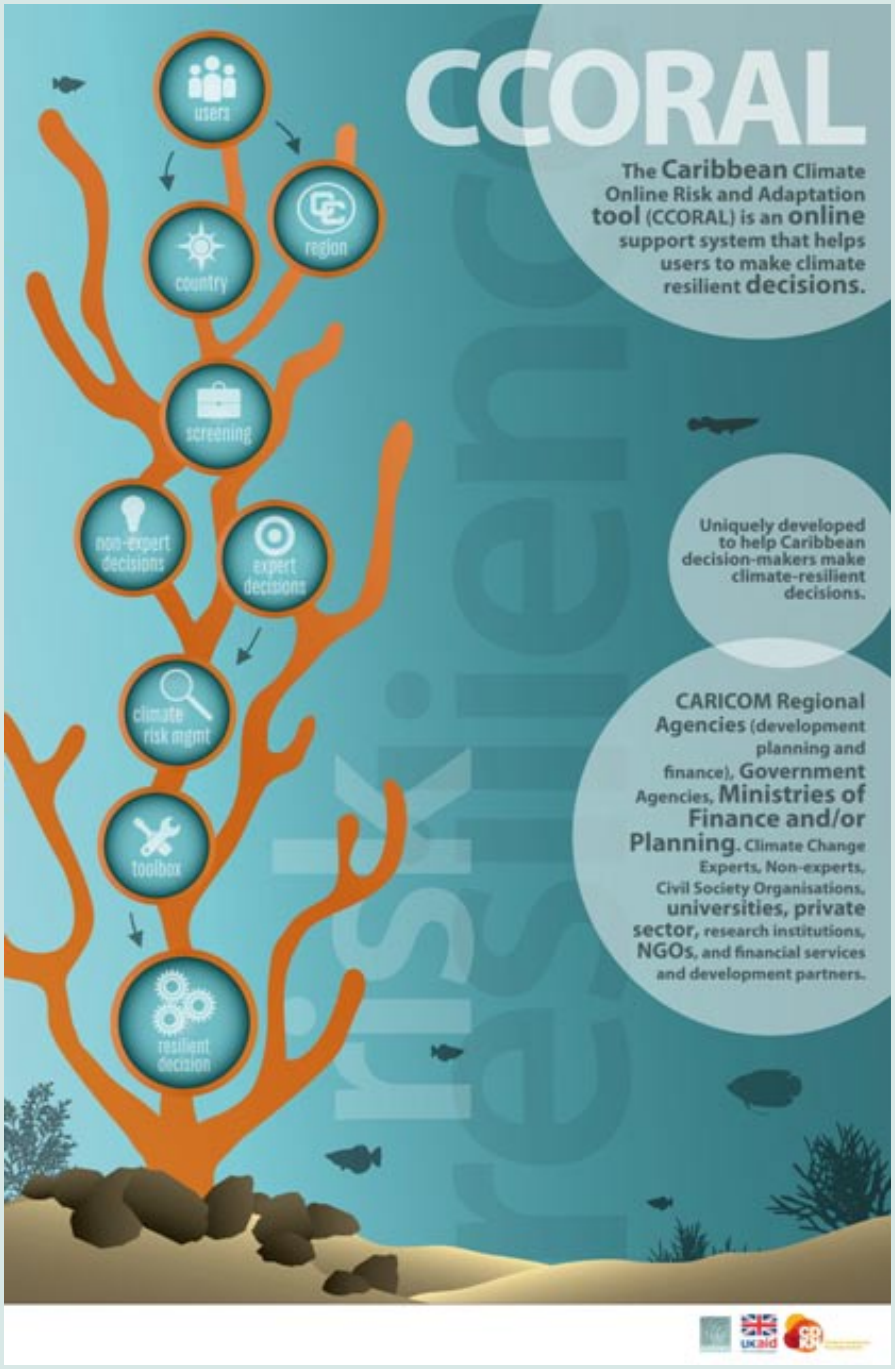
The newly funded projects include studies of whether populations of animals have the genetic capacity to adapt to ocean acidification.

"These awards will extend our understanding of the physiological abilities of organisms to adjust to acidifying oceans in the near-term, and the evolutionary capacities of populations to adapt to predicted ocean acidification in the next century," says William Zamer, program director in NSF's Directorate for Biological Sciences.

Has ocean life faced similar challenges in our planet's past?

"Earth system history informs our understanding of the effects of ocean acidification in the present and the future," says Garrison.

For a true comprehension of how acidification will change the oceans, he says, we need to integrate paleoecology with marine chemistry, physics, ecology and an understanding of the past environmental conditions on Earth.



Caribbean Climate Online Risk and Adaptation Tool (CCORAL) is a Caribbean-focused tool to help your organisation make climate resilient decisions.

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Insight into marine life's ability to adapt to climate change

CO2 vents. Credit: Plymouth University

A study into marine life around an underwater volcanic vent in the Mediterranean, might hold the key to understanding how some species will be able to survive in increasingly acidic sea water should anthropogenic climate change continue.

Researchers have discovered that some species of polychaete worms are able to modify their metabolic rates to better cope with and thrive in waters high in carbon dioxide (CO2), which is otherwise poisonous to other, often closely-related species.

The study sheds new light on the robustness of some marine species and the relative resilience of marine biodiversity should atmospheric CO2 continue to cause ocean acidification.

A team of scientists led by Plymouth University, and including colleagues from the Naples Zoological Station in Ischia; the Marine Ecology Laboratory ENEA in La Spezia, Italy; the University of Texas Galveston; and the University of Hull, conducted a three-year research project into the potential mechanisms that species of worm polychaetes use to live around the underwater CO2 vent of Ischia in Southern Italy.

The researchers collected specimens found in waters characterised by either elevated or low levels of CO2, and placed them in specially-constructed 'transplantation chambers', which were then lowered into areas both within and away from the volcanic vent.

They monitored the responses of the worms and found that one of the species that had been living inside the CO2 vent was physiologically and genetically adapted to the acidic conditions, whilst another was able to survive inside the vent by adjusting its metabolism.

Project leader Dr Piero Calosi, of Plymouth University's Marine Institute, said: "Previous studies have shown that single-cell algae can

genetically adapt to elevated levels of carbon dioxide, but this research has demonstrated that a marine animal can physiologically and genetically adapt to chronic and elevated levels of carbon dioxide.

"Furthermore, we show that both plasticity and adaptation are key to preventing some species' from suffering extinction in the face of on-going ocean acidification, and that these two strategies may be largely responsible to defining the fate of marine biodiversity."

The results revealed that species normally found inside the CO2 vent were better able to regulate their metabolic rate when exposed to high CO2 conditions, whilst species only found outside the CO2 vent were clearly impaired by acidic waters. In fact, their metabolism either greatly decreased, indicating reduced energy production, or greatly increased, indicating a surge in the basic cost of living, in both cases making life inside the vent unsustainable.

Dr Maria-Cristina Gambi, of the Naples Zoological Station in Ischia, explained: "Despite some species showing the ability to metabolically adapt and adjust to the extreme conditions that are found inside the CO2 vents, others appear unable to physiologically cope with such conditions.

''In this sense, our findings could help to explain mass extinctions of the past, and potential extinctions in the future, as well as shed light on the resilience of some species to on-going ocean acidification."

The team also found that those species adapted to live inside the CO2 vent showed slightly higher metabolic rates and were much smaller in size – up to 80% smaller – indicating that adaptation came at a cost of energy for growth.

Dr. Calosi concluded that: ''Ultimately, species' physiological responses to high CO2, as those reported by our study, may have repercussions on their abundance and distribution, and thus on the structure and dynamics of marine communities. This in turn will impact those ecosystem functions that humans rely upon to obtain goods and services from the ocean."

The research was funded by a Natural Environment Research Council UK Ocean Acidification Research Programme grant, and an Assemble Marine EU FP7 scheme, and is the first of its kind to bring together both the physiological and genetic evidence for adaptation to elevated pCO2 in a multicellular organism.

Infectious diseases and climate change
intersect with no simple answers

Climate change is already affecting the spread of infectious diseases - and human health and biodiversity worldwide - according to disease ecologists reporting research results in a recent issue of the journal *Science*.

Modeling disease outcomes from host and parasite responses to climate variables, they say, could help public health officials and environmental managers address the challenges posed by the changing landscape of infectious disease.

Monarch butterflies carry infections in parts of the U.S. where they breed year-round. Credit: P. Davis and S. Altizer

"Earth's changing climate and the global spread of infectious diseases are threatening human health, agriculture and wildlife," said Sam Scheiner, National Science Foundation (NSF) program director for the joint NSF-National Institutes of Health Ecology and Evolution of Infectious Diseases Program, which funded the research.

"Solving these problems requires a comprehensive approach that unites scientists from biology, the geosciences and the social sciences."

According to lead author Sonia Altizer of the University of Georgia, the issue of climate change and disease has provoked intense debate over the last decade, particularly in the case of diseases that affect humans.

In the Science paper, Altizer and her colleagues--Richard Ostfeld of the Cary Institute of Ecosystem Studies; Pieter Johnson of the University of Colorado; Susan Kutz of the University of Calgary and Canadian Cooperative Wildlife Health Centre; and Drew Harvell of Cornell University--laid out an agenda for future research and action.

"For a lot of human diseases, responses to climate change depend on the wealth of nations, healthcare infrastructure, and the ability to take mitigating measures," Altizer said.

"The climate signal, in many cases, is hard to tease apart from other factors like vector control, and vaccine and drug availability."

In diseases affecting wildlife and agricultural ecosystems, however, findings show that climate warming is already causing changes.

"In many cases, we're seeing an increase in disease and parasitism," Altizer said. "But the effect of climate change on these disease relationships depends on the physiology of the organisms and on the structure of natural communities."

At the organism level, climate change can alter the physiology of parasites. Some of the clearest examples are found in the Arctic, where temperatures are rising rapidly. Parasites are developing faster as a result. A lungworm that affects muskoxen, for instance, may be transmitted over a longer period each summer, making it a more serious problem for the populations it infects.

Climate change is also affecting entire plant and animal communities.

Community-level responses to rising temperatures are evident in tropical marine environments such as the coral reef ecosystems of the Caribbean. Warmer water temperatures have directly stressed corals and facilitated infections by pathogenic fungi and bacteria. When corals succumb, other species that depend on them are affected.

Potential consequences of these changes are serious. The combination of warmer temperatures and altered disease patterns is placing growing numbers of species at risk of extinction, the scientists say.

In human health, there is a direct risk from pathogens like dengue, malaria and cholera. All are linked to warmer temperatures.

Indirect risks also exist in threats to agricultural systems and game species that are crucial for subsistence and cultural activities.

The scientists recommend building on and expanding data on the physiological responses of hosts and parasites to temperature change. Those mechanisms may offer clues to how a system will respond to climate warming.

"We'd like to be able to predict, for example, that if the climate warms by a certain amount, then in a particular host-parasite system we might see an increase from one to two disease transmission cycles each year," Altizer said.

"But we'd also like to try to tie these predictions to actions that might be taken."

Some of those actions might involve more monitoring and surveillance, adjusting the timing of vector control measures and adopting new management measures.

These could include, for instance, closing coral reefs to human activity if a disease outbreak is predicted, or changing the planting strategy for crops to compensate for unusually high risks of certain diseases.

The researchers also point out that certain local human communities, such as those of indigenous peoples in the Arctic, could be disproportionately affected by climate-disease interactions.

Predicting where these local-scale effects might be most intense would allow societies to take measures to address issues such as health and food security.

"Involving local communities in disease surveillance," said Altizer, "could become essential."

Muskoxen may be susceptible to arctic climate change and emerging infectious diseases. Credit: S. Kutz

FAO Statistical Yearbook paints a big, and detailed, picture of food and agriculture

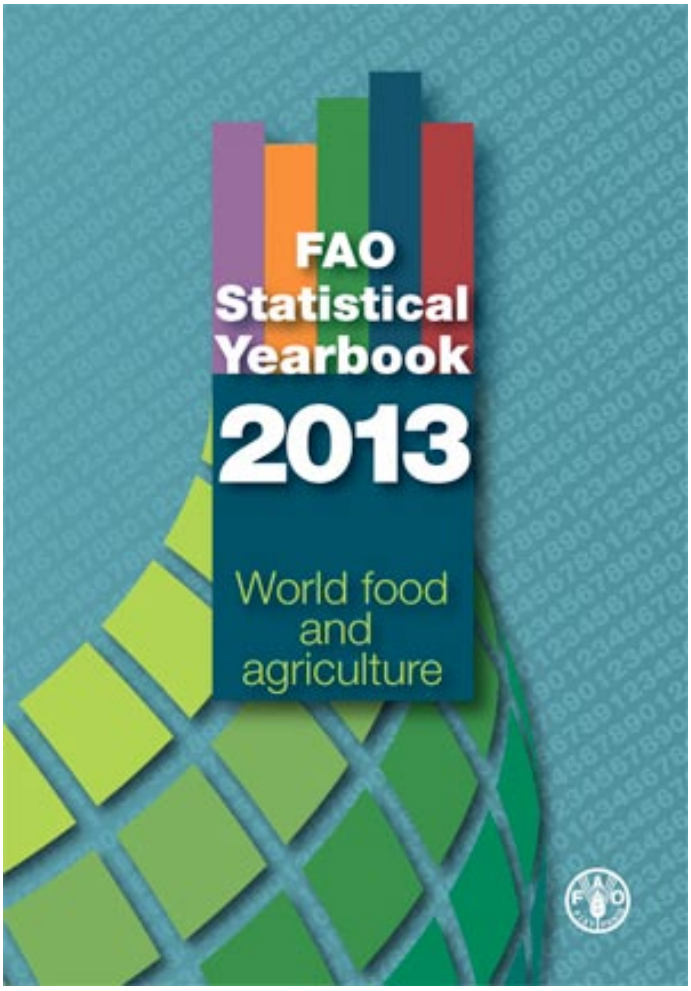
Updated edition of data compendium sheds new light on greenhouse gas emissions from food production

The 2013 edition of FAO's *Statistical Yearbook* sheds new light on agriculture's contribution to global warming, trends in hunger and malnutrition and the state of the natural resource base upon which world food production depends.

Greenhouse gas emissions from agriculture grew 1.6 percent per year during the decade after the year 2000, new FAO data presented in the yearbook show, with the sector's total annual output in 2010 reaching 5 billion tons of carbon dioxide equivalents (CO2 eq, a measure used to compare and aggregate different greenhouse gases). This equals 10 percent of all anthropogenic greenhouse gas emissions.

Among the various agriculture sectors, livestock activities and the use of synthetic fertilizer are the largest contributors. This does not include emissions caused by land use change and wild fires.

Issued annually, FAO's *Statistical Yearbook* is an authoritative compendium of data on the major trends shaping global food and agriculture today. For each thematic area, brief analyses of the main trends are paired with graphical data visualizations as well as tables with key indicators.



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The topics it covers include: capital and investment; climate change; food availability; food production and trade; food prices; hunger and malnutrition; the consequences of political instability and natural- and human-induced disasters on food security; the state of the agricultural resource base and sustainability and environmental impacts.

Greenhouse gas emissions from agriculture grew 1.6 percent per year during the decade after the year 2000

Key facts and figures

Hunger and malnutrition

- Almost 870 million people, or 12.5 percent of the world's population, were undernourished in 2010-2012; the vast majority of them (852 million) live in developing countries.
- Between 2005 and 2011, one out of four African countries reported a stunting rate of at least 40 percent. Stunting rates also exceeded 40 percent in South and South East Asia during the same period, with peaks in India, the Lao People's Democratic Republic, Nepal and Timor-Leste.
- African countries show the highest rates of underweight prevalence. During 2005-¬2011, 16 African countries showed underweight rates of at least 20 percent, with the highest levels recorded in the Horn of Africa.

Food production and supply

- Global crop production has expanded threefold over the past 50 years, largely through higher yields per unit of land and crop intensification.
- Global per capita food supply rose from about 2 200 kcal/day in the early 1960s to over 2 800 kcal/day by 2009. At 3 370 kcal/person/day, Europe currently has the highest average per capita food supply.
- Cereals occupy more than half of the world's harvested area and are the most important food source for human consumption. Of the 2.3 billion tonnes of cereals produced each year, 1 billion are destined for human consumption, 750 million tonnes are used as animal feed and 500 million tonnes are either processed by industry, used as seed, or wasted.

Economic trends

- Following a decade of slower growth in the 1990s, global public spending on agricultural R&D increased steadily from $26.1 billion in 2000 to $31.7 billion in 2008. Most of this increase was driven by developing countries. China and India accounted for close to half of this growth, but other countries - particularly Argentina, Brazil, Iran, Nigeria and the Russian Federation - also significantly increased their spending on public agricultural R&D. Still, these trends mask the negative developments that have taken place in numerous smaller, poorer and less technologically advanced countries.
- Buoyed by high commodity prices, agriculture has demonstrated astonishing resilience during global economic turmoil. In 2010, agricultural value-added at the world level rose by 4 percent, in contrast to a 1 percent increase in overall GDP.


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