



IWMI Research in Southeast Asia

- Growing food sustainably in the face of rapid change
- Vietnam: Balancing economic growth and environmental degradation
- Lao PDR: Assessing impacts of new infrastructure and climate change
- Cambodia: Rehabilitating surface irrigation schemes to benefit all
- Thailand: Sharing knowledge on aquifer recharge initiatives
- Selected current research initiatives in the region



Our vision

Water for a food-secure world

Our mission

To improve the management of land and water resources for food, livelihoods and the environment

About IWMI

IWMI is an international non-profit organization that is one of the 15 research centers supported by the Consultative Group on International Agricultural Research (CGIAR).

Water and food challenges for Southeast Asia

- Southeast Asia's water resources are abundant but unequally distributed geographically and seasonally. This affects food security for farmers, as well as supply to non-agricultural sectors.
- Achieving the Millennium Development Goals (MDGs) while continuing to sustain the population and deliver economic growth, presents water managers with a considerable challenge. Decision-makers and communities need to find ways to manage change in light of the climatic shifts forecast for the region.
- The mega-deltas of the Chao Phraya, Red, Mekong and Irrawaddy rivers, along with the Tonle Sap Floodplain, are the rice bowls of Southeast Asia and are crucial to meeting global grain demand. Current agricultural practices contribute to high rates of deforestation and soil erosion, declining soil fertility, and changes in water volumes and quality. Addressing this degradation, while maintaining effective ecosystem services, will be vital for enhancing the future agricultural performance of the region.
- Southeast Asian nations need to transform underperforming medium- and large-scale surface-based rice irrigation systems to secure future regional and global food supplies. There is a need to rethink irrigation in the region so that a combination of surface water and groundwater resources are used efficiently.
- Rising populations and the industrialization of the region is rapidly increasing the demand for electricity. Dams, which would produce substantial power, are planned for all the major rivers. However, the likely trade-offs between the economic benefits of hydropower generation and impacts on ecosystem services and the livelihoods and food security of millions of people need to be carefully assessed.
- During the next 20 to 30 years, the management of land and water resources in Southeast Asia will be shaped by a complex mixture of social, economic and environmental factors. Together these will have impacts which will be comparable to, or greater than, the direct effects of climate change.



Southeast Asia is undergoing rapid population growth accompanied by social, economic and environmental change.

Photo credit: Andrew Noble, IWMI

Introduction

The countries of Southeast Asia exhibit vastly different hydrological, land and socioeconomic characteristics reflecting their varying degrees of economic development and contrasting political backdrops. Although individual nations and regions are progressing at different speeds, agricultural trends are generally following the same pattern: intensification, specialization, increased agrochemical use and mechanization. All the governments in the region recognize the critical role that land and water resources management will play as the area develops further.

Growing food sustainably in the face of rapid change

Southeast Asia is undergoing rapid change. The population has doubled in the last 40 years to an estimated 260 million. This is expected to rise to 320 million by 2050. The economies of the region are growing rapidly due to increasing investment in the industrial sector and infrastructure. The gross domestic product (GDP) per capita for the region grew between 5% and 10% per annum over the past decade. However, many people still live below national poverty lines. The 2010 Global Hunger Index indicated 'serious to alarming' levels of hunger in all countries except Thailand, Malaysia, Singapore and Brunei.

Agricultural production has increased across Southeast Asia in the past 20 years. This is due to land expansion, increased use of effective irrigation and fertilizer, and improved plant varieties. Production of commodities such as rice, oil crops and coarse grains has more than doubled since 1990, outpacing the region's rapid population growth. Meanwhile, in the more developed nations such as Thailand, other industries have outgrown agriculture's contribution to GDP. Thai farmers now only contribute around 10% of GDP.

This increased agricultural production has not come without environmental cost. Land degradation now affects between 10% and 40% of the region. High rates of deforestation, soil erosion, declining soil quality, and changes in water volumes and quality are directly linked with agricultural practices and other human activities. Changes in landscapes associated with agriculture have weakened or eradicated essential regulating ecosystem services such as flood-retention capacity, erosion control and biological pest control.

Proposed water resources infrastructure development in the major river basins of Southeast Asia will result in changes to river flows at an unprecedented scale and rate. The projected water irrigation demand of the combined Lower Mekong countries is estimated to be less than the low-flow season discharge of the river system, and presents significant opportunities to develop irrigated agriculture. However, with freshwater fisheries vital to food security in the region, the productive capacity of freshwater ecosystems should be protected from the impacts of such developments.

Over the next 20 to 30 years, agriculture and water resources will be shaped by a complex mix of social, economic and environmental factors with impacts of at least the same order of magnitude as the forecast impacts of climate change. The challenge facing agricultural and water resource developers in the region is how to sustainably produce more food in this period of rapid change. Agriculture must be transformed to deliver food security, reinvigorate environmental services (including carbon sequestration) and underpin economic security in rural areas. Global awareness of climate change has brought an enhanced understanding of the vulnerability of natural systems and a new, longer-term perspective to national and regional planning. This new perspective presents an opportunity to radically rethink approaches to natural resource management.

International donors

Agence Française de Développement (AFD)
Asian Development Bank (ADB)
Australian Agency for International Development (AusAID)
Australian Centre for International Agricultural Research (ACIAR)
Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung (Federal Ministry for Economic Cooperation and Development) (BMZ), Germany
Danish International Development Agency (DANIDA)
Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Germany
European Commission (EC)
French Ministry of Foreign Affairs
International Fund for Agricultural Development (IFAD)
Japan International Cooperation Agency (JICA)
Ministry of Foreign Affairs, the Netherlands
Swedish International Development Cooperation Agency (SIDA)
Swiss Agency for Development and Cooperation (SDC)
UK Department for International Development (DFID)
United States Agency for International Development (USAID)
World Bank

International partners

Centre de coopération internationale en recherche agronomique pour le développement (CIRAD)

CGIAR Challenge Program on Water and Food (CPWF)

Commonwealth Scientific and Industrial Research Organisation (CSIRO)

Danish Hydraulic Institute (DHI)

Food and Agriculture Organization of the United Nations (FAO)

Helsinki University of Technology (TKK)

Institut de recherche pour le développement (IRD)

International Centre for Environmental Management (ICEM)

International Center for Tropical Agriculture (CIAT)

International Rice Research Institute (IRRI)

International Union for Conservation of Nature (IUCN)

Japan International Research Center for Agricultural Sciences (JIRCAS)

National Institute for Rural Engineering (NIRE), Japan

Nicholas Institute for Environmental Policy Solutions

Stockholm Environment Institute (SEI)

United Nations Environment Programme (UNEP)

Wageningen University and Research Centre (WUR)

World Vegetable Center

WorldFish Center

Summary of IWMI's research in Southeast Asia

IWMI's work focuses on the Greater Mekong Subregion (GMS), which encompasses Vietnam, Lao PDR, Cambodia and Thailand, while new research has expanded into other Southeast Asian countries. IWMI focuses on land and water management research tailored to the needs and priorities of individual countries.

Vietnam: Balancing economic growth and environmental protection

As Vietnam evolves to become a middle income country, it faces significant challenges in balancing rapid economic growth with environmental protection. IWMI's research has focused on three geographic regions where poverty is endemic and persistent and where the development of water resources infrastructure could have potentially negative impacts on livelihoods: the Mekong Delta, Central Highlands and Northern Uplands.



Photo credit: Andrew Noble, IWMI

Soil erosion causes problems in Vietnam, as sediments washed into rivers cause dams to silt up.

- Over the past ten years, IWMI in partnership with the Institut de Recherche pour le Développement (IRD) and the Soils and Fertilizers Research Institute (SFRI), have conducted research to better understand and manage soil erosion. For instance, in the Northern Uplands, the partners have investigated how hydrology within small catchments responds to land-use changes. Human activities within these highly incised catchments have increased the quantity of sediment arriving in rivers and lakes. This in turn has had negative impacts on water storage structures such as reservoirs.
- An ongoing research program is studying ways to negotiate benefit-sharing deals between hydropower companies and communities located within the impact zones of selected dams. The hope is to provide incentives so communities adopt appropriate land-stewardship practices and alternative livelihoods that prevent soil erosion and generate smaller volumes of sediment.
- IWMI and partners have also worked on the use of wastewater for irrigation. In Hanoi, wastewater is used extensively in peri-urban areas to grow rice and vegetables, as well as for rearing fish. Researchers quantified the degree of contamination in several food crops and established interventions to limit the potential health risks of wastewater use.

- In 2010, research aimed at optimizing reservoir management for enhancing livelihoods began in the Central Highlands of Vietnam. Part of a regional initiative with complementary activities in Lao PDR and Cambodia, the research is expected to improve the productivity and increase the equitable use of water stored in reservoirs. Project researchers will compare various possible uses, such as irrigating crops and rearing fish, in conjunction with hydropower production and seek to optimize income, food security, water productivity and environmental sustainability.
- Dramatic developments in rice productivity have helped the Mekong Delta become an important supplier to global markets. However, competition between rice farmers (needing freshwater) and shrimp growers (requiring brackish conditions) has resulted in conflict. IWMI and partners helped develop a land use map and sluice gate protocol to regulate salinity levels in river and canal systems that met the needs of both users.
- An initiative, instigated in 2011 by the International Rice Research Institute (IRRI) and partners (including IWMI), is addressing adaptation to climate change at the farm level in the delta, focusing on more efficient use of soil and water resources.

Lao PDR: Assessing impacts of new infrastructure and climate change

Lao PDR differs from other countries in the GMS in that it has low population density, underdeveloped infrastructure and a widely dispersed population. Agriculture employs over 80% of the population, and at least a third of people remain below the poverty line. However, Lao PDR is the largest contributor of water to the Mekong and over the coming decade it will develop this resource. Research carried out by IWMI's office in Vientiane has focused on the impacts that new water resources infrastructure will have on the basin and livelihoods and on how climate change will influence future flow regimes of the river.

- A regional initiative on Mekong Water Futures is being implemented by the Australian Commonwealth Scientific and Industrial Research Organisation (CSIRO), supported by IWMI. To address household food security there is a need to diversify and intensify agricultural production systems. This requires improved access to water resources in the dry season. At a pilot village in Savannakhet Province in southern Lao PDR, researchers are exploring the potential for community-based groundwater irrigation and management to provide farmers with water during the dry season.

Regional partners

Asian Institute of Technology (AIT)
 Mekong Program on Water, Environment and Resilience (M-Power)
 Mekong River Commission (MRC)
 Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA)
 Southeast Asia START Regional Center, Global Change System for Analysis, Research and Training (START)
 Sustainable Mekong Research Network (Sumernet)
 The Wetlands Alliance
 World Wildlife Fund (WWF)
 Greater Mekong Programme



Photo credit: Chu Thai Hoanh, IWMI

Water sampling for studying soil erosion in the Houay Pano watershed, Luang Prabang, Laos.

National partners

Cambodian Agricultural Research and Development Institute (CARDI)

Can Tho University, Vietnam
Chulalongkorn University, Thailand

Department of Agriculture (DoA), Ministry of Agriculture and Cooperatives, Thailand

Department of Agricultural Extension (DAE), Ministry of Agriculture, Forestry and Fisheries (MAFF), Cambodia

Department of Irrigated Agriculture (DIA), Ministry of Water Resources and Meteorology (MOWRAM), Cambodia

Department of Energy Promotion and Development (EPD), Ministry of Energy and Mines (MEM), Lao PDR

Department of Irrigation (DoI), Ministry of Natural Resources and Environment (MoNRE), Lao PDR

Hanoi University of Agriculture, Vietnam

Inland Fisheries Research and Development Institute (IFReDI), Cambodian Fisheries Administration, Cambodia

Institute of Meteorology, Hydrology and Environment (IMHEN), Ministry of Natural Resources and Environment (MoNRE), Vietnam

Kasetsart University, Thailand

Khon Kaen University, Thailand

Land Development Department (LDD), Ministry of Agriculture and Cooperatives, Thailand

Nam Ngum River Basin Committee (NNRBC), Lao PDR

National Agriculture and Forestry Research Institute (NAFRI), Ministry of Agriculture and Forestry (MAF), Lao PDR

Cambodia: Rehabilitating surface irrigation schemes to benefit all

Although garment manufacturing, tourism and construction all contribute to the Cambodian economy, agriculture still plays a significant role. Two-thirds of the population is employed in the agriculture sector. Many Cambodian farmers still struggle to secure household food security. Achieving the intensification of farming systems required to guarantee sufficient crops is contingent on there being adequate water supplies for irrigation during the dry season.

IWMI has helped the Cambodian Government implement Participatory Irrigation Management (PIM) in rehabilitated surface-based irrigation schemes. Commune Agroecosystem Analysis (CAEA) enables communities to improve resource management decision-making and take into account non-agricultural uses such as fishing. The CAEA process is continually under review and improvements, suggested by IWMI, were pilot-tested in four communes in the Tonle Sap Basin, and will be applied nationwide.



Photo credit: Vladimir Smakhtin, IWMI

Cambodia's waterways provide water for irrigation and fish for protein, as well as supporting floating communities.

Thailand: Sharing knowledge on aquifer recharge initiatives

IWMI's work in Thailand originally focused on:

- mapping cadmium contamination of rice crops;
- rehabilitating degraded soils by applying clay-based materials; and
- nurturing river basin organizations.

As the country has developed, IWMI has concentrated more on marginalized regions. In the northeast of the country, for instance, IWMI's researchers are investigating community-level Participatory Irrigation Management (PIM) and developing key indicators for agricultural sustainability.

Selected current research initiatives in the region

Maximizing water productivity in Laos

Lao PDR produces more than one-third of the Mekong River flows and has a wealth of water resources that are yet to be harnessed. The Nam Ngum River Basin is one of the most important in terms of annual flows, population and food production. With water availability far greater than water needs in the Nam Ngum catchment, IWMI and partners are exploring ways to develop this untapped resource for the benefit of the nation. They are assessing likely impacts on livelihoods and analyzing trade-offs under different development scenarios.

Managed groundwater recharge in Thailand

Researchers are examining the feasibility of Managed Aquifer Recharge (MAR) as a technique for halting the decline of groundwater levels in the lower north region of Thailand. This is when excess summer flows are stored underground and used during the dry season for irrigation. IWMI is providing expert guidance and helping local Thai hydrogeologists and engineers to develop their MAR skills. IWMI will contribute to the design of extension materials, develop operating plans, advise postgraduate students and produce joint publications on the project findings.

Regional initiative on water storage infrastructure

Researchers are exploring ways in which riparian communities can improve their livelihoods by developing water storage infrastructure. Suitable strategies will broaden the uses of reservoir water to support livelihoods, benefit riparian and downstream communities, increase the life span of reservoirs and maintain hydropower-generating capacity. The research will take into account the various needs of different user groups with a focus on the importance of gender.

Transboundary water governance and the logic of hydropower development

Water governance in the GMS almost always means transboundary water management. Researchers are working to provide information and advice to improve the way internationally shared waters are cooperatively managed. Current studies aim to improve the links between transboundary decision-making bodies and national bureaucracies, and ensure that policy measures in hydropower planning are in line with the governments' aspirations to generate revenue and improve well-being.

Regional initiative on agriculture

Agriculture in the GMS is rapidly shifting from traditional subsistence farming to modern commercial farming. Population increase, economic growth, social change, global trade and climate change are among the main drivers of this change. IWMI researchers are exploring how climate change may affect food security and environmental degradation in the GMS. This involves mapping, assessing and analyzing information. This data can then contribute to the development of opportunities to use agriculture to mitigate climate change and environmental degradation.

National partners

National University of Laos (NOUL), Lao PDR

Nong Lam University, Ho Chi Minh City, Vietnam

Royal Irrigation Department (RID), Ministry of Agriculture and Cooperatives, Thailand

Soils and Fertilizers Research Institute (SFRI), Vietnamese Academy for Agricultural Science (VAAS), Vietnam

Southern Institute for Water Resources Planning (SIWRP), Ministry of Agriculture and Rural Development (MARD), Vietnam

Water and Environment Research Institute (WERI), Ministry of Natural Resources and Environment (MoNRE), Lao PDR



Photo credit: Kim Geheb, CPWF

The Mekong River where IWMI researchers are working to improve governance of transboundary cooperation.

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