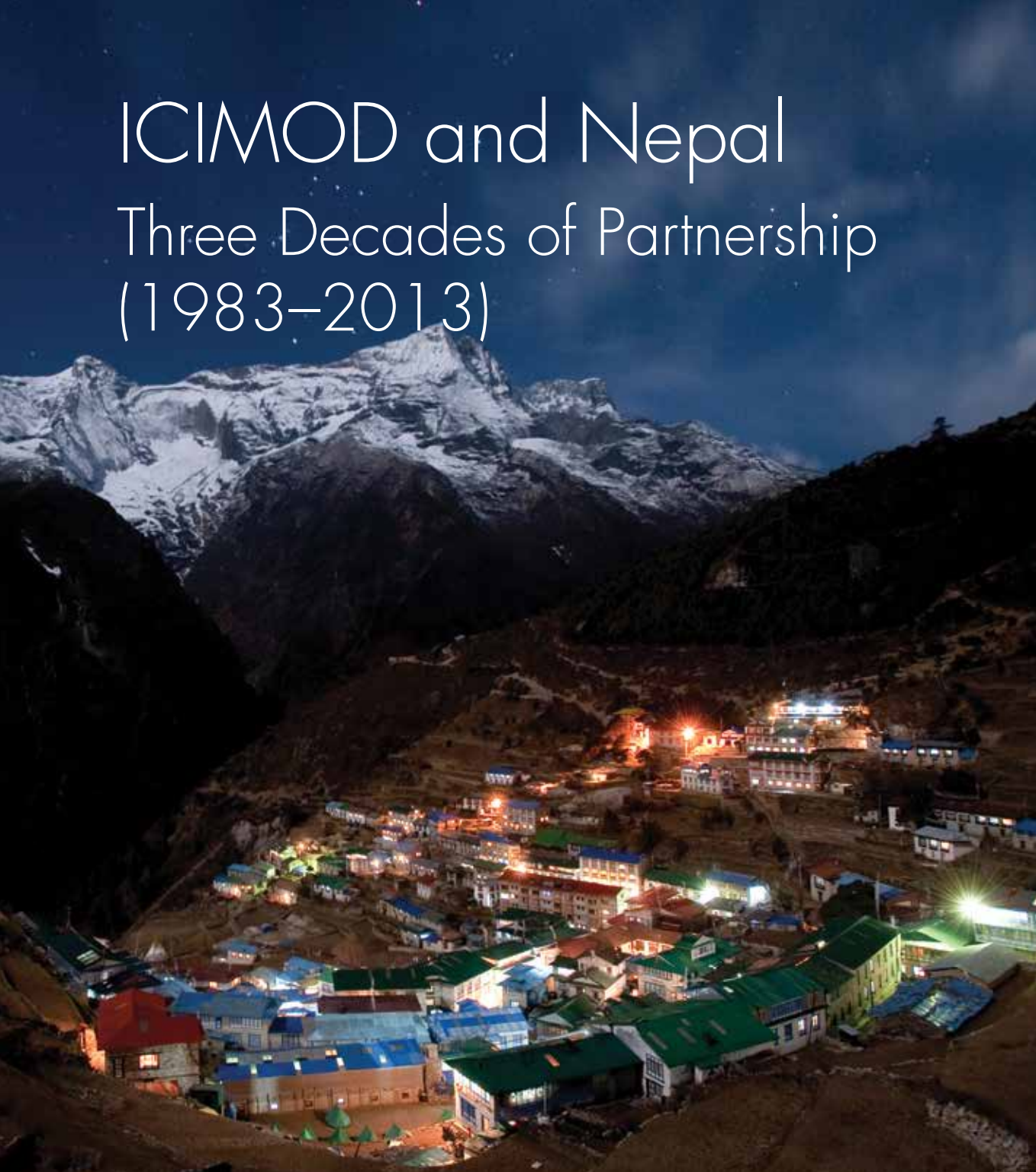


ICIMOD and Nepal

Three Decades of Partnership (1983–2013)





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Acronyms and Abbreviations

GIS	Geographic information systems
GIZ	German Society for International Cooperation, formerly, the German Agency for Technical Cooperation (GTZ)
HKH	Hindu Kush Himalayas
MAPs	Medicinal and aromatic plants
NEPCAT	Nepal Conservation Approaches and Technologies
NGO	Non-governmental organization
NTFP	Non-timber forest products
PARDYP	People and Resource Dynamics Project
REDD or REDD+.	Reducing emissions from deforestation and forest degradation
RS	Remote sensing
SNV	Netherlands Development Organization
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization

Foreword

I am pleased to present this book documenting over 30 years of cooperation between Nepal and ICIMOD. Since the Centre's inception, Nepal has played a key role in moving ICIMOD toward its goals of improving the lives of mountain people in the Hindu Kush Himalayas – by spearheading its formation, by hosting the ICIMOD Headquarters, by playing an active role in ICIMOD's activities, and by cooperation with ICIMOD to take the message of the mountains to the global community. It is certain that the Centre would not be what it is today without the support and cooperation of many different people and organizations in Nepal.

ICIMOD has gained incredible experience through its work in Nepal, and in return the Centre has helped mountain people to adapt and respond to the many challenges they face. Ultimately, ICIMOD will be measured by the impact our work makes on the lives of mountain people and the environment in the Hindu Kush Himalayas. This book documents the activities undertaken and the impact generated through the work of ICIMOD and its partners in Nepal. Many of the lessons from Nepal have crossed borders and have helped other countries in the Hindu Kush Himalayan region and around the world in the pursuit of sustainable mountain development.

With climate change, the pressures of globalization, outmigration, and the rapid push for economic development, many challenges remain. Like Nepal, ICIMOD continues to evolve in order to address the complex issues being faced by mountain people and environments. In many ways, ICIMOD and Nepal have grown together and, through close cooperation, will continue to work in collaboration to tackle challenges in Nepal and the greater Hindu Kush Himalayan region. I would like to thank the Government of Nepal and the people of Nepal for this long and fruitful cooperation.



Dr David J Molden
Director General, ICIMOD
Kathmandu, Nepal
April 2014



Message

I am delighted to be able to introduce this report on 'ICIMOD/Nepal – Three Decades of Partnership (1983-2013). Nepal and ICIMOD have had a long and fruitful relationship, and this publication is a welcome effort to capture and highlight the many endeavours that they have embarked on together over the years. The Government of Nepal rejoices in ICIMOD's success as a regional intergovernmental centre and commends the good work that has taken place in the region and in Nepal.

Our archives show that on 30 Sept 1981 the then Royal Nepalese Ambassador to France (HE Mr Krishna Raj Aryal) joined his counterpart, the Director-General of UNESCO in Paris, to sign the historic agreement that would lead to the establishment of the International Centre for Integrated Mountain Development (ICIMOD) through an Act of Parliament. There was much anticipation of the benefits the Centre would bring in furthering sustainable mountain development, but on that day it would have been difficult to predict that ICIMOD would become the resounding success that it is today.

The Centre was established to address two major interrelated concerns: the deteriorating environment of the Hindu Kush-Himalayan mountains and the growing poverty of the region's people. The challenges that were identified 30 years ago are still as real and imposing, but the context is changing, both in terms of the trends that are unfolding and in terms of our understanding of the problems. Over the past three decades, ICIMOD has continued to address these problems and the Government of Nepal has been a willing and supportive partner in this undertaking. The present report documents how many government ministries have been involved in ICIMOD's work from its very early days. In return, Nepal has unquestionably benefited from this collaboration at many levels. Not only has ICIMOD helped develop information to support policy and planning at local and country level, it has contributed to friendly regional collaboration with neighbouring countries on many topics from water resources to hazard management. Over the years, ICIMOD has provided the Government of Nepal with careful insights on many development issues of national and international importance; while at home, it has contributed to the capacity building of researchers and scientists and has laid the groundwork for others to be similarly trained. More recently, ICIMOD is helping to link Nepal to the rest of the world on subjects such as climate change, where Nepal is not only learning but is also contributing to the global dialogue by sharing its valuable data on glaciers and the cryosphere.

The Government of Nepal takes this opportunity to congratulate ICIMOD on successfully completing 30 years of service to the region. It also congratulates the Director General on preparing a document that captures for posterity the fruitful collaboration that has existed between Nepal and ICIMOD during that time. The Himalayas reach their loftiest heights in Nepal, and the Government of Nepal is proud to host this unique institution devoted solely to the mountains and its people. We wish ICIMOD every continued success and we look forward to greater collaboration for an even brighter future.

Khil Raj Regmi

Chairman of the Council of the Ministers of Nepal

Singh Durbar, Kathmandu, Nepal

February 2014

Message



The National Planning Commission of Nepal congratulates the International Centre for Integrated Mountain Development on preparing this document chronicling its 30-year history in the country.

The Planning Commission has worked very closely with ICIMOD for the past three decades; especially since the early 1990s, when either a member or the Vice-Chair of the Planning Commission was designated to be Nepal's representative on the ICIMOD Board of Governors. Throughout the many planning cycles of the past 30 years, ICIMOD has been ready and willing to support the Commission by providing substantive information and documentation on different aspects of development in Nepal. The Commission, in its turn, has always been supportive of ICIMOD and has been able to provide assistance in many ways.

ICIMOD has been and continues to be an important link for Nepal to research and development communities around the world. The Centre has assisted the Commission with advice related to its basic functions of formulating basic development policies; exploring internal and external resources and indigenous and foreign technology and making recommendations to the government; and exploring innovative approaches for sustainable development. As part of the global community, Nepal has become a signatory to many global international agreements, and ICIMOD has helped greatly with interpreting requirements and achieving compliance. Issues such as climate change further highlight the interconnected nature of the modern world – and our challenges. Data from glaciers high in Nepal's frozen peaks are not only important for Nepal's population downstream but are invaluable indicators for scientists worldwide. While data from regional scientists on the airborne pollutants affecting those glaciers, and the country at large, are needed in Nepal. The incredible biodiversity resources of Nepal and their management for global goods and services in collaboration with ICIMOD has been an exemplary contribution. The same is true for themes such as REDD+, where Nepal's experience in community forestry provides valuable lessons for other countries, while foreign expertise in carbon accounting helps Nepal's preparedness efforts. ICIMOD is helping to connect Nepal with the regional and global, and linking it with expertise across the globe.

ICIMOD's support and input have been greatly appreciated, both at a time when our capacity to fulfil our obligations was more limited than today, and more recently when the importance of international linkages has become more prominent. We thank ICIMOD for their contributions over the past three decades, and look forward to a long and fruitful partnership in the years to come.

Dr Rabindra Kumar Shakya,
Vice Chair, National Planning Commission of Nepal
Singh Durbar, Kathmandu, Nepal
February 2014





ICIMOD and Nepal: A Successful Collaboration

A Short History

ICIMOD was established in response to a perceived need for an institution that would help to promote ecologically sound development in the Hindu Kush Himalayas by responding to the demand for integrated ecological research and training. The United Nations Educational, Scientific and Cultural Organization (UNESCO), with help from the Federal Republic of Germany and the Government of Switzerland, played an integral role in the establishment of ICIMOD, as did the Government of Nepal, which offered to establish the proposed institution in Kathmandu. The legal basis for ICIMOD was signed at UNESCO headquarters in Paris on 30 September 1981 by the Government of Nepal and UNESCO. The Centre was finally established and inaugurated in December 1983 with its headquarters in Kathmandu, Nepal and legitimized by

H.E. Krishna Raj Aryal, Royal Nepalese Ambassador to France and Nepalese Permanent Delegate to UNESCO; and Dr. Amadou Mahtar M'bow, Director-General of UNESCO; signing the agreement on behalf of the Government of Nepal and UNESCO.



the Government of Nepal through an Act of Parliament. The first Board of Governors Meeting was held the same year with a Board consisting of representatives from the eight regional member countries: Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal, and Pakistan.

ICIMOD has endeavoured to work for sustainable mountain development and has shared the valuable knowledge it gathers with both its member countries and the world. The importance of ICIMOD's mission was legitimized and further reinforced by the Earth Summit in Rio in 1992, whose Chapter 13 of Agenda 21 is devoted to sustainable mountain development. ICIMOD's mission was further reaffirmed in 2012 at the Rio+20 United Nations Conference on Sustainable Development, whose declaration 'The Future We Want' specifically mentions mountain development in its articles 210-212.

With changing times – a change in emphasis

ICIMOD's original mandate and focus were the people, the natural resources, and the phenomenon of the mountains in the Hindu Kush Himalayan (HKH) region. The Centre's original five programmes were: Watershed Management, Off-farm Employment Generation, Rural Energy Planning, Engineering in Fragile Environments, and Information Systems for Mountain Development, together with Documentation, Information Exchange, and Training. During its first two decades, the Centre was technology based and the focus was on the generation and transfer of technologies such as soil conservation, green roads, and alternative energy. Since the 1990s, greater capacity has become available in Nepal and throughout the

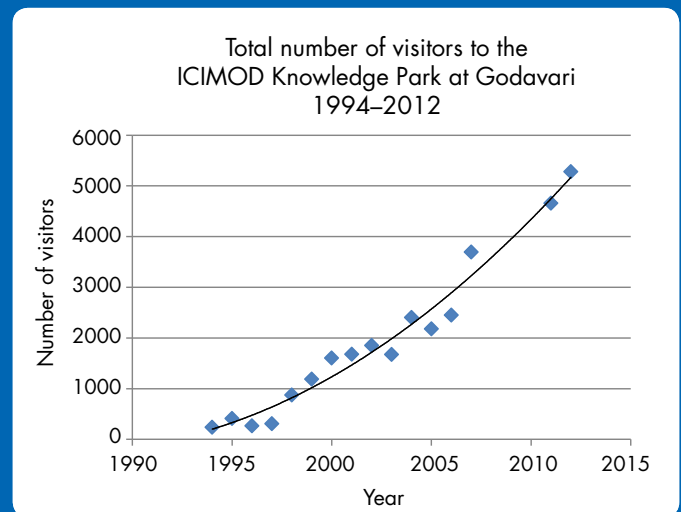
The ICIMOD Knowledge Park at Godavari

The Godavari Knowledge Park was established in 1993 as the 'Godavari Trial and Demonstration Site' on 30 hectares of land generously provided by the Nepal Government on the southern slopes of the Kathmandu Valley, where, in a microcosm, it represents the mid hill areas of Nepal and the Eastern Himalayas. The local communities still practise a traditional agricultural lifestyle, and staff at the centre (mostly women) come from neighbouring villages, bringing their traditional skills and taking back inspiration for new approaches. At the time it was handed over, a large part of the site was heavily degraded and the initial activities focused on the rehabilitation of degraded forest land by promoting conservation of natural regeneration and afforestation activities. Today, the site stands as a shining example of good land management practices.

Located fairly close to the Centre, the Knowledge Park offers a practical venue for the testing, monitoring, and demonstration of innovative technologies and practices.

Mountain researchers, students, development practitioners, and civic leaders can experience for themselves the innovative possibilities for communities to adapt to the impacts of climate and other change. These include technologies for renewable energy, improved cooking stoves, water harvesting, and irrigation; vegetation and soil management; livestock and aquaculture; high-value crops; medicinal and aromatic plants; and biodiversity conservation. All plants are grown under organic conditions without inputs of inorganic fertilizer or pesticides. Thus the site reflects the results that could be obtained by poor farmers in remote areas throughout the HKH who have little access to commercial agricultural inputs.

Over the past ten years, more than 90% of visitors have either been Nepalese or based in Nepal. The graph shows the increasing visitor numbers, with close to 5,300 visitors from Nepal in 2012, around 15% of them policy makers or development workers, 12% farmers, and 73% students.





region so that both governments and non-governmental organizations (NGOs) have been able to step up to fulfil many of these technological roles. ICIMOD has moved on to forge a different role for itself by working with governments and NGOs to address broader and more context-specific dimensions, so that it is now more involved in strategic and policy issues at the regional level. Over the 30 years since its foundation, ICIMOD has worked to address emerging development needs in the region and has embraced and disseminated new tools and technologies to help meet new challenges. While the process has changed, ICIMOD's core mandate and focus have not changed, and it is possible to trace the origins of today's programmes to those that the Centre started with three decades ago.

Some of the needs that have evolved since ICIMOD's inception are now those that are driving the development agenda. Foremost among the new challenges is climate

change, and ICIMOD has met this challenge with a focus on adaptation and mitigation strategies that build on its long history in watershed management, mountain farming, and natural resource management. Another emerging challenge is providing alternative livelihood strategies for mountain communities. The beginning of this account finds its origins in ICIMOD's original off-farm income generation programme. ICIMOD has also incorporated new technologies such as remote sensing tools to allow it to monitor remote mountain environments and make assessments of glaciers, snow, and potentially dangerous glacial lakes, much of which has its origin in ICIMOD's first information systems activities and the geographic information systems (GIS) technologies introduced in the mid-1990s. Advanced technologies are also being used for flood forecasting alongside traditional knowledge for adaptive water management and flood and disaster preparedness. Cross-cutting analysis of gender, governance, poverty alleviation, and economics issues, which were just emerging at ICIMOD's inception, are now an integral part of all programmes, and provide a basis for programmes dealing with new topics such as payment for ecosystem services and access and benefit sharing. New technologies have forced a greater awareness of the interconnectedness of the countries of the region, and issues of climate change connect all the regions in the world. ICIMOD has responded to this new awareness of interconnection and complexity in its new Strategic Framework by placing a greater emphasis on programmes that transcend international boundaries and address challenges more holistically by enabling neighbours to cooperate at a regional level. ICIMOD's vision for the upcoming years is elaborated below.

Ten Highlights of ICIMOD's Programmatic Contributions to Nepal 1983–2013

- Community forestry has moved forward and REDD+ readiness has been developed through 20 years of action research, information, capacity building, and network building, including support to the Federation of Community Forest Users and for the establishment of a REDD cell within the Ministry.
- Livelihoods have improved, crop pollination has been promoted, and Nepal's indigenous bees have received greater recognition as a result of 20 years of research, training, and microenterprise support for bees and beekeeping.
- National capacity has been strengthened through training of Nepali nationals in geospatial techniques, mapping, modelling, data collection, and decision support tools and the development and provision of frameworks for environmental and socioeconomic analysis.
- National activities to reduce risk and mitigate hazards have been supported for more than 20 years through activities such as the mountain risk engineering handbook; manuals and training on flash flood risk management; the promotion of a regional flood information system; and, more recently, a forest fire monitoring and alert system and a station for accessing international satellite information during disasters.
- Mountain producers and entrepreneurs now enjoy an increased share of the profits from their trade in non-timber forest products, medicinal and aromatic plants, honey, and tourism based on a better understanding of value chains and learning to apply value chain processes.
- Regional agreements for conservation and development in the Kailash and Kangchenjunga landscapes have been facilitated by the development of a transboundary landscape approach building on many years of work on rangelands, biodiversity, and other features of landscapes and people.
- Mountain farmers are benefiting from solutions developed for soil erosion and land and water resource management during ten years of action research, development, and training; the widely-used technologies are now demonstrated at ICIMOD Knowledge Park at Godavari.
- ICIMOD's contributions have supported the government in international advocacy for the Mountain Agenda; in fulfilling international commitments under conventions on biodiversity, climate change, and others; and in developing regional agreements
- Government planners, decision makers, and others are supported by access to data and information, including regional and global information, on biodiversity, climate, water resources, glaciers, glacial lakes, and others.
- General awareness and capacity in Nepal have been greatly increased through books and booklets (114,000), general publications (360,000), and downloaded documents (around 40,000) shared with government and NGO staff, researchers, and the public at large. Hundreds of farmers have received training and thousands of visitors have a better appreciation of mountain farming, water harvesting, and sustainable energy after visiting the ICIMOD Knowledge Park at Godavari.

ICIMOD Headquarters at Khumaltar

For 20 years, ICIMOD was housed in rented premises in Jawalakhel, Kathmandu. In the early 2000s, the Nepal Government generously provided 1.5 hectares of land, with an estimated value of more than USD 1,000,000, for a headquarters building in Khumaltar (in Lalitpur District). ICIMOD graciously welcomed this offer and used the land to construct a permanent headquarters building. Construction started in May 2003, and the new building was inaugurated by HE King Gyanendra on 5 December 2004, the 21st anniversary of the founding of ICIMOD. The building stands as a concrete symbol of ICIMOD's continuing existence, its unwavering commitment to the region, and the unity and cooperation of its regional member countries, who each gave generous contributions for its completion.



In addition to the donation of land, Nepal has been a gracious host to ICIMOD and representatives of the other regional member countries, which has enabled ICIMOD to truly function as an international headquarters. One example is that in recognition of its international standing, the Government of Nepal granted ICIMOD full diplomatic status; another is the straightforward visa conditions for all of the regional member countries and for donors from around the world.



About this Report

This report is an attempt to summarize some of the benefits that ICIMOD has brought to Nepal during the past three decades while recognizing the benefits that Nepal has given to ICIMOD. The answer to the question of what ICIMOD has done for Nepal parallels very closely the history of ICIMOD itself. Since ICIMOD is situated in Kathmandu, and Nepal's high mountains, numerous rivers, exceptional biodiversity, high-altitude cold desert areas, and tropical lowland areas provide good testing grounds, many of the Centre's original and ongoing programmes were and are located in Nepal. This report traces the history of ICIMOD in Nepal in terms of the major themes outlined above. The following chapters describe the many contributions and benefits to Nepal arising from programmatic activities, some of the major highlights are summarized in the box on the following page.

This publication is a distillation of the papers and reports that have summarized the work performed by ICIMOD over the past 30 years. In particular, it draws heavily on the ICIMOD Annual Reports and the biannual ICIMOD Newsletter for Sustainable Development in the Hindu Kush Himalayas. All of these reference materials can be searched by browsing the Himalayan Document Centre site (www.icimod.org/himaldoc). A topic-wise selected bibliography can be accessed online.

Nepal's Commitment to ICIMOD

The establishment of ICIMOD was a real accomplishment for the Government of Nepal since this was the first, and remains the only, headquarters of an international intergovernmental organization to be established in the country. Nepal not only agreed to host the Centre and provide it with a legal foundation, over the years it has also provided generous in kind and financial support, some examples of which are described in the following sections.

In November 1992, the government provided 30 hectares of land at Godavari, Lalitpur, for use as a testing and demonstration site. The site was inaugurated in 1993 and was further developed as a training centre (see box). In the early 2000s, the government generously provided 1.5 hectares of land for the construction of a permanent headquarters building, as ICIMOD had expanded beyond the capacity of its rented buildings. The new headquarters was inaugurated in 2004 (see box) and provided the basis for further expansion of the Centre's work, as well as being an excellent venue for meetings and training. Nepal also makes a direct financial contribution to ICIMOD, which has doubled over the last decade, and again quadrupled in the past year.

Working with and through Partners in Nepal

ICIMOD's partners in Nepal help it fulfil its mandate within the country, and over the years these have grown to encompass a wide spectrum of players from government agencies to NGOs, the academic sector, and even private industry. A small sample of the most recent partners is shown in the table below.



Some of ICIMOD's Key Programme Partners in Nepal, 1983–2013

Programme Partners within the Government

The list below provides the key ministries and departments with whom ICIMOD has been involved. Over the past three decades, some of these departments have changed names and some have changed the ministries under which they serve. The names given below reflect the more recent forms of address.

National Planning Commission (ICIMOD's focal ministry)
Ministry of Science, Technology and Environment
Ministry of Forests and Soil Conservation
Department of Agriculture, Bee Keeping Dev Division
Department of Livestock Services
Department of National Parks and Wildlife Conservation
Department of Hydrology and Meteorology
Nepal Tourism Board

Programme Partners in the Academic Sector

Tribhuvan University, Kirtipur
Tribhuvan University, Institute of Forestry, Pokhara
Tribhuvan University, Central Department of Botany
Kathmandu University, Dep of Env Sci and Eng, Kavre
Kathmandu University, Dhulikhel
Nepal Engineering College (NEC), Kathmandu
Nepal Agricultural Research Council (NARC)
Nepal Academy of Science and Technology (NAST)
Research Centre for Applied Sci and Tech (RECAST)

Programme Partners in the NGO and INGO Sector

ICIMOD has collaborated with a large number of NGOs over the past three decades. In the intervening years, many of these have either merged with other groups or have changed their names. The list that follows provides a small sample of the NGOs which have figured most prominently as ICIMOD's partners in Nepal in recent years.

Alital Multipurpose Cooperative Limited
Asia Network for Sustainable Agriculture and Bioresources
Leasehold Forestry and Livestock Improvement Project
Local Initiatives for Biodiversity Res and Dev, Kaski
Federation of Community Forest Users Nepal
Federation of Nepal Beekeepers
Herbs and NTFP Coordination Committee, Kathmandu
iDEAS Nepal
Institute for Social and Environmental Transition – Nepal
National Trust for Nature Conservation, Lalitpur
Namsaling Community Development Centre
SNV Great Himalaya Trail Tourism Development Program
Nepal Chepang Association
Western Uplands Poverty Alleviation Project
World Wildlife Fund Nepal

Private Sector Partners

Dabur Nepal
NABIL Bank

Governance Structure: Representation of Nepal within ICIMOD

At its inception, ICIMOD's Board of Governors consisted of representatives from the eight regional member countries, UNESCO, and the Swiss and German governments. Regular annual meetings are supplemented by special meetings as required. In the early years, all meetings were held in Kathmandu, after which the venue for annual meetings alternated between the regional member countries (see details of meetings in Annex 1). During the first ten years, usually three or four distinguished academics or advisors to different ministries from Nepal also sat on ICIMOD's Board. These early years helped to shape the

direction of the Centre. In the early 1990s, ICIMOD broadened the base for its programmes attracting more core donors, and today the Centre is governed by a Board comprising members from each of its eight regional member countries and seven professional experts nominated by the ICIMOD Support Group. The ICIMOD Support Group consists of representatives of the regional member countries and donor organizations, and is the main linkage for interaction between the Centre and the donor community. Nepal has always been a full member of ICIMOD's Board and the ICIMOD Support Group. For the past 15 years or so, ICIMOD's Board Member from Nepal has either been a member of, or has been the Vice Chair of, Nepal's Planning Commission (for names see Annex 1). ICIMOD itself is managed by a small Directorate, which has usually included two Nepalese nationals, led by the Director General.



Nepal and ICIMOD on the World Stage

Working with Nepal to fulfil international and regional commitments

Nepal is signatory to a number of global commitments, such as international treaties and conventions, which require periodic inputs and knowledge gathering. ICIMOD works with the Government of Nepal to support the fulfilment of these obligations. Prominent international agreements include the Convention on Biological Diversity (CBD), Ramsar Convention on Wetlands, Convention to Combat Desertification (UNCCD), International Plant Protection Convention, Male Declaration on Control and Prevention of Air Pollution and its Likely Transboundary Effects for South Asia, the Convention on the Elimination of all Forms of Discrimination Against Women (CEDAW), and the UN Framework Convention on Climate Change (UNFCCC).

The Centre also supports the Government of Nepal in advocating for mountain issues at global forums. This work is important since the resolutions from these meetings often influence international policies, which can have beneficial ramifications. One recent example is the brief which ICIMOD worked on with the Government of Nepal for the recent Rio+20 UN Conference on Sustainable Development; another is the Mountain Initiative Conference. Both of these helped to draw international attention to the green economy and options for sustainable development in mountain areas. Another example is

ICIMOD's input to the Government of Nepal's contribution to the influential UNDP's publication 'Asia-Pacific Human Development Report on Climate Change'.

International data sharing

Similarly, ICIMOD is Nepal's conduit for the systematic sharing and acquisition of international long-term disaggregated data in areas such as hydrology, glaciology, and atmospheric science for mountain areas. Through ICIMOD, it has been easier for well-established, international monitoring efforts to share information and know-how with Nepal. For example, international data sets have been shared from the Global Precipitation Climate Centre, the Global Precipitation Climatology Project, and the Climate Research Unit. Other sources of data on climatology and biodiversity include the SHARE network (EV-K2-CRN), Atmospheric Brown Cloud monitoring project, Global Climate Observing System (GCOS), Global Terrestrial Observing System (GTOS), Global Mountain Biodiversity Assessment (GMBA), Global Biodiversity Information Facility (GBIF), Global Observation Research Initiative in Alpine Environments (GLORIA), and the mountain research community (GLOCAMORE Mountain Research Strategy), among others.

In addition to these international efforts, ICIMOD has also helped to facilitate numerous regional cooperation agreements, including agreements between the Governments of Nepal and China and of Nepal and India in the field of biodiversity conservation, and a regional cooperation framework between China, India, and Nepal for the conservation and development of the Kailash Sacred

Landscape, which included the drafting of a regional cooperation framework on access and benefit sharing from genetic resources and associated traditional knowledge.

ICIMOD as a host to international forums

Under the auspices of ICIMOD, other international centres have come to Nepal and are housed within ICIMOD itself. With these centres, ICIMOD (and Nepal) is becoming a hub for external networks.

Asia Pacific Mountain Network

ICIMOD has managed the Asia Pacific Mountain Network (APMN), which became a node of the Mountain Forum, since 1995, and for some years hosted the Mountain Forum Secretariat. ICIMOD also serves as a link for the Asia Pacific Water Forum and Asia Pacific Adaptation Network.



SANDEE

Since August 2009, ICIMOD has hosted the South Asian Network for Development and Environmental Economy (SANDEE), a regional network that addresses development and environmental problems in the region. In terms of Nepal, SANDEE works to strengthen the capacity of individuals and institutions to undertake research on the interlinkages among economic development, poverty, and environmental change, and to disseminate practical information for development policies.



SERVIR



In 2010, ICIMOD formed a partnership with NASA and USAID to develop the SERVIR-Himalaya Initiative. This partnership has helped to bring to the Centre (and to Nepal) the most up-to-date access to and use of Earth observation data and information.

The ICIMOD Foundation

The ICIMOD Foundation is a not-for-profit organization that was originally created with the goal of giving the Centre a greater international presence in recognition of the implications its Mission has for all of mankind. It is supported by contributors from around the world who have an interest in the region and its people.





Other Benefits to Nepal

Nepal enjoys a range of indirect 'spin-off' benefits for the government, local governing bodies, the local economy, and the population in general, simply from having ICIMOD as a thriving international enterprise situated in the country. Some examples are given below.

- ICIMOD employs a large number of staff, a large proportion of whom are Nepalese nationals, with the Centre's support staff almost exclusively Nepalese. ICIMOD offers an opportunity for Nepalese professionals to gain experience of regional and international work and bring this back to other organizations in Nepal or move on to international careers. The Centre's programme for interns has benefited many newly qualified young professionals and enabled them to gain scholarships for further study at acclaimed institutions, or move to other regional and international organizations.
- People living in Nepal enjoy easier access to ICIMOD's technical training courses. Overall, some three-quarters of participants in workshops and short courses are Nepalese nationals. Course alumni often become ambassadors in the field, where they have been instrumental in promoting innovative practices in areas throughout the country. While these students, farmers, NGOs, and others are on the ICIMOD premises they can, and most often do, avail themselves of ICIMOD's printed publications on different areas of relevant interest, and thus further disseminate information in Nepal on a wide range of relevant topics.
- ICIMOD hosts a large number of regional and international meetings, and members of government departments, national and local organizations, and academia, often have the opportunity to participate and interact with leading researchers and development workers from across the world.
- Since many of ICIMOD's pioneering case studies and research pilots are first implemented in Nepal, Nepal benefits from these before other countries, where the work is implemented later.
- ICIMOD links Nepal to other countries both in the region and internationally. These links take place at many levels. Civil servants are encouraged to meet their counterparts in relevant ministries in countries throughout the region. Technical working groups discuss common regional issues and learn from each other's experience. University exchanges help technical experts to acquire relevant skills from abroad. Participants in courses build a network of regional contacts to use in their later work. Even lead farmer groups have travelled abroad to teach and learn.
- ICIMOD has facilitated the publication of documents worked on in collaboration with the Government of Nepal in various areas of mutual interest and has provided relevant input to drafts of legislation and guidelines on a wide range of topics.
- Nepal also benefits from having easy access to face-to-face meetings with ICIMOD staff and partners. These personalized meetings with staff of local ministries are useful for imparting knowledge and clarifying points, especially in areas of policy formulation.

- In addition to a very active web page and the knowledge that ICIMOD shares electronically, the residents of Nepal and of Kathmandu in particular have a hands-on experience of ICIMOD through events such as ICIMOD Days and the frequent local school, charity, and other awareness raising events, such as the Climate+Change exhibition. This helps to increase awareness of environmental and development issues on a broad level.
- The local employment and tourism and transport sectors all benefit from the many visitors who come to ICIMOD every year. After their meetings at ICIMOD, these visitors often take the opportunity to travel to other places of interest both in Kathmandu and elsewhere in Nepal, thus enriching the local economy, and many become ambassadors for Nepal on their return to their home countries.



Looking to the Future

Nepal has experienced significant change in recent years, with rapid population growth, economic development, urbanization, high rates of migration, environmental change including climate change, and globalization all posing a challenge to mountain livelihoods and environments. ICIMOD has adapted its approach to mountain development in light of these local, regional, and global changes. In 2012, it revised its Strategic Framework to respond better to these changing needs and to emphasize impact, integration, innovation, work with partners, and better linkages between development of knowledge and improved evidence for policy and practice.

The new framework firmly recognizes ICIMOD's regional niche and role. ICIMOD is transitioning from a sectoral and country-based project approach to a more regional programmatic approach. ICIMOD works across boundaries to share knowledge between its member countries on difficult problems and to address transboundary issues such as biodiversity, water, energy, value chains, and pollution. There is no other organization that deals with mountains and has this intergovernmental status. Countries in the region are increasingly aware of the transboundary nature of many of the problems that they are confronted with; this is especially evident when water-related disasters upstream affect communities downstream; when air pollution that originates in one country is transported to regional neighbours, and when shared biodiversity resources are depleted in one country because of environmental changes in a neighbouring country. The countries of the region

have always been aware that physical changes transcend borders, but now there is both more regional information available, especially from remote sensing programmes, and more scope for addressing transboundary issues. ICIMOD's approach under its new Strategic Framework takes advantage of the improved technology and communication that are now available to address these concerns.

ICIMOD's new regional programmes will test, pilot, and monitor innovative approaches and facilitate transboundary cooperation; most importantly, they are targeted at positive impact. Detailed studies and pilot tests will continue to take place at sites in individual countries, but the results will be linked so as to provide synergistic use of the knowledge across the region. It is ICIMOD's belief that Nepal will benefit greatly from these regional and transboundary approaches. Nepal and its neighbours will profit from the greater knowledge that such regional programmes will make available and from the adaptation strategies that can be pooled between countries that share similar physiographic features and concerns. The countries of the Hindu Kush Himalayan region will be able to benefit from technological innovations to mitigate the impacts of disasters that affect them across international borders and from joint solutions for environmental management.

ICIMOD will continue to work in an interdisciplinary way for truly 'integrated' mountain development; impacts will be delivered through five regional programmes – Adaptation to Change, Transboundary Landscapes, River Basins, Cryosphere and Atmosphere, and Mountain Environment Regional Information System – with a sixth programme, the Himalayan University Consortium, seen as an emerging regional

programme. ICIMOD will continue to address capacity building needs in the region and will continue to be oriented towards integrative knowledge products and delivering impacts. Working in partnerships, the Centre will develop and customize methodologies and tools and carry out innovative applied research to support future programme development. Knowledge Management and Communication will remain core functions of the Centre to see that the knowledge it has gathered is made available throughout the region.

Nepal is already at the centre of this regional integrated approach, and is part of all regional programmes. Several pilot studies have been set up in Nepal to help communities adapt to changes and to share what has been learned across countries. The Koshi River basin, that encompasses China, Nepal, and India, is a centrepiece of the River Basins Programme, which also features the implementation of a Regional Flood Information System. Nepal is also part of the Transboundary Landscape Programme that includes Kailash Sacred Landscape and Kangchengjunga Landscape. Nepal is the testing ground for landscape and climate change approaches such as REDD+. Intensive work on the cryosphere and atmosphere started in Nepal, where ICIMOD is a hub of regional knowledge sharing activities. Many of the pilot studies initiated by MENRIS are conducted in Nepal and the knowledge is shared with other countries.

ICIMOD looks forward to a continued strengthening of the special relationship with Nepal, its host country and supporting the Government of Nepal with its specialist departments and agencies in its continued work to improve the wellbeing of its citizens while protecting and maintaining its unique environment.





Agriculture and Food Security

ICIMOD has always worked to provide in-depth knowledge and a sound understanding of the social and economic conditions needed to help improve the lives of the people in Nepal. Over the past 30 years, it has customized knowledge about drivers of change and their impacts, has looked at ways to counter emerging challenges, and has taken every opportunity to advocate new methods and approaches that would help to improve the lives of mountain people.

The majority of Nepal's population is involved in the agricultural sector. The challenge is how to help improve their lives beyond simple improvement in agriculture and soil management. Over the past 30 years ICIMOD has initiated measures to help smallholder farmers through a targeted strategy of diversified agriculture which can improve income opportunities including unconventional and high-value products and services based on non-timber forest products, medicinal and aromatic plants, honeybees and beekeeping, and others.

During the first two decades ICIMOD dealt with the direct implementation of these approaches, but more recently it has taken a broader view which has lead to analysing

value chains and assisting policy and decision makers to develop policies which will facilitate getting products to market.



Sustainable Agriculture and Soil Management

Throughout its first 20 years, ICIMOD sought to actively facilitate better living standards for farmers through an improved understanding of farming technologies using a mountain farming systems approach. Studies focused on ways to enrich the soil and bolster it against erosion and natural processes; conservation of biodiversity; and finding ways to mitigate the impacts of the forces of nature on mountain lands. ICIMOD conducted case studies in Nepal to document farming practices and how they are viewed, managed, tested and then demonstrated best practices in mountain farming. The emphasis during these early years was mainly, but not exclusively, related to the management of privately owned farming land and the hands-on practical application of numerous options for sustainable farming systems.

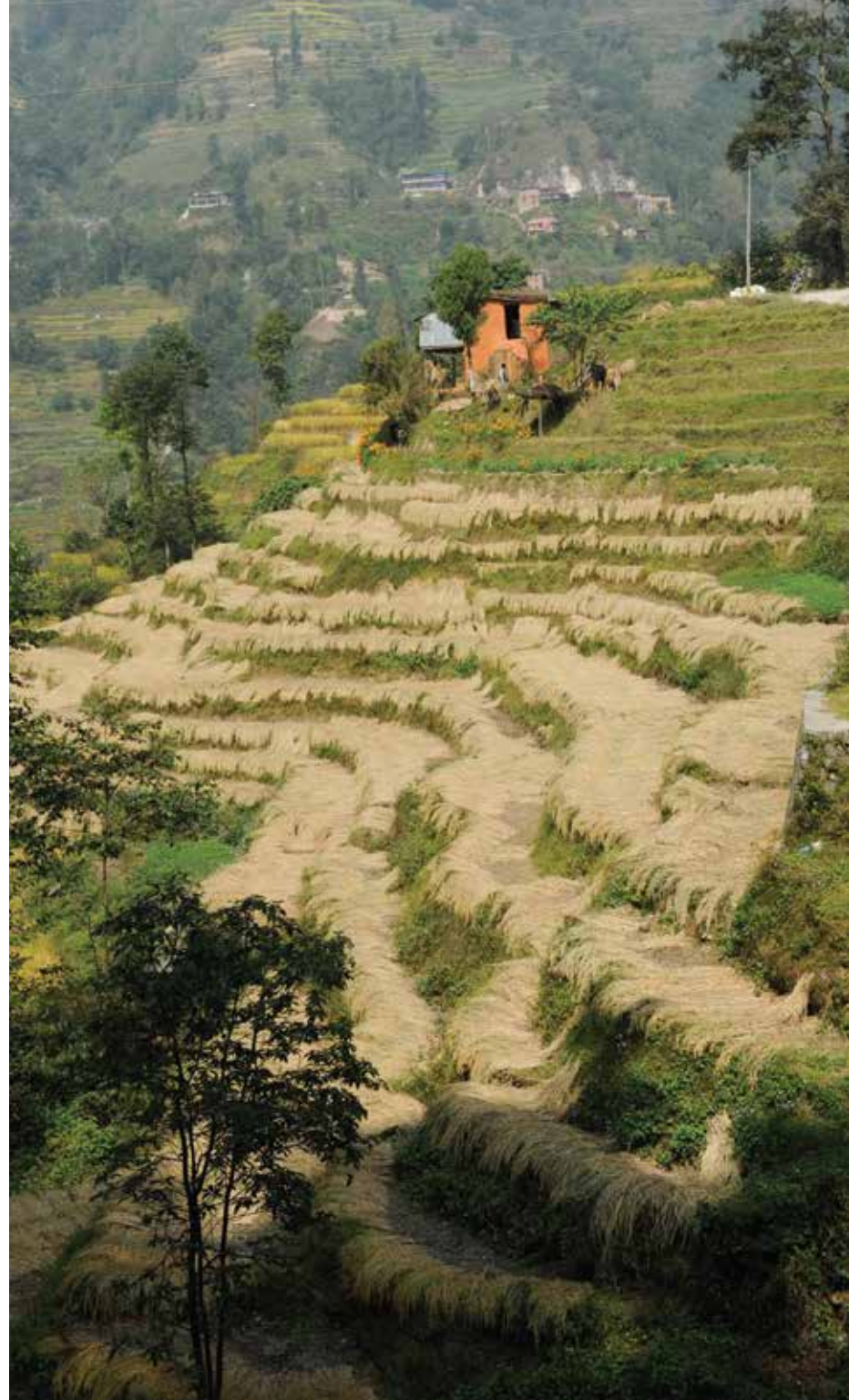
During the most recent decade, the emphasis has shifted from collecting case studies and testing best practices to disseminating these for the benefit of a larger number of farmers in Nepal and throughout the region, both by working directly with farmers' groups and by making this knowledge available to policy makers.

Soil erosion, soil degradation, and declining soil fertility are widely regarded as major problems threatening the sustainable use of sloping agricultural land in Nepal and throughout the region. During the early 1990s, ICIMOD's major activities in support of sustainable soil management in Nepal consisted of presenting options for sustainable

mountain agriculture and using the mountain-perspective framework to examine farmers' production and resource management practices, their adaptations to specific mountain conditions, and their responses to development interventions. Studies of soil fertility management strategies included, for example, a case study in Tauthali sub-watershed (Sindhupalchowk District) and Singhuwa sub-watershed (Dhankuta District). In the mid-1990s, a case study in Benigaon and Ranagaon in Gorkha District collected and published agricultural technologies selected by women farmers.

A major project focused on developing, testing, and demonstrating the use of sloping agricultural land technology (SALT) in the middle mountains based on a methodology developed for tropical areas. The method combines the strengths of terracing with the strengths of natural vegetation to stabilize sloping land and makes it available for farming. Degraded slopes are divided into strips of land for cultivation separated by double hedgerows of nitrogen fixing trees or bushes planted along contour lines. The method was successfully adapted to Nepal; training courses for farmers over many years, and a handbook in Nepali, supported the uptake of the method. This work continued in Nepal into the 2000s, with bioterracing, studies of soil erosion and soil fertility, and other soil conservation studies.

The People and Resource Dynamics Project (PARDYP), funded by Swiss Development Cooperation (SDC) and the International Development Research Centre (IDRC), focused on natural resource degradation in the middle mountains of the Himalayas from 1996 to 2006. The



Soil Management and High-Value Crops

Nepal Conservation Approaches and Technologies (NEPCAT) Fact Sheets

These fact sheets offer a basket of options with technologies and approaches covering the wide range of geographic areas, land forms, and agro-ecological zones in Nepal to land users, managers, and decision makers so that they can choose appropriate technological packages and practices to address issues of soil erosion, land degradation, water scarcity, poor soil fertility, food security, and environmental and climate change. The fact sheets were prepared in collaboration with the Sustainable Soil Management Programme, the Department of Soil Conservation and Watershed Management, Nepal Agricultural Research Council, HELVETAS-Nepal, International Development Enterprises-Nepal, Local Initiatives for Biodiversity Research and Development, and Kathmandu University (KU), supported by the Austrian Development Cooperation. They are available online at <http://lib.icimod.org/record/28262>

A low-cost polyhouse for tomato production in the rainy season
Agroforestry
Better quality farmyard manure through improved decomposition
Biodynamic composting
Black plastic covered farmyard manure
Conservation agriculture
Contour bunding
Cultivation of fodder and grasses
Grazing land management
Gully plugging using check dams
Gully/rehabilitation
Hedgerow technology
Improved cattleshed for urine collection
Improved compost preparation
Improved farmyard manure through sunlight, rain and runoff protection
Improved terraces
Improving terraces with farmers
Integrated watershed management for landslide and stream bank stabilisation
Kiwi fruit cultivation
Land distribution and allocation for riverbed farming
Landslip and stream bank stabilisation
Learning about no-till methods through farmer-to-farmer dissemination
Legume integration
Local initiatives for rehabilitating degraded communal grazing land
Manuring/composting
No-till garlic cultivation
Organic pest management
Participatory hedgerow management
Pest management
Plastic film technology
Polypit nursery

Protected gullies – a traditional sustainable land management practice
Rehabilitation of degraded communal grazing land
Riverbank protection
Riverbed farming
Sharing labour to implement contour bunding
Stream/ river protection
Sustainable land management using controlled gully in 'jagidol' areas
Terraces/bio terraces
Tomato grafting
Traditional irrigated rice terraces
Urine application through drip irrigation for bitter melon production
Using Salix plants to protect stream banks
Using the participatory market chain approach to help smallholder farmers market their produce
Vegetative strips/cover
Vermicomposting

Techniques for water management

A multiple-use water system
Community efforts for improving drinking water quality
Drinking water quality improvement through conservation measures
Evaluation of the system of rice intensification (SRI) through participatory research and development
Low cost drip irrigation
Low cost micro-sprinkler irrigation
Participatory action research on drip irrigation
Plastic-lined conservation pond to store irrigation water
Rooftop rainwater harvesting system
System of rice intensification (SRI)
Treadle pump
Water use master plan



project had a major component in Nepal, implemented in the Jhikhu Khola in Kabhre-Palanchok District and Yarsha Khola in Dolakha District. PARDYP was a research for development project, and the main objectives were to find options and approaches to support sustainable and equitable access to water, land, and forests; to improve productivity of farming systems and agricultural land and to test and disseminate improved water management options. Many of the technologies and approaches demonstrated at ICIMOD's Knowledge Park were developed and tested in the field by PARDYP-Nepal, and the project published many useful summaries and handbooks on water and soil management as well as case studies on a range of natural resource management issues.

From 2008 to 2012, Nepal was one of three focus countries in a regional project on Promoting Innovative Policy and Development Options for Improving Shifting Cultivation in the Eastern Himalayas, supported by IDRC. Rotating agroforestry or shifting cultivation ('jhum') provides a way of life for many ethnic minorities and poor and marginalized upland communities. Earlier studies had culminated in five countries in the region agreeing on the Shillong Declaration (2004) to be used to petition governments to recognize shifting cultivation as a viable practice that can be improved through innovations rather than trying to replace it with permanent farming. ICIMOD, with support from partners, conducted a number of studies aimed at understanding the relationship of shifting cultivation with local culture, comparing trends, reviewing government policies, and analysing economic and technical factors. The research showed that shifting cultivation has many advantages over settled farming in areas with steep slopes and high rainfall; it contributes to forest cover and biodiversity conservation, while at the same time maintaining agricultural and forest productivity and providing social security for local farmers.

In 2009 and 2013, ICIMOD supported the publication of a series of fact sheets on natural resource management, with a special focus on water and soil management, for Nepal Conservation Approaches and Technologies (NEPCAT). The factsheets capture many of the good practices in both technologies and approaches that have been learnt over the past 30 years during the course of projects implemented in Nepal (see box).

Value Chains for High-Value Products

The diversity of mountain conditions in Nepal provides a comparative advantage for these areas to produce a variety of high-value niche products and services. Medicinal and aromatic plants (MAPs), indigenous honeybees, and mountain tourism are of particular interest as they have a strong potential to provide sustainable livelihood options for mountain people. However, in Nepal, as elsewhere in the HKH, most collection, processing, and marketing suffers from a multitude of problems, which in many cases prevents mountain people from benefiting adequately from the resources they are endowed with. Value chains describe the activities involved in bringing products to market. ICIMOD has worked on the analysis of value chains and has identified improvements to help small producers, traders, and processors gain higher benefits from their products.

In addition to helping with specific case studies and specific high-value products, ICIMOD has also worked with the Government of Nepal to help address the multitude of constraints that prevent mountain people from gaining their fair share of the remuneration from the products they collect and produce. In particular, ICIMOD has highlighted that mountain specificities influence value chain analysis for products from mountain areas. An example of value chain analysis is the recent study by ICIMOD of collection and marketing of Indian bay leaf by poor mountain farmers in selected villages in Udayapur. The subsequent activities resulted in a marked increase in the benefit gained by farmers. Other studies that have used the value chain approach in Nepal are described in the relevant product sections below.

Non-Timber Forest Products

In many areas in Nepal, households with small landholdings are faced with the dual problem of a small land base and low agricultural productivity. Non-timber forest products (NTFP) can provide a significant source of income for this community. Medicinal and aromatic plants, discussed separately below, offer a particular opportunity for improving livelihoods since they are both high-value and low-volume. The development of NTFPs taps into ICIMOD's mandates for poverty alleviation and environmental conservation. However, challenges remain: unsustainable harvesting practices, inequitable benefits distribution, and overall economic inefficiencies tend to characterize current practices in this sector.



ICIMOD's early activities in Nepal in the 1990s included the investigation and dissemination of knowledge on the many uses of seabuckthorn (*Hippophae rhamnoides* spp.), a rugged shrub that grows on marginal lands at high altitudes. The use of seabuckthorn to meet subsistence needs was developed in China. While the bushes are often used to stabilize degraded land, the fruit can be used for the production of medicinal and consumer goods (shampoo, wrinkle creams, soft drinks, and sweetmeats). Thanks to the early efforts of ICIMOD and others, bottled seabuckthorn juice is now commercially available in supermarkets in Kathmandu. ICIMOD also started investigations, continued for many years, into the cultivation of large cardamom (*Amomum subulatum*) in forest groves of the nitrogen-fixing Himalayan alder (*Alnus nepalensis*). This agroforestry practice offers multiple opportunities to farmers to improve farm production and incomes. ICIMOD also worked with the Western Uplands Poverty Alleviation Project (WUPAP), together with IFAD, helping to develop NTFP exploitation in Humla, Jumla, Bajura, and Bahjanga.

During the mid-2000s ICIMOD helped to link mountain communities in Humla and Jumla with Dabur Nepal, a private pharmaceutical company, in a partnership that will provide communities with an assured market for selected products that are used by Dabur Nepal in the production of natural medicines. Lead farmers were trained in the propagation, cultivation, management, harvesting, processing, and marketing of NTFPs. Seven medicinal plant species were propagated in two research nurseries in the project area. Emphasis was placed on farmer-led testing of propagation techniques and composting regimes. Satellite nurseries were established across the two districts. ICIMOD helped identify



Yuvaraj Bhusal, Secretary of the Ministry of Forests and Soil Conservation, laying the foundation stone for the construction of the Common Facility Centre (CFC) at Bhatkanda, Dadeldhura District, Nepal, on 10 February 2011

other potential non-timber forest products in Nepal and continued to work with the private sector in western Nepal (Jumla, Humla, Bahjanga and Bajura) to develop NTFPs.

Various studies have shown that in Nepal a core problem is that the collectors have insignificant bargaining power as they are not organized, thus their profit margins are low. ICIMOD is helping to form partnerships by bringing together, public, private and community groups so that the people of the area will be able to capitalize on the comparative advantages of different institutions. The development of the bael fruit (*Aegle marmelos*) value chain is an example of successful community-based entrepreneurship in Nepal. The trees grow in the Churia hills region but have little value as timber, and the fruit has very little market value on its own. A project to process the bael fruit and market its juice now promises to help generate rural employment and raise rural incomes.

Medicinal and Aromatic Plants

Nepal's Herbs and NTFP Development Policy (2004) addresses the holistic development of the NTFP sector. It set the long-term goal of NTFPs providing a substantial contribution to the Nepalese economy by conserving and preserving high-value herbs and NTFPs and establishing Nepal as a major source of herbs and NTFPs internationally by the year 2020. In keeping with this, ICIMOD has worked over the past two decades on the study of medicinal and aromatic plants and assessing their commercial potential to enhance livelihood options and reduce the poverty of poor rural households in Nepal. This has included research in collaboration with a number of institutions in Nepal and abroad, as well as activities such as regional consultation meetings focused on strategic research, networking, and collaboration to address critical research issues related to the sustainable and equitable use of medicinal and aromatic plants.



Some of the history can be traced back to the Medicinal and Aromatic Plants Programme in Asia (MAPPA) initiated by IDRC with support from the Ford Foundation, which ran from 1998 to 2009. The programme devolved from IDRC to ICIMOD in 2005, after which ICIMOD worked as a coordinating hub for the regional MAPPA programme. In Nepal, ICIMOD was able to generate funding for the scaling up of good practices, for documentation of traditional knowledge on MAPs, for pro-poor value chain development and streamlining MAPs supply chains, and to assist the government in a review of policies. ICIMOD forged strategic partnerships with the Nepal Government's High Level Committee on Herbs and NTFP Coordination Committee as well as with the Ethnobotanical Society of Nepal and local NGOs and experts in the field. These have helped to inform both technological and policy aspects for the development of the sector as well as to develop innovative mechanisms to strengthen MAPs-based livelihoods and facilitate scaling up. During this time the project improved the skills and knowledge of producers and collectors of MAPs in production, management, processing, and marketing, as well as their negotiating power with traders, as witnessed in a regional consultative meeting which took place at the close of the project.

With the support of ICIMOD, the Ethnobotanical Society of Nepal developed a database on medicinal and aromatic plants of Nepal, under the umbrella of the Medicinal and Aromatic Plants Network (MAPs-Net). The MAPs-Net webpage contains a comprehensive database which summarizes all available information on the medicinal and aromatic plants (MAPs) of Nepal, including 40 commercially important species, with digital images,

detailed botanical information, taxonomy, ecology, and both Latin names and vernacular names in a host of local languages (see www.eson.org.np/mapsnetnepal.php).

More recently, ICIMOD worked with the Common Fund for Commodities (CFC), an autonomous intergovernmental financial institution established under the framework of the United Nations, on the use of medicinal plants and herbs in order to develop sustainable supply chains which will enhance rural livelihoods. This project, which ran until 2012, trained farmers in the production and collection of medicinal and herbal plants and in post-harvest management practices. As part of this undertaking, a Common Facility Centre has been started in Bhatkanda, Dadeldhura District.

In addition to government agencies, the commercial sector also plays an important role in promoting sustainable livelihoods through wise development of the medicinal and aromatic plants sector. ICIMOD has entered into a five-year partnership with Dabur Nepal, a leading company with a 125-year history in plant-based and ayurvedic-based products for food, health, and home care. It is hoped that the partnership between Dabur Nepal and ICIMOD will contribute to the accumulation and sharing of knowledge about herbal medicinal and aromatic plants and the development of new technologies and practices for sustainable land use and natural resource management, and will encourage and promote research in herbal, medicinal, and aromatic plants, which will eventually benefit local farmers in Nepal. Information on propagation, gene banking, and multiplication techniques will be an integral part of the technical knowledge transfer generated by the initiative.

ICIMOD recently implemented an action research project which promoted specific interventions for mountain producers of Indian bay leaf (*Cinnamomum tamala*) in selected areas of Udaipur District in Eastern Nepal with financial support from IDRC and in collaboration with the UK Overseas Development Institute (ODI) and the Federation of Community Forest Users Nepal (FECOFUN). The project targeted households in remote regions to engage more successfully in bay leaf value chains and thus increase their income. The major value chain intervention was linked to the organization of producer groups, which helped producers to integrate quality aspects into their production and strengthened their bargaining power. Farmers adopted improved techniques for collecting, grading, sorting, and marketing the leaves. Using these improved methods, bay leaf producers tripled the price they received for their product.

A project in Nepal and other areas of the Eastern Himalayas which was completed in 2012 provides another example of enhancing rural livelihoods by developing sustainable supply chains for medicinal plants and herbs. The project was a blend of conservation of plant resources through sustainable utilization, streamlining the supply chain for raw materials from quality medicinal plants, and expansion of economic opportunities for the rural poor. The target species in Nepal included *Sapindus mukorossi*, *Swertia chirayita*, *Valeriana jatamansii*, and *Zanthoxylum armatum*. ICIMOD helped to develop and promote models of good practices in the niche-based transformation of poor producer communities to improve livelihoods and reduce poverty.

Bees and Bee Products

Beekeeping contributes to rural development by supporting agricultural production through pollination and by providing honey, wax, and other products for home use and sale. It offers a good way for resource-poor farmers to obtain income, as it requires only a small start-up investment, can be carried out in a small space close to the home, and generally yields profits within a year of operation. Supported by the Austrian Government, ICIMOD developed and implemented a beekeeping programme which has continued through different phases for more than 20 years, leading to significant improvements in the livelihoods of poor mountain producers in Nepal as well as supporting biodiversity conservation at national and regional levels. The first phase of the project focused on beekeeping with the indigenous bees of the Himalayas, particularly *Apis cerana*, and increasing productivity through improved bee stocks and beekeeping techniques. Over the years, the focus of the project moved towards the development and sale of high-value products from bees, and most recently the promotion of value chains of bee products and pollination services. The programme has included training, extension, networking, capacity building, micro-enterprise development, documentation, and action research for generating and sharing knowledge and building the capacity of individuals and institutions to increase income and improve livelihoods. Research and development was undertaken in collaboration with national partner institutions, including government organizations, NGOs, associations, federations, and cooperatives in Nepal and throughout the region.

ICIMOD's assistance to beekeeping in Nepal started in the early 1990s with a project on 'Indigenous Honeybees of the Himalayas: a Community-based Approach for Conserving Biodiversity and Increasing Farm Productivity' supported by the development agencies of the Austrian Government and implemented with partners in Jumla (Mid West), Dadeldhura (Far West), and the Kathmandu Valley (Central region). The project involved training, extension, networking, capacity building, and micro-enterprise development, as well as promoting the use of bees to provide pollination services to fruit and vegetable farmers. The project has continued in different forms until today. A resource book in Nepali published in 2000 provided guidance for beekeeping trainers, beekeepers, technicians, and bee lovers. ICIMOD also became one of the founding members of ApiNet-Nepal, a network focusing on sharing experiences related to pollinators and pollination for the development of sustainable agriculture with more than 100 members, including beekeepers, beekeeping organizations, and scientists.

A publication in the early 2000s drew attention to the Himalayan cliff bee (*Apis laboriosa*) and the honey hunter communities associated with it in the high mountain areas of Kaski District in central Nepal. Case studies were conducted to examine the role of pollinators in the reduction in productivity of many fruit and vegetable cash crops, and action research was carried out on indigenous honeybees using a community-based approach to conserve biodiversity and increase farm productivity. The approach combined tools of community empowerment with the conservation and genetic improvement of indigenous bee species and streamlining and marketing of bee products. Advisory technical support and training on managed



Working with beekeepers in Far Western Nepal

The villagers of Alital in Dadeldhura District, Far Western Nepal are traditional beekeepers. In 2000, ICIMOD began to work with them to help develop a community-based beekeeping enterprise, addressing key challenges related to honey production, quality, marketing, and income by providing training in bee and hive management, harvesting and processing, selection and multiplication of productive, disease resistant colonies, and queen rearing. ICIMOD also introduced movable-frame hives, which enable harvesting of cleaner, higher-quality honey without damaging the combs or killing the bees. To develop market linkages, beekeepers were supported to participate in exhibitions and honey festivals. ICIMOD also helped to brand and label the honey as Alital Chiuri Honey and promote it in Kathmandu. The project also promoted the conservation and planting of chiuri trees and other bee flora and facilitated savings and credit provisions.



These efforts had a marked impact on the lives of local honey farmers. Annual honey production in the project area increased from less than 100 kg (using traditional methods) to over 2,500 kg, and multiplying and selling bee colonies emerged as an additional income option for some beekeepers. Increased honey quality contributed to better market access, and with the increase in production, beekeeping has become an important source of income for each household, representing 35–50 per cent of annual earnings. The focus on honey quality and market linkages, combined with branding and promotion, enabled beekeepers to earn more than double the market average per kilo of honey.

pollination was given in various communities, especially in Jumla and Alital. Women farmers especially reported that beekeeping offered them greater income opportunities with less labour intensive work.

By the mid-2000s, *Apis cerana* colonies had increased substantially at three project sites in Nepal (Dadeldhura, Jumla, and Kaski districts) as a result of partnerships, networking, training, and other capacity-building efforts by ICIMOD. An independent study found that in Dadeldhura district beekeeping provided around a quarter of average annual household income; additional multiplier effects included increased income from apples and other fruit through pollination services and income-generating opportunities for hive makers, as well as contributions to biodiversity conservation. This good news encouraged a publication describing the integral links between beekeeping and rural development.

By the late 2000s, ICIMOD was helping Nepal to develop quality standards and policy instruments, and to scale up existing successful activities and develop pro-poor value chains for honeybee products and services. Attention to the beekeeping sector also attracted tourists to watch wild bees, and farmers began seeing the potential for ecotourism following ICIMOD's support for honey hunting. Smaller NGOs were facilitated to implement honeybee projects on their own with thematic support from ICIMOD to build the capacity of instructors.

A fully updated 'Beekeeping Training for Farmers in the Himalayas - Resource Manual for Trainers' was published in English and Nepali in 2012, and in 2013 a publication on quality assurance for the honey trade – designed to

help government agencies, policy makers, and planners establish and implement quality assurance systems in the honey supply chain – provided information on the standards and good practices needed for trade in international markets.

ICIMOD's programme on bees and bee products has been such a success that in 2013 the stakeholders came together to prepare a request that ICIMOD become a Centre of Excellence for Asian Bees and Pollination. The proposal is still in its preliminary stages, but it is evident that there is great scope for the proposed Centre to ensure the recognition, conservation, and sustainable use of indigenous bee species and to provide coordination for efforts towards integration of science, policy, and practice by sharing of best practices at local, national, and regional levels.

Beekeeping and bee product training in Nepal

The beekeeping programme has a strong focus on capacity building. Beekeeping courses have been developed to meet the various needs of the groups who apply for training, whether farmers/beekeepers, local trainers, group/community based organization leaders, staff of partner organizations, or other stakeholders/development workers. Training is available in conservation apiculture; *Apis cerana* management; queen rearing; hive making; group mobilization, bookkeeping and accounting; pollination and bee forage management; and harvesting and processing of hive products and value addition. Many thousands of people have been trained in aspects of beekeeping in Nepal over the past two decades; including 1,260 beekeepers and others, one-third of them women, trained in bee product value chains between 2008 and 2012.

Courses available in Nepal on beekeeping, bee products, and marketing

- Harvesting, processing, and value addition of honey and beeswax – three-day training course for honey traders and entrepreneurs
- Conservation-based apiculture development – five-day training course for development and extension workers
- Group mobilization, bookkeeping, accounting, and networking for sustainable apiculture development – five-day training course for group/community based organization leaders
- *Apis cerana* colony management, bee forage, and pollination – seven-day basic training course for beekeepers
- Colony management, bee forage and pollination, and hive making – ten-day training course for beekeepers
- Honeybee colony management, queen rearing, and hive making – intensive twenty-one day training course for lead farmers and trainers







Livelihoods

ICIMOD has worked with Nepal to help it harness the unique opportunities that its rich natural and socio-cultural diversity offer to help improve livelihoods. These have included niche products and services related to ecotourism, rural energy, traditional knowledge, and migration. In so doing there has been a realization that it is important to work in an integrated way which is inclusive of traditional knowledge and gender and governance issues, since these all affect how markets and livelihood approaches function.

Ecotourism

The Centre has used a range of different approaches to support the development of tourism as an instrument for poverty reduction, especially in areas facing the challenges of remoteness and poor accessibility. Being labour intensive, having relatively high multiplier effects, and requiring relatively low levels of capital and land investment, tourism can yield significant benefits in remote and rural areas where traditional livelihoods are under threat. The Centre has focused on good practices and policies in mountain tourism, especially pro-poor community-based ecotourism.

ICIMOD began working on ecotourism in 1989 with activities to prioritize mountain tourism as an adaptation strategy to provide mountain people with alternative livelihood options. A few years later saw the start of the 'Tourism for Local Community Development in Mountain Areas' project funded by the Norwegian Government and with a large component in Nepal. The project advocated

for a local community development approach to mountain tourism, with a broader development goal of assisting Nepal to manage and deal with mountain tourism on a sustainable basis so that it can contribute to the environment as well as economic development of tourist areas.

During the mid to late 1990s, ICIMOD published reports on tourism for mountain community development in Annapurna and Gorkha, an overview of mountain tourism in Nepal, a description of mountain tourism and environment in Nepal, and a discussion of the impacts of tourism on Nepalese women. It also completed case studies in the Annapurna area, Gorkha, Ghandruk, Syaphrubesi, Langtang National Park, Phewa Lakeside, Pokhara, Upper Mustang, Sirubari, and the Tsum Valley.

It soon became clear that ecotourism was indeed contributing to development and that this needed to be supported in a more formal way. Training manuals on mountain tourism for local development were published by ICIMOD and a book on 'Tourism as Development: Case Studies from the Himalayas' through Himal Books. Tailored training manuals were developed for policy makers, planners, and others in Nepal to elucidate the issues, problems, and approaches to mountain tourism for different audiences. Others focus on conceptual and practical understanding of issues. For local communities, the manuals emphasize identification of opportunities that tourism can provide for local development, and the role that local communities can play in planning and managing sustainable tourism that is both environment and people-friendly. Later, ICIMOD published a two-volume manual on sustainable mountain tourism in collaboration with

the Nepal Tourism Board and Netherlands Development Organisation (SNV) based on course materials used in a training course supported by SNV.

A pro-poor tourism project in Upper Mustang in the late 2000s was much appreciated by local entrepreneurs. Elsewhere in Nepal, farmers began to see the potential for ecotourism by themselves when they saw tourists coming to Nepal to watch wild bees. This 'bee tourism' is a spin-off of ICIMOD's programme on indigenous bees which managed to attract the interest of the BBC for production of a documentary about Nepal's Himalayan cliff bees and the importance of honeybees for pollination and livelihoods.

At this time, ICIMOD and SNV also worked on the concept for a 'Great Himalaya Trail' in collaboration with the Nepal Tourism Board and the Sustainable Tourism Network. The intention was to exploit the significant potential for product and marketing synergies that exist within and between mountain districts in Nepal. The vision is that the proposed trail will help to attract more trekking tourists to mountain areas of Nepal, as well as encourage them to make repeat visits to the region and to explore different products and destinations, thus helping to spread the benefits of tourism to the more remote and least developed parts of the Himalayas. The Rt. Honorable Dr Ram Baran Yadav, President of the Federal Democratic Republic of Nepal, noted that the Great Himalaya Trail will "... showcase how sustainable tourism can be used as a tool for poverty reduction...". Building on this success, ICIMOD has recently launched the Himalayan Heritage Routes programme at a workshop organized by ICIMOD and Eco-Himal in collaboration with SNV.



Clean energy for rural households – solar energy, biogas, and bio-briquettes

ICIMOD, in collaboration with local partners, has helped to introduce energy alternatives in Nepal such as passive solar energy, biogas, and bio-briquettes that can help local communities to cope with their domestic energy needs without damaging the environment, and to reduce their household contributions to black carbon in the atmosphere.

Solar energy is plentiful in Nepal during most months of the year. ICIMOD has provided information and training in collaboration with partners to help promote the use of solar

dryers and solar cookers, both of which provide clean and emission-free sources of energy. Fruit and vegetables can be dried on racks in a small chamber with a solid earth back wall and plastic film covering, or freestanding chambers constructed from locally available inexpensive materials. Solar parabolic cookers use a reflecting surface in the form of a parabolic dish which concentrates the solar rays at a focal point, and can be used to boil water and cook rice or lentil soup (dal). The methodology has been included as an approach in places like the Annapurna Conservation Area.



Biogas is potentially one of the most economical sources of energy for mountain farmers, especially those who keep cattle. While this was a relatively new technology in Nepal 30 years ago, it is now widely accepted, and many farmers who have sufficient cattle have introduced it, as have owners of hotels and tourist resorts.

Bio-briquettes have proven particularly successful. Unwanted biomass, for example from forest weeds, is converted into charcoal and then turned into solid fuel bio-briquettes. The technology for making briquettes has been widely disseminated both by ICIMOD and others. It is now not only used locally but has become a commercial enterprise; beehive briquettes can be bought by city dwellers in supermarkets in Kathmandu.

Rural Energy

Mountain communities in Nepal rely heavily on traditional biomass for cooking and heating and often find it difficult to meet their daily energy needs sustainably. Poor people in mountain areas can be given access to clean and sustainable energy services by developing decentralized renewable energy options based for example on water, solar, biogas, and wind power; and the use of efficient technologies for power use. These options can help reduce greenhouse gas emissions; the pressure on fragile ecosystems; and drudgery and health hazards, especially for women, as well as contributing to reducing poverty.

ICIMOD's first long-term project on rural energy was introduced in 1987 with financial support from the European Economic Community (EEC). During the early 1990s the Centre started assessments of energy needs in Nepal and a thrust towards labour-saving technologies, commencing with technologies selected by farm women, and work on alternative types of energy for mountain people. Other activities included work on installing mini and micro-hydropower for rural development for local electricity generation, especially for remote communities. The interest in this was great enough to prompt ICIMOD to published four practical manuals on designing, installing, operating, and maintaining private micro-hydropower plants for use by mountain communities and entrepreneurs. In the 1990s, work on renewable energy was received with enthusiasm at a time when mountain regions, as elsewhere, were beginning to feel the energy crunch and environmentally friendly sources of energy could

be used with little or no input from outside the country. This prompted a study on the implications of national policies on the use of renewable energy technologies and policy recommendations to promote the development of renewable energy resources and technologies.

In the early 2000s, ICIMOD engaged in participatory action research in Yarsha Khola in Dolakha District and Sirubari VDC in Syangja District on energy consumption patterns, technologies employed, and availability of energy resources, as a basis for assessing the suitability of renewable energy technologies and helping communities to prepare energy action plans. Together with the Centre for Rural Technology, ICIMOD helped to strengthen the organizational capacity of traditional water mill (ghatta) owners in Makawanpur and Kavre District; and worked with the Netherlands Development Organisation and the Government of Nepal to introduce improved water mills. Other renewable energy technologies, such as improved cooking stoves, biomass briquettes, and solar panels, were also introduced in Nepal. ICIMOD was also instrumental in popularizing gravity ropeway technology in Nepal. In 2001, Practical Action Nepal demonstrated two gravity ropeways in Marpha, Mustang District with financial and technical support from ICIMOD, and since then, 21 gravity goods ropeways have been installed in other areas of Nepal.

A joint United Nations Environment Programme (UNEP)-ICIMOD project on 'Incorporating the Needs and Roles of Women in Water and Energy Management in Rural Areas in South Asia – Capacity Building of Women in Rural Areas of the Himalaya', supported by Swedish International Development Co-operation Agency (SIDA),

was implemented from 2002 with the Centre for Rural Technology (CRT/N) as the partner in Nepal, working through NGOs in Dhankuta and Palpa. The project helped to transform the lives of women, their families, and communities by working to introduce simple, cost-effective energy and water-related technologies. A training of trainers manual was published on incorporating the needs and roles of women in water and energy management, together with accounts of project learning and policy guidelines. Based on experiences in a model village in Dhankuta, the local government replicated and integrated the demonstration village approach in the Government of Nepal's Village Development Programme. The Dhankuta initiative also included demonstrations of women's entrepreneurship in action, and the exposure led to scaling up of use of these technologies to other VDCs.

ICIMOD also helped in the designing of curricula for a Master's Degree in Energy Engineering and Bachelor's Degree in Agricultural Engineering in Nepal as well as a review of the energy sector for Nepal (1991-2001). More recent work with the Alternative Energy Promotion Centre investigated and promoted the use of sustainable energy technologies for rangeland areas. The work concluded with a project promoting decentralized clean energy services for enhanced adaptive capacity in rangeland sites as solutions to energy problems for nomadic herders.

Gender

Women have an intricate relationship with natural resources, since they are mainly responsible for meeting the daily food, water, and energy needs of households. In order to focus on the needs of women, it is essential that they be at the forefront of the dissemination of technological options that are pro-environment and pro-poor. It is important to focus on identifying women's needs and providing them with options that they can use and control. Since men and women have different roles and responsibilities in natural resource management and governance systems, they also have different access to decision making and the information, knowledge, and benefits that accrue from natural resources. ICIMOD's work recognizes that gender is an important development element for sustainable management and use of natural resources.

ICIMOD's work on gender in Nepal over the past 30 years has centred on advocating at the global and regional level for the empowerment of women and for gender mainstreaming; conducting research on traditional knowledge and local adaptation strategies that highlight women's roles and capacities; building capacities to better understand gender issues related to biodiversity conservation; and promoting uses of alternative energy sources that relieve women from drudgery and reduce the pressure on mountain natural resources.

ICIMOD's work on gender started with a workshop on women's entrepreneurship in the late 1980s, probably the first of its kind in Nepal. In the early 1990s, ICIMOD

conducted a series of case studies of women in forest management in Hattisunde, Dhading District, and analysed women's participation in off-farm income activities in Nepal. It also researched labour-saving technologies for mountain women, studied the impact and implications of tourism for Nepalese women, and initiated participatory approaches to agricultural technology promotion with women in hill areas. In the mid-1990s, ICIMOD supported the establishment of the Himalayan Grassroots' Women in Natural Resources Management Network (HIMAWANTI), and was involved with the Information Network for Women in Development (INWID), the first-ever women's networking group, established by the United Nations Fund for Women (UNIFEM) with the assistance of UNICEF.

In the late 1990s, a study showed that national-level planning agencies, line agencies, NGOs, and projects in Nepal, and throughout the region, had not incorporated gender concerns into their research and programme planning, and that government plans did not reflect gender concerns to a sufficient degree; the publication 'Searching for Mountain Women's Voices in the Hindu Kush-Himalaya' elaborated these findings. ICIMOD also implemented a project on 'Capacity Building for Incorporating Gender in Sustainable Development Policies, Strategies and Programmes in the Hindu Kush-Himalayan Region, which aimed to improve gender awareness and introduce more gender-friendly working practices into institutions working on mountain farming systems and natural resource management in Nepal and throughout the region.

In 2001, ICIMOD published a manual which was both a guide and a source of resource materials for training



programmes on gender and organizational change; the manual has been much used in Nepal by those attempting to develop programmes that seek to help development organizations incorporate gender concerns into their workplace and training, extension, and research programmes. Later, ICIMOD published a training of trainers manual which provided learning tools for carrying out gender analysis, mobilizing communities, identifying prioritized needs and solutions, and designing and using gender sensitive participatory action planning in water and energy and other related fields.

Most recently, a study in the mid-Western and far-Western regions of Nepal concluded that more attention must be given to the specific needs of mountain women because of their critical role in mountain livelihoods; and that development programmes in mountain areas must provide resources to reduce women's drudgery and increase their access to and control over fundamental assets. Similarly, an analysis of the gender dimensions of biodiversity management in mountain ecosystems, including a case study on gender aspects of biodiversity conservation and management in Nepal that focused on community forestry leadership, provided recommendations on policy and research for promoting and improving gender-sensitive and gender-inclusive biodiversity conservation and management practices in complex mountain contexts. And a study on gender and pastoralism found that rangelands women do not fare much better; the study focused on the dynamics between gender and the management of natural resources, including gender division of labour, and control and ownership of property in rangelands.

Preserving Nepal's Traditional Knowledge

Traditional knowledge refers to the knowledge, innovations, and practices of indigenous and local communities. It is developed from experience gained over centuries and adapted to the local culture and environment. Traditional knowledge, particularly in such fields as agriculture, fishing, health, horticulture, and forestry, is increasingly being tapped as a resource by modern industry, but indigenous and local communities rarely receive an equitable share of the benefits of the use of their traditional knowledge, and as an undervalued resource, this knowledge is rapidly being lost. Documentation is the first step to protecting traditional knowledge

In recent years, awareness has grown in Nepal about the value of its genetic resources and associated traditional knowledge. In 1992, Nepal became a signatory to the Convention on Biological Diversity (CBD), whose objectives include the conservation and sustainable use of biological diversity, and the fair and equitable sharing of benefits arising from the utilization of biological resources and traditional knowledge. The Convention on Biological Diversity recognizes the importance of the knowledge, practices, and innovations of indigenous and local communities in the conservation of biological diversity and makes provision for the prior informed consent of the holders to be obtained by any public or private enterprise seeking access to genetic resources. ICIMOD, supported by the Deutsche Gesellschaft für Internationale

Zusammenarbeit (GIZ) (formerly, the German Agency for Technical Cooperation (GTZ)), is helping to facilitate the process of implementing the Convention on Biological Diversity in Nepal and other countries of the eastern Himalayas by developing the required mechanisms, raising awareness, and fostering the participation of indigenous and local people, especially women, in activities. For the future, the challenge for Nepal will be to employ the Convention on Biological Diversity's framework for access and benefit sharing to convert bio-resources and their associated traditional knowledge into meaningful economic wealth in an ecologically sustainable and socially equitable way, and to channel the benefits to the communities that are the conservers and custodians of these genetic resources.

Another area in which indigenous knowledge has proven useful is disaster prevention. Here it is slowly being recognized that local people often have a profound understanding of the local conditions and land, and can thus offer valuable insights on disaster prevention; this knowledge is now being used in combination with modern scientific methods to help mitigate the effects of natural disasters.

Some early studies in the mid- and late 1990s looked at how farm women in Nepal's Benigaon and Ranagaon in the Gorkha District responded to the introduction of new technologies that were introduced alongside traditional technologies. Other studies reported on the negative and positive impacts of tourism on the local culture in Khumbu District. A synthesis report on applied ethno-botany collated case studies on the use of medicinal plants and traditional resource management systems in Nepal.



In the mid-2000s, ICIMOD launched a regional awareness-raising programme on 'Access and Benefit Sharing (ABS) from Genetic Resources and Associated Traditional Knowledge' supported by GIZ, with a large component in Nepal. The aim of this programme was to enhance and strengthen the ecological and livelihood security of marginalized mountain communities (including women and indigenous people) by facilitating fair access to and equitable sharing of benefits arising out of the use of their biodiversity resources and associated traditional knowledge. The project included research and training components, and publications included a training of trainers and resource manual, a glossary of terms, and a range of information leaflets. The manual was so popular that ICIMOD was requested to publish a wall poster in English and Nepali illustrating the steps involved in the general legal process for access and benefit sharing, now widely used by local development workers for awareness raising.

An eight-year long project that ended in 2012 served to document indigenous practices, traditional knowledge, and farmers' innovations in shifting cultivation, following the Shillong Declaration of 2004 which recognized the contribution of shifting cultivation to the livelihoods of many ethnic and tribal groups as a traditional resource management mechanism. Later, a case study in Nepal's eastern Terai under the Living with Risk: Sharing Knowledge on Disaster Preparedness project (funded mainly by the European Commission through their Humanitarian Aid department under the South Asia DIPECHO programme), documented local knowledge, practices, and contexts related to disaster preparedness for integration into modern

disaster management activities. The findings were published in English and Nepali to raise awareness of this important source of knowledge.

Work on Nepal's traditional knowledge intensified in the late 2000s. One case study looked at indigenous rangeland resources management in the mountain areas of northern Nepal, in Rasuwa District. Two other studies examined how hill people pursue adaptive strategies for disaster risk reduction, focusing on six villages in Sankhuwasabha and Dhankuta districts in the Koshi River basin. The studies examined local responses to water and other stress, and factors enabling local adaptation, and were carried out under the projects 'Too much water, too little water', funded by the Swedish International Development Cooperation Agency (Sida), and 'Himalayan Climate Change Impact and Adaptation Assessment' (HICIA), funded by the Norwegian Ministry of Foreign Affairs.

Most recently, ICIMOD and the GIZ offered Via Storia and partners in Nepal initial support to conduct an inception pilot study on a heritage route in the Kailash Sacred Landscape in Nepal. The study identified and assessed the main heritage sites and routes that would need to be conserved to maintain the integrity of the sacred landscape. It also identified other traditional travel routes in several poor districts of Far Western Nepal and documented their historical significance. At about the same time, ICIMOD also conducted an analysis of indigenous people's dependency on forest resources for livelihood support in the middle hills of Nepal as well as a study of the Chepang people of Nepal.

Migration and Remittances

Mountain people have migrated for centuries in search of work, better livelihoods, or human security; the numbers have risen sharply in the last two decades. ICIMOD is attempting to help understanding of the linkages between migration and development so that benefits can be maximized and negative impacts minimized. Activities focus on improving the collection, disaggregation, and analysis of data on migration, and assessing the costs and benefits of migration for migrants, the families left behind, and the environment. ICIMOD is also working to identify and test innovative methods and technologies to leverage migration for poverty reduction and development, and sensitizing the government to socioeconomic migration processes and potentials in its development approach.

Early work in this area dates to the 1990s, with case studies in Mustang and Dhading districts which analysed and assessed off-farm employment to identify factors that enhanced or inhibited off-farm employment and income opportunities. By the late 2000s, migration had increased to a point where it was important to conduct case studies on migration from Nepal to assess the impact of outmigration on gender roles in general and the feminization of mountain economies in particular.

A recent study examined the changes over time (1970s-1990s) in rural livelihoods in the hill regions of Nepal and found that an increasing proportion of small-scale producers in the hills had some form of

non-agricultural income, and that many workers had migrated permanently to the towns. Other studies examined the culture of migration that traditionally existed in the middle hills of Nepal and how this evolved to encompass the needs of migration in the twenty-first century, and the impact of the global economic financial crisis on remittances. The latter showed that the economic crisis slowed the remittance growth rate and caused a temporary decline in migration outflows from Nepal but that overall Nepal's remittance economy had suffered little. Most recently, work, based largely in Nepal, aimed to increase understanding of the relationship between labour migration and the environment, and the circumstances under which labour migration can be an adaptation to the impacts of environmental hazards. This work examined how household context in communities affected by water hazards can influence the decision to migrate for work, and looked at the policy implications.







The Environment

Reliable environmental data, information, and analyses are needed to inform policy and planning for sustainable mountain development, and provide a critical analysis of the impacts of policy and the status of environmental governance. However, environmental data is still a new and incomplete area in Nepal, as a result both of lack of capacity and the difficulties associated with data collection in some of the most poorly accessible terrain in the world. Over the past three decades ICIMOD has worked with government ministries and university departments, as well as with international donors, to support the development and application of environmental data for Nepal.

Two major studies prepared by the Centre in collaboration with partners have helped provide an overview of the status of environmental data in the country: the 'State of the Environment: Nepal 2001', prepared together with the Ministry for Population and Environment and published by the United Nations Environment Programme; and the 'Environment Assessment of Nepal: Emerging Issues and Challenges' prepared for and published by the Asian Development Bank. These studies contain a wealth of data and information and highlight key environmental issues, emerging problems, and strategic priority areas. The Environment Assessment remains a landmark publication for Nepal. Some of the highlights of activities in the areas of air, the cryosphere, water resources, and landscapes and biodiversity are summarized below.

The Air

There are three main areas where air quality is of concern in Nepal. The first is the problem of outdoor air pollution in Nepal's cities, especially Kathmandu; the second is the problem of transboundary transport of pollution high up in the atmosphere, and the subsequent deposition of carbon particles on the snow and ice of the Himalayas; and lastly, indoor air quality is of particular concern in rural areas because of the health effects of smoke from domestic fires in poorly ventilated spaces. ICIMOD has worked in all three of these areas.

Urban air quality

Until 2001, there were few quantitative studies of ambient air quality in Nepal's cities, even though healthcare professionals had often warned of the health risks associated with the increasing air pollution. Some sporadic air quality monitoring studies took place during the 1990s. Then in 2001, ICIMOD, with the help of the Danish International Development Agency (DANIDA), and in collaboration with Nepal's Ministry of Population and Environment, established the first continuous air quality monitoring sites in Kathmandu. In 2006, ICIMOD produced a detailed account of the status of the Kathmandu Valley environment highlighting five key environmental issues, among which air quality was firmly identified as a growing concern. Further studies included a method for rapid assessment of air quality with Kathmandu used as an example.

ICIMOD's work in the Kathmandu Valley clearly identified the major problem to be high levels of suspended carbon particulates, NO₂, and sulphur dioxide; with emissions from vehicles and brick kilns as the most serious sources of pollution. ICIMOD helped develop policy recommendations, and worked with Nepal to help implement the Malé Declaration on the control and prevention of air pollution and its likely transboundary effects for South Asia. Of late, ICIMOD has been directly involved in conducting workshops such as a recent one in Kathmandu on cleaner brick technology to help reduce emissions from brick kilns.

In January 2013, ICIMOD established the Atmosphere Initiative as part of its Regional Programme on Cryosphere and Atmosphere to improve understanding and promote regional cooperation to address issues related to the atmosphere of the HKH region. This initiative is the culmination of more than a decade of groundwork by ICIMOD, most of which was conducted in Nepal with Nepalese and international partners.

Transboundary air pollution

The atmospheric brown cloud (ABC), or high level brown haze, over South and Southeast Asia is caused by air pollution, principally black carbon from vehicular emissions and burning agricultural biomass together with other sub-micron aerosol particles emitted from a range of anthropogenic and natural sources. This layer of polluted air travels with the prevailing winds and absorbs and scatters incoming solar radiation along its path, which can weaken the monsoon circulation and decrease monsoon rainfall. Recent evidence indicates that when the clouds

reach the high Himalayas they deposit black carbon on the snow fields and glaciers; the layer of carbon particles is thought to lower the albedo of the snow causing it to absorb more sunlight and melt more quickly, with grave implications for both the regional and global climate.

Indoor air quality

Biomass fuels are still used widely for cooking in rural Nepal, but they emit a complex mixture of aerosols containing significant amounts of pollutants which carry severe health threats. ICIMOD has been involved in improving indoor air quality in Nepal for many years. In the 1990s, ICIMOD helped to introduce clean alternatives to biomass fuels such as solar cookers, beehive briquettes, and improved cooking stoves for use in rural areas. More recently, the same topic is being addressed under REDD+ activities as discussed in the section on climate change. Recent work helped to promote biogas and improved cooking stove technologies in the Kayerkhola Watershed in Chitwan, Ludikhola Watershed in Gorkha, and Charnawati Watershed in Dolakha to help reduce forest dependency, as well as providing health benefits through clean indoor air.



ICIMOD's role in bringing climate observatories to Nepal

In March 2001, at the request of the United Nations Environment Programme (UNEP), ICIMOD facilitated a visit to Kathmandu by the Nobel Laureate Paul Crutzen and the ABC Project Chief Scientist, Prof V Ramanathan. During the visit, an aerial survey was conducted to explore the intensity of the haze over the Hindu Kush Himalayan region, which indicated the need for further studies. The long-term result is that the ABC Asia Project, for which UNEP is the Secretariat, has established two monitoring stations (and is establishing another two) to support a focus on the Himalayan region, both located in Nepal and known as the Nepal Climate Observatories. These observatories are managed by ICIMOD.

Collection and analysis of long-term monitoring data for the Himalayas poses a general challenge in Nepal as elsewhere, and ICIMOD is also committed to training regional students and post-doctoral researchers in areas such as environmental monitoring, climate modelling, investigating the long-term effects of pollution on agriculture and health, and studying air pollution-related policy issues, much of which will take place through scientific exchange between Asia, Europe, and the USA.



Sun tracker and pyranometers Medium volume sampler Automatic weather station Wet only collector (plastic and glass)

The Nepal Climate Observatory located at ICIMOD Headquarters in Khumaltar collects information on radiation and aerosols.

The Cryosphere

The cryosphere refers to those parts of the Earth where water is present in its frozen state: snow, glaciers, permafrost, seasonally frozen ground, lake and river ice, sea ice, and ice sheets. In mountain areas, where snowmelt runoff often makes up a large part of river discharge, the cryosphere is a key source of water, as well as a major component of water storage. It is important to study the cryosphere, particularly at higher altitudes since it plays a significant role in the regional climatic system. The study of the cryosphere in Nepal is a challenge, since limited capacity and the challenges of access have limited ground-based meteorological and hydrological observation in the high mountains. ICIMOD is working with partners to remedy this situation both by building new weather stations and by developing approaches to take advantage of the satellite information which is now available.

Snow

Snow has the largest spatial coverage of any cryosphere component and snow pack is an extremely important storage component in the water balance of alpine basins. Due to its seasonality, snow cover is more variable than glacier cover and more difficult to measure, thus despite its importance for the water cycle, snow cover is still poorly monitored and understood in the region. The lack of basic facts and figures on snow and ice has been a real setback for advanced research on snow and hydrology so that it has not been possible to assess how changing snow dynamics are affecting water resources. The gaps that exist in data, knowledge, and

capacity for monitoring are now being addressed using the newly available wide range of spatial, temporal, and spectral satellite data, which allow the mapping of inaccessible mountain regions. With the use of new remote sensing tools, ICIMOD is now able to monitor the extent and variation in snow cover and facilitate a much increased understanding of the cryosphere, despite rapid seasonal changes and large spatial variation. Since Nepal does not have a national space programme of its own, it relies on ICIMOD to make this data available for mapping studies.

In 2011, ICIMOD published a report on snow-cover mapping and monitoring in the Hindu Kush Himalayas based on satellite data, which included an analysis of snow cover in Nepal. The average annual snow cover area in Nepal was estimated to be 21,680 km², or 15 per cent of the total area of the country. ICIMOD is now making snow cover data available on a web portal that will provide climate information services on snow cover. The database is organized in terms of the large river basins; users can perform analyses for selected basins and sub-basins. This information will be especially useful for planners and policy makers in formulating policies related to climate change and the downstream consequences for water resources.

Glaciers

The challenge for ICIMOD is to identify and collate consistent, detailed, and long-term information in a region containing an estimated 54,000 glaciers with a total area of 60,000 km², of which more than 5,000 km² lies in Nepal.

ICIMOD has been working with partner institutes in the region to develop a regional database of HKH glaciers

since the late 1990s. In March 1996, ICIMOD hosted a series of events in Kathmandu, in collaboration with several international partners (notably, UNESCO's International Hydrology and Man and the Biosphere Programmes, the World Meteorological Organisation, the International Geosphere-Biosphere Programme, the International Association of Hydrological Sciences, and the International Commission on Snow and Ice). These events helped to meld international partnerships that continue to this day, and provided the basis for investigations of the high mountain areas in Nepal. Over the subsequent one-and-half decades, ICIMOD has worked with specialists from different countries to study the glacier and snow cover in Nepal and the entire HKH region. In 2001, ICIMOD published an inventory of glaciers, glacial lakes and glacial lake outburst floods: monitoring and early warning systems in Nepal, and in 2011, a comprehensive report of glacier coverage across the region, including Nepal, based on standardized satellite images. The data from this landmark publication is also accessible online (<http://apps.geoportal.icimod.org/HKHGlacier/index.html#>).

Glacier mass balancing, which uses in situ measurements, is the only way to discover how much ice is stored in a glacier and the rate at which this is changing. The direct glacier mass balance measurements are complemented by analyses from remote sensing products and modelling. Over the years, ICIMOD has trained partners in Nepal to carry out field-based glacier mass balance measurements and continues to help them establish a long-term scientific programme to monitor the cryosphere – glaciers, snow, and ice. The capacity building is part of a project to establish a glaciological and hydrometeorological observation network

Measuring the Yala and Rikha Samba glaciers

Glaciers are not only strongly affected by climate change, they are also excellent climate indicators. ICIMOD, in collaboration with partners, has developed a functioning system for regular monitoring of snow and glacier data to analyse the changes each decade in two selected glaciers, the Yala Glacier in Langtang Valley and the Rikha Samba Glacier in Lower Mustang. This project is a case study for monitoring and assessing the changes in glaciers, snow, and glacio-hydrology. The project has initiated a web-based cryosphere portal and an operational database of information on hydrology, glaciology, and water-induced disasters, which is already being used by project partners and academic institutions.



in selected glacier catchments for monitoring and assessing changes in glaciers, snowfields, and glacio-hydrology. The technical methodology includes meteorological measurements, hydrological measurements, geodetic measurement techniques, and the use of GPS and total station surveying equipment. With ICIMOD's help, starting in 2011, Kathmandu University now offers a Master's programme in glaciology – the first in South Asia. The programme also has a provision to provide scholarships for outstanding women graduates.

ICIMOD's work on glaciers in Nepal has been multi-faceted and has encompassed both scientific work and providing advice and support to the government on policy issues related to glaciers. The Centre has collaborated with, and been supported by, a number of international partners for the cryosphere studies in Nepal including EV-K2-CNR (Italy), Norwegian Ministry of Foreign Affairs, Swiss Federal Institute of Technology Zurich (ETH), the United States Department of State, The World Bank (Global Facility for Disaster reduction and Recovery), the Swedish International Development Cooperation Agency and LGGE and LTHE, the Glaciology and Hydrology Laboratories of Grenoble, France (GLACIOCLIM project).

ICIMOD continues to work to strengthen the capacity of Nepalese organizations through the HKH Cryosphere Monitoring Project, which is creating an HKH regional snow cover and glacier inventory database, with standardized data and information from a single consistent source that can be used across the Hindu Kush Himalayan region. In Nepal, ICIMOD has signed agreements to study climate impacts with the Central Department of Hydrology

and Meteorology of Tribhuvan University, the Department of Hydrology and Meteorology of the Ministry of Environment, and the Water and Energy Commission Secretariat.

ICIMOD's new Cryosphere Initiative is contributing to improving knowledge and understanding of the cryosphere by analysing changes in the region's glaciers, snow, and glaciohydrology in relation to the impacts of climate change on water resources management in the HKH region. The Cryosphere Initiative establishes ICIMOD as a cryosphere knowledge hub for the region that will focus on the monitoring of glaciers, snow, and glacial lakes, and glacio-hydrology, with an emphasis on in situ measurement, remote sensing, and modelling. Among others, this work will contribute to capacity building and to the development of effective measures and policies for water resource and risk management. The many conferences and workshops on these topics bring together top scholars and practitioners from across the globe and help to strengthen the exchange of knowledge, enhance regional cooperation for cryosphere monitoring, and promote regional efforts to better understand the cryosphere. They provide Nepal with a unique opportunity to benefit from the most recent research and develop strong regional and international connections with others working in this field.

Glacial lakes

As glaciers recede, the meltwater can collect in large pools or lakes behind the loosely consolidated end moraine dams formed when the glaciers attained their Little Ice Age maxima. These dams are inherently unstable; failure can lead to a glacial lake outburst flood (GLOF) and potentially

catastrophic flooding in the valleys below with loss of life and property. Recent surveys have shown that many glacial lakes in Nepal are expanding at a considerable rate so that the danger they pose may be increasing. ICIMOD has been supporting Nepal for many years through surveys and investigations of lakes and capacity building of Nepalese nationals in this area.

ICIMOD's work on Nepal's glacial lakes started with the outburst flood from Dig Tsho in the Khumbu Himal in August 1985, which destroyed the nearly completed Namche Small Hydel Project and caused extensive damage further downstream. ICIMOD published a report on 'Glacial Lake Outburst Floods and Risk Engineering in the Himalaya' in 1986 by Professor Jack D Ives. Subsequent studies focused on developing an inventory and identifying potentially dangerous lakes using a combination of remote sensing images and published maps, and criteria such as large and rapidly expanding lake size, rise in lake water level, activity of supraglacial lakes, position of lakes in relation to moraines and associated glaciers, dam stability, glacier condition, and surrounding physical conditions.

Methods for identifying and classifying glaciers and glacial lakes using remote sensing and other data have been improved, and methods have been developed for mapping the vulnerability of downstream communities. ICIMOD has worked with government and university partner institutions in Nepal to prepare a detailed inventory of glacial lakes and a risk assessment for glacial lake outburst floods (GLOFs) in Nepal. This 2011 publication remains the major source of information for the country. The study identified close to 1,500 glacial lakes, almost two-thirds of

them moraine-dammed, with a total area of approximately 65 km². Detailed field investigations and socioeconomic assessments were carried out for three lakes thought to be potentially dangerous (Imja, Thulagi, and Tsho Rolpa) which showed that none was at immediate risk of bursting out, although careful monitoring was recommended. Information was shared with the local communities (in Nepali) during public events and by information leaflets. Guidelines were also prepared for GLOF risk management in Nepal. The same methodology is now being used by private hydropower developers.

ICIMOD has built extensive databases on glaciers, glacial lakes, and GLOFs across the region. Through these, Nepal also has access to information on potentially dangerous lakes upstream on the Tibetan Plateau. The identification of potential GLOF sites and information dissemination has resulted in greater awareness among policy makers in Nepal.

Water Resources

The mountain people and communities of the region are not benefiting fully from the economic potential of water resources; equally, hydrological processes in upstream areas are still poorly understood and the region continues to lack cooperation on water resources. ICIMOD's activities have focused on being a regional centre for technical information on water resources, on studying the implications of policies for water, and on

promoting regional cooperation on water resources and integrated water and land management. Cooperation between Nepal and other countries in the region in hydrological research is essential because most rivers pass through multiple countries.

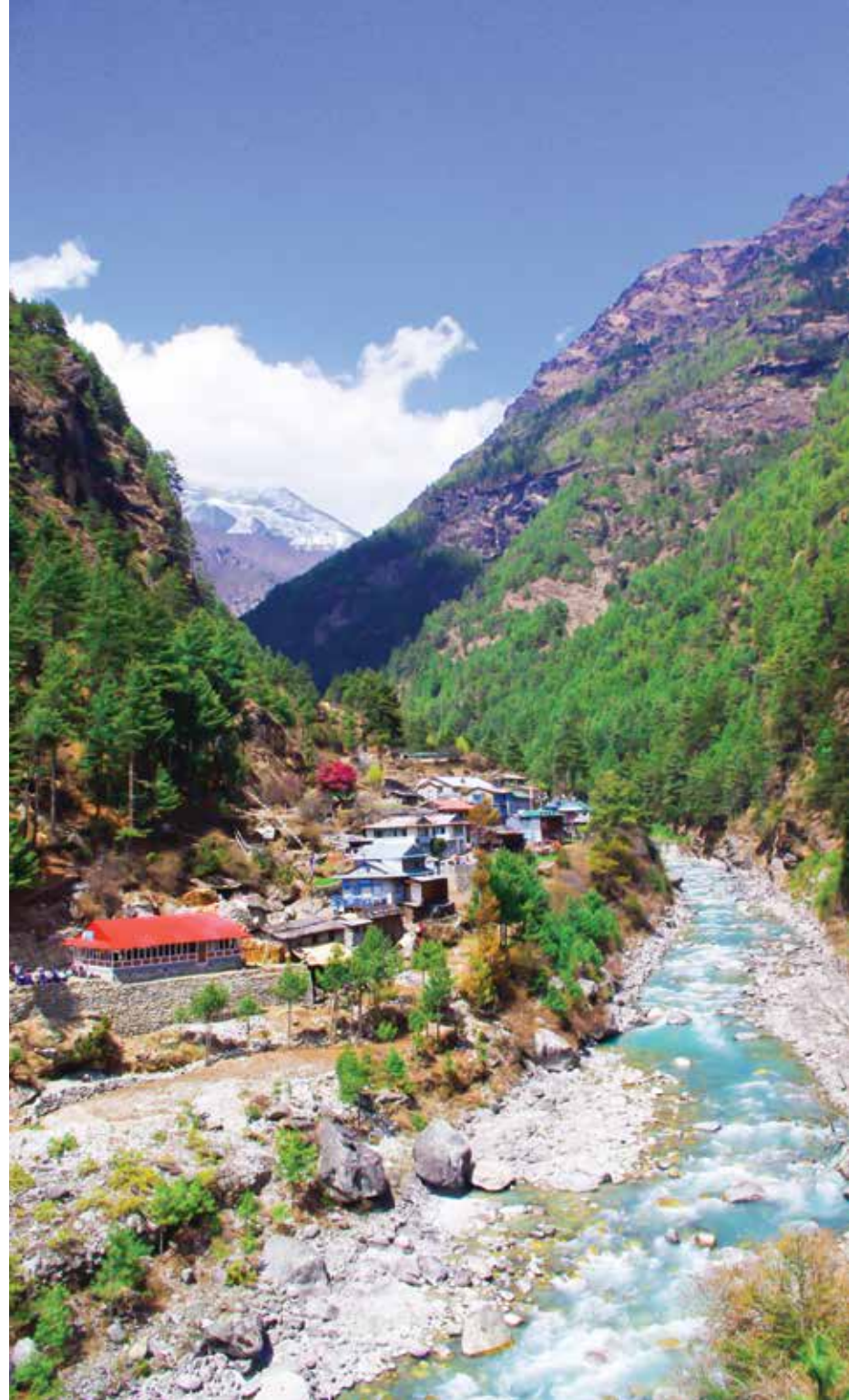
Hydrological data for water management and flood forecasting

ICIMOD is keenly aware that any policy advice or collaboration with neighbouring countries on water issues needs to be firmly grounded in sound hydrological data. Over the years ICIMOD has become a respected regional repository and centre for the exchange of hydro-meteorological data on the HKH in general and Nepal in particular, working with and supported by key partners such as the German IHP/OHP National Committee; Federal Institute of Hydrology in Germany; UK Centre for Ecology and Hydrology (CEHW); Ministry of Foreign Affairs, Government of Finland; United States Agency for International Development Office for Foreign Disaster Assistance (USAID/OFDA); United States Department of State, Regional Environment Office for South Asia; and World Meteorological Organization (WMO) for technical and conceptual backstopping.

ICIMOD is working with Nepal to support informed decision making based on an understanding of water dynamics and threats to water resources. Activities started soon after the Centre was established with development of software for Nepal's rivers that allowed users to rapidly estimate water availability, followed by publication of the Climatic and Hydrological Atlas of Nepal, a resource

which is still extensively used and widely quoted. ICIMOD's support enabled the launch of HKH-FRIEND under UNESCO's International Hydrological Programme for better understanding of hydrology across the region through support for mutual exchange of timely hydrological data. ICIMOD also established the Regional Flood Information System in the Hindu Kush Himalayan Region (HKH-HYCOS) project under the World Meteorological Organization's World Hydrological Cycle Observing System (WHYCOS), which promotes timely exchange of flood data and information. The project has continued through different phases to the present, with ICIMOD working with partners to develop a system for flood forecasting, including selection and upgrading of hydro-meteorological stations with instruments of international standards.

Other projects such as that on the snow and glacier aspects of water resource management in the Himalayas (SAGARMATHA) and the application of satellite rainfall estimation (SRE) all contribute to improved water management and flood forecasting. Since 2006, ICIMOD has commissioned various case studies, including two in Nepal (Lal Bakaiya, and Madi), to create a knowledge base on flash flood processes in areas with diverse climatic and socioeconomic conditions in order to understand existing flash flood risk management mechanisms and increase awareness about flash floods. The aim is to develop regional recommendations to be brought to the attention of policy makers. In 2012, ICIMOD assisted the Government of Nepal in determining the cause of a catastrophic flash flood in the Seti River, which resulted in the death or disappearance of at least 72 people and caused great loss of property.





The river basin approach

Recently, ICIMOD has embraced the river basin approach to water management in the transboundary river basins of the Hindu Kush Himalayan (HKH) region. The approach recognizes that a river basin has common biophysical, economic, social, and cultural attributes, and that management activities are closely interconnected. There is a need for collaboration in the sustainable development of the economic potential of river systems for domestic use, fisheries, hydropower, navigation, and irrigation in order to reduce poverty, improve livelihoods, conserve ecosystems, and contribute to drought and flood management. In Nepal, this approach is being used under a major project supported by the Australian Government for the Koshi River basin, which traverses China, Nepal, and India. The basin contains a rich biodiversity, plays a key role in the irrigation of downstream areas, has a large potential for hydropower development, and is a source of valuable ecosystem services that sustain the lives and livelihoods of millions of people. The aim of the programme is to support evidence-based policy interventions, develop and test appropriate and adaptable livelihood strategies, and ultimately contribute to reducing poverty through integrated natural resources management.

Watershed management

Scarcity of water affects rural households, the economy, and the environment in a multitude of ways. During the late 1990s, various projects looked at both the technical challenges and the policy implications of water harvesting in rural areas of Nepal. Projects and workshops were held

to promote the sustainable use of local water harvesting technologies and management systems for small-scale irrigation to alleviate poverty and reduce drudgery of women, and to review policies for local water harvesting systems for mountain households (such as the national task force on sustainable water harvesting of the Water and Energy Commission Secretariat, Ministry of Water Resources HMG/Nepal). The policy work was supplemented with case studies (such as those in the Jhikhu Khola in Kabhre-Palanchok District and Yarsha Khola in Dolakha District) which highlighted the inadequate water supply for domestic and agricultural use. A further study published in 2004 showed that water resources are not necessarily scarce in the selected catchments, but that a combination of water management issues and marked seasonality has led to a perception of scarcity.

A summary document on 'Good Practices in Watershed Management: Lessons Learned in the Mid Hills of Nepal' covered a wide range of challenges related to water management and the solutions developed over a number of years through participatory action research in Nepal. Continued work outlined the potential for rainwater harvesting and groundwater recharge as a means for water storage in the Kathmandu Valley. More recently, ICIMOD facilitated the publication of fact sheets on a wide variety of water management techniques for practitioners by the Nepal Conservation Approaches and Technologies (NEPCAT) initiative, together with the Sustainable Soil Management Programme (HELVETAS, Swiss Intercooperation, and the Government of Nepal). The topics are listed in the earlier section on sustainable agriculture.

Landscapes and Biodiversity

ICIMOD has been involved in a wide range of activities related to Nepal's landscapes, and especially the forests, rangelands, wetlands, and flora and fauna, since its inception. Some of the highlights are presented below.

Flora and fauna

Nepal's Biodiversity Resource Book published in 2007 (prepared in collaboration with the Ministry of Environment, Science and Technology and supported by UNEP) is a landmark publication in the conservation history of Nepal and provides a compilation of the rich flora and fauna found in Nepal's protected areas, Ramsar sites, and World Heritages Sites. This book updated previously published information and verifies field information about biodiversity in Nepal. It discusses currently reported data on flora and fauna including some analysis of the trends since the 1996 'Biodiversity Profiles of Nepal', and makes a note of threatened and protected species, and endemic floral and faunal diversity in individual protected and unprotected sites. It also advances key recommendations based on a comprehensive assessment of the status and issues which future work on Nepal's biodiversity must address.

Forests

Community participation in natural resource management and ecosystem conservation in Nepal's forests has been widely practised over the last three decades and significant progress has been made both in terms of millions of hectares covered and thousands of communities engaged.



Widespread support for the programme has led to these accomplishments and has shown that community-based forest management can reverse trends in forest degradation and provide benefits to local communities, especially the mountain poor, women, and other marginalized groups.

ICIMOD has had a focus on community forestry, and especially community forestry in Nepal, since the early 1990s, working together with and supported by international partners such as FAO Forestry, Trees and People Programme/WATCH, The Ford Foundation, Asian Development Bank, Dutch Ministry for Foreign Affairs (DGIS); the Centre for Clean Technology; Centre for Clean Technology and Environmental Policy, University of Twente, Netherlands; and examples of local partners are the National Trust for Nature Conservation and the Federation of Community Forestry Users Nepal (FECOFUN).

In the late 1980s and the early 1990s, much of ICIMOD's work was centred on documenting case studies, for example, studies of the ecology of the Arun River basin, of different aspects of forest management in Dhading, Sindhupalchok, and Kabhrepalanchok, and of the ways in which forest and tree products contribute directly to the food and income requirements of mountain people. A concerted effort was made to document how communities in Far Western Nepal managed their community forests, with case studies of indigenous protection and management systems for forests in Baitadi, Achham, Palpa District and the Phewa Watershed, Kaski District, and of dwindling forest resources and local forest practices and government intervention compared to two decades earlier. ICIMOD also looked at the conflicts that can arise in community forestry and studied

the legal issues in a woman's community forestry group by comparing with user groups in India, and worked to identify key issues (including legal and policy issues) necessary to make community forestry an effective mechanism for sustainable mountain development. A decade of investigation showed that development of community-based natural resource management is more advanced in those areas of Nepal where natural resources are heavily linked to people's livelihoods, social ethos, economic underpinning, and environmental security, and that an integrated approach seems to be the key. The factors that led to successful innovations and those that slowed progress were documented.

From the late 1990s, the studies tended to look at wider issues such as the use of alternative technology on reducing pressure on forest resources, how non-timber forest products can add to livelihoods, and the use of satellite remote sensing in forest resource management. Other studies looked at participatory forest management in Nepal and the implications for policy and human resources' development; policy issues such as the role of decentralization legislation in Nepal with regard to community forestry; and the regional and national status of community forestry and other initiatives like leasehold forestry and parks and protected area management. Looking farther afield, ICIMOD analysed participatory forest management approaches adopted in Nepal as compared to those in Bangladesh, Bhutan, and India. Recent work considers the role of forests as providers of ecosystem services, and how to estimate the monetary value of the goods and services that forests provide and include such calculations in planning decisions.



Reducing Emissions through Deforestation and Forest Degradation (REDD+)

Much of ICIMOD's present work on forests focuses on the approaches related to reducing carbon emissions and helping prevent degradation by reducing emissions from deforestation and forest degradation, known as REDD+. REDD+ is designed to reward conservation and advocates compensating countries for not cutting down trees, thus reducing emissions, and for increasing forest cover, thus increasing carbon sinks. Sustainable management of forests provides a relatively cheap way of mitigating greenhouse gas emissions. The co-benefits

of REDD+ activities can include poverty reduction and biodiversity conservation, which are also recognized by the Convention on Biological Diversity.

The first field studies in Lamatar Community Forest in 2007 showed that communities can carry out the measurements needed to quantify carbon sequestration. This was followed by an action research project in three watersheds (in Chitwan, Dolakha, and Gorkha) in partnership with the Federation of Community Forestry Users Nepal (FECOFUN) and the Asia Network for Sustainable Agriculture and Bioresources (ANSAB) supported by the Norwegian Agency for Development Cooperation (Norad). The pilot project tested ways to implement REDD+ and build capacity at ground level to support Nepal in its REDD+ preparation efforts. Local communities were trained extensively and involved in the field measurement of forest carbon within their forested area. ICIMOD developed a carbon inventory manual to facilitate the implementation, and the project developed a pilot forest carbon trust fund and mechanism for distributing carbon payments to communities as financial incentives for their forest conservation and enhancement efforts. Performance-based incentives were distributed from a seed grant, and communities used these for various activities focusing on environmental and social safeguards.

Working with communities on REDD+ is paving the way for the future of forestry in Nepal. With international recognition of the ground-breaking efforts being implemented at community level, Nepal is again at the forefront as a world leader in innovative forest management.



Rangelands

Nepal's rangelands are estimated to cover about 1.75 million hectares, or nearly 12 per cent of the country's land area, with grass and shrublands in the mountains constituting 80% of the total. These fragile and critical ecosystems were originally administered by the Department of Forest, but more recently rangelands were included under the Ministry of Agricultural Development, Department of Livestock Services. Despite the fact that so much of the total land area of Nepal is rangeland, these vast areas have been poorly acknowledged in government planning and development spending. Until the 1990s, despite the extent and importance of rangelands, very little (even baseline) data was available throughout the HKH and most governments and development agencies had neglected them.

With an understanding that an improved understanding of pastoral production systems and rangeland dynamics was needed as a basis for rangeland development planning, ICIMOD started working on rangelands in 1995, and 1999 saw the start of a three-year Regional Rangelands Programme, co-funded by the Government of Austria, with a second phase from 2004, and a third phase from 2007 to 2009. ICIMOD also succeeded in raising awareness and knowledge among governments, policy makers, academia, and development organizations on rangeland co-management philosophy, principles, and approaches throughout the region.

Early highlights in Nepal include the first regional training course on 'Participatory Approaches to Rangeland Research and Development in Nepal' held in June 1999 funded by the King Mahendra Trust for Nature Conservation and the



Regional Community Forestry Training Centre/Thailand and a major workshop on grassland ecology and management in protected areas of Nepal. In 1999, Nepal's Department of National Parks and Wildlife Conservation, ICIMOD, and the World Wildlife Fund (WWF)-Nepal worked to improve rangeland management practices through rural development projects; in 2005, the Western Upland Poverty Alleviation Project (WUPAP) promoted rangeland development through various activities including raising of seedlings for fodder species; and in 2006, the principle of co-managing natural resources was incorporated in Nepal's Upper Mustang Biodiversity Conservation Master Plan.

Over the past decade and a half, as better baseline data for the understanding of rangeland communities have emerged and reliable baseline data have become available for new studies, ICIMOD and its partners have started developing information on the socioeconomic conditions of sample pastoral communities in Nepal and elsewhere. More recently, specific concerns have been integrated such as promoting the use of decentralized clean energy in rangeland areas to enhance adaptive capacity; gender specific issues; and questions related to climate change impact. ICIMOD has helped establish a knowledge base on energy uses in rangeland areas, tested new technologies through participatory processes, and build partners' capacities. In Nepal, the Alternative Energy Promotion Centre has included scaling up of the piloted technologies in their annual plan for rangeland areas. Major partners for the Development of Sustainable Energy for Rangelands (DESER-II) project include the National Trust for Nature Conservation in Nepal, and the People's Agriculture Research and Development Centre (PARC), Nepal.

Overall, ICIMOD's work has successfully led to the adoption and scaling up of various rangeland technologies and options for livelihood diversification that can lead to better adaptation to climate change, and for the valuation of ecosystem services. Results are now emerging from ICIMOD's cumulative efforts and the Government of Nepal has recently promulgated the Rangeland Policy 2012.

Wetlands

High-altitude wetlands are an important, yet often overlooked, component of mountain ecosystems, in spite of the fact that they contribute to water storage and the hydrological cycle for downstream areas. Their degradation can impact the entire river system down to coastal outlets. Wetlands contain high biological and cultural diversity and are important staging points for migratory birds and are a major component in livelihood support in mountains, especially in rain shadow areas where they provide water for pastoralists and farmers. The presence of rare and endangered species of and fauna and flora, including wild native rice and other indigenous plants and the provision of resting places for migratory birds and waterways for migratory fish render global importance to Nepal's wetlands.

ICIMOD's work on wetlands, especially high-altitude wetlands, goes back to 1985. Activities have focussed on compilation of relevant data and information, and understanding and raising awareness of the importance of these wetlands. Partners include Wetlands International (UK), Centre for Ecology and Hydrology (UK), ARGEOPS (NL), and the EU Asia Pro Eco Programme. ICIMOD established and now hosts a regional technical support platform called

the 'Greater Himalayan Wetlands Information System', which provides internet-based wetland databases with geographic information for use in a regional wetland inventory. These databases, which include remote sensing data, can be used together with hydrological models, ecological experimental models, and social and cultural information and experience to provide a basis for Nepal to develop plans for integrated water resource (catchment) management. In 2006, ICIMOD started work which extended support for the conservation of high-altitude wetlands through the application of the Asian Wetland Inventory approach and stakeholder-led catchment management.

In order to enhance ecosystem services of the Himalayas like water storage and to promote the conservation and sustainable use of Himalayan wetlands, ICIMOD initiated the Himalayan Wetlands Initiative (HWI) in 2009 in collaboration with the Ramsar Convention Secretariat, Wetlands International, and the World Wide Fund for Nature. The overall goal of the inter-programme initiative is to promote the conservation and sustainable use of Himalayan wetlands in the Hindu Kush Himalayan (HKH) region.

Transboundary resource management

Recognizing the need for regional cooperation to sustain ecosystem goods and services and protect biodiversity in landscapes and river basins that cross national borders, ICIMOD is working with the countries in the region to adopt a people-centred approach that makes it possible to address the conservation and sustainable use of natural resources in areas that are defined by ecosystems rather than administrative boundaries.





The Kailash Sacred Landscape (KSL) comprises the cultural and geographical area surrounding Mt Kailash and covers the remote southwestern portion of the Tibet Autonomous Region (TAR) of China and adjacent parts of northwestern Nepal and northern India.

ICIMOD's integrated transboundary programmes take the view that landscapes which extend across international political boundaries share common biophysical, economic, social, and cultural attributes that can facilitate relations among those living in them because of shared resource utilization patterns and emergent issues. Integrated transboundary landscape approaches promote meaningful interaction and reconciliation among the various actors at the landscape scale to maximize benefits by developing a comprehensive understanding of the system dynamics, providing impact analysis, and facilitating decision making based on an improved knowledge base.

Nepal figures prominently in three of the seven landscapes that ICIMOD has identified for detailed research: Kangchenjunga Landscape, Kailash Sacred Landscape, and Everest Sacred Landscape. ICIMOD has worked with Nepal to conduct strategic environmental and socioeconomic assessments, planning, and analysis to inform policy decisions that straddle the traditional international borders.

Kanchenjunga Landscape: This region extends across Nepal in the east, India and Bhutan to the west, and TAR, China to the north. Since the 1990s, ICIMOD has assisted these countries to develop a common vision and long-term action plan that would help to connect the protected areas along their international borders. Feasibility assessments are underway to develop conservation strategies and plans and to provide policy inputs for the conservation and sustainable use of biodiversity resources, with the aim of establishing biodiversity conservation corridors to connect the mosaic of protected areas. Support has come from the John D and Catherine T MacArthur Foundation and

the GIZ; at present, Nepal's Ministry of Forests and Soil Conservation is a major partner.

Kailash Sacred Landscape: This region represents a sacred landscape significant to hundreds of millions of people in Asia, and around the world. The landscape is shared by three countries – China, India, and Nepal – and attracts thousands of pilgrims every year because it is significant to Hindu, Buddhist, Bon Po, Jain, Sikh, and other groups. The landscape contains the source of four of Asia's great rivers – the Indus, Brahmaputra, Karnali, and Sutlej. The preparatory phase for this collaboration was concluded in 2012 and now planning has commenced for the implementation of activities to improve natural resource management, livelihood options, and the wellbeing of people living in the landscape. In Nepal, this includes in part, establishing long-term biodiversity monitoring sites and weather monitoring stations. The United Kingdom's Department for International Development (DFID) has joined UNEP and GIZ, to support the Programme; the major implementing partner in Nepal is the Ministry of Forest and Soil Conservation.

Everest Sacred Landscape: ICIMOD has worked since 1995 for biodiversity conservation in the four contiguous protected areas in Nepal and TAR China that link hands around Mount Everest to conserve a large, continuous ecosystem and the rich cultural and natural heritage. Looking to the future, the challenge will be to reconcile the needs of the local communities with conserving ecosystems and biotic diversity. Major partners for early activities included The Mountain Institute, the Governments of Nepal and China, the MacArthur Foundation, and Ev-K2-CNR.





Hazard and Risk

ICIMOD has worked with Nepal for many years investigating ways to help protect the land and its people. This work has entailed both working with the Government of Nepal and also working directly with mountain people to implement improved policies for mountain risk engineering and disaster risk reduction at the national level. The emphasis has been on an integrated multidisciplinary approach, and this is reflected in the training courses, materials prepared for capacity building, hazard mapping, and vulnerability assessments, as well as ICIMOD's attempts to foster dialogue among stakeholders.

The most common natural disasters encountered by people in Nepal are floods, landslides and debris flows, forest fires, and earthquakes. The very steep slopes of the Himalayas mean that loss of life and property due to landslides is a common feature of life in the mountains. Extreme weather events that can trigger flash floods, landslides, and debris flows are a constant source of concern. During the dry season, forest fires, often caused by poor agricultural practices and a general lack of awareness, are a threat to

local life and property, and can have far-reaching adverse ecological and economic impacts. Disaster mitigation requires better understanding of the physical nature of the region and the impact of human activity, with integration of knowledge from such diverse fields as geology, geophysics, engineering, hydrology, and meteorology to facilitate more effective planning and implementation of activities.

Over the past 30 years ICIMOD's approach to risk management has been that as a regional institution it can make the greatest contribution by publishing baseline assessments and undertaking research, training, education, and capacity building. The approach has evolved to encompass new technologies and new approaches that focus on flood early warning systems, satellite-based weather forecasting, and web portal dissemination of information. In particular, GIS and remote sensing technologies are now playing a greater role in delineating morphology and have made hazard mapping more accurate and less time-consuming. Hazard mapping using modern GIS tools has become an integral part of risk assessment studies. Over the past 10 years, there has also been a new emphasis on community preparedness and disaster risk management strategies based on community experience rather than simple post-disaster response and recovery. This approach examines how issues related to gender, equity, and vulnerability can be properly incorporated into work on disaster risk reduction, and explores opportunities to include local knowledge, innovations, and practices in disaster management. By working to strengthen the capacity of local people, this work mainstreams disaster risk reduction activities into development work.



Risk Assessment and Hazard Management

A hazard is a potentially damaging physical event or phenomenon, and in particular the probability that a particular event will occur in a particular area within a given period of time; risk is the probability of harmful consequences or losses resulting from the hazard and is the combined effect of the probability of occurrence of the event, the magnitude of the event, and the vulnerability of the structures that it impacts. Disaster risk reduction aims to reduce disaster risk through systematic efforts to analyse and manage the causal factors, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events.

Even before ICIMOD was officially inaugurated, two of its supporters, Professor Jack Ives (University of Colorado) and Professor Bruno Messerli (University of Berne) made a first attempt to produce prototype mountain hazard maps of representative areas in Nepal. This project was supported by United Nations University (Natural Resources Programme), UNESCO (Committee for Man and the Biosphere), and His Majesty's Government of Nepal. In the output map, the hazard assessment of the single unit areas was accomplished through the cooperation of dozens of people who conducted fieldwork over many months. The project activities and outputs were not only the first of their kind in Nepal, it is believed that they were the first in the whole of the Hindu Kush Himalayan region.

Mountain Risk Engineering

ICIMOD's mountain risk engineering programme started in 1988 supported by the European Economic Community (EEC) and was followed by a Mountain Risk Engineering Project which ran to 1998 supported by the EEC, Swiss Agency for Development Cooperation (SDC), and GIZ. The project focused on training courses and materials on mountain risk engineering and landslide disaster management, and during this time many planners, technical officers, and practitioners from Nepal were trained in mountain risk engineering. The courses also helped to promote risk awareness among those involved in the development of infrastructure in mountain areas and to recommend to them measures for mitigating risk. The mountain risk engineering concept led to ICIMOD's work in landslide hazards and control. Based in part on this work, Nepal established a national working group which prepared a National Action Plan on Landslide Hazard Management and Control, and in 1998 ICIMOD helped to institute a post-graduate course on mountain risk engineering at Tribhuvan University. The three-volume Mountain Risk Engineering Handbook published by ICIMOD in 1991 is still used today as a text book in many of Nepal's engineering institutes.



Mountain roads

During the late 1980s, there was a keen awareness that inaccessibility was the most serious constraint in the development of mountain areas. ICIMOD endeavoured to investigate whether the environmental impacts and seemingly small returns on what seemed to be very large investments were worthwhile and attempted to identify and record the lessons of the road project from Lamosangu to Jiri undertaken by the Government of Nepal and the Government of Switzerland. The findings led to a number of recommendations to improve planning and execution of road projects to facilitate the delivery of socioeconomic benefits.

In the 1990s, ICIMOD conducted a study of the appropriateness of different approaches to constructing roads and infrastructure in mountain regions which drew upon experiences from across the region but focussed mainly on Nepal. The study created awareness of the various considerations for infrastructure in mountain regions. A further study highlighted some experiences in road building in the mountain areas of Nepal and discussed both challenges and achievements in terms of costs, the environment, and economic benefits. It suggested guidelines and underlying features for approaches to road construction to improve access at relatively low cost without damaging the environment, and how to mobilize local people so that they could benefit both financially and by gaining experience for future road maintenance. Finally, a study was published highlighting some of the issues related to planning, construction techniques, and utilization and benefits of rural roads using four roads in Nepal (in Baglung, Dhading, Illam and Kabhre Districts) as examples.

Landslides

During the early 1990s, ICIMOD instituted a programme on 'Landslide Hazard Management and Control' supported by the Government of Japan, and a state-of-the-art review was commissioned for Nepal which covered the geology as well as specific topics such as erosion and sediment yield in the Himalayas; landslides and their geological causes were classified and mitigation measures were discussed.

During the 1990s, ICIMOD conducted workshops on landslide hazard management and control (sometimes on specific areas such as the Northern Sunkoshi and Bhotekoshi catchment areas), which were attended by government line department officers, cooperation agencies, and representatives from private companies. Case studies were conducted on landslide dynamics and management at the community level in the Modi watershed in western Nepal; on perception and needs for hazard management at the local community level; and on monitoring and management near the Sunkoshi powerhouse site, on the Kathmandu-Trishuli Road, and on the Arniko Highway. A three-volume document on 'Landslide Hazard Management and Control in the HKH Region' was published, and a report on Landslide Hazard Mitigation in the Hindu Kush Himalayas which contains many examples from, and much information relevant to, Nepal.

Floods

Nepal is exposed to hazards from both riverine floods, especially in the Terai area and upper valleys, and flash floods, especially in the mountains and hills. Flash floods occur with little or no warning and can be triggered by events such as intense rainfall, the outburst of a landslide dam lake, the failure of a natural or artificial dam, or a glacial lake outburst flood (GLOF). The frequent occurrence of flash floods in Nepal poses a severe threat to lives, livelihoods, and infrastructure, both in the mountains and downstream. ICIMOD has explored different ways to reduce the risk posed by both flash floods and riverine floods and has always emphasized the need for end-to-end information systems – including satellite data, flood forecasting models, and community-based early warning systems – that promote the timely exchange of flood data and information. In addition there is now a greater awareness of the need to document local adaptation strategies to flood hazards to better inform policy and decision makers. In the HKH solutions always need to be both integrated and regional, since floods know no borders, and intense rainfall, snow melt, or dam outbursts in one country can result in floods in other countries downstream.

ICIMOD's earliest work in Nepal was a study of the role of extreme weather events, mass movements, and land use change in increasing natural hazards in the Bagmati catchment of south-central Nepal, conducted in collaboration with faculty members from Tribhuvan University in the early 1990s. In the mid-2000s, ICIMOD worked



on assessments and mapping of flood hazard, risk, and vulnerability in the Ratu Khola watershed in the central Terai; the Ratu River originates in a highly flood-prone area in the Siwaliks and many people lose their lives and thousands of hectares of fertile land are washed away annually due to sedimentation, bank cutting, and inundation.

In the late 2000s, ICIMOD prepared the first satellite rainfall estimates for Nepal, which is still ongoing, and outlined a methodology for mapping glacial lakes and identifying those that might be dangerous in a publication on GLOFs and GLOF risk assessment for Nepal. More recently, it has assisted the government in determining the cause of a catastrophic flash flood in the Seti River, and has documented case studies in the Bhote Koshi/Sun Koshi basins to help create a knowledge base on flash flood processes; increase understanding of flash flood risk management mechanisms, including policies and institutional mechanisms; and increase awareness on flash floods. In 2013, ICIMOD investigated the governance of flood mitigation infrastructure in Nepal and the reasons behind failure of structural measures, and it also surveyed traditional coping and adaptation strategies to deal with floods.

ICIMOD has also prepared a set of three resource manuals and a training of trainers manual (published between 2008 and 2012) on flash flood risk management. These training materials are used in Nepal and other regional countries; and help to build the capacity of trainers so that they can then disseminate the knowledge to a larger number of practitioners. The publications are expected to contribute meaningfully towards reducing disaster risk and providing greater physical security for people in Nepal.

Flood information systems that save lives

ICIMOD has worked with the World Meteorological Organization since 2003 to establish a regional flood information system (HKH-HYCOS) to help reduce flood vulnerability and minimize the negative impacts of floods in the Hindu Kush Himalayas and its downstream plains areas. By the end of 2013, more than 80 hydro-meteorological stations in Nepal were feeding into the Regional Flood Information System (RFIS) to improve disaster risk reduction efforts. The Centre also initiated a system for managing flood risk by estimating rainfall in real-time using satellite data to predict potential flood-related risks, which included a remote sensing approach for measuring rainfall and monitoring flow in pilot catchments in Nepal and related areas in the HKH.

Disaster Preparedness

In the field of disaster risk reduction, there has been a shift in focus from response toward prevention, preparedness, and mitigation. From 2005 to 2007, ICIMOD implemented the project 'Living with Risk – Sharing Knowledge on Disaster Preparedness in the Himalayan Region' based on the Hyogo Framework for Action with financial support from the European Commission Humanitarian Aid Department, with Nepal as one of four countries involved. The project encouraged knowledge sharing and strengthened capacity among key practitioners in the field of disaster preparedness and management through training courses, workshops, knowledge compilation and dissemination. A

study on the status of disaster preparedness in Nepal was undertaken; other publications included a framework on local knowledge for disaster preparedness and gender and vulnerability aspects in disaster risk reduction. Recently the importance of integrating local knowledge and practices into disaster preparedness has started to receive recognition. Local knowledge on disaster preparedness from Nepal's eastern Terai was captured in both Nepali and English in the 2007 publication 'The Snake and the River Don't Run Straight' to help increase awareness and understanding of local knowledge, practices, and contexts related to disaster preparedness. Subsequent workshops focused on planning processes, social inclusion, and local knowledge for disaster preparedness.

Forest Fire

During the dry season, forest fires, often caused by poor agricultural practices and a general lack of awareness, are a threat to local life and property and can have far-reaching adverse ecological and economic effects. ICIMOD has been instrumental in bringing up-to-date geospatial and earth observation technologies to monitor and detect forest fires in Nepal in a system where those potentially at risk can be warned by phone and SMS. ICIMOD worked in close collaboration with the Department of Forests, United States Forest Service, US Department of State, and USAID to develop this system. The forest fire alert system was officially launched during a workshop held at ICIMOD in April 2013 by Dr Krishna Paudel, Secretary of the Department of Forest and Soil Conservation.





Climate Change

Nepal contains some of the world's most fragile and sensitive landscapes with a large number of endemic species, many threatened, and is home to some of the world's poorest people, most of whom depend on biological resources for their daily needs and livelihoods. Thus climate change is likely to exert wide ranging effects on Nepal's environment, natural resources, and socioeconomic conditions. Notwithstanding the considerable work of the past 30 years, understanding of the vulnerability of Nepal's mountain areas to climate change and the potential impact on human well being remains limited. ICIMOD's new strategy focuses on 'Responding to the challenges of global change: enhancing resilience and supporting adaptation of mountain communities'. Thus 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. ICIMOD's multifold approach includes generating and strengthening knowledge about the ecology and sustainable development of mountain ecosystems; supporting development of new methods for gathering climate related data and modelling of potential impacts of change; and promoting adaptation and mitigation strategies as well as diversified livelihood opportunities. Many of these are described briefly in the relevant thematic sections; some activities specific to climate change, and especially climate change in Nepal, are summarized in more detail in this chapter.

Assessment for Nepal

ICIMOD has undertaken a number of activities towards a preliminary assessment of the impacts and vulnerability to climate change in Nepal, including rapid surveys, thematic workshops, interaction with stakeholders, and investigations by individual experts. This is only a beginning, and ICIMOD will continue to work with Nepal to fill data gaps by systematic observations, including extensive use of earth observation and GIS capability to gather information from Nepal's poorly accessible terrain. The long-term goal is to acquire more precise information both to inform policy at the national level, and to stimulate enhanced capacity for research in the country. By their nature, many climate change assessments are carried out on a regional scale but are still highly relevant to Nepal; a few of these are also mentioned here.

Climate change can manifest in many ways including glacier recession, an increase in the frequency and magnitude of extreme weather events, and a shift in the monsoon patterns, all of which will affect water availability and may pose increased risks from hazards. In all cases quantification of change requires knowledge of a baseline, thus ICIMOD's Climatic and Hydrological Atlas of Nepal published in 1996 proved to be an important first step in climate change studies as it provides a baseline for many values. Since then, ICIMOD has initiated compilations of data on weather patterns, snow cover, and glacier status in Nepal and throughout the HKH as discussed above in the chapter on the cryosphere.



1950

Taboche (6,367 m) in 1950 as seen by Erwin Schneider from the east. The photo was taken from above the Nangkartshung monastery. Taboche, and its neighbour Jobo Laptsan (6,440 m, centre, the mountain that looks as though it is bent and pointing north), preside over the lower Khumbu valley. At their base is the path to Everest base camp. Tsholo Tso is a moraine dammed lake at the foot of Jobo Laptsan. The moraine, seen as a white, glacial-like feature, is blocking the lake.

Photo: Erwin Schneider, Khumbu, Nepal, 1956–1961; Courtesy of the Association for Comparative Alpine Research, Munich; (Archive of Alton Byers, The Mountain Institute)



2007

Bottom: Taboche (6,367 m) seen from the same point in 2007. The clean, debris-free glaciers and ice nestled below the Taboche summit have been reduced considerably by recent warming trends. The ice in the small glaciers below the ridgelines to the right (north) has suffered the most, perhaps because of its lower altitude, below 6,000 m. Comparison of satellite images of Sagarmatha (Everest) National Park taken in the 1970s, and in recent years shows that hundreds of these small glaciers have disappeared.

Photo: Alton Byers, Khumbu, Nepal, 2007, The Mountain Institute

Supported by the MacArthur Foundation, ICIMOD undertook a series of research activities together with partners in the late 2000s to provide a preliminary assessment of climate change impact and vulnerability in the eastern Himalayas, including Nepal. Activities included rapid surveys at country level, thematic workshops, interaction with stakeholders at national and regional levels, and development of technical papers by individual experts in collaboration with institutions that synthesized the available information on the region. The findings were published in a series of publications which included a vulnerability synthesis report and technical papers on the thematic topics of climate change projections, biodiversity, wetlands, water resources, hazards, and human wellbeing.

In 2009, ICIMOD published a simple summary of present knowledge on the observed and projected effects of climate change for planners, policy makers, and other concerned professionals in the region – ‘The Changing Himalayas: Impact of Climate Change on Water Resources and Livelihoods in the Greater Himalayas’. A more detailed summary of the state of current knowledge on climate change in the Hindu Kush Himalayas was published in 2011, aimed at professionals in all the countries of the region including Nepal.

The vulnerability of rural communities to climate change and their capacity to adapt was assessed in selected villages in Nepal in 2010 in collaboration with the International Fund for Agriculture Development (IFAD). The aim was to develop a better understanding of likely changes and how they will affect livelihoods, of the

adaptation approaches developed over the years for survival in this challenging region, and of the mechanisms people are already using to cope with climate variability and change. ICIMOD also developed an analytical framework and methodology for community-based climate vulnerability and capacity assessment that looks at the environmental and socioeconomic changes affecting the livelihoods of rural, natural resource-dependent communities living in mountain environments, which was used to study community perceptions of and response to climate change in villages in eastern and western Nepal. ICIMOD recently collaborated with the Stockholm Environment Institute (SEI), the International Institute for Environment and Development (IIED), and national partners in Nepal to study the role of policy and institutions in local adaptation to climate change, with case studies in Dhankuta and Kavre districts. The field research showed the extent to which households are adapting through actions that are independent of structured programmes and policy. ICIMOD also conducted a baseline study in the Kailash Sacred Landscape as a basis for subsequent climate change studies.

Adaptation and Mitigation

Adaptation and mitigation measures aim to enhance the resilience of vulnerable mountain communities to climate and other changes. Whereas mitigation measures aim to reduce the impact of climate change and lessen future change, adaptation measures work by developing strategies to live with and adapt to change. In the HKH region, adaptation and land-based mitigation are intimately linked; mitigation activities can become an important complement to adaptation initiatives. ICIMOD promotes innovative livelihood improvement

and sustainable natural resource management strategies that promote adaptation and improved resilience. It also works to capture indigenous knowledge on autonomous adaptation approaches and to provide scientific input as to whether, when, and how these time-tested methods can be used. Building on its long experience, ICIMOD has also extended its support to the Government of Nepal to help develop its national adaptation programme of action (NAPA) and to fulfil its commitment obligations on adaptation and mitigation under various international agreements. For example, last year ICIMOD initiated work with the Adaptation Learning Highways initiative, working with the Western Upland Poverty Alleviation Project and Leasehold Forestry and Livestock Promotion Project in various districts in Nepal. The Initiative encourages





working with communities to adapt to climate change in order to bridge the gap between communities, scientists, and policy makers; and is a strategic process for making local governance more responsive to community needs. A number of ongoing activities and programmes focus specifically on adaptation and mitigation, as described in the following paragraphs.

Rewarding providers for ecosystem services

Payment for ecosystem services (PES) is an emerging global paradigm in the management of environmental resources, including for mitigation. One of the most significant approaches for climate change is 'REDD+', rewarding communities for avoiding deforestation and degradation to

reduce emissions and increasing forest cover to act as a carbon sink. ICIMOD has developed a detailed approach in Nepal, which is described above in the 'Forestry' section.

The Mountain Initiative for Climate Change Adaptation in Mountain Regions

The Government of Nepal, in consultation with various regional and global stakeholders including the Mountain Partnership, launched the Mountain Initiative for Climate Change Adaptation in Mountain Regions Initiative

in May 2010; the Ministry of Environment (MoE) was designated as the focal ministry to carry the work forward. The Initiative plans to bring mountainous countries together and build a common platform to support the Mountain Agenda. It provides a framework within which mountain countries, in collaboration with specialized global and regional agencies, can work together for greater recognition of the critical role of mountain ecosystems in the context of global climate change, and highlights the need to better advocate for mountain ecosystems based on state-of-the-art knowledge so that mountain people can be supported more effectively in their struggle to adapt to the new challenges, and enabled to benefit from emerging opportunities. ICIMOD is providing technical support and backstopping for the initiative.

Himalayan Climate Change Adaptation Programme

The Himalayan Climate Change Adaptation Programme (HICAP), funded by the Government of Norway, is a pioneering collaboration among three organizations – CICERO (Centre for International Climate and Environment-Oslo), ICIMOD, and UNEP GRID-Arendal. It aims to contribute to enhanced resilience of mountain communities, particularly women, through improved understanding of vulnerabilities, opportunities, and potential for adaptation to climate change. The Himalayan Climate Change Adaptation Programme is organized around seven interlinked components: climate change scenarios; water availability and demand scenarios; ecosystem services; food security; vulnerability and adaptation; gender and adaptation; and communications and outreach. Research conducted under the Himalayan Climate Change Adaptation Programme in Nepal in 2013 showed that diversification of agriculture provides a range of benefits in terms of household adaptive capacity. Agroforestry – the integration of trees with agriculture – is particularly promising. A case study carried out in Upper and Lower Mustang reviewed the use of trees for agricultural diversification by communities in response to climate-related stresses, as part of a larger project documenting local adaptation strategies to climate-induced water stress and hazards in the HKH region. Another case study in Mustang investigated how flexible local agricultural systems are for adjusting to unpredictable changes, and identified opportunities for change in the farming system, as well as factors that constrain flexibility.

High Mountain Agribusiness and Livelihood Improvement

The High Mountain Agribusiness and Livelihood Improvement (HIMALI) project on climate change adaptation in Nepal was implemented from 2010 to 2012 as an investment project of loan finance from the Asian Development Bank (ADB) to the Government of Nepal, managed by the Ministry of Agriculture and Cooperatives (MoAC) and technically supported by ICIMOD. The project worked with local partners in Jumla (the DDC) and Mustang (LI-BIRD) districts with the aim of enhancing the socio-ecological resilience of rural mountain populations to climate change-induced water shortages and land degradation. The project addressed the challenges and built on the opportunities provided by the vulnerability of high mountain areas and their underutilized agribusiness potential. Participatory action research was used to identify viable climate-resilient agribusiness options through multi-stakeholder participation and consultation. A photo story entitled “Mountain women and men adapting to climate change” from Mustang district was presented at the Bhutan+10 Conference.





Geospatial Solutions

ICIMOD is internationally regarded as a regional resource centre for geoinformation and earth observation applications with a specific mountain focus. For the past two decades it has focused on technologies and applications related to geographic information systems (GIS) and remote sensing (RS), and it has applied geoinformation and earth observations to many projects based in Nepal as well as playing a substantial role in training GIS practitioners in the country. Through this, ICIMOD aims to help improve environmental decision making in Nepal and the Hindu Kush Himalayan region.

Mountain Environment Regional Information System

ICIMOD's Mountain Environment Regional Information System (MENRIS) was established in the 1990s as the Mountain Environment and Natural Resources' Information System with the aim of helping to bridge data and information gaps related to integrated mountain development through environmental data, information, and knowledge applications based on GIS/RS methodologies. MENRIS focuses on working with ICIMOD's programmes and partners to make appropriate GIS/RS data available, raising awareness on GIS/RS methodologies, and increasing the capacity to apply GIS/RS data across the region through training and collaboration.

The vastness, low population density, and poor accessibility of the Hindu Kush Himalayan region means that mapping and inventorying are a challenge, and remote sensing has increasingly become the method of choice for obtaining the much of the baseline and trend information required as a first step in planning and development processes. Recently, there has been an unprecedented growth and convergence of GIS, GPS, earth observation, and internet technologies, and MENRIS has worked hard to keep pace in transferring these new technologies to ICIMOD's programmes and partners. ICIMOD's GIS capability received early recognition as a node of UNEP-GRID, and these strong links with UNEP have been maintained ever since. In 2010, ICIMOD became the third regional node of the United States Agency for International Development (USAID) and National Aeronautics and Space Administration (NASA) programme SERVIR, a regional visualization and monitoring system that integrates earth observation information, such as satellite imagery and forecast models, together with in situ data and other knowledge for improved and timely decision-making. SERVIR-Himalaya is now using the SERVIR technology platform for regional monitoring and visualization of key environments and natural resources in the region. Nepal is an active member of the SERVIR user community; in 2013 members of the US SERVIR Demand Team met with members of Nepal's Ministry of Forest and Soil Conservation; National Emergency Operation Centre (NEOC), Ministry of Home Affairs; National Information Technology Centre (NITC); Ministry of Agriculture Development; and Department of Hydrology and Metrology to discuss their requirements for geospatial information products and services .

ICIMOD also hosts a satellite receiving station from the Japan Aerospace Exploration Agency (JAXA), intended to support disaster response in the region. The satellite receiving station has a high speed communication link and can receive data from satellite systems in Japan, India, Thailand, Taiwan, and Korea to guide response efforts in emergency situations like floods and fires, and where the communication infrastructure is poor. The system is the first of a series being set up in South Asia, and will be able to provide information to help guide Nepal's emergency response efforts when needed.

GIS/RS Applications in Nepal

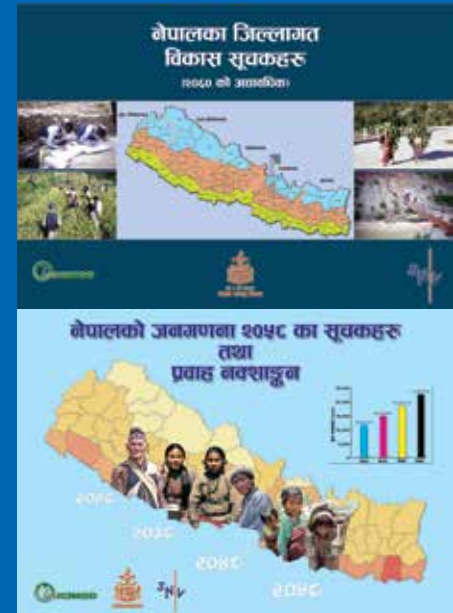
Use of geo-based and remotely-sensed data has become ubiquitous, and is now an integral part of much of ICIMOD's work. GIS/RS data are used extensively in areas such as snow-cover, glacier, and glacial lake mapping; hydrology assessments; GLOF risk assessment; flood forecasting; forest fire detection; forest cover measurement; rangeland assessment; land cover mapping and change assessment; and many others throughout the HKH. Nepal has benefited considerably from the availability of this expertise.

In the 1990s, MENRIS worked on new methods to prepare some of the first computer-based climatological maps for the Himalayas, with examples from Nepal; and GIS and

Mapping census data in Nepal

In 2003, a collaboration between ICIMOD and Nepal's Central Bureau of Statistics, supported by SNV-Nepal, produced the first graphical display for Nepal of different socioeconomic indicators at district level, using data from the 2001 National Population Census supplemented from other relevant sources. The indicators were presented district-wise in the form of thematic maps. Trend analyses were prepared for selected indicators using the data from four consecutive censuses and presented in maps to indicate the changes over a forty-year period. The publication was issued in both English and Nepali and proved very useful for a wide range of users.

In 2003, ICIMOD (with assistance from SNV-Nepal) also updated the study 'Districts of Nepal Indicators of Development', first issued in 1997. This much cited publication was particularly useful for Nepal's development community as it provided an assessment of the comparative development status of Nepal's districts, and helped both in understanding of differences across the country and prioritising of activities.



RS technologies were used for planning and assessment of natural resources in Lamjung District and agricultural development in Gorkha District. Graphical representations of data often help to yield greater insights, which proved particularly true for the popular publications in 1997 on 'Districts of Nepal: Indicators of Development' (later updated with new census data) and in 2003 on 'Mapping Nepal Census Indicators 2001 and Trends'. Municipal officials welcomed a GIS database for the Kathmandu Valley and case studies showing the use of GIS for municipal planning in Kirtipur Municipality and for seismic building loss estimation in Lalitpur.

As satellite products improved and became more accessible, studies extended to mapping of land cover and landscape changes; with a first case study conducted in Lamjung in 2004 and a full assessment of land cover in Nepal in 2010. Similarly, GIS and hydrodynamic modelling were combined for hazard assessment in the Sagarmatha region, and flood disaster mapping and hazard assessment in the Ratu watershed. In the late 2000s, MENRIS worked with the Hindu Kush-Karakoram-Himalaya (HKKH) Partnership Project funded by the Government of Italy and implemented by International Union for the Conservation of Nature, ICIMOD, CESVI and Ev-K2-CNR to produce a comprehensive study of Sagarmatha National Park.

Recent applications of RS and GIS in Nepal include improving knowledge of cropping systems to support food security; testing bias-adjustment of satellite-based rainfall estimates over the central Himalayas in Nepal to support flood prediction; using remote sensing to estimate forest carbon at REDD+ pilot sites; mapping of above-ground

carbon using worldview satellite images and Lidar data in Kayerkhola watershed in Chitwan; mapping of air quality over Kathmandu; assessing impacts of the community forestry programme in Dolakha District; development of a forest fire detection and monitoring system; and linking spatio-temporal land cover change to biodiversity conservation in the Koshi Tappu Wildlife Reserve, Nepal.

Web-Based GeoPortals

ICIMOD maintains web-based geoportals on a wide range of topics such as HKH conservation, forest fire detection and monitoring, and mapping haze as an indicator of air quality, which are useful to all countries in the region. There are also a number of portals specific to Nepal including

- Biodiversity of Nepal – a conservation portal with interactive mapping features using Google Maps to provide information on topics such as protected areas, mammals, reptiles and amphibians, birds, IUCN Red List, and protected species (National Parks and Wildlife Conservation Act)
- Nepal Climate Observatory at ICIMOD Headquarters – real time data view data on atmospheric parameters collected at ICMOD headquarters under the ABC project in collaboration with UNEP
- Nepal Geospatial Platform
- Emergency response system for Kathmandu Valley in the case of an earthquake disaster

Training of GIS/RS Experts in Nepal

ICIMOD has run courses on GIS since the early 1990s. The courses originally focused on technical training for planners and policy makers, forest resource persons, and others involved with disaster preparedness and similar topics. These technical courses still form the core of training, but the focus over the past ten years has broadened to include workshops on thematic areas and projects. On average, courses have 15 to 30 participants with about half from Nepal, many from Kathmandu University, Tribhuvan University, the National Forestry Service, and a range of government ministries.

These courses have been very successful in Nepal, especially the 'Introductory GIS' course. The notes from the introductory course were issued as a publication with an interactive CD-ROM in 2001 (GIS for Beginners: Introductory GIS Concepts and Hands-on Exercises), made available in Nepali in 2005. Large numbers of GIS professionals from the region have either been taught or have received some form of assistance or training in GIS through ICIMOD. More than 3,500 participants have received some form of training in GIS/RS and related geospatial topics since courses started in 1992, approximately 2,300 of them from Nepal. The annual number of participants is increasing rapidly, and in 2013 alone more than 300 persons from Nepal received training.







Knowledge Management and Communication

ICIMOD serves as an open house for knowledge initiatives on sustainable mountain development and its knowledge grows from competencies in the thematic areas involved in the implementation of projects and programmes. From its inception, ICIMOD has focussed on making accumulated information and knowledge accessible across the region using a variety of approaches. This includes promoting capacity development at many levels, including among youth; helping partners and policy makers transform the results of research into knowledge that can be used for improved decision making and practical action; distilling and communicating relevant messages for action towards sustainable mountain development at all levels; and encouraging the active involvement of ICIMOD's partners in the knowledge development cycle. Specific information and knowledge is communicated through publications, databases, web content, and multimedia, all of which are available globally online.

Many knowledge sharing activities take place within programmatic activities. Others, such as publications and web communications are facilitated across the

Centre by the Knowledge Management and Communication unit. While ICIMOD's publications and web-based data products have a truly global reach, other means of imparting information, such as training courses, demonstrations, and exhibitions, are more limited in the audience that they can attract. Since people in Nepal, and especially in Kathmandu, have easy access to ICIMOD's headquarters, they have more opportunities to benefit from such events. Some of the major pathways of communication, and their relevance to Nepal, are described below.

Communicating Knowledge

Communication of knowledge is central to ICIMOD's efforts to disseminate knowledge and findings. The Centre has always kept abreast of the latest communication technologies in order to package the information in forms appropriate to different audiences, whether researchers, practitioners, decision makers, or the public at large. Most recently this has meant having a presence on social media sites like Twitter and Facebook.

Books, brochures, and training manuals

ICIMOD's publications over the past three decades have covered a wide range of topics related to mountain development. The publications target different audiences



depending on the content, with the most common audience comprising educated specialists among policy makers and decision makers at different levels of governmental, and policy, planning and extension workers in non-government organizations. Some of ICIMOD's publications are well recognized resources and form the backbone of specialized courses, and a few target the public at large. These publications are generally distributed in printed form, however, during the last decade, all of the more than 600 books and booklets, and many of the more than 700 general publications, published by ICIMOD have been made freely available to download online. News about new publications is distributed via a mailing list, which includes nearly 2,500 people in Nepal, around one-third of the total. Over the years, around 114,000 printed books and booklets and 360,000 general publications have been distributed within the country. In recent years, more books and booklets have been downloaded than distributed in hard copy, and around 20% of those for which the location can be attributed are downloaded in Nepal, some 6,000 books annually.

In Nepal, ICIMOD's publications have also served the purpose of documenting, and making available internationally, knowledge on aspects of Nepal's environment and its integrated development that might otherwise be difficult to access, whereas others provide a source of learning that would otherwise be difficult to obtain. Training of trainers manuals on a range of topics enable courses to be provided to a much larger audience, as the trainers adapt the contents for activities in the field. Examples include publications on mountain risk engineering and tourism that have been used for courses at Tribhuvan University for more than a decade. Similarly,

ICIMOD books and manuals available in Nepali

Year	Title
1995	Agricultural Technologies Selected by Farm Women in Nepal
1996	Nepal Madhyasthata Samuha, Community Forestry in Nepal
1996	Nepal Madhyasthata Samuha, Jalbire Women's Community Forestry Group
1996	Madhyasthata Samuha Seminar on Conflict Resolution in Natural Resources
1996	Community Forestry in India and Nepal, Learning from Each Other
1997	Community Forestry: The Language of Life – Report of the First Regional Community Forestry Users' Group Workshop
1999	Manual on Contour Hedgerow Inter-cropping Technology
2000	Pollination Management of Mountain Crops through Beekeeping
2000	Widening Horizons: Regional Workshop on the Role of Local, Elected Institutions in Community Forestry Management in the HKH
2001	Himawanti – Women of the Hindu Kush-Himalayas
2001	Proceedings of a National Stakeholders Workshop on Strategy Papers Prepared for Nepal on Information Technology for Development
2002	Water and Erosion Studies of PARDYP Nepal: Data of the Yarsha Khola Watershed
2004	Mapping Nepal Census Indicators 2001 and Trends
2004	Districts of Nepal: Indicators of Development Update 2003
2004	Queen Rearing in <i>Apis Cerana</i> : Training Resource Book
2005	GIS for Beginners: Introductory GIS Concepts and Hands-on Exercises
2005	Advocacy Strategies and Approaches: A Training of Trainers Manual on Advocacy Strategies for Community-based Organisations in the Hindu Kush-Himalayas
2007	Increasing Access to Environmental Justice: A Resource Book for Advocacy and Legal Literacy in South Asia
2007	The Snake and the River Don't Run Straight: Local Knowledge on Disaster Preparedness in the Eastern Terai of Nepal
2012	Beekeeping Training for Farmers in the Himalayas

the introductory course on GIS provided a backbone for the introduction of GIS techniques in the country. Manuals on land management techniques and beekeeping and advocacy strategies, and practical descriptions of technologies and approaches for natural resource management, have supported extension activities across the country. General information leaflets have helped a wider public to understand topics ranging from climate change and GLOFs, to sustainable energy and value chains. In general, publications are prepared in English, which are easily accessible to the majority of Nepal's government officers, professionals, and students. Equally ICIMOD has always encouraged partners and programmes to undertake translation into Nepali where appropriate, and in a few cases where the primary audience comprises farmers, the primary publication has been written in Nepali. Publications that have appeared in Nepali are shown in the table on the previous page.

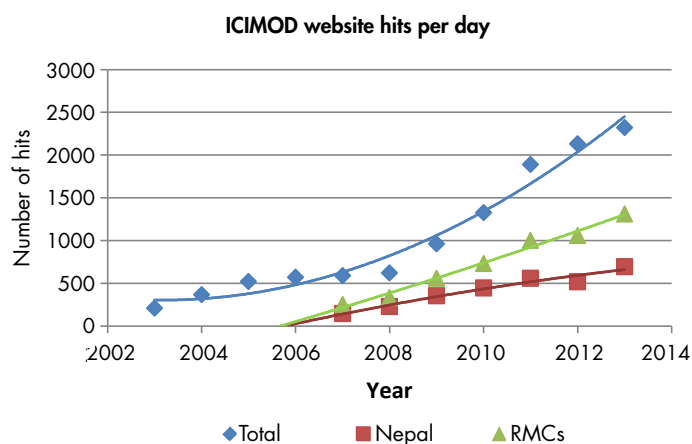
Web-based communication

ICIMOD's website provides access to a wide range of information on thematic topics, publications to download, and information portals and databases. The impressive number of online visitors and downloads and the growing media coverage attest to the expanding reach and use of ICIMOD knowledge products in general. The graph shows the average number of visits to the site each day, and the percentage of users from Nepal. In the years for which records are available, users in Nepal have comprised 25 to 35 per cent of the total.

Alternative media and multimedia

ICIMOD has also explored alternative ways to share information and knowledge, including the use of folk and traditional media, and combinations of these with multimedia techniques.

ICIMOD has encouraged and guided grassroots development workers in Nepal to use traditional communication methods for sharing information, raising awareness, and forming stronger community coalitions. In 2004, ICIMOD worked with Spiny Babbler, a Nepalese NGO, to conduct training in developing alternative media 'prototypes', such as puppetry, drama, collage festivals, and workshops. Trained groups were encouraged to conduct training for other community groups and to utilize these media for community mobilization, advocacy, and education. The media prototypes developed in Nepal were performed in the local communities and were even translated into the local Newari language to better stimulate the awareness of the communities in the areas



of natural resource management and environmental issues. In 2007, ICIMOD prepared an alternative media guide in booklet form illustrating different methodologies to stimulate and support their wider use. More recently, ICIMOD has supported the development of street plays on environmental topics in Nepali which have been performed in public spaces at different events.

ICIMOD has also encouraged the use of film to raise awareness on mountain issues. In 2002, the Centre sponsored four films by independent producers on natural resources issues, including one on 'Timber to Tibet' about the cross-border trade in timber in northern Nepal. A number of films have been made to disseminate information on thematic issues, for example on bee pollination. ICIMOD supports the Kathmandu International Mountain Film Festival (KIMFF) organized by the Himal Association to help strengthen awareness of Himalayan issues and cultures, and co-sponsored the event in December 2004. The film festival provides a forum for screening both documentary and feature films from various parts of the world covering a wide spectrum of sociocultural, and environmental issues. At a local level, ICIMOD supported the Dhading Film Festival in 2004 in Dhading Besi to help create awareness of issues that affect the lives of mountain people.

ICIMOD regularly uses social and multimedia to convey information in a more visual or extensive way, as well as to provide databases and interactive tools for exploring information in depth and creating individual outputs, such as for the Nepal 2001 Census data. Interactive interfaces are also provided to facilitate interpretation of data.

Training and Education

ICIMOD organizes training on specialized topics ranging from beekeeping and compost making to GIS applications and glacial mass balancing for a range of participants. The majority of training courses are held at ICIMOD's headquarters in Khumaltar or at the close by Knowledge Park at Godavari; on average around half of the participants at courses in Kathmandu are from Nepal. Training may take the form of seminars or workshops, as well as formal courses, and often involves fieldtrips to sites in Nepal. In general, courses are arranged by thematic programmes, but remain an integral part of ICIMOD's communication approach.

'Seeing is believing' – sharing practical knowledge at Godavari

The ICIMOD Knowledge Park at Godavari (formerly the Godavari Demonstration and Training Centre) was set up for testing and demonstration of various methodologies related to integrated mountain development, land rehabilitation, and sustainable farming practices on the sloping land of the mid-hills of the Hindu Kush Himalayan region. The site provides a practical pendant to the often more theoretical activities of the Centre – a place where technologies and farming practices can be tested, selected, and demonstrated; where farmers and those who work with them can learn using a hands-on approach; and which can serve as a repository for plant germplasm resources and associated floral and faunal biodiversity. The most recent development has been a renewed focus on community

outreach, with off-site demonstration and training activities in the communities of the Phulchowki watershed in collaboration with a partner NGO.

Over the years, hands-on training has been provided at Godavari for lead farmers and others directly involved in development work. The majority of trainees are from Nepal, and staff from a range of government and non-governmental organizations, as well as farmers groups, have benefited; many of the good practices which were shared have now been replicated in farmers' fields in different parts of the country. A far greater number of people visit Godavari simply to view the demonstrated practices and take away ideas that they can test in their own villages and plots.

Raising Awareness

All communications activities contribute to raising awareness in some way. But since its inception, ICIMOD has also worked directly to raise awareness of key issues among a broader audience using different approaches depending on the topic and intended audience. Some examples of awareness raising events in Nepal are given below.

Within thematic areas, dissemination of brochures, press releases, newspaper and journal articles, contributions on radio and television, e-discussions, and participation in discussion events, have been used together with training, demonstration and other approaches to raise awareness on key issues like tourism for local community

development, the importance of indigenous honeybees, the implications of climate change, and the role of women in mountain farming and need to mainstream gender. As a result, in Nepal, many donor programmes arose to support eco- and pro-poor tourism, farmers have become aware of the potential of high-value bee products and services, discussion of gender approaches has increased, and awareness of issues related to mountains and the concern with mountain issues can be seen reflected in the statements and actions of policy makers.

ICIMOD has also supported information dissemination in Nepal through public exhibitions, most notably Himalaya – Changing Landscapes, first held in customized format at Everest Base camp in 2008, and then at full size in Kathmandu Durbar Square, after which it was installed permanently in the International Mountain Museum in Pokhara. This exhibition used repeat photography to introduce a broad public to glacier recession and other environmental changes in Nepal. Most recently, in December 2013, the Climate+Change exhibition was opened at the Nepal Art Council building in collaboration with GlacierWorks and several partners. Smaller exhibitions have been held in Nepal in parallel with other events.

ICIMOD uses annual Environment Day celebrations to raise awareness on environmental issues. Usually school groups from Nepal and government officials from relevant ministries are invited to a talk programme; and ICIMOD staff participate in programmes organized by the government in Kathmandu. Similarly, celebrations of ICIMOD Day and International Mountain Day, and other 'International Days' like World Water Day, International



Biological Diversity Day, National Conservation Day, and the like are used to raise public awareness through such activities as a statement from the Director General and publication of appropriate articles in local newspapers.

ICIMOD regularly holds open days where knowledge is shared with the general public through a wide range of events from street plays and films to posters, interactive displays, and quiz sessions. These days attract large numbers of visitors and help inspire students to learn more about environmental topics.

Youth initiatives

Youth can play an important role in bringing about change. To help youth develop their capacity in this regard and their understanding of the environment, ICIMOD has recently started to intensify outreach activities aimed at youth. Youth from Nepal have successfully taken up the challenge; in many cases, local ICIMOD Youth Ambassadors have driven events with minimal guidance and financial support from ICIMOD.

In 2010, ICIMOD arranged for young people from Nepal and other countries in the region to participate in a youth forum on Empowering Youth with Earth Observation Information for Climate Actions, where the participants learned how remote sensing and geographic information systems resources could be used for climate change initiatives. In collaboration with the National Trust for Nature Conservation and the Private and Boarding Schools Organisation of Nepal, school children learned about herbal gardens to mark the 2010 Year of Biodiversity; and a Café Climate was organized in conjunction with the British Council to bring science to young people from Nepal by getting them to participate in a debate and a capacity-building workshop.

ICIMOD's Asia Pacific Mountain Network (APMN) has also organized workshops to engage youth and media representatives in discussions on climate change, green economy, and sustainable development. Youth from Nepal and 17 other Asian countries participate in activities that help build the next generation of leadership in sustainable mountain development and climate action. As a part of the NASA DEVELOP programme, three Nepalese interns from Kathmandu University created a climate change vulnerability index for Nepal. With some assistance, this team developed a technical report, presentation, poster, and video on their project, which won the grand prize in the NASA Develop Virtual Poster Session. Most recently, ICIMOD, the Asian Institute of Technology and Management (AITM), and the Nepal GIS Society invited participants to discuss emerging issues and learn about remote sensing and geographic information systems under the framework of the SERVIR-Himalaya Youth Initiative, supported by USAID and NASA.





Annexes

Annex 1 Meetings of the ICIMOD Board of Governors (1983–2013)

In general, a regular annual meeting is held towards the end of the year, with additional special meetings held in the summer when required.

Meetings of the ICIMOD Board of Governors (1983–2013)

Venue	Date	Regional Board Members from Nepal
Kathmandu, Nepal	30 Aug–1 Sept 1983	Dr Ratna SJB Rana
Kathmandu, Nepal	7–9 Dec 1983	Dr Ratna SJB Rana and Dr Narsingh Narayan Singh
Kathmandu, Nepal	4–8 May 1984	Dr Ratna SJB Rana, Dr Dor Bahadur Bista, and Dr I P Upadhyay
Kathmandu, Nepal	7–8 May 1985	Dr Ratna SJB Rana, Dr Dor Bahadur Bista, and Dr. Narsingh Narayan Singh
Kathmandu, Nepal	16–17 Nov 1986	Dr Ratna SJB Rana and Dr Dor Bahadur Bista
Kathmandu, Nepal	14 May 1987	Dr Ratna SJB Rana, Dr Narsingh Narayan Singh and Mr Madhukar SJB Rana
Kathmandu, Nepal	11–13 Dec 1987	Dr Narsingh Narayan Singh, Mr Madhukar SJB Rana and Dr P Pradhan (member elect)
Kathmandu, Nepal	27–29 May 1988	Dr Prachanda Pradhan, Mr Madhukar SJB Rana, and Dr Narsingh Narayan Singh
Kathmandu, Nepal	2–4 Dec 1988	Dr Prachanda Pradhan, Mr Madhukar SJB Rana and Dr Narsingh Narayan Singh
Thimphu, Bhutan	4–7 June 1989	Dr Prachanda Pradhan, Mr Madhukar SJB Rana, and Dr I P Upadhyay,
Kathmandu, Nepal	2–4 Dec 1989	Dr Prachanda Pradhan, Mr Madhukar SJB Rana, and Dr Narsingh Narayan Singh
Kathmandu, Nepal	28–30 June 1990	Dr Prachanda Pradhan and Dr Narsingh Narayan Singh
Kunming, China	12–18 Nov	Dr Prachanda Pradhan, Mr Madhukar SJB Rana and Dr Narsingh Narayan Singh
Berne, Switzerland	24–5, 28 June 1991	Dr Prachanda Pradhan, Mr Madhukar SJB Rana, and Dr Narsingh Narayan Singh
Kathmandu, Nepal	11–15 April 1992	Dr Harka Gurung
Kathmandu, Nepal	2–3 July 1993	Dr I.P. Upadhyaya
Kathmandu, Nepal	4–5 Dec 1993	Dr I.P. Upadhyaya
Kathmandu, Nepal	27–29 June 1995	Mr Lokendra Man Pradhan,
Pokhara, Nepal	27–28 Nov 1996	Mr Rabindra Kumar Shakya
Bhurban, Pakistan	4–5 Nov 1997	Mr Varun P Shrestha
Kathmandu, Nepal	9–13 Nov 1998	Mr Varun P Shrestha
Kathmandu, Nepal	9–11 July 1999	Mr Varun P Shrestha
Chengdu, China	10 Nov 1999	Dr Govind Raj Bhatta
Kathmandu, Nepal	3 Nov 2000	Dr Govind Raj Bhatta
Thimphu, Bhutan	8 Dec 2001	Dr Mukti Narayan Shrestha
Berchtesgaden, FRG	1–3 July 2002	Dr Mukti Narayan Shrestha
Kathmandu, Nepal	12 Dec 2002	Mr Chandi Prasad Shrestha
Pokhara, Nepal	4 Dec 2003	Mr. Lokhendra Man Pradhan
Kathmandu, Nepal	9 Dec 2004	Mr Dev Raj Regmi
Shillong, India	25 Nov 2005	Mr Ram Prasad Chaudhary
Swat, Pakistan	5 Nov 2006	Dr Jagadish C Pokharel
Dhulikhel, Nepal	28 Nov 2007	Dr Jagadish C Pokharel
Kathmandu, Nepal	4 Dec 2008	Dr Pitamber Sharma
Chengdu, China	20 Nov 2009	Dr Yubaraj Khatriwada
Mussoorie, India	24 Nov 2010	Mr Kishor Thapa
Thimphu, Bhutan	21–25 Nov 2011	Mr Deependra Bahadur Kshetry
Yangon, Myanmar	28–30 Nov 2012	Mr Deependra Bahadur Kshetry
Kathmandu, Nepal	3–4 June 2013	Dr Rabindra Kumar Shakya
Kathmandu, Nepal	29–30 Nov 2013	Dr Rabindra Kumar Shakya



Annex 2 Nepal's Financial Commitment to ICIMOD

Nepal doubled its financial commitment to ICIMOD between 2001 and 2011, and further quadrupled the amount in the past year. This is in line with commitments made by the other regional member countries, which have also increased their contributions over the past few years. Furthermore, Nepal has already approved its core contribution commitment until 2020 in accordance with the new Funding Strategy of ICIMOD.

Year	USD	Year	USD	Year	USD
1991	11,737	1999	7,396	2006	13,784
1992	11,737	2000	13,568	2007	21,246
1993	10,204	2001	13,369	2008	23,566
1994	20,408	2002	6,553	2009	19,231
1995	8,993	2003	12,903	2010	20,175
1996	9,023	2004	13,523	2011	20,819
1997	8,811	2005	14,154	2012	80,000
1998	7,601				

Annex 3 Nepali Nationals among ICIMOD Alumni (1983–2012)

Over the course of the past 30 years many Nepalese nationals have served as ICIMOD staff, and many more have worked as consultants or had short-term employment with ICIMOD, and ICIMOD also has a formal internship programme for young professionals. All Nepali staff who have had contact with partners in the field have shared their expertise and generally contributed to capacity building in Nepal. Many of those who have moved on now hold important positions in governments, universities, and international agencies concerned with mountain development both regionally and globally, and are able to bring Nepal's voice to these forums. As leaders in their fields they have been entrusted with important responsibilities as vice-ministers, heads of research and development institutions, vice-chancellors of universities, and employees of other international agencies. Those who have had short contracts or who have been interns have continued on to graduate school or have founded their own NGOs, and many have been recognized with awards in their fields. The list given below is necessarily incomplete; many more Nepalese nationals have worked at ICIMOD in various capacities over the years, for example on contracts of less than a year, as consultants, and as part-time staff.



Meeting of the ICIMOD Board of Governors held 29–30 November 2013 at ICIMOD Head quarters in Kathmandu, Nepal

Acharya, Saroj	Dhital, Megh Raj	Khadka, (Late) Sambhu	Pandey, Anita
Adhikari, Birendra Raj	Dixit , AM	Khanal, Bishnu Prasad	Pandey, Bikash
Aksha, Sanam Kumar	Dongol, Bhawani Shankar	Khanal, Narendra Raj	Pandey, Madhav
Amatya, Krishna Ram	Gauchan, Anita	Khanal, Niranjana	Pandey, Sangeeta
Bagale, Bijay Raj	Gautam, Ambika	Khatrri, (Late) Krishna B	Pandey, Saroj
Baidya, Amit	GC, Ezee	Kiran, Namita	Pandeya, Mukunda
Bajagain, Tulsi Ram	Ghale (Upreti), Yamuna	Koirala, Achyuta	Pandit, Bishnu Hari
Bajracharya, Deepak	Ghimire, Padam	Kuenkel, Bishnu	Pant, Alok
Bajracharya, Leena	Ghimire, Shobhana	Lacoul, Mona	Parajuli, Kedar Nath
Bajracharya, Shanti Prabha	Gurung, Binod Das	Lama, Sonam	Paudel, Deewakar
Bajracharya, Subarna	Gurung, Gumdu	Lama, Dawaman	Poday, Shyam
Banskota, Kamal	Gurung, Prabin	Lamichhane, Anupa	Pradhan, Bishwombher Man
Banskota, Mahesh	Gurung, Samar B.	Lamsal, Basanta	Pradhan, Jit "Bhuktan"
Baral, Nabin	Gurung, Sher Bahadur	Limbu, Srijana	Pradhan, Kishor
Basnyet Saroj	Gurung, Tika Laxmi	Lohani, Pradeep Prasad	Pradhan, Paribesh
Belbase, Laxman	Hamal, Nagma	Lohani, Sunil Nath	Pradhan, Pramod
Bhadra, Binayak	Joshi, Anuja	Maharjan P. L.	Pradhan, Sabina
Bhandari, Binod	Joshi, Anusha	Maharjan, Pancha Narayan	Pradhan, Sushil Man
Bhandari, Bishnu B	Joshi, Laxman	Maharjan, Ram Lal	Pradhan, Umesh Lal
Bhatta, Balram	Joshi, Surendra Raj	Mahat, T. B. S.	Prajapati-Merz, Bandana
Bhatta, Mandakini	Joshi, Sushil Man	Mahat, Tek Jung	Rai, (Late) Jeet Bahadur
Bhattarai, Basundhara	Josse, Ojaswi	Malla, Prem Dhoj	Rai, Megh Ranjani
Bhattarai, Nirmal	K.C., Ram Bahadur	Malla, Sadhana	Rai, Numa
Bhuju, Mohan	Kakati, Niraj	Manandhar, Anita	Rai, Saran Dhoj
Bista, Hikmat	Karki Singh, Tika	Manandhar, Reena	Rai, Suman
Bohara, Babita	Karki, Archana	Maskey, Byanju Rejina	Rajbhandari, Beryl
Budhathoki, Chakra	Karki, Krishna Bahadur	Maskey, Pravin Raj	Rajbhandari, Lokap
Chalise, Suresh Raj	Karki, Kumar	Maskey, Vishakha	Rajbhandari, Nanu
Chaudhary, Sunita	Karki, Madhav Bahadur	Moktan, Dasarath	Rajbhandari, Shreeza
Chhetri, Parveen Kumar	Karki, Prem Bahadur	Moktan, Esther	Rana Magar, Eak Bahadur
Chhetri, Prativa	Karki, Sameer	Moktan, (Late) Monica	Rana, Pavitra
Dahal, Prabina	Karma, Phuntsho	Nakarmi, Gopal	Rana, Reeta
Dangol, Manju	Karmacharya, Ashish	Nepal, Akil	Rasaily, Rabina
Dangol, Bhawani Shankar	Karmacharya, Ramesh	Nepal, Sugam	Rasaily, Rekha
Deoja, Birendra B	Kayastha Pradhan, Bandana	Neupane, Ram Lal	Raut, Yogendra
Devkota, S.	KC, Madhab	Neupane, Arun	Regmi, Prajna
Dhakal, Ashish	KC, Ram Bahadur	Neupane, Prem Raj	Rijal, Kamal
Dhakal, Susmita	Khadka, (Late) Chitra Bahadur	Osti, Krishna Prasad	Sah, Ram Pratap
Dhakal, Tara	Khadka, Raju	Panday, KK	Shah Khadka, Binita

Shah, Narayan Deep
 Shah, Pravakar Bickram
 Shah, Rajendra
 Shahi, Sally
 Shakya, Lalit R
 Shakya, Samma
 Shakya, Surya
 Sharma, Aseem Raj
 Sharma, Kedar Prasad
 Sharma, Manisha
 Sharma, Pitamber
 Sharma, Sandhya
 Sharma, Suresh
 Sherpa, Dechenla
 Shipakar, Rajendra Lal
 Shrestha, Anil
 Shrestha, Anirudra Man
 Shrestha, Anju
 Shrestha, Arati
 Shrestha, Deepak M
 Shrestha, Erina
 Shrestha, Ganesh Ram
 Shrestha, Gyan K. Chippi
 Shrestha, Junu
 Shrestha, Krishna Kumar
 Shrestha, Madan Lal
 Shrestha, Pravin Lal
 Shrestha, Rachana
 Shrestha, (Late) Raj Bahadur
 Shrestha, Ram
 Shrestha, (Late) Ram Krishna
 Shrestha, (Late) Reeta
 Shrestha, Renuka
 Shrestha, Sandhya
 Shrestha, Sudarshan
 Shrestha, Sugandha
 Shrestha, Surendra
 Shrestha, Tirtha Bahadur
 Shukla, Anirudha Nath

Singh, Madhusudan Man
 Singha, Veneeta
 Sthapit, Keshar Man
 Subba, Minerva
 Subba, Ruben
 Subba, Sadhana
 Subedi, Bhakta Bahadur
 Subedi, Mahendra Nath
 Sunar, Karna Bir
 Tachamo, Ram Devi
 Tamang, (Late) Krishna Bahadur
 Tamang, Mohan
 Tamang, Nar Bahadur
 Tamang, Usha
 Tegi, Uday
 Thacker, (Late) Prabha
 Thapa, (Late) Babu Kaji
 Thapa, (Late) Bhaskar
 Thapa, Dipti
 Thapa, Khadga Bahadur
 Thapa, Mona
 Thapa, Rabindra
 Thapa, Rajesh
 Tiwari, Binod
 Tiwari, Sagendra
 Tshering, Doma
 Tuladhar, Anjesh
 Tuladhar, Milan Raj
 Upadhaya, Satananda
 Upadhayay, Lokendra
 Upadhyay, Basudev
 Vaidya, Ramesh Anand
 Wagley, Sunil Kumar
 Yadav, Ram P

Some awards and advanced degrees conferred on Nepali staff



Mandira Shrestha: Awarded the level 'A' Nepal Vidhya Bhusan Award in 2012 – completed her PhD in Engineering from Kyoto University in Japan in 2011 with a dissertation entitled 'Bias adjustment of satellite-based rainfall estimates over the central Himalayas of Nepal for flood prediction.'



Bhaskar Karky: Conducted research on the economics of climate change policy at a number of ICIMOD case study sites throughout Nepal, and was awarded a PhD for this work in by the University of Twente in the Netherlands in September 2008. He was awarded the prestigious Nuffic Scholarship.



Manohara Khadka: Awarded a PhD in 2009 from the International Institute of Social Studies of Erasmus University in the Netherlands with a dissertation entitled 'Why does exclusion continue? Aid, knowledge, and power in Nepal's community forestry policy process'; awarded level 'A' Nepal Vidhya Bhusan Award in 2012



Santosh Nepal: Returned to ICIMOD after earning a PhD in Hydrology and Modelling from Friedrich Schiller University of Jena, Germany, for his thesis 'Evaluating Upstream Downstream Linkages of Hydrological Dynamics in the Himalayan Region'; Dr Nepal, has Masters Degrees in Environmental Management and Anthropology, he worked at ICIMOD for nearly three years before entering the PhD programme. He was awarded the 'Nepal Bidhya Bhusan Medal Ka.'

About ICIMOD

The International Centre for Integrated Mountain Development, ICIMOD, is a regional knowledge development and learning centre serving the eight regional member countries of the Hindu Kush Himalayas – Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal, and Pakistan – and based in Kathmandu, Nepal. Globalization and climate change have an increasing influence on the stability of fragile mountain ecosystems and the livelihoods of mountain people. ICIMOD aims to assist mountain people to understand these changes, adapt to them, and make the most of new opportunities, while addressing upstream-downstream issues. We support regional transboundary programmes through partnership with regional partner institutions, facilitate the exchange of experience, and serve as a regional knowledge hub. We strengthen networking among regional and global centres of excellence. Overall, we are working to develop an economically and environmentally sound mountain ecosystem to improve the living standards of mountain populations and to sustain vital ecosystem services for the billions of people living downstream – now, and for the future.



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