twas

International Centre for Integrated Mountain Development

KATHMANDU, NEPAL

ICIMOD



EXCELLENCE IN SCIENCE

Profiles of Research Institutions in Developing Countries

PUBLISHED IN COLLABORATION WITH

COMSATS

EXCELLENCE IN SCIENCE

Profiles of Research Institutions
in Developing Countries

EXCELLENCE IN SCIENCE
Profiles of Research Institutions in Developing Countries

Published by The World Academy of Sciences (TWAS)
for the advancement of science in developing countries

ICTP Campus, Strada Costiera 11, 34151 Trieste, Italy
tel: +39 040 2240327, fax: +39 040 224559
e-mail: info@twas.org, website: www.twas.org

ISSN 2222-7385

TWAS Executive Director
Romain Murenzi

TWAS Public Information Office
Edward W. Lempinen, Gisela Isten, Cristina Serra, Sean Treacy, Francesca Pettoello

Design & Art Direction
Studio Link, Trieste (www.studio-link.it)

Printing
A.R. Printers, Islamabad, Pakistan 2016

This text may be reproduced freely with due credit to the source.

twas
The World Academy of Sciences
for the advancement of science in developing countries

International Centre for Integrated Mountain Development

KATHMANDU, NEPAL



EXCELLENCE IN SCIENCE

Profiles of Research Institutions in Developing Countries

PUBLISHED
IN COLLABORATION WITH
COMSATS

TWAS COUNCIL

President
Bai Chunli (China)

Immediate Past President
Jacob Palis (Brazil)

Vice-Presidents
Africa:
Moctar Toure (Senegal)
Arab Region:
Mohammed Hamdan (Jordan)
Central and South Asia:
Rabia Hussain (Pakistan)
East and Southeast Asia:
Khatijah M. Yusoff (Malaysia)
Latin America and Caribbean:
Manuel Limonta-Vidal (Cuba)

Secretary General
A.K. Sood (India)

Treasurer
Samira Omar Asem (Kuwait)

Council Members
Africa:
Robin Crewe (South Africa)
Arab Region:
Abdel Nasser Tawfik (Egypt)
Central and South Asia:
Habib Firouzabadi (Iran)
East and Southeast Asia:
Bishal Nath Upreti (Nepal)
Latin America and Caribbean:
Mahabir Prashad Gupta (Panama)

Ex-officio Council Member
Fernando Quevedo (Guatemala) [Director, ICTP]

Foreword

On 25 April 2015, just a few minutes before noon, a violent earthquake struck the Himalayan mountain nation of Nepal. The damage was widespread and severe: Nearly 9,000 people were killed and more than 22,000 injured. Tens of thousands of buildings were damaged, and some entire villages were destroyed. Hundreds of thousands of people were left homeless.

Confronted by such a disaster, Nepal had a vitally important resource to help the earthquake response: The International Centre for Integrated Mountain Development, or ICIMOD. The centre provided sophisticated analysis of satellite images to help rescue teams identify damaged villages and roadways in remote mountain areas, and to pinpoint landslides that could impede the rescuers. The ICIMOD web page became a source of maps, data and other information to support rescue and relief efforts.



For this reason and many others, ICIMOD makes a fascinating case study of the growth and evolution of science in the developing world. It was founded in 1983, the same year as TWAS. It is an intergovernmental centre involving eight nations in the Hindu Kush Himalayas – Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal and Pakistan. It is a centre built on scientific cooperation between member nations, with broader connections to global South-South and South-North scientific networks.

Over more than three decades, ICIMOD has grown from a small office to an institution with over 300 employees. It has built extensive knowledge of the Himalayas, in fine detail. Its work and influence extend far beyond these majestic mountains, following rivers such as the Yangtze, the Mekong and the Irrawaddy from their sources in the Himalayas as they flow thousands of miles into China, Vietnam and Myanmar.

ICIMOD takes a holistic view of science. It understands that knowledge about the atmosphere and the Earth's tectonic plates – and everything in between – can help to support the health and sustainable prosperity of human communities. For that reason, ICIMOD offers experience and insight to mountain regions all over the world. Indeed, its ability to assemble innovative projects and mobilize resources, its commitment to international cooperation and its record of bringing real benefits to people and their communities make ICIMOD a model for science centres worldwide.

Because China is a member of ICIMOD, the Chinese Academy of Sciences (CAS) has had a long relationship with the Centre. When the earthquake struck, we were able to offer support from CAS and two scientific centres of excellence that it operates with TWAS.

ICIMOD director general David James Molden asked us to support rescue and relief activities with high-resolution satellite data and sophisticated weather forecasts. Some of that work was conducted in Beijing at the headquarters of the CAS-TWAS Centre of Excellence on Space Science for Disaster Mitigation (SDIM), which is based at the CAS Institute of Remote Sensing and Digital Earth. SDIM's high-resolution satellite data and interpretation helped to identify more than 30 landslides. CEWE worked with Nepalese scientists and government agencies to help restore the water supply networks and provide emergency technologies and treatment.

At such a difficult time, it was a duty and an honour to join our neighbours and colleagues in a truly global recovery effort. It is a measure of ICIMOD's importance that it has been able to build these constructive relationships. They bring benefit not only to Nepal, but also to all of the eight member nations. And our recent collaboration is certain to strengthen our partnership, so that in the future we are better able to address common challenges and take advantage of opportunities.

Since 2007, TWAS and its partners have published 13 profiles in the Excellence in Science series, all of them focused on exceptional science and research centres in the developing world. [Please see www.twas.org/publications/excellence-in-science.] They are innovation leaders, and they bring tangible benefits to their communities, their countries and their regions.

On behalf of TWAS and CAS, I want to offer sincere thanks to director general Molden and all of the scientists and staff members at ICIMOD. Their support – including many hours in interviews, visits to its projects and poring through photo archives – has allowed the TWAS Public Information Office to tell this fascinating story.

We also owe thanks to the Commission on Science and Technology for Sustainable Development in the South (COMSATS) and its executive director, Imtinan Elahi Qureshi, whose support has made this book possible. Based in Islamabad, Pakistan, COMSATS is a respected global science leader, with 23 member countries and 20 centres of excellence across Asia, the Middle East, Africa and Latin America.

At TWAS, we are fortunate to be part of such strong networks. Working together, we form an international community that is committed to advancing science and building sustainable prosperity for people everywhere.

Bai Chunli, *president*
The World Academy of Sciences (TWAS)
The Chinese Academy of Sciences (CAS)



Contents

The Hindu Kush-Himalayan Region	10
Board of Governors	16
Growth and Evolution	22
The Early Years 1983–1987	22
Expansion 1987–1993	23
Consolidation 1994–2002	24
Developing Regional Partnerships 2003–2007	25
Regional Knowledge, Global Impact 2008 Onwards	25
Science Cooperation and Diplomacy	28
Adaptation to Change	34
Transboundary Landscapes	38
River Basins	41
Cryosphere and Atmosphere	45
Mountain Environment and Natural Resources Information System	50

Himalayan University Consortium 54

Knowledge Management and Communication 56

Toward a Sustainable Future 60

Acknowledgements 65

About the Authors 65

SIDEBARS

Key Personnel

David James Molden, director general 26

Eklabya Sharma, director of Programme Operations 37

Neera Shrestha Pradhan, water and adaptation specialist 48

Snapshots

Vision 12

Mission 13

The 2015 Nepali Earthquake 18

The Hindu Kush Himalayan region



The Hindu Kush Himalayan region is one of the most important and complex mountainous areas of the world. It's a line of secluded valleys, hills and massive peaks that extends 3,500 kilometers and spans over 4 million square kilometers, which is almost 3% of the total land on Earth and about 18% of the global mountain area.

This region contains the world's tallest peaks, like the Mount Everest, K2 and Kangchenjunga, yet the importance of this majestic landscape goes beyond extreme mountaineering and world records. What happens here affects the lives of million people, both in Asia and around the globe.

At the heart of this region lies Nepal, and in the capital city of Kathmandu there is a centre that since 1983 has worked to help these mountains and their people to overcome difficult challenges and compelling dangers. It's the International Centre for Integrated Mountain Development (ICIMOD), an institution that plays a pivotal role in supporting the region's scientists, development workers, policymakers and diplomats.

"We see borders not as a place that divides people, but a place where people can meet and do great things together," says David Molden, ICIMOD's director general. "So our niche is really to be a meeting place for people in this region, and we do that very much around knowledge, around science, around sharing experiences in the Hindu Kush Himalayan region."

ICIMOD stands in the middle of a massive area that crosses eight countries: Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal and Pakistan. People who live in this extremely diverse part of the world speak about 600 different languages and dialects. Still, they share resources, problems and challenges such as pollution, climate change and the risk of natural disasters.

INTERNATIONAL CENTRE FOR INTEGRATED MOUNTAIN DEVELOPMENT, ICIMOD

- *Khumaltar, Lalitpur*
  G.P.O. Box 3226, Kathmandu, Nepal
- *Tel: (977) 1 5003222 – Fax: (977) 1 5003299, 5003277*
- *E-mail: info@icimod.org*
- *Website: www.icimod.org*





This region is also the source of water of some of the world's biggest river systems: Amu Darya, Indus, Ganges, Brahmaputra (Yarlungtsanpo), Irrawaddy, Salween (Nu), Mekong (Lancang), Yangtse (Jinsha), Yellow (Huanghe), and Tarim (Dayan). A staggering 219.5 million people are dependent upon this region for their livelihoods, and around 1.3 billion people – one out of five people on Earth – rely on its river basins as their primary water source. But what happens in this area indirectly affects the lives of some 3 billion people who benefit from food and energy produced in these river basins. Its 6,000 cubic kilometres of ice reserves makes this area the largest such reserve outside the poles – a quantity of frozen water so enormous that it influences global wind and rainfall patterns.

The Hindu Kush Himalayas host many diverse micro-climates and endemic species – some 25,000 species of angiosperms, 75,000 species of insects, 1,200 species of birds and all or part of four Global Biodiversity Hotspots – the Himalayas, Indo-Burma, Mountains of South-West China, and Mountains of Central Asia. To preserve this rich biodiversity, almost 40% of the region is managed as protected areas. Still, many of the animals and plants are at risk of extinction.

Human inhabitants are from diverse ethnic groups, and they, too, suffer from significant stresses. Many who live in these mountain communities are marginalised subsistence farmers, and today their cities and villages are experiencing disruptive events such as globalisation, out-migration and shifting climate patterns.

VISION

Men, women and children of the Hindu Kush Himalayas enjoy improved well-being in a healthy mountain environment.

MISSION

To enable sustainable and resilient mountain development for improved and equitable livelihoods through knowledge and regional cooperation.

According to Molden, global warming is one of the major threats to this region, with impact on both the ecosystem and its inhabitants. In particular, climate change is likely to affect the cryosphere (namely places where water is in its solid form, such as ice sheets, glaciers, sea ice, and snow on ice and land) putting at stake surface water availability, and raising the frequency and intensity of natural hazards and disasters. It can impact biodiversity, agriculture and food security, and this increased human vulnerability can result in demographic changes and cause movements of populations.

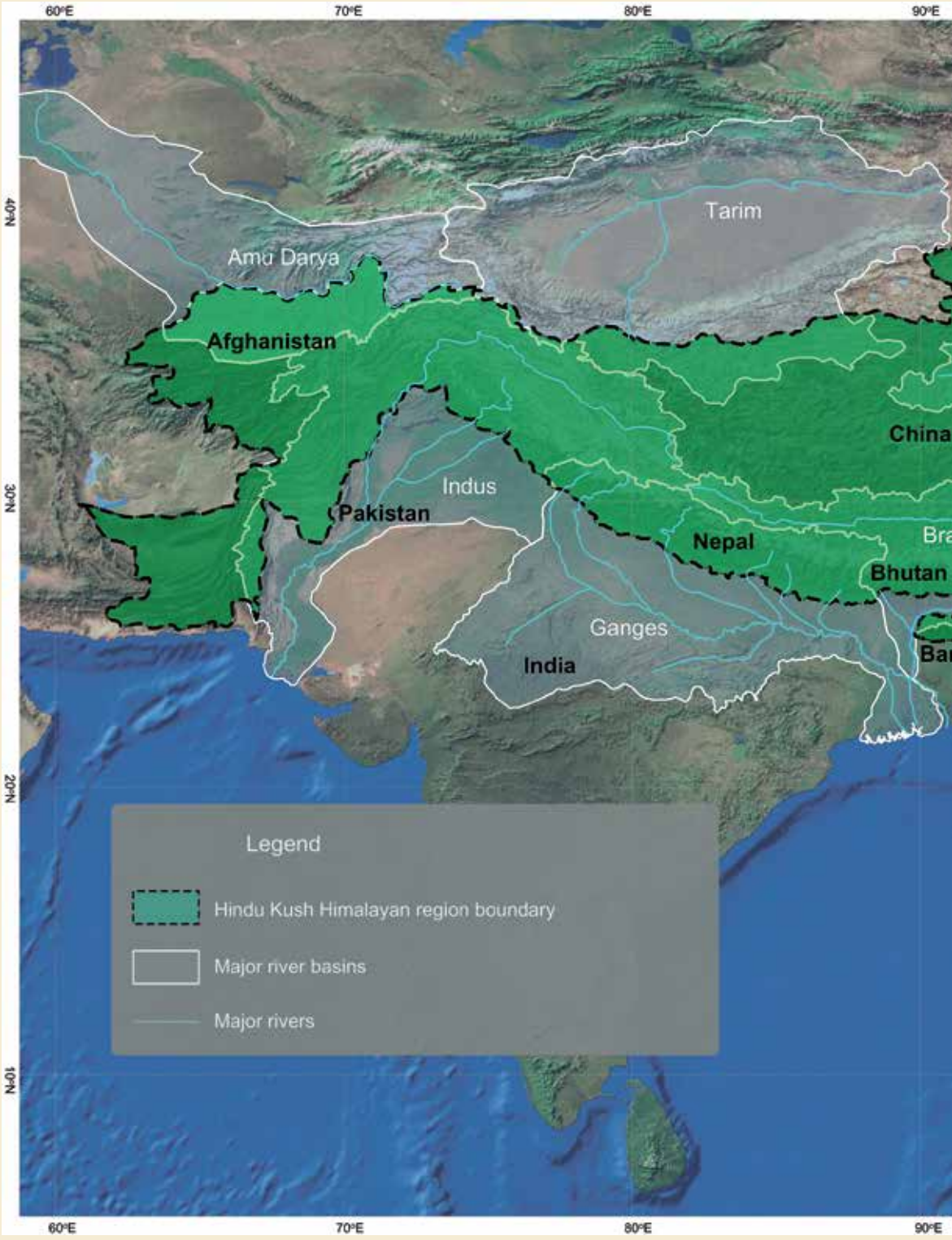


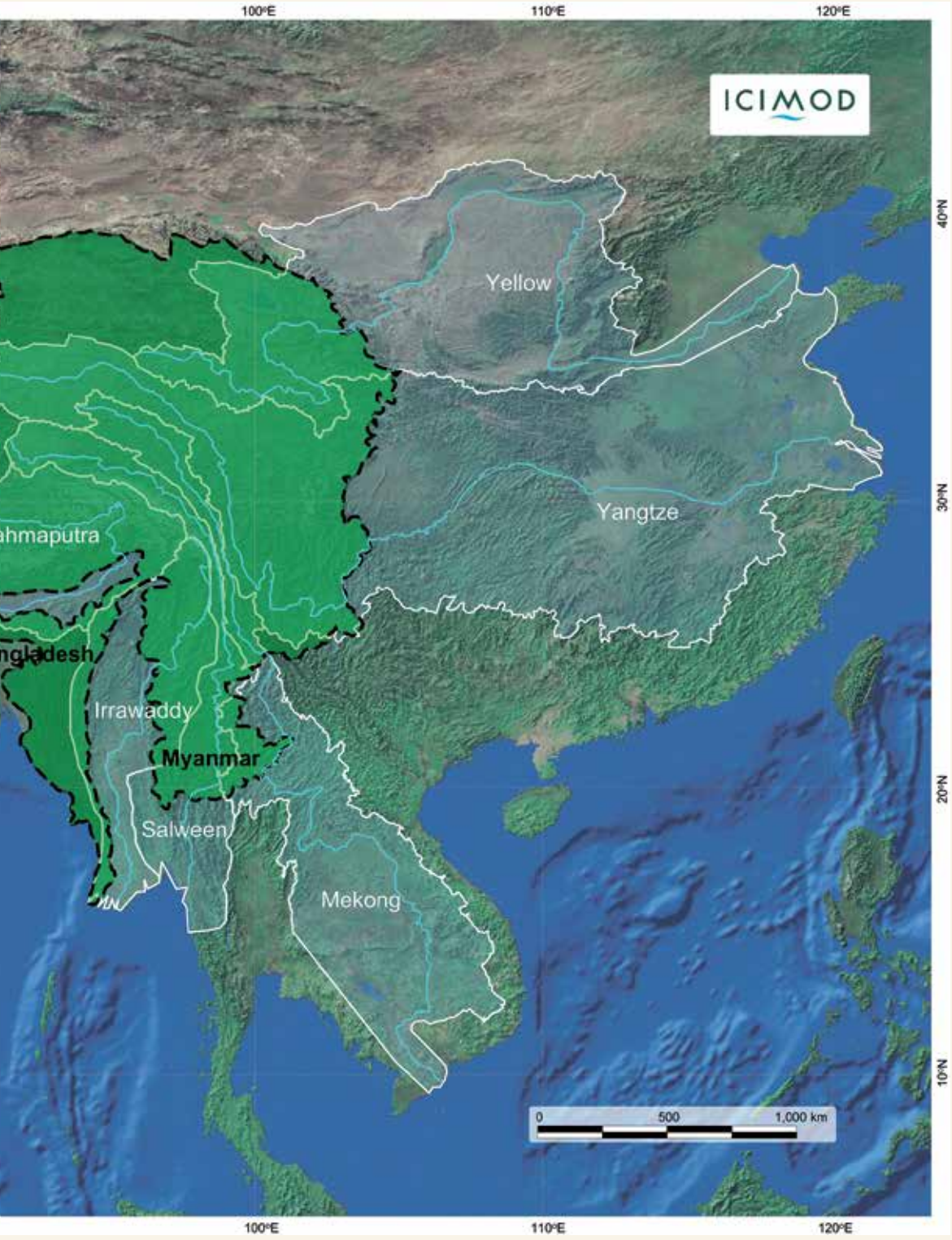




But mountain areas also can play a key role in climate change mitigation. Almost all ICIMOD activities are involved in some way with climate change in mountain areas, whether measuring change *per se*, or helping communities to recognise, respond and adapt to such changes. For example, ICIMOD's work on community-managed forests aims to enhance the role that they play in sequestering carbon and avoiding emissions from land-use changes.

"It is an extremely fragile environment and prone to hazards and disasters," says Molden. "We need to get better appreciation of mountains by the rest of the world, and get some of the resource flow coming back to mountain areas. We need to communicate that message to Asia as well as the globe."


60°E
70°E
80°E
90°E
40°N
30°N
20°N
10°N
Tarim
Amu Darya
Afghanistan
China
Indus
Pakistan
Nepal
Bhutan
Ganges
India
Legend
Hindu Kush Himalayan region boundary
Major river basins
Major rivers


100°E
110°E
120°E
ICIMOD
Yellow
Yangtze
ahmaputra
ngladesh
Irrawaddy
Myanmar
Salween
Mekong
40°N
30°N
20°N
10°N
0
500
1,000 km

Board of Governors *(as of March 2016)*

REGIONAL BOARD MEMBERS

Afghanistan

H.E. Raz Mohammad Raz
Deputy Minister of Irrigation
and Infrastructure
Ministry of Agriculture, Irrigation
and Livestock
Government of Afghanistan

Bangladesh

Mr. Naba Bikram Kishore Tripura
(Chairperson, ICIMOD Board of Governors)
Secretary
Ministry of Chittagong Hill Tracts Affairs
Bangladesh Secretariat
Government of the People's Republic
of Bangladesh

Bhutan

Dasho Tenzin Dhendup
Secretary
Ministry of Agriculture and Forests
Royal Government of Bhutan

China

Prof. Ding Zhongli
Vice President, CAS
Chairman of CN-ICIMOD Chinese Academy
of Sciences (CAS)
People's Republic of China

India

Mr. Ashok Lavasa
Secretary
Ministry of Environment and Forests
and Climate Change
Government of India

Myanmar

Dr. Nyi Nyi Kyaw
Director-General
Forest Department Ministry
of Environmental Conservation
and Forestry
Union of Myanmar

Nepal

Dr. Yubraj Khatiwada
Vice-Chairman
National Planning Commission
Government of Nepal

Pakistan

Mr. Muhammad Abid Javed
Secretary
Ministry of National Food Security
and Research
Government of Pakistan

INDEPENDENT BOARD MEMBERS

Canada

Dr. Margaret Catley-Carlson
(Chairperson, PAC and
Vice Chairperson, ICIMOD Board
of Governors)
Vancouver, BC, Canada

Germany

Dr. Thomas Labahn
Schwerin, Germany

China

Dr. Yanfen Wang
Vice President
Graduate University of Chinese Academy
of Sciences (GUCAS)
China

Bhutan

Lyonpo Dr. Kinzang Dorji
President
Bhutan Indigenous Games and Sports
Association (BIGSA)
Royal Government of Bhutan

Switzerland

Prof. Hans Hurni
Erlenbach, Switzerland

Norway

Dr. Asuncion Lera St. Clair
Senior Principal Scientist
Low Carbon Future
DNV GL - Strategic Research & Innovation
Norway

Netherlands

Dr. Teresa Christina Fogelberg
Deputy Chief Executive
Global Reporting Initiative (GRI)
Netherlands

- - -

Dr. David James Molden
Director General
ICIMOD
Ex officio

THE 2015 NEPALI EARTHQUAKE

On 25 April 2015, a 7.8-magnitude earthquake hit Nepal's capital Kathmandu and its surrounding areas, destroying buildings and historic temples. Many aftershocks followed the disaster, including a 7.3-magnitude earthquake on 12 May. According to government estimates, the earthquakes killed over 8,790 people and injured some 22,300.

ICIMOD's headquarters in Kathmandu suffered only minor damages and reported no causalities among its staff, but many of its projects were affected by the disaster. For instance, the Climate Smart Villages were badly hit. Though no one died, almost 50% of







the households were affected: houses and cattle sheds were damaged, plots and water collection ponds were destroyed, and other equipment was broken. Still, disaster did not stop the project. "We do not see any drastic impact on our innovation on Climate Smart Villages in the future, and so we will continue our efforts with some additional support," explained Laxmi Dutta Bhatta, ecosystem management specialist at ICIMOD, a month after the quake.

ICIMOD's knowledge park in Godavari, a few kilometres from Kathmandu, suffered minor damages, and the disaster made its

SNAPSHOT



staff realise that it should also be used to demonstrate how to reconstruct quake-affected areas. For this reason, in the future it will probably include in its exhibition an earthquake-resistant home.

Immediately after the disaster ICIMOD formed a team of GIS and remote-sensing experts that worked together the Ministry of Home Affairs of the government of Nepal to process and analyse the latest satellite imagery provided to ICIMOD from space agencies around the globe.

The team mapped pockets of settlements in affected districts and created profiles of affected Village Development Committees to inform relief and recovery operations. It also set up a dedicated a temporary web page to provide the latest maps, data, and information about the situation in earthquake zone.

ICIMOD provided immediate relief support to partners and communities, reaching out to areas where it has worked through its projects. Following a request of the Ministry of Home Affairs and the Nepal Army, ICIMOD used remote sensing and GIS tools to provide the personnel involved in rescue and relief activities with maps of terrain, safe landing spots, as well as potential hazard areas. On



BEFORE



AFTER

SNAPSHOT



BEFORE



AFTER

top of that, ICIMOD provided some interpretation of weather conditions in the flight paths.

Landslides were a major obstacle to aid. Many roads were damaged or blocked, cutting off earthquake-hit villages from the rest of the world. Further, many slopes were destabilized by the earthquake – a situation that could have led to other landslides. Analysts feared that moraine dams of glacier lakes may have been weakened during the earthquake, which could have resulted in floods. For this reason, ICIMOD worked with colleagues from around the world to monitor landslides, glacier lakes and river courses by analysing the latest satellite images and communicating the findings to the government and relief agencies.

At the same time, the scientific community from the region and beyond offered support to Nepal. ICIMOD coordinated teams from Nepal, the Indian Space Research Organization, and the Chinese Academy of Sciences (CAS); as well as Disasters Charter; the Japan Aerospace Exploration Agency; and, in the United States, NASA, the US Agency for International Development (USAID), the US Geological Survey, the University of Arizona and Esri.



SNAPSHOT

Two centres of excellence organized in Beijing by CAS and The World Academy of Sciences for the advancement of science in developing countries (TWAS), based in Trieste, Italy, also provided support. The CAS-TWAS Centre of Excellence on Space Science for Disaster Mitigation and the CAS-TWAS Center of Excellence on Water and Environment provided assistance to ICIMOD and the Nepali people.

"The response from CAS and TWAS has been immediate, very effective and very much appreciated," Molden said a few weeks after



the first earthquake, "and we hope it will go on further, which I am sure it will."

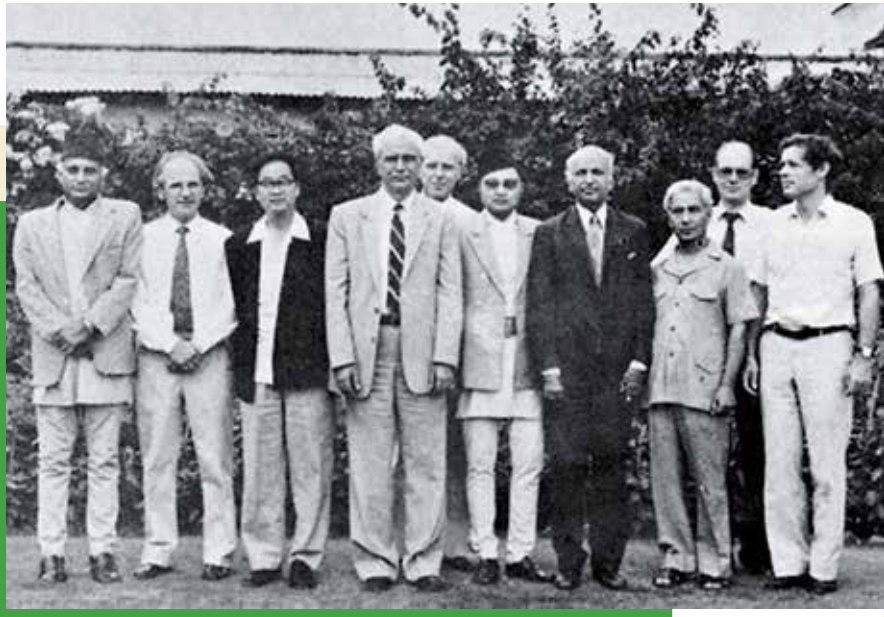
The earthquake will not be forgotten by ICIMOD, and not only because of the emotional impact on those who work there. For decades, the centre has been monitoring glaciers, basins, and ecosystems that have been impacted by the disaster, so in the coming years ICIMOD will need to take the quake into consideration while analysing data and evaluating research priorities. But all things considered, says Molden, the earthquake will not change ICIMOD's essence.

Growth and Evolution

The Early Years

1983–1987

The spark that started ICIMOD's story was an informal conversation in Munich in 1974. During a workshop on development in mountain environments, a group of participants began to discuss the need for an organisation that could promote environmental protection and sustainable development in mountain regions. This idea become a commitment in 1981, when the government of Nepal and UNESCO signed an agreement to provide the legal basis for the establishment of the International Centre for Integrated Mountain Development.



The Centre was inaugurated on 5 December 1983, and started with five programmes: watershed management, off-farm employment generation, rural energy planning, engineering in fragile environments, and information systems for mountain development, together with a documentation and information-exchange service. From 1983 to 1987, ICIMOD built its identity, held its first seminars and workshops on key mountain issues, and established its base of operations.





Expansion

1987–1993

Before the end of the 1980s, ICIMOD was ready to broaden its operations. "What happened is that, once we've got a lot of ideas about what was happening and what needs to be done in these countries, regional cooperation programmes were developed," says Farid Ahmad, head of strategic planning, monitoring and evaluation. Ahmad believes one of the biggest issues at that time was how to deal with risk. "Mountain areas are prone to disasters," he says, "so we had a long-standing programme on risk engineering. That programme was well-received and lots of people were trained."

The Centre kick-started many projects that had a strong impact on the Himalayas. For instance, it pioneered geographical information systems (GIS) by establishing its remote sensing facilities, and published its *Mountain Risk Engineering Handbook*, which later became part of the curriculum of engineering programmes in many institutions. On top of that, it developed new projects in the areas of mountain farming systems and rural energy.

"The value of ICIMOD started to be recognised at a government level, and ICIMOD started its practical work, helping the countries with good analysis and research papers," says Eklabya Sharma, director of programme operations.

Consolidation
1994–2002

To promote the well-being of mountain people and fight poverty, inequality and marginality, ICIMOD then focused on boosting donor funding, strengthening partnerships, and establishing new programmes and projects. This is why it launched the Regional Collaborative Programme Phase I (1995-98) and Phase II (1998-2002), increased dramatically the number and range of its publications, and put a lot of emphasis on building the capacity of partner institutions.



ICIMOD gained a position of prominence as a centre of excellence in mountain development, and in 2002 it organized and co-organized several national, regional and global events, such as the Asia High Summit in Kathmandu. It was also selected as the host of the Global Mountain Forum Secretariat, and played a lead role in celebrating the UN-declared International Year of the Mountains.

> *"The main challenges were how to generate knowledge and how to help the Himalayan counties to cooperate. ICIMOD was seen as the institution which could do it."*





Developing Regional Partnerships
2003–2007

ICIMOD then worked towards defining a strategic approach for enhancing development in the region. "We matured as an institute and we became more structured," says Ahmad. In 2006, the Centre began to contribute to research on the region's atmosphere, and inaugurated the ICIMOD-China National Committee Secretariat and the Pakistan Country Office, which was followed by the Afghanistan Country Office.

The Intergovernmental Panel on Climate Change (IPCC) then published its fourth assessment report, which was missing data about the Hindu Kush Himalayas. This was seen as a critical problem by ICIMOD, so it embarked on the work of collecting data about the effects of global warming on this region. "At that time", says Sharma, "the main challenges were how to generate knowledge and how to help the Himalayan counties to cooperate. ICIMOD was seen as the institution which could do it."

Regional Knowledge, Global Impact
2008 ONWARDS

2008 was a pivotal year for the Centre: it became part of the global discourse on climate change and water by becoming member to the United Nations Framework Convention on Climate Change, and by gaining observer status at IPCC.

DAVID JAMES MOLDEN, director general



David Molden was a 22-year-old American psychology student volunteering in Lesotho, in Africa, when he decided to devote his working life to help those who live in the developing world. He was working on a project to help some villagers set up a drinking water system and this eye-opening experience had a great impact on his beliefs and future aspirations. "Seeing how important it was to do what I could to help to bring water to that village – that's when I changed," he recalls.

So when he went back to the United States, he switched his degree from psychology to civil engineering, and in 1987 was awarded a Ph.D. in civil engineering from Colorado State University specializing in water resources. He has since developed broader interests in integrating social, technical and environmental aspects of natural resources management, and has worked in many countries across Africa and Asia.

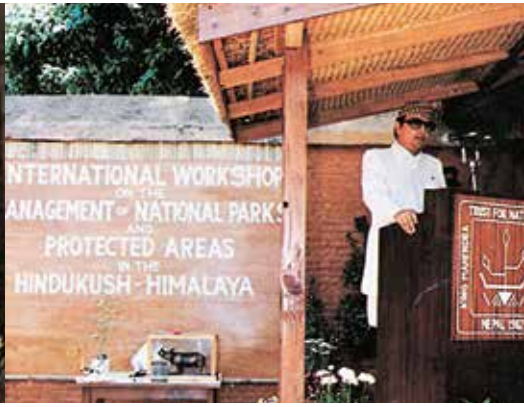
Molden joined ICIMOD as director general in December 2011. Before that, he was the deputy director general for research at the International Water Management Institute, based in Sri Lanka. He has worked in several Hindu Kush Himalayan countries, including China, India, Nepal and Pakistan, and has experience in research for development projects in the Indus, Ganges, Yellow, Mekong, Yangtze and Amu Darya and Syr Darya river basins. He has acquired management experience in a number of positions, including chief of party for the Irrigation Management Project in Nepal, chief of party for a water resources strategic research programme in Egypt, and leader of the multi-institute Comprehensive Assessment of Water Management in Agriculture programme.

Today, Molden has more than 30 years of experience in designing, planning, executing, and research on water management, livelihoods, environment and ecosystem services. He has contributed to the publication of over 200 works in books, refereed journals, research and project report series, the news media and educational materials. He has also received many awards, including the Outstanding Scientist Award from the Consultative Group for International Agricultural Research (CGIAR) in 2009.

> *"ICIMOD's activities have evolved in response to emerging and pressing issues in its eight member countries, from its start in rural energy and engineering in fragile environments to its current focus on transdisciplinary regional programmes."*

ICIMOD shifted its focus from being a project-driven centre to an interdisciplinary centre. “We started discouraging small and short-term projects, so we said that we have to have a ‘programmatic approach’,” explains Ahmad. ICIMOD not only supported regional networks in academia and civil society, but further increased its commitment to international cooperation.





Over the last 32 years, ICIMOD’s activities have evolved in response to emerging and pressing issues in its eight member countries, from its start in rural energy and engineering in fragile environments to its current focus on transdisciplinary regional programmes – not to mention the crucial role it played in coordinating international aid and the work of the scientific community after the 2015 earthquake in Nepal. ICIMOD today generates and shares knowledge to develop solutions to critical mountain issues. By connecting science with policy and practice, the centre acts as a platform where policymakers, experts, planners, practitioners, and residents can exchange ideas and perspectives to foster sustainable development in the Hindu Kush Himalayan region.

Science Cooperation and Diplomacy

Mountains are often hard-to-cross barriers, and they can form natural borders between countries. This is especially true for the Hindu Kush Himalayas, where towering peaks divide eight nations with different traditions, laws, and political systems. Still, for more than 30 years, ICIMOD's ultimate objective has been to help policymakers, planners, development workers and local communities to make decisions informed by science. Its initiatives and programmes focused on the shared resources and shared challenges of the mountain region serve to bridge political divisions.

Indeed, science can contribute to better relations between countries, especially when science-related challenges could cause tensions. Science is a common language, and scientists from different nations can collaborate on shared problems even when political relations



between their nations are uneasy. ICIMOD's work in the Himalayas clearly shows that the problem-solving power of science can be an important ally in handling sensitive diplomatic issues. Science cooperation and science diplomacy are embedded in its mission and work.

Good information and sound data provide fertile soil for diplomacy. "We have highlighted issues of mountain environment, we have influenced policies about range lands, about use of biodiversity resources, we have found many ways to help people adapt to change and really improve different livelihoods," says Molden, ICIMOD's Director General.





This goal is achieved through ICIMOD's many different initiatives. These are practical activities developed within the centre's "regional programmes", plans that always involve at least three different countries. This is where science diplomacy can be seen in action.

For instance, the Centre encouraged ecotourism on the Holy Mount Kailash area, a region on the border between China, Nepal, and India. In past years, the presence of thousands of visitors in this fragile ecosystem caused many problems, from open defecation to groups leaving garbage on this mountain's paths, and tensions caused by visitors who did not respect local people. In 2013 ICIMOD and its partners brought together the tour operators

> *"Science is a common language, and scientists from different nations can collaborate on shared problems even when political relations between their nations are uneasy."*





that work in the area to address these problems. The outcomes of this discussion were the Guidelines for Travelling Responsibly in the Kailash Sacred Landscape, published in 2014 and today adopted by all the major tour operators of the area.

This initiative made China, India and Nepal realise that they have to join their efforts to protect a unique landscape, and now ICIMOD and its partners share a common communication strategy to raise awareness about this area both at a community and policy level. The three countries also are working on a single ecosystem-management framework that in the future they all may adopt. And a mentorship programme allows researchers from the region to meet twice a year to deepen their knowledge about this landscape and develop solutions for sustainable management of its ecosystem.

International science cooperation and science diplomacy are woven into the core of ICIMOD's structure.

The Centre's Board of Governors is a key strength in fostering better regional relations through science. It includes one representative from each of the eight regional member countries, usually high-level government policy representatives, plus independent members who are nominated by the ICIMOD Support Group based on their professional achievements. This Group is composed of representatives from all the organizations and institutions that provide financial contributions to the Centre. The Board represents a strong network of contacts within the nations of the Hindu Kush Himalayan region, and members of these bodies and the broader network help ICIMOD to build support for sustainable and resilient development across these mountains.

"A role we see for ourselves is bringing the scientists from the region together, scientists that might actually not even be able to get visas to visit each other," says Arnico Panday, coordinator of ICIMOD's Atmosphere Initiative.

For example, Panday explains, the recent annual meeting of regional atmospheric scientists presented an opportunity to "get the Pakistani and Indian scientists, who might have known each other from when they were doing their Ph.D. somewhere, to start working with each other."

"There are two levels of diplomacy," says Sharma. "One is at the government level and the other one is at the technical cooperation level." Technical cooperation, he says, brings more fellowships, defining life experiences that allow researchers to build lasting relationships that transcend national barriers.

"This feeds into national diplomacy," Sharma explains. "You create a very good group of people who have influence on those governments and they can make a difference."



"A role we see for ourselves is bringing the scientists from the region together, scientists that might actually not even be able to get visas to visit each other."

ICIMOD also brings different institutions together to study what is happening across the region, organising conferences and workshops, and hosting international events. It publishes studies, reports and assessments about key issues for mountain development. It works with world-class research institutions like the Indian National Science Academy (INSA) and the Chinese Academy of Science (CAS), and then delivers its findings and publications to policymakers at the local and national levels, and to regional and global bodies.

ICIMOD and CAS have been strategic partners for decades, joining their efforts to carry on scientific research and share knowledge. In 2014, they agreed to help further scientific understanding of climate change in the Hindu Kush Himalayas and bolster cooperation among countries in the region under the Third Pole Environment Programme. This agreement was signed by Molden and Yao Tandong, co-chair of Third Pole Environment and director of the CAS Cold and Arid Regions Environmental and Engineering Research Institute, and it clearly outlined areas for cooperation such as cryospheric and atmospheric monitoring, climate change and anthropogenic impact assessments.





“We picture ourselves as spanning a gap between people who are producing basic science, like universities, and people who need that information, like practitioners and policymakers.”



Of course, ICIMOD's work influences policies in the Himalayas, but it also advances science by bringing diplomats and policy makers from different countries together in a cooperative venture. "Science diplomacy is a diplomacy where knowledge-creation is quite important," says Sharma.

ICIMOD fosters international cooperation by providing the scientific evidence that there are problems that need to be addressed. As a result, different governments fund joint research projects that advance scientific expertise. Then these studies end up printed in high-impact peer reviewed journals, and eventually contribute to the global discourse on some of the world's most pressing problems.

"We value the science, but we also value the uptake of that science," Molden explains. "We picture ourselves as spanning a gap between people who are producing basic science, like universities, and people who need that information, like practitioners and policymakers." ICIMOD, he concludes, is "a bridge between science and policy in practice."

Adaptation to Change

The human cultures of the Hindu Kush Himalayas are experiencing many disruptive changes. Agricultural practices are shifting because of water scarcity and climate variability. People are moving from the country to the cities to find better jobs or education, while many others – especially men – are leaving their country to improve their lives and the lives of their families, and to flee insecurity, disaster and famine. As a result, today about 30 million citizens from the region live outside their homeland.

All of these challenges can be compounded by climate change, because its impact on ice reserves and water resources can put at risk both ecosystem services and food security.

"The big question is: How do people adapt to these changes and move forward to improve livelihoods and have sustainable mountain development?" says Molden.







The goal of ICIMOD's regional programme, Adaptation to Change, is to enhance resilience of mountain communities, and to support adaptation by both communities and ecosystems. Following a community-based approach, it seeks to capture and use indigenous knowledge, and provides scientific support to contribute to adaptation. Still, according to Neera Shrestha Pradhan, a hazard and community adaptation specialist, many of the farmers that she met in her career are not familiar with the scientific concept of climate change. But at the same time, she says, "most of them say that the temperature is rising, it's becoming hotter and hotter, and rainfall is decreasing."

"They don't care if that's climate change or not – they are vulnerable, and they are adapting to these changes," adds Molden. "We have several sites on the ground with communities across our eight regional member countries for understanding as well as trying out different solutions, and then a strategy for outreach to take that forward."

For instance, the Himalayan Climate Change Adaptation Programme (HICAP) is a collaboration among three organizations – ICIMOD, the Center for International Climate and Environmental Research-Oslo (CICERO) and GRID-Arendal. Together, these institutions study the relationship between climate change, water, ecosystem, food, vulnerability, gender, adaptation.

HICAP pays special attention to women and gender-related issues. This not only because women face many social, economic and political barriers, but also because they have important responsibilities as stewards of natural and household resources. These roles put them in the ideal position to contribute to adaptation strategies.





Consider the women who live in the two "Climate Smart Villages" that ICIMOD and its partners set up in the Kathmandu Valley. These are pilot villages where local people are being trained to adopt organic farming, integrating both low-tech and modern technologies as part of their work.

Since training started in June 2014, everyday life in these villages has undergone many changes. Farmers now use virtually no chemicals. Instead, they spray their fields with cow urine, a highly effective bio-fertilizer. New combinations of crops and cropping patterns maintain soil fertility and moisture, assuring higher yields for the whole village. And when it comes the time to sell produce, they are able to decide what is the best day to do it because they can check market prices on their mobile phones via text messages.

According to Ilamala Timilsina, a 35-year-old woman from Kavre District in Nepal, these technologies improved the lives of villagers dramatically.

"Our income increased, and we are using this extra money for the education of our children," Timilsina says. Today, she adds, all those who switched to organic agriculture no longer need costly and polluting chemicals, and they are able to sell their products at a higher price. And although her village is still a small a pilot project site, it already has inspired other farmers. "The people who live in the neighbouring village asked us for information on smart technologies" she says with a smile, "because they want to adopt them as well."

But the smart villages are not the only ones that are enjoying higher incomes. As a result of ICIMOD's work, many communities in this region are earning more money by selling products that have low volume, high value, long shelf life, and have some comparative advantages over similar goods. Basically, "products that fit the mountain context", explains Surendra Raj Joshi, ICIMOD's high-value products specialist. These can be medicinal herbs, spices such as cardamom, fruits such as kiwi, and other highly profitable non-timber forest products like honey, a product that ICIMOD has been promoting for more than 25 years.

EKLABYA SHARMA, director of Programme Operations



Eklabya Sharma was born in Darjeeling, India. While some of his family members were involved in farming, others were working in the government, and he believes this natural and social environment played an important role in his future career as a top-level scientist.

"I come from mountains and now I work for mountains" – that's how he sums up more than three decades spent working as an ecologist. During these years he developed, managed and implemented many programmes, mainly on sustainable natural resource management in the Hindu Kush Himalayan region.

Sharma has a PhD in ecology from Banaras Hindu University, India, where he started his career in 1985 as a postdoctoral fellow. Between 1989 and 2001, he established the GB Pant Institute of Himalayan Environment and Development in Sikkim, an autonomous regional research centre of the Indian Ministry of Environment and Forests, and served as the founding scientist-in-charge. He joined ICIMOD in 2001.

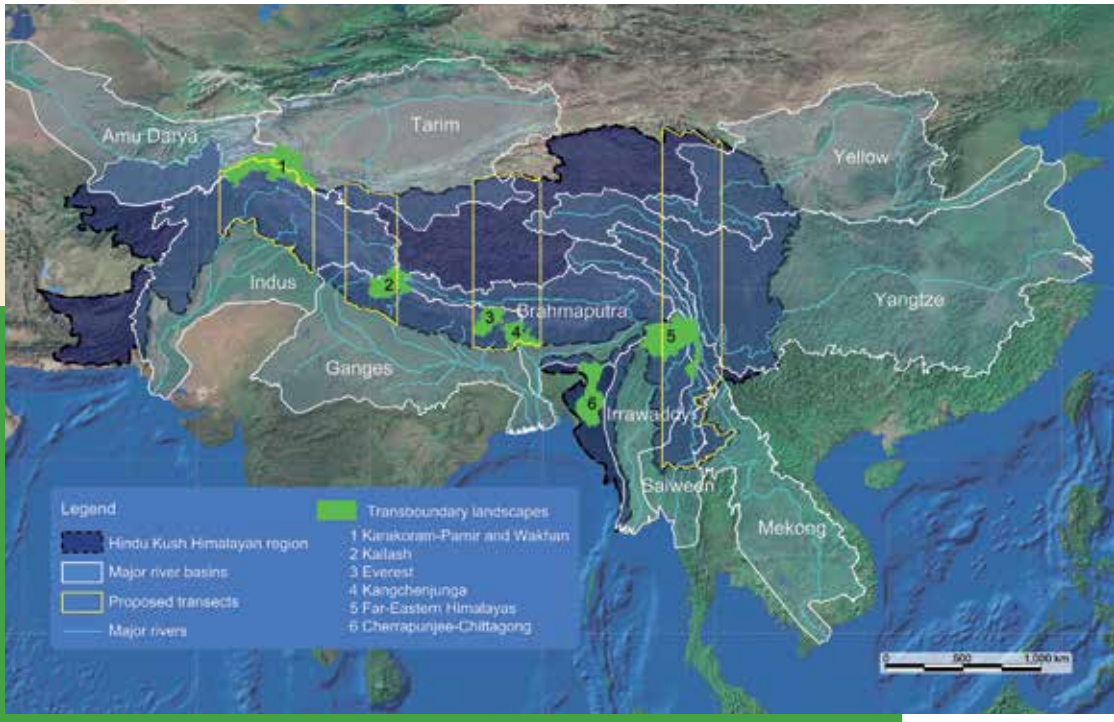
He has received many national and international awards, from the Indian National Science Academy's Young Scientist Award that he won in 1988, to the Eminent Scientist Award that he received from the Ministry of Environment and Forests in 1995. Since 2014, he has been a fellow of the Indian National Science Academy; he has published 18 books and has more than 160 total publications to his credit, the majority in peer-reviewed international journals. He has supervised seven PhD theses on ecology, primarily dealing with natural resource management of the eastern Himalayas.

He gained experience in many fields, from participatory mountain development to biodiversity conservation and watershed management. But what he regards as the most important aspect of his work is the impact of science on everyday people. "Whatever knowledge I or my colleagues generated," he says, "it needs to be used in an optimum way for the well-being of the people in the mountains, as well as downstream."

> *"Our income increased, and we are using this extra money for the education of our children. The people who live in the neighbouring village asked us for information on smart technologies, because they want to adopt them as well."*

Transboundary Landscapes

The Kailash Sacred Landscape is a magnificent area located within the remote south-western portion of the Tibet Autonomous Region of China, the Far-Western region of Nepal, and the north-eastern flank of Uttarakhand State in northern India. It is spread over an area of about 31,000 square kilometres and represents a diverse, multi-cultural and fragile landscape. It was named "sacred" because it hosts numerous holy sites, including high-altitude lakes, snow peaks and a fine network of religious places across the three countries. The most important among them are the majestic 6,638 meters of the revered Mount Kailash and the deep blue waters of the adjacent Lake Manasarovar.







Both these places are within the Tibet Autonomous Region, and have represented the ultimate pilgrimage destination for as many as five religions – Hinduism, Buddhism, Jainism, Sikhism, and Bon – for several millennia.

"I consider myself a very, very fortunate human being," says Rajan Kotru, heads of ICIMOD's Transboundary Landscapes Programme, recalling his three visits to this area. "It is truly the centre of the universe for me. The moment you enter this landscape there is an inner feeling that you are part of this universe and that this universe is really in you."

"Every human being responds differently, but for me it was a kind of inner journey: if this peak can stand tall, then I should also stand tall and do benefit to the whole world."

The area around Mount Kailash is one of the seven transboundary landscapes identified by ICIMOD and its partners. "These landscapes are quite fascinating", says David Molden, "in the sense that we have intentionally chosen geographic areas that span boundaries of at least three different countries."

The Transboundary Landscape programme deals with ecosystems rather than administrative boundaries. This is because ICIMOD believes transnational cooperation can improve livelihoods and tackle conservation issues while pushing for economic development, and socio-cultural resilience to environmental changes. "Where people in the Himalayas are managing their ecosystems properly, they should qualify for certain incentives," explains Kotru, referring to local development programmes.

Conserving ecosystems is critical in the Hindu Kush Himalayas, but today intensive exploitation and pollution put this region's natural resources at risk. Unfortunately, protecting this region's environment is an enormous challenge. First, the area is extremely heterogeneous, with interlinkages between biomes (areas that share similar climatic conditions, plants and animal species) and habitats. Second, strong connections between upstream and downstream areas influence the supply of fresh water and food, construction materials and medic-



inal plants, and these are the ecosystem services that sustain the lives and livelihoods of mountain communities. On top of that, this region's ecosystems are often crossed and divided by national borders.

The Kailash Sacred Landscape Conservation and Development Initiative is a transboundary collaborative programme between China, India and Nepal. "Geopolitically, it's a very, very sensitive issue to bring China and India together and putting Nepal on board," notes Kotru. In fact, the diplomatic process that laid the foundations of this initiative took three years to come together, from 2009 to 2012.

The initiative evolved through negotiations among various local and national research and development institutions: the CAS Institute of Geographic Sciences and Natural Resources Research; the Indian Ministry of Environment & Forests, the G.B. Pant Institute of Himalayan Environment and Development; and, in Nepal, the Ministry of Forests and Soil Conservation and its Department of Forests.

The Kailash-Manasarovar area plays a pivotal role in the region's spirituality, but its mountains are important for more temporal needs as well because they form the upper catchment of four of Asia's major rivers: Indus, Sutlej, Brahmaputra, and Karnali. Still, livelihood options there are limited for local communities. For this reason, this initiative set up many projects, like cooperatives with mountain communities from different countries that today harvest Indian Butter trees and trade its fruits, which are used to make everything from cream to oil. The initiative also promoted ecotourism and the installation of an effective waste management system that ensures garbage is collected and brought down from the mountain. But ICIMOD's commitment to protect this landscape and its ambition do not stop there.

Says Kotru: "We are hoping that someday the Kailash Sacred Landscape will be a UNESCO World Heritage site."

> *"Every human being responds differently, but for me it was a kind of inner journey: if this peak can stand tall, then I should also stand tall and do benefit to the whole world."*

River Basins

Rivers are a source of both life and death. In this part of Asia they provide water, ecosystem services, and the basis for livelihoods to more than 210 million people. They can be harnessed to produce electricity through hydroelectric power plants, but every year they cause floods that kill hundreds of people and leave entire communities without means to make a living. The Pakistani floods of 2010, for instance, killed about 2,000 people and affected some 20 million. “Most of the people in this region are actually affected by disasters because of flash floods, so that is quite important for us,” says Eklabya Sharma, director of programme operations.



The objective of ICIMOD's River Basins Programme is to improve integrated river basin management – that is, management which takes into account many interrelated sectors such as energy, agriculture, communication and transportation. "It is a concept that promotes integration also among teams," explains Arun Bhakta Shrestha, River Basins regional programme manager.





"It is much more than just the technical aspect of water flow," Shrestha continues. Water management, he adds, should always take into account what sectors are using water, the administrative areas involved, the upstream and downstream context, and the social and economic issues related to water use.

The river basin approach deals with the communities' expectations for livelihoods, industry, recreation, nature management, energy and agriculture. Its aim is to maximize the economic and social benefits from water resources in an equitable manner while conserving and restoring freshwater ecosystems.

All of these issues are analysed by ICIMOD to reduce physical vulnerabilities and improve food and energy security. This is done with a holistic approach, taking into account both mountain and downstream communities. However, in many parts of this region water is related to hazards such as landslides and glacial lake outburst floods. Furthermore, many parts of the Himalayas are prone to flash floods, disasters that claim lives, destroy infrastructures and proprieties and eventually aggravate poverty.

Some of the most dangerous floods are those which have a transboundary nature, which means they originate in one country and affect another one. And even if only 10% of floods have a transboundary nature, they cause 30% of global flood causalities and account for close to 60% of the displacements caused by these disasters.

For this reason, ICIMOD is establishing a regional flood information system project that promotes the timely exchange of flood data and information between countries. The Hindu Kush Himalayas Hydrological Cycle Observation System involves four countries as participants (Bangladesh, Bhutan, Nepal and Pakistan), and two countries with an observer status (China and India). Its objective is to minimize the loss of lives and livelihoods by reducing flood vulnerability in the Ganges-Brahmaputra-Meghna and Indus river basins.

To do that, in all these countries ICIMOD selected several locations that were already equipped with a measurement station and employed trained local staff. Then ICIMOD upgraded some of their equipment in order to make sure the data they collect are internationally comparable, and provided them with a real-time communication system.

Today these hydrometereological stations record river levels, rainfall and related data. This information travels through direct telemetry to the national hydrometereological services of the partner countries and to ICIMOD. Eventually ICIMOD puts all the information collected by this network on a web-based platform, making the data available in real time. Then ICIMOD uses all this information and other data provided by other agencies such as NASA to develop models that allow its scientists to project a flood outlook. "This does not prevent the damage," says Shrestha, "but can actually save lives."





ICIMOD is establishing a regional flood information system project that promotes the timely exchange of flood data and information between countries.

This initiative is fairly new and there is a lot to be done. "Actually," he explains, "the network we have is very small – 35 stations." The initiative is far from solving Himalyan flood problems, but he believes that ICIMOD and its partners are on the right track. "In the future, we will enrich this network and improve the floods outlook," he says, "and we believe it will create more impact."





This is a critical initiative for ICIMOD, and the centre hopes to bring other countries on board soon. "China and India are very important members in this context because large areas of river basins lie between these countries," Shrestha says. "One day I think they will realise the importance of what we are doing, and then participate as full members and start sharing information from their territory as well."

> *"Some of the most dangerous floods are those which have a transboundary nature, which means they originate in one country and affect another one."*

Cryosphere and Atmosphere

Air and water move freely from one country to another, and what happens to them affects everyone in the region. This is a central issue for those who live in the Hindu Kush Himalayas, as both water availability and air quality are threatened by the impact of climate change on glaciers and by atmospheric pollution.

However, the region still lacks information about what is happening to its cryosphere – the places where water is frozen into ice or snow – and its atmosphere. ICIMOD's Cryosphere and Atmosphere Programme addresses the need for this knowledge, and works towards increasing water resources, improving risk management and reducing pollution.



ICIMOD's work on the cryosphere focuses on the monitoring of glaciers, snow and glacial lakes. It also deals with glaciohydrology, with an emphasis on modelling, remote sensing, and *in situ* measurements. By working with its partners, the centre aims to build a regional cryosphere knowledge hub to collate and share knowledge, and to build capacity to study the cryosphere.

ICIMOD also pays special attention to the air pollution that chokes the skies in many parts of the Himalayan region, from Kathmandu to Islamabad and Beijing. Air pollution contributes to climate change, but according to Arnico Panday, ICIMOD's senior atmospheric scientist and coordinator of the Atmosphere Initiative, its negative effects do not stop there. "It has direct impacts on people's health and on visibility," Panday says. "And visibility has an impact on tourism. Who will go to the mountain places if you don't see the mountains?"





Atmospheric pollution has increased significantly in this region in the past two decades, and to tackle this problem ICIMOD in 2013 established its Atmosphere Initiative. Some of the most dangerous pollutants for this region are black carbon aerosols, particles emitted during incomplete combustion of fossil fuels and biomass. A large portion of black carbon in the region is emitted by traditional cooking stoves that affect indoor air quality and thus the health of women and children.

But black carbon aerosols absorb sunlight as well, disrupting the delicate balance of atmospheric conditions which shape Asian monsoon circulation patterns and rainfall. Further, black carbon can accelerate the melting of snow and ice in the Himalayas, influencing the water cycle and increasing the risk of flooding.





Unfortunately, solving air pollution is not easy. One of the main problems is that the pollution produced in one country often ends up in another. "We see a role for us to help improve scientific knowledge about the atmospheric changes taking place in the region, about atmospheric problems, and using science as a way to help influence policy," explains Panday.

As this is a relatively new programme, ICIMOD is still planning many activities, such as monitoring of atmospheric changes taking place, and measuring pollution levels in different part of the region. Even so, ICIMOD already set up an in-house modelling centre that uses state-of-the-art atmospheric models. "We're using the modelling centre to do weather forecasts, but we'll be moving towards pollution forecasts and using the models not just to understand past pollution episodes, but also to run scenario analysis," says Panday. This will allow scientists to predict, for example, what would happen if some of the many brick kilns that are widespread across the region are shut down.

This initiative also works on mitigation. For instance, the government of Nepal has an ambitious project to replace all traditional cook stoves by 2017, and Panday says ICIMOD will add value "by doing research projects looking at how much actual improvement of emissions you get from different cook stoves in real-life situations".

> *"[Air pollution] has direct impacts on people's health and on visibility. And visibility has an impact on tourism. Who will go to the mountain places if you don't see the mountains?"*

NEERA SHRESTHA PRADHAN, water and adaptation specialist



Millions of those living in the Hindu Kush Himalayan region know how dangerous floods can be. Some of the worst floods in living memory have occurred in South Asia. For instance, the Pakistan floods of 2010 killed about 2,000 people and affected 20 million, while a breach of the Koshi embankment in Nepal in 2008 displaced more than 4 million people in India and another 70,000 in Nepal.

Neera Shrestha Pradhan, water and adaptation specialist at ICIMOD and associate coordinator at the Himalayan Climate Change Adaptation Programme, has devoted her career to community-based adaptation measures and has been working at ICIMOD since 2012. "That means looking at the people who are really vulnerable to climate change and how they are adapting to this change," she explains.

Before joining the centre she worked at IUCN, the International Union for Conservation of Nature, focusing on hydropower for the regional environmental impact assessment programme on Asia. Then she joined WWF-Nepal and for almost seven years worked as freshwater programme manager, but she also carried on projects at community and government level.

Pradhan says that very often communities in flood-prone areas do not have access to information about flood forecasting. As a result, they do not have sufficient time to

The centre already organised trainings for governments' staff, but it also set up courses for atmospheric modellers and has been brainstorming a degree programme focused on atmospheric issues in mountain areas. "We've built an enthusiasm," Panday explains, "about the possibility of working together across the borders".

In February 2015, ICIMOD hosted a meeting of the Climate and Clean Air Coalition. Over 100 state and non-state partners met in Kathmandu to develop a five-year strategic plan of action. At this meeting, the Working Group agreed on more than $5 million of new funding for initiatives like soot-free urban bus fleets, investigating methane produced by ruminant species, and a new regional assessment on air pollution.

Still, it remains a challenge to set up a network of measurement stations throughout the Hindu Kush Himalayan region. "We are trying to set them up in collaboration with national partners, with government ownership or co-ownership from the start," says Panday, "That

evacuate and put their cattle and belongings in a safe area, and floods result in enormous human and economic losses.

ICIMOD's answer is the Community-Based Flood Early Warning system, which allows communities downstream to access almost real-time information about the water level upstream.

The cost of one system is low – around USD1,000, and works in a simple and straightforward way. A solar-charged transmitter has a flood gauge set up on a river, and a receiver has a control unit installed in a household on the river bank. As the water rises, the electronic sensors produces an alarm, which is communicated to the receiver through a wireless device. The person chosen as caretaker observes the risk level and sends a flood warning message via mobile phones. The message is relayed to the focal person living in flood-prone downstream villages, the project team and the district disaster management authorities, who disseminate it to the vulnerable communities further downstream.

The service has already benefitted thousands of people living in at least 45 flood-prone villages downstream of the Jiadhal and Singora rivers in India, providing average lead time of one or two hours to prepare the communities to cope with rising waters. For this reason, this system was chosen in 2014 among the winners of the UN Climate Change secretariat's Lighthouse Activity Awards, which recognize innovative and transformative solutions that address both climate change and wider economic, social and environmental challenges.

takes time – more time that we expected – but it also ensures the sustainability of the stations much beyond the current funding cycle.

"Our hope over the years," he concludes, "is to influence regionally coordinated policy-making that takes into account the impact of emissions of one country on resources in other countries."

> *"Our hope over the years is to influence regionally coordinated policy-making that takes into account the impact of emissions of one country on resources in other countries."*

Mountain Environment and Natural Resources Information System

The Himalayas are colossal mountains and vast areas isolated from the rest of the world. From the cold deserts of Afghanistan to the inaccessible slopes of the Tibetan Plateau, researchers often have to spend days to reach the most remote areas of this region in order to collect data. But technologies such as earth observation applications and GIS tools help to overcome this problem. ICIMOD has embraced these technologies since the 1990s, and today promotes them through its Mountain Environment and Natural Resources Information System.

"Reaching the most distant glaciers is one of the biggest challenges in the mountains," says GIS specialist Birendra Bajracharya. "Therefore remote sensing is the only means sometimes to have an overview of the region."







These technologies also allow researchers to compare data, making it possible for them to look at the changes in the region, especially in terms of the effects of climate change, and to understand the linkages with natural and anthropogenic factors.

Reliable data are critical for informed policy-making. Still, when IPCC released its fourth assessment report in 2007, data for the whole Hindu Kush Himalayan region were for the most part absent. ICIMOD realised the countries of the region needed to bridge this knowledge gap, and in 2011 it organised a workshop in Kathmandu that convened leading experts in the different fields of climate science from across the region and abroad. The outcome of this meeting was *Climate Change in the Hindu Kush Himalayas – The State of Current Knowledge*, a report that synthesised the most up-to-date science-based information available.

This report illuminated how gaps in knowledge about climate change can have consequences for the region's mountain system, but it also showed a way forward for the future and laid the foundations for ICIMOD's Mountain Environment and Natural Resources Information System Programme. Today this programme includes long-term monitoring, database development and uptake of knowledge for the Hindu Kush Himalayas, and includes information on the cryosphere, meteorological and hydrological parameters, air pollution, ecological and climate change, status and change of land use and land cover, biodiversity, floods and natural disasters, and socio-economic changes.

> *"Reaching the most distant glaciers is one of the biggest challenges in the mountains. Therefore remote sensing is the only means sometimes to have an overview of the region."*

But if data are not easily accessible they can be useless, so the centre addressed this issue as well with a dedicated initiative. "ICIMOD has been working on different programmes and different projects for many years, and we felt necessary that the data should remain available," explains Bajracharya. "So the Regional Database Initiative was established to facilitate this information-sharing."

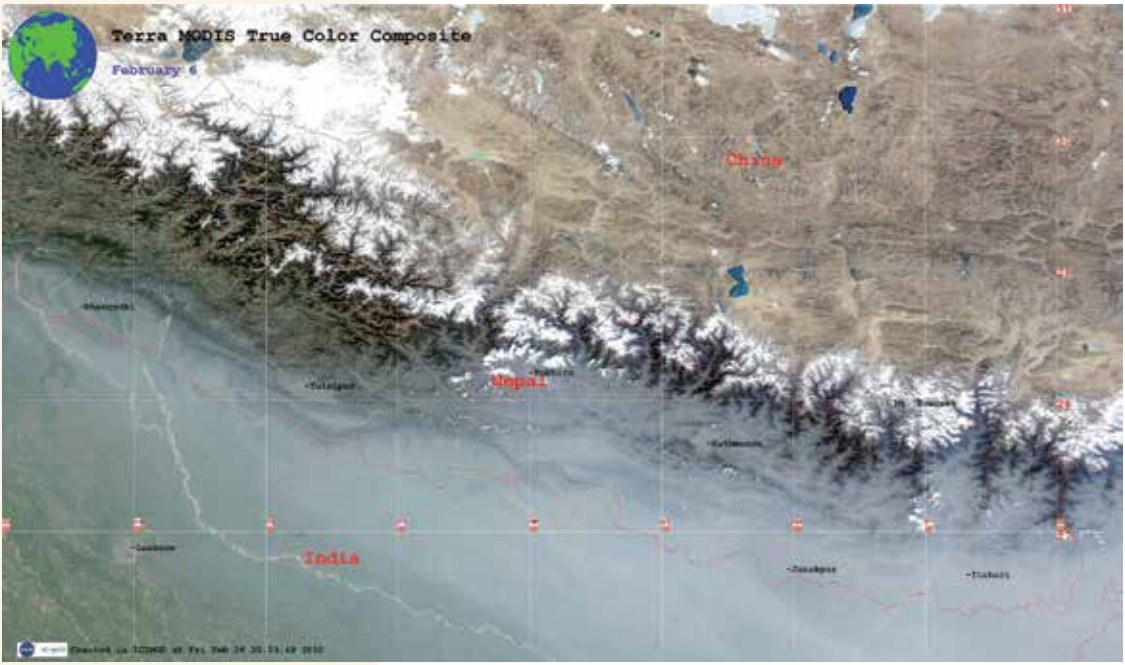
The database where all this data is stored is located at ICIMOD, but the information is available for free through a web portal. In this way, researchers from the region and beyond can use this data-sharing platform and benefit from the work that has been done in the past.

The other initiative developed by ICIMOD as part of this programme is SERVIR-Himalaya, a joint venture with NASA and USAID. The project aims to provide developing nations with satellite-based Earth-observation data and science applications to help them improve environmental decision-making.





> *ICIMOD's rooftop features a detection and monitoring system that uses real-time satellite data to detect forest fires. The project already has saved lives, property, and Nepal's environment. Soon the technology will be adopted in Bhutan, as well.*



Since 2013, these agencies have been working together with ICIMOD to establish a regional visualization and monitoring system in the Himalayas. The platform is being developed through ICIMOD's network, and will integrate Earth-observation information, such as satellite imagery and forecast models, together with *in situ* data. SERVIR-Himalaya will provide this information to help countries assess environmental threats and damage from natural disasters and to respond these challenges.

As technology without capacity is useless, ICIMOD trains those who work in the region's land agencies and government departments in using GIS. That's important – this technology in the Himalayas can save lives.

ICIMOD's rooftop provides a compelling example: The roofline features a detection and monitoring system that uses real-time satellite data to detect forest fires. If the system detects a fire, it identifies the location, assesses the damage and automatically sends a notification via email and text message to fire managers, rangers, local communities and other officials in Nepal. The project already has saved lives, property, and Nepal's environment. Soon the technology will be adopted in Bhutan, as well.

Himalayan University Consortium

When scientists are not aware of what their colleagues in other countries are doing, they risk missing opportunities to collaborate; that, in turn, can waste vital resources. This risk is very concrete in the Hindu Kush Himalayan region, where national barriers prevent universities from collaborating. On top of that, mountains have their peculiar challenges, and university curricula do not always fit with the needs of mountain communities.

For these reasons, ICIMOD in 2007 initiated the Himalayan University Consortium (HUC), an organisation that initially convened 16 members from the region, and nine associate members from outside the Himalayas. The vision of HUC is to enhance collaboration among the universities of the region and to promote centres of excellence on key mountain-related







topics. By developing joint research and knowledge-management programmes, ICIMOD and its partners want to ease some of the capacity and funding limits faced by regional institutions.

"ICIMOD is a small institution," says Eklabya Sharma. "We cannot do all the science that is required for such a big region, so we need to have a very strategic approach of collaborating. He explains that by building a strong network of universities, ICIMOD wants to get professors, students and researchers together to allow them to share ideas and experience, to learn from each other. Doing that can help to advance mountain-related knowledge.

"Most of the universities or institutions in the Himalayan region are influenced largely by knowledge which has been generated in the plains, so there is no curriculum which is directly matching with the requirements of the mountains," continues Sharma. For instance, universities are teaching to mountain people the agricultural techniques developed for the plains. And the region suffers a chronic lack of glaciologists. HUC wants to develop new curricula in order to train a critical mass of students who will be able to meet the mountain challenges of the future.

While the consortium is still at a development stage, it already has grown to 28 full members from across the Hindu Kush Himalayas, and nine associate members from Austria, Japan, the Netherlands, Norway, Tajikistan, Thailand, the UK and the US. In the near future, it will launch many initiatives, like small grants, exchange and mobility opportunities, and scholarships.

"This is a very exciting programme and we are picking up lots of interest in the countries," says David Molden. "This is where the future lies, because we really need to build the capacity locally, especially of young women and men from the region – our future mountain leaders, to address these mountain problems."

Knowledge Management and Communication

Since its beginning, ICIMOD's aim has been not only to produce cutting-edge research, but to improve life in the Hindu Kush Himalayas. "Science in itself does not move anything," says Anja Møller Rasmussen, who manages ICIMOD's Knowledge Management and Communication. "We need an institution like ICIMOD to play the role of the translators for those who utilise the research – figure out how to convince people, how make sure that the result that comes out is actually easily taken up by the people who can benefit from it."

When people understand the research, they can use the knowledge more effectively. And that means ICIMOD has a greater impact. "You have to talk to the hearts, not only to brains," explains Rasmussen.



ICIMOD sees itself as an open house for knowledge initiatives on sustainable mountain development, and this centre aims to reach many different audiences, from governments to politicians, lawmakers, NGOs and big transnational organisations, but also school children, local communities, and women's groups. "We need different strategies for each of these groups," she explains. ICIMOD uses online publications, databases, multimedia and web content, all of which are available globally.





To engage with the general public, in 2013 ICIMOD also organised CLIMATE+CHANGE, a travelling photo exhibition that showcased the rapidly changing Himalayas and highlighted adaptation solutions. This exhibition was a real success: more than 100,000 people visited the exhibition in Kathmandu and Pokhara, including many schoolchildren, tourists and local families.

> *"We need an institution like ICIMOD to play the role of the translators for those who utilise the research – figure out how to convince people, how make sure that the result that comes out is actually easily taken up by the people who can benefit from it."*





New communications and interactive knowledge-sharing tools are constantly emerging. For this reason, ICIMOD seeks to keep abreast of these innovations while remaining relevant to the region's socio-cultural context. "We write a lot of peer-reviewed articles, we write a lot of books, but it's not our main communication tool," says Rasmussen. "Our main communication tool is face-to-face meetings, it's videos, it's TV series, it's our knowledge park in Godavari where you have hands-on experiences. "

The ICIMOD Knowledge Park at Godavari, on the southern slopes of the Kathmandu Valley, was set up in 1993 on 30 hectares of land provided by His Majesty's Government of Nepal. At the time, a large part of the site was heavily degraded and the initial activities focused on the rehabilitation of land systems. Since then, a considerable part of it has been gradually restored to semi-natural forest.

> *"Our main communication tool is face-to-face meetings, it's videos, it's TV series, it's our knowledge park in Godavari where you have hands-on experiences."*

Walking the paths through this park is both pleasant and informative. Some slopes have been converted to lush crop-bearing terrace land, using contour hedgerows of nitrogen-fixing plants; others host orchards and fruit trees. Some demonstration sites showcase various water-management techniques, like roof-top and natural spring water harvesting, drip irrigation systems and foot-powered water pumps. Other plots exhibit income-generation ideas, such as beekeeping and high-value cash crops as Shitake mushrooms. But at Godavari there are also agricultural and renewable energy technologies, not to mention a plant nursery, a meteorological monitoring station, and the prototype of ICIMOD's Flood Early Warning System.

This site also provides training facilities to improve the skills and the technical knowledge of farmers, development workers, and members of ICIMOD's partner institutions. From 1994 to 2012, the park hosted 186 training events and welcomed more than 42,000 visitors and trainees among farmers, development workers and students. But the most recent development has been a renewed focus on community outreach, with off-site demonstration and training activities among local communities.







"That can keep people in the mountains," explains Rasmussen. "If we end up with empty mountains because everybody loses their livelihoods, we're going to lose a very important element of biodiversity: the human beings."

Toward a Sustainable Future

Since its founding in 1983, ICIMOD has grown from a small office to a major centre that employs more than 300 people and is engaged with over 200 partners. Its growth was driven by both its ambition and success, and even if it has been working for the Himalayan mountains and its people for more than three decades, this centre feels young and vital. With abundant creative energy, it is focused on the challenges that lie ahead.

One thing that has never changed in ICIMOD's history is its approach to science. Since its beginning, a core assumption has been that knowledge should always be used to guide innovation. It also believes in the consensus-building, problem-solving power of science diplomacy and international cooperation.



Of course in the future ICIMOD will continue to generate knowledge, and in 2017/2018 it will publish an international peer-reviewed assessment containing state-of-the-art information on the Hindu Kush Himalayan region. This document will make it possible for researchers and policymakers to understand the drivers of changes now underway, how those drivers are impacting this area's resources, and what sustainable development approaches are available.





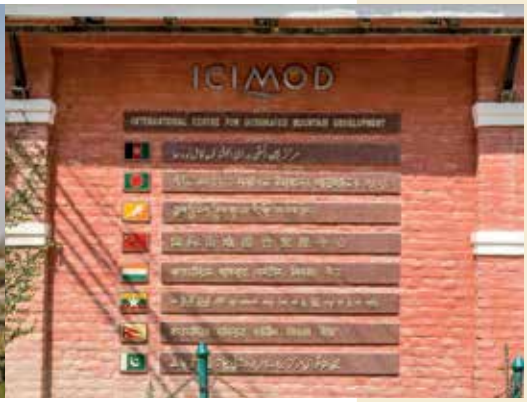
"This will be the best information [available] from this region, so that in the future we can refer to this and then compare," says Sharma. "We do lots of science, we are generating data analysis. It should not remain just for scientific and academic purposes," he says.

Sharma stresses that the knowledge must translate to direct human value: alleviating poverty in the region.

And to create that value and fulfil other elements of its mission, the centre will continue to foster transnational collaboration within the region. Sharma sees it as a moral obligation. "This is the only institute which is of intergovernmental nature established by eight countries," he explains, "and we are given the regional mandate to work on the mountains."

> *"Since its founding, ICIMOD has symbolised the consensus-building, problem-solving power of science diplomacy and international cooperation."*





Farid Ahmad, head of strategic planning, monitoring and evaluation, believes that even as the centre grows and evolves, it must always remember its mission and vision. "We should continue to focus on regional cooperation – I think that's the niche for ICIMOD," he says. "We have to create an environment where all the countries can share more and more information and data which will eventually build up a trust in the countries."

According to Ahmad, today climate change is ICIMOD's main focus, but in the near future this centre will have to deal more and more with other factors that are influencing change, such as globalisation and the influence of markets. "I think it is critical to look also at such changes which are affecting livelihoods in mountain areas," he says. This point of view is shared by Molden as well, who thinks ICIMOD will have to focus also on topics like disaster risk reduction, energy and agriculture.

"We should not leave the roadmap," adds Ahmad. "I think we should continue to push the frontiers as much as possible and eventually we will get where we need to be, because we want to have an ecologically sustainable livelihood for mountain people."

"There are many national institutions, let them do the national part," agrees Sharma. "But they can cooperate with ICIMOD to do the regional aspect.

"There are many governments that talk about mountains," he continues, "but they need hard facts, they need science backup, they need science to do diplomacy – and ICIMOD can bring that science for the governments to do diplomacy. For this reason, ICIMOD needs to exist and needs to work at this level."

ICIMOD in fact does more than solve practical problems: It brings countries together. Molden believes scientists can play a pivotal role in making sure that countries cooperate.

"It's so encouraging to see the scientists, when they get together, how open they are, how they share ideas," Molden says.

"Our strategy is: Those scientists will talk to their countries and they have influence on their policies. So it is a way that different kinds of conversations can happen that otherwise are politically difficult in this environment."

According to Molden, areas such as water management are more difficult to discuss than others, yet ICIMOD still works to engage different nations on sensitive issues.

"In a way we don't tackle that directly," he explains. "We work around, we try to find scientific information and deal with topics like the cryosphere and disaster risk reduction, where everybody will have an interest in reducing the damage from floods, so that is a conversation we can have. It's easier. But we recognise it is science for diplomacy, and I do feel very much a diplomat many times."

The director general thinks networking and transnational cooperation will always be a powerful tool to fulfil the centre's mission.





"We should continue to focus on regional cooperation – I think that's the niche for ICIMOD. We have to create an environment where all the countries can share more and more information and data which will eventually build up a trust in the countries."





"Of course our board members are great champions, but amongst our partners we have other people who really appreciate the work that we have done, and we have built a significant amount of social capital at ICIMOD over more than 30 years," he says. This is a valuable asset that allows ICIMOD to push for sustainable mountain development. "We have many, many friends in the different countries too, so we often pull on that social capital and really try to build on that to make a difference as well."

"As a knowledge organisation, we do value very much the science," Molden continues. "But we also do value our collaboration and association with TWAS – a lot of our partners are members of TWAS."

Looking to the future of global development, ICIMOD can be seen as a successful case study that other institutions from all over the world can study and learn from. The challenges faced by the Himalayas have their unique qualities, but many issues faced here in Asia are similar to those faced by other regions. For instance, most developing countries are prone to floods and landslides, and the challenges of climate change will be felt most acutely across the developing world. But fortunately – as ICIMOD's history shows – transnational collaboration can help to improve the lives of those who live in the South, from the Himalayas to Atlas Mountains of Morocco, the Andes of Peru and beyond.

"Why there is no such an institution in Africa or in South America?" asks Sharma. "More than 30 years ago it was good thinking of visionaries who have seen ICIMOD, and have imagined ICIMOD. The same thing must happen for Africa and other mountain regions."

Acknowledgements

First of all we would like to thank David Molden, ICIMOD director general, and Eklabya Sharma, director of programme operations, for opening the doors of the Centre to us.

A special 'thank you' goes to the knowledge management and communication team, especially Anja Møller Rasmussen, Amy Elizabeth Sellmyer, Jitendra Raj Bajracharya and Utsav Maden for their assistance in setting up interviews and organising tips around Kathmandu Valley. Our gratitude also goes to all those who answered our questions, shared their expertise, and made our stay in Nepal wonderful.

We would also like to thank Edward Lempinen, public information officer at TWAS, for his invaluable editorial help and moral support.

Giovanni Ortolani and *Paola Di Bella*

About the Authors

Giovanni Ortolani is a freelance multimedia journalist and documentary maker. He is a United Nations Foundation Press Fellow and has been shortlisted for best newcomer in Association of British Science Writers' British Science Writing Awards for Britain and Ireland 2015.

Paola Di Bella is a freelance photographer specialising in science and reportage. Her photos have been featured in National Geographic Extreme, SciDev.Net, La Stampa and Pagina99, among other publications.

About TWAS

The World Academy of Sciences for the advancement of science in developing countries (TWAS) works to advance sustainable prosperity through research, education, policy and diplomacy. TWAS was founded in 1983 by a distinguished group of scientists from the developing world, under the leadership of Abdus Salam, the Pakistani physicist and Nobel Prize winner. Today, TWAS has nearly 1,200 elected Fellows from more than 90 countries; 16 of them are Nobel laureates. The Academy is based in Trieste, Italy, on the campus of the Abdus Salam International Centre for Theoretical Physics (ICTP). Since 1983, its mission has focused on supporting and promoting excellence in scientific research in the developing world and applying scientific and engineering research to address global challenges. TWAS receives core funding from the Government of Italy. The United Nations Educational, Scientific and Cultural Organization (UNESCO) administers TWAS funds and personnel.

- ICTP Campus, Strada Costiera 11, 34151 Trieste, Italy
- Tel: +39 040 2240 327
- Fax: +39 040 224 559
- e-mail: info@twas.org

For additional information, see **www.twas.org**.

THE EXCELLENCE IN SCIENCE SERIES

Over the past nine years, TWAS has published a series of profiles focusing on some of the best scientific institutions in the developing world. The case study on the International Centre for Integrated Mountain Development (ICIMOD) contained in this volume is the third with our partner COMSATS, the Commission on Science and Technology for Sustainable Development in the South. All books in the Centres of Excellence series can be found online at:
www.twas.org/publications/excellence-in-science

For print copies, please contact **info@twas.org**.

About COMSATS

The Commission on Science and Technology for Sustainable Development in the South (COMSATS) is an inter-governmental organization headquartered in Islamabad, Pakistan. Established in 1994, the organization comprising 23 member states strives to promote South-South cooperation in the fields of science and technology that are most relevant to socio-economic development. A network of 20 centres of excellence affiliated with COMSATS – spanning four continents – provides the necessary pool of human resources and scientific infrastructure for undertaking a variety of capacity-building programmes, bilateral and multilateral cooperative research and consultancy/advocacy for the promotion of S&T as primary ingredient of national development plans. COMSATS also provides an institutional platform for North-South technical cooperation in areas of common interest such as energy, health, education, information technology and environment.

The mission of COMSATS is to help create a world where all nations are at peace and capable of providing good quality of life to their people in a sustainable way using modern S&T resources. The President of Ghana, H.E. John Dramani Mahama, is the current chairperson of COMSATS.

For additional information, see **www.comsats.org**.

All photographs courtesy of International Centre for Integrated Mountain Development (ICIMOD), except the following by Paola Di Bella: 5, 18 (center, interior ICIMOD), 26, 30 (left, interior ICIMOD), 35 (right, village), 36, 37, 48, 50, 51, 52 (left, researchers), 54, 56, 57, 58, 59, 61, 62 (right, exterior ICIMOD), 63 (left and center, Nepali woman and class), 64 (right, researchers). Photo page 51 (right, mountains): steynard/Flickr (CC by 2.0, cropped image). Photo page 7 courtesy of Chinese Academy of Sciences



EXCELLENCE IN SCIENCE

This series of booklets, published by The World Academy of Sciences for the advancement of science in developing countries (TWAS), highlights successful scientific institutions in the South. It explains how their research has been sustained over a number of years and how it is helping their host nations achieve sustainable economic development.

ISSN 2222-7385

twas