

Aquatic agricultural systems in Cambodia: National situation analysis



AQUATIC AGRICULTURAL SYSTEMS IN CAMBODIA: NATIONAL SITUATION ANALYSIS

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LIST OF ACRONYMS

AAS	CGIAR Research Program on Aquatic Agricultural Systems
ACIAR	Agricultural Center for International Agricultural Research
ADB	Asian Development Bank
AFD	Agence Française de Développement (French development agency)
AusAID	Australian Agency for International Development
CARDI	Cambodian Agricultural Research and Development Institute
CAVAC	Cambodia Agricultural Value Chain Project
CDC	Council for the Development of Cambodia
CDRI	Cambodia Development Resource Institute
DANIDA	Danish International Development Agency
DFID	Department for International Development, United Kingdom
ECOSORN	Economic and Social Relaunch of Northern Provinces
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
GDP	gross domestic product
GIZ	Gesellschaft für Internationale Zusammenarbeit (German development cooperation agency)
HARVEST	Helping Address Rural Vulnerabilities and Ecosystem Stability
HDI	Human Development Index
IFAD	International Fund for Agricultural Development
IFReDI	Inland Fisheries Research and Development Institute
JICA	Japan International Cooperation Agency
KOICA	Korean International Cooperation Agency
MAFF	Ministry of Agriculture, Forestry and Fisheries
MoE	Ministry of Environment
MoP	Ministry of Planning
MoWA	Ministry of Women's Affairs
MoWRAM	Ministry of Water Resources and Meteorology
MPWT	Ministry of Public Works and Transportation
NACA	Network of Aquaculture Centres in Asia-Pacific
NGO	non governmental organization
RGC	Royal Government of Cambodia
SCW	Save Cambodia's Wildlife
SEAFDEC	Southeast Asian Fisheries Development Center
TSLRDP	Tonle Sap Lowlands Rural Development Project
UK	United Kingdom
UN	United Nations

UNDP	United Nations Development Programme
US	United States
UNEP	United Nations Environment Programme
UNIFEM	United Nations Development Fund for Women
USAID	US Agency for International Development
WFP	World Food Program

Currency

AUD	Australian dollar(s)
EUR	Euro(s)
GBP	British pound(s) sterling
JPY	Japanese yen
USD	US dollar(s)

Units

g	gram(s)
ha	hectare(s)
km	kilometer(s)
kg	kilogram(s)
km ²	square kilometer(s)
mm	millimeter(s)

EXECUTIVE SUMMARY

The objective of the current report produced for the CGIAR Research Program on Aquatic Agricultural Systems (AAS) is to provide basic information on key constraints driving poverty and vulnerability in aquatic agricultural systems, in order to identify solutions and propose effective development options.

Background

Cambodia is characterized by five major agro-ecological zones: the coast, the Tonle Sap Lake and its floodplains, the lowland plains, the Mekong River mainstream, and the northeast plateau and uplands. Population centers, roads and markets are concentrated around the Tonle Sap and in the lowlands. Land concessions are situated in low-density and high-poverty areas.

The Tonle Sap area is characterized by its high fishery and agricultural productivity. The lowlands are characterized by the highest population density and high rice production but relatively limited fisheries, while the Mekong mainstream ecozone is characterized by important fisheries but low rice production. In the three hubs, rural livelihood activities are very dependent on natural resources and are timed to coincide with the availability of water, fish, and other animals and plants.

Cambodia has enjoyed rapid economic growth during the last decade; its population is resource-poor, growing fast and—on average—moving out of poverty. However, increasing inequality is an issue, and the recent economic growth has not provided a solution to food insecurity and malnutrition.

Aquatic agricultural systems in Cambodia

Agriculture and fisheries are essential to the domestic economy of Cambodia, and most of the population relies on them for livelihoods and food security. Since 2000, rice production has increased significantly and has helped Cambodia achieve national rice self-sufficiency. Yet insufficient farmland is a major challenge in the agriculture sector, especially for resource-poor households. Fish production has increased significantly over time, coming mainly from capture fisheries. Women have played a major role in agriculture, and account for more than half of the primary workforce in subsistence and market-oriented fishing activities. However, they are more exposed to poverty than men, and agricultural extension does not respond well to specific challenges and constraints women face. There is great potential for research to improve gender-based approaches in fisheries and aquaculture.

Lack of irrigation infrastructure, low use of fertilizer and limited technical assistance to farmers still weaken agricultural production, and the national budget allocated to the agriculture sector suggests that agricultural development is not given the high priority stipulated in strategic policies. Landlessness, insecure land rights and land grabbing in rural areas continue to disharmonize Cambodia's agriculture. In fisheries, the cancellation of fishing lots has been socially welcome, but its overall outcome is still uncertain. More generally, Cambodian agriculture still relies heavily on rice production, while non-rice crops are limited. Wild fisheries are by far the major source of protein in Cambodia, and there are still limited alternatives to capture fish production.

External influences on aquatic agricultural systems

Population growth and the recent “baby boom” are major challenges to Cambodia. In this context, job creation is a clear requirement. The integration of economies, road networks and exchange policies at the regional level will also be a strong driver in the coming years, resulting in substantial migrations and changes among rural communities. Among the other drivers of change are large-scale logging and deforestation, large-scale foreign investment in land concessions granted by the government, the drive for irrigation in order to become a rice export country, and climate change. Lastly, hydropower development is clearly expected to result in heavy impacts on fish yields and food security.

The Royal Government of Cambodia has developed a vision for the long-term and sustainable development of the agriculture and fisheries sectors through various strategic plans. However, a number of inconsistencies and contradictions still plague the government’s sectoral plans. Land has been largely privatized, but mechanisms for ensuring farmers’ secure land ownership are not in place. Knowledge gathering and long-term planning regarding groundwater management have yet to be initiated. The shift from human labor to mechanization and the emergence of high levels of emigration in rural areas have not been integrated.

Although there are currently more than 20 organizations supporting projects in agriculture and rural development in Cambodia (including the Asian Development Bank [ADB], Australian Agency for International Development [AusAID], International Fund for Agricultural Development [IFAD], Japan International Cooperation Agency [JICA] and the European Union [EU]), most policy and donors’ interventions in Cambodian aquatic agricultural systems do not integrate farming with fishing. Cambodian agricultural products are also exposed to competition in open markets without being backed by national support. Lastly, the role of women in primary production has been recognized, but specific development strategies have not yet been articulated to assist women in the agriculture and fisheries sectors.

Conclusions and ways forward

Aquatic agricultural systems management is faced with a number of specific gaps and weaknesses. However, multiple opportunities can also be identified in terms of institutional approaches, technical interventions and social approaches.

Improving governance, decentralization and deconcentration reforms, and private-public partnerships is promising. At the technical level, decreasing the pressure on and dependence on fisheries is essential. Increased agricultural productivity and diversification can be achieved not only through irrigation and fertilization, but also through better farming practices resulting from improved extension. Significant potential lies in the diversification and improvement of value chains, and there is room for improvement in agricultural and irrigation planning.

On the social front, landlessness, land scarcity and land ownership rights are challenging issues among rural communities and require research on how risks and food insecurity among landless households can be reduced, and how social land concessions can be promoted. In terms of social networking, development and management opportunities exist outside formal groups, and there is clearly a need to engage women on their own terms and to create realistic options for their participation. Last but not least, capacity building and learning by doing remain central to development.

Background

The CGIAR Research Program on Aquatic Agricultural Systems (AAS) is focused on understanding how commodities and drivers of change interact, and on providing opportunities for the resource-poor.

Approximately 500 million people in Africa, Asia and the Pacific depend on aquatic agricultural systems for their livelihoods; 138 million of these people live in poverty. Occurring along the world's floodplains, deltas and coasts, these systems provide multiple opportunities for growing food and generating income.

However, factors like population growth, environmental degradation and climate change are affecting these systems, threatening the livelihoods and well-being of millions of people. Based on the belief that new approaches to agricultural research are needed if sustainable improvements in agricultural productivity, poverty reduction and food security are to be achieved, AAS embraces an approach that ensures science and innovation are specifically designed and implemented to address the needs of the resource-poor.

Cambodia is one of the priority countries of AAS; in Cambodia three main hubs (Tonle Sap, lowland plains and Mekong mainstream) have been identified. In each country, the program's engagement is focused through hubs, defined as "geographic locations providing a focus for innovation, learning, and impact through action research" (WorldFish 2011). Three hubs have been defined for Cambodia: the Tonle Sap Lake, the lowland floodplains and the Mekong mainstream (Figure 1). These hubs were selected on the basis of poverty and nutrition status, key development challenges, and opportunities based on aquatic agricultural systems. In accordance with the program rollout plan, in 2013 the focus of the program was on the Tonle Sap hub.

Purpose and content of the study

AAS researches key constraints driving poverty and vulnerability in aquatic agricultural systems, in order to identify solutions and to propose effective development options. Six objectives and corresponding research themes are included in the program: sustainable increases in productivity; equitable access to markets; resilience and adaptive capacity; empowering policies and institutions; reduced gender disparity; and expanded benefits for the resource-poor.

The objective of the current report is to provide basic information on the circumstances within which AAS operates.

The program's detailed rollout strategy integrates planning, scoping, diagnosis and design. A key conceptual consideration is the definition of the development challenges and opportunities that can be addressed within the context of the program. In this report, we characterize the three hubs in Cambodia, their population, and the overall governance, policies and institutions that drive them. We review the main aquatic agricultural systems (status, specific policies and strategies, interventions, challenges, and options), then review the main drivers of change. This leads to an identification of plans and strategies important to AAS, with a particular focus on perspectives, gaps and opportunities in national policies, community engagement, increased benefits, adaptive capacity, and gender. This review, of potential interest to decision makers and all development partners, leads to conclusions and recommendations aimed at policymakers and institutional as well as private investors in development.



Figure 1. Location map and the three AAS focal hubs.

Physical geography

Cambodia is characterized by three main altitudinal zones: highlands, central dry plains, and the Tonle Sap and southeastern floodplains. Cambodia, a country of more than 181,035 square kilometers (km²), is characterized by three main altitudinal zones: (i) hills in the northeast (Ratanakiri), in the east (Mondulkiri) and in the Cardamom Mountains; (ii) central dry plains along the Mekong River and north of the Tonle Sap Lake; and (iii) floodplains around the Tonle Sap Lake and in the southeastern part of the country (Figure 2). The country is also characterized by a tropical climate consisting of two main seasons: a wet season from May to November (5–21 rainy days per month), and a dry season from December to May (0–5 rainy days per month). Rainfall is more intensive in the southwest part of the country, which receives 2000 to 3700 millimeters (mm) per year; the northeast is drier, receiving 1800 mm/year. The country is overall very flat and subject to large-scale floods, so 30% of its surface area is either permanently or temporarily inundated. Thus, the extent of the Tonle Sap Lake varies four- to sixfold between seasons, forming vast floodplains whose maximal area is similar to that of Lake Ontario (Baran 2005). This seasonal inundation supports extensive wetlands and aquatic systems that in turn drive agricultural production and support a whole range of goods and services.

Soil fertility varies throughout the country. It is high around the Tonle Sap and moderate in the southeastern lowlands. It is also moderate along the Mekong mainstream and along major rivers.

Five major agro-ecological zones are found in Cambodia: the coastal zone, the Tonle Sap and its floodplains, the lowland plains, the Mekong River mainstream, and the northeast plateau and uplands. Seasonal hydrology is a key factor distinguishing these ecozones; each zone's specific conditions determine its agricultural practices and production systems. The AAS hubs focus on three of these five main ecozones: the Tonle Sap, the lowland floodplains and the Mekong mainstream, since these zones are priority areas for intervention given their poverty and nutrition status and the opportunities offered by their aquatic agricultural systems.

Human geography

Population, roads and markets are concentrated around the Tonle Sap and in the lowlands. A population density map (Figure 3) shows clearly that villages and cities are concentrated along rivers, around the Tonle Sap Lake and in the southeastern part of the country. This population distribution is closely correlated with the distribution of villages and road network density.

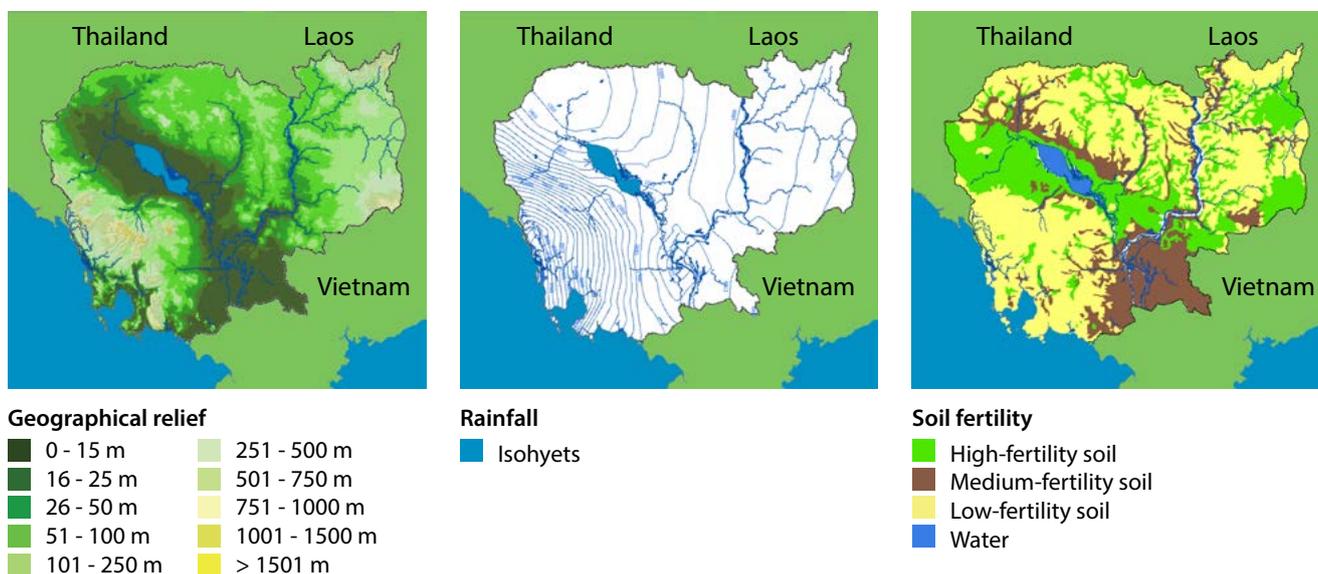


Figure 2. Cambodia's physical geography: relief (left), rainfall (middle) and soil fertility (right). Source: Save Cambodia's Wildlife (SCW) 2006.

Communes in the lowlands are more affluent than the average, while concessions are situated in low-density and high-poverty areas. An analysis of commune poverty scores produced by the Ministry of Planning in 2006 (Figure 5) shows that the most affluent communes in the country are located in Kandal, Takeo, Prey Veng and Svay Rieng provinces. The most resource-poor communes are located

in the hilly areas (Cardamom Mountains, Ratanakiri and Mondulakiri) and in dry plains (Preah Vihear, Kampong Thom, Kratie and Stung Treng). Conversely, the recent map of land concessions shows that economic, mining and forestry concessions are mainly located in more impoverished areas but also in protected areas (Figure 4).

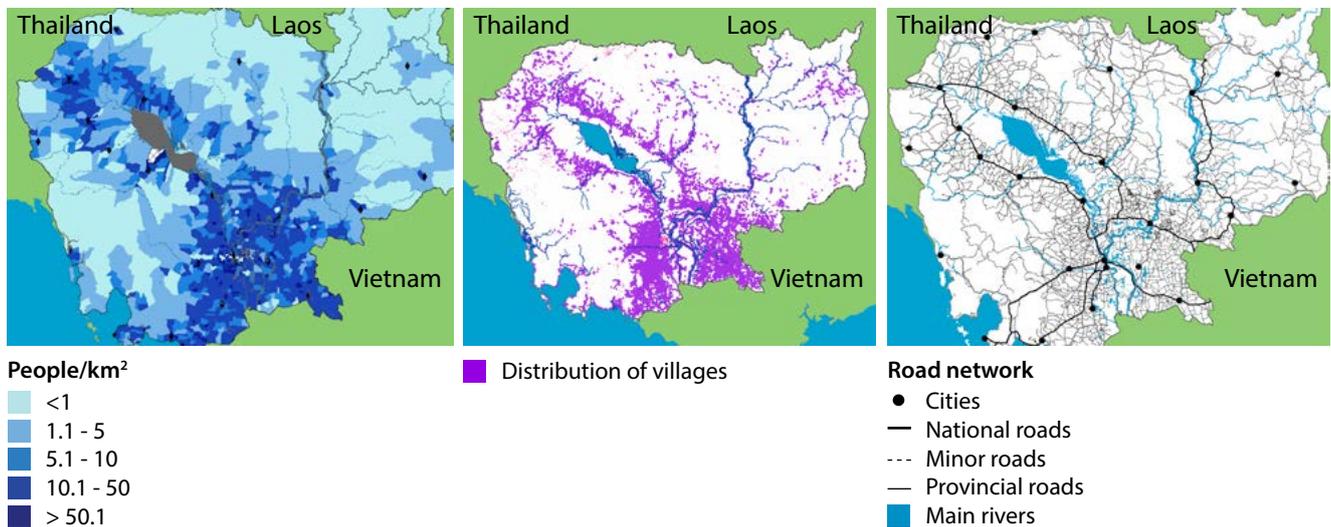


Figure 3. Cambodia's human geography (part 1): population density (left), distribution of villages (middle) and road network (right). Source: Data from the Ministry of Public Works and Transportation (MPWT) and SCW 2006.

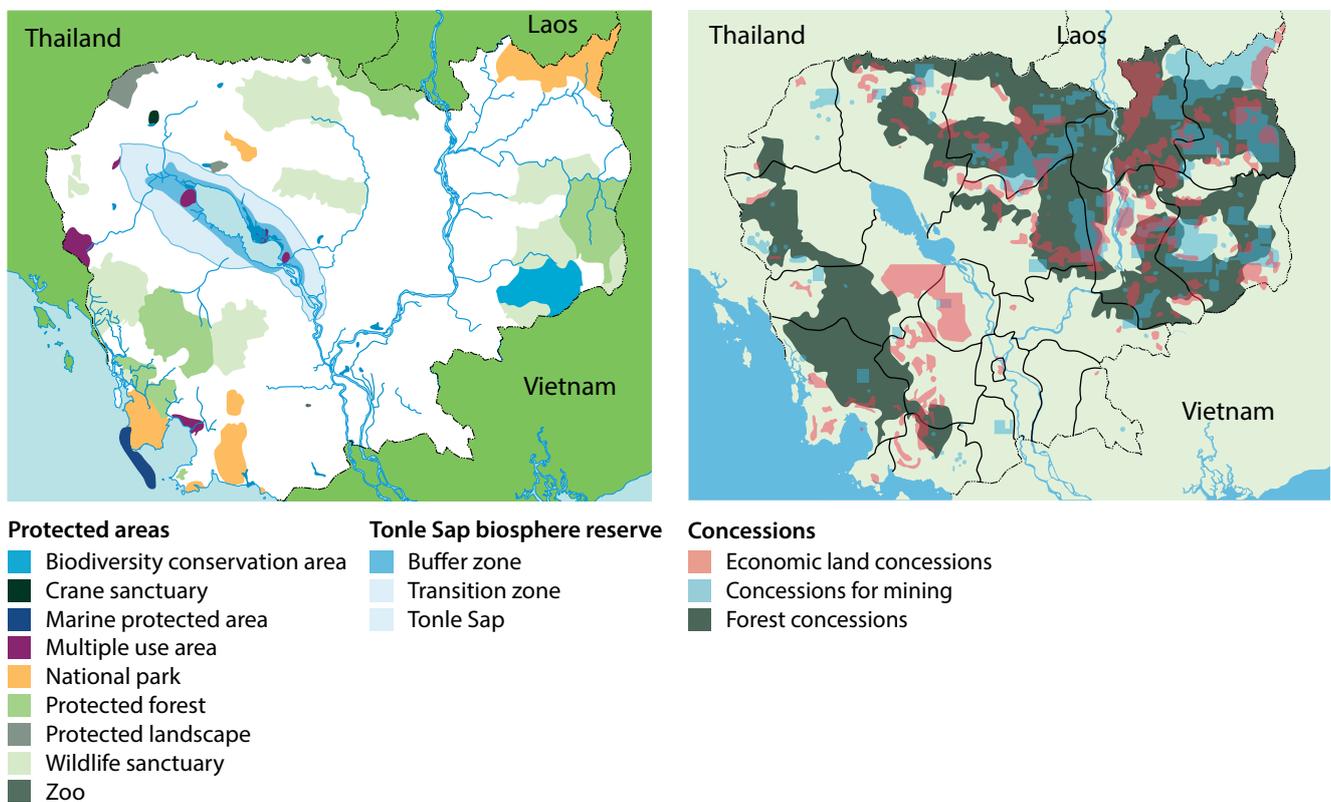


Figure 4. Cambodia's human geography (part 2): map of protected areas (left) and map of economic, mining and forestry concessions (right). Sources: SCW 2006 and concession map from Open Development Cambodia (www.opendevdevelopmentcambodia.net/maps).

People emigrate away from Kratie and Pursat provinces, and move towards the western and eastern parts of the country. A map of recent migrations (Figure 5) shows that the net migration rate is highly negative in Kratie and Pursat provinces, followed by Svay Rieng and Takeo provinces, whereas there is a net positive migration flux in Battambang and Pailin at the Thai border, and in Ratanakiri and Mondulakiri at the Vietnamese border. The population loss in Pursat province can be explained by the attraction of Pailin, but explaining the loss of inhabitants in Kratie would require further analysis, since this area is also classified as being relatively wealthy.

Farming in Cambodia is characterized by four rice-based systems, two systems of diverse crops and one peri-urban intensive system. More specifically, farming in Cambodia can be classified into seven major systems according to AusAID (2006):

- rain-fed lowland rice, frequently associated with sugar palm (low productivity)
- flood recession rice (high productivity)
- floating rice in deep flooded areas (4% of the total rice cropping area)

- rain-fed upland rice systems mixed with cash crops (2% of rice cropping area)
- riverbank farming systems following the annual flooding cycle (diversified cropping systems called *chamkar*)
- upland farming systems on red and black soils, characterized by rubber and other cash crops, such as maize, soybeans, cashew nuts or bananas (systems also called *chamkar*)
- river banks and terraces with intensive commercial cropping, industrial chicken farming, orchards, etc.

At least four of these farming systems combine aquatic and agricultural resources.

Fishing dependency is highest around the Tonle Sap and along the Mekong mainstream.

A recent analysis (Nasielski et al. 2013) shows that fishing dependency (a combination of fisher density and poverty index) is the highest along the coast, around the Tonle Sap Lake, along the Mekong mainstream, and in Kratie and Stung Treng provinces (Figure 6).

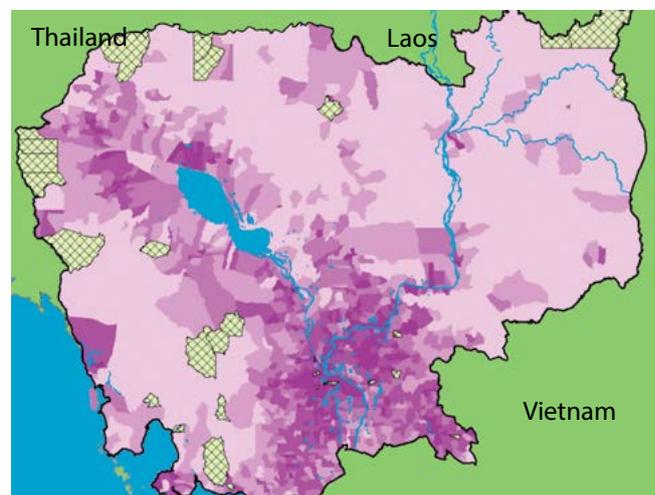
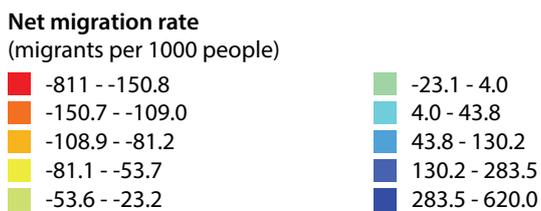
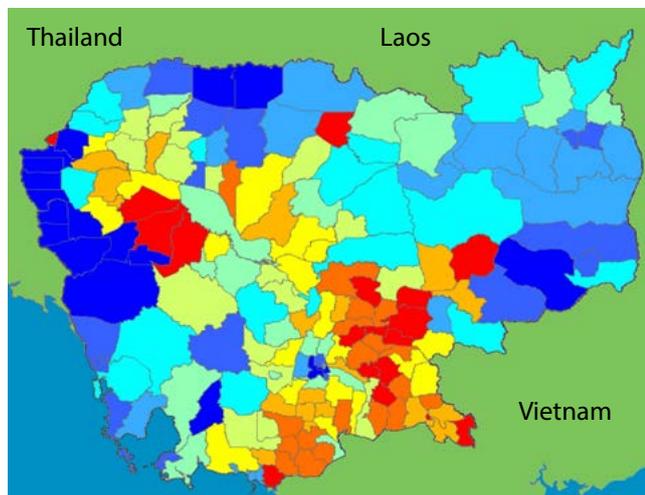


Figure 5. Cambodia's human geography (part 3): net migration rate (left) and commune poverty scores (right). Source: R. Sandoval (SCW), personal communication, 2013, and Ministry of Planning 2006 data. (See Annex for detailed maps).

Characterization of the three hubs

The Tonle Sap Great Lake is characterized by its high fishery and agricultural productivity, and by three different types of communities whose livelihoods are largely dependent on the lake's resources. The lake lies in the central plains of Cambodia, and is surrounded by five provinces: Battambang, Pursat, Kampong Thom, Kampong Chhnang and Siem Reap (Figure 7). The Tonle Sap is connected to the Mekong River through the 100-kilometer-long Tonle Sap River, and 59% of its water originates from the Mekong (the rest coming from local tributaries and rainfall over the lake; Baran et al. 2007b).

The lake is home to at least 296 fish species (Baran et al. 2006), and its productivity is one of the highest in the world. Tonle Sap fisheries account for about 60% of the national fish catch (Baran 2005), and these fish resources serve the livelihoods and food security of several million people (Hap et al. 2006). In 2008, the population of the Tonle Sap Basin alone was more than 4 million (NIS 2008). It is estimated that between 1.2 and 1.7 million of the total population live between the two National Roads #5 and #6, marking the limit of the Tonle Sap floodplains (Keskinen 2012). We focus here on the latter zone as an aquatic agricultural zone, not on the overall Tonle Sap watershed.

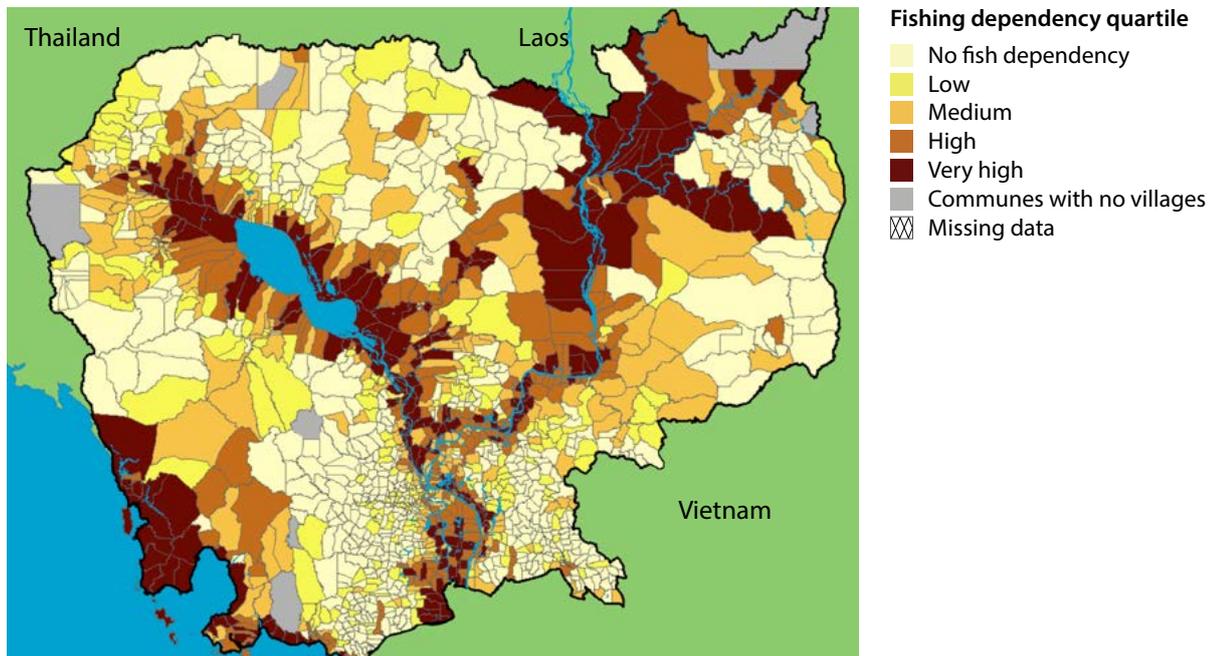


Figure 6. Fishing dependency in Cambodia. Source: Nasielski et al. 2013.

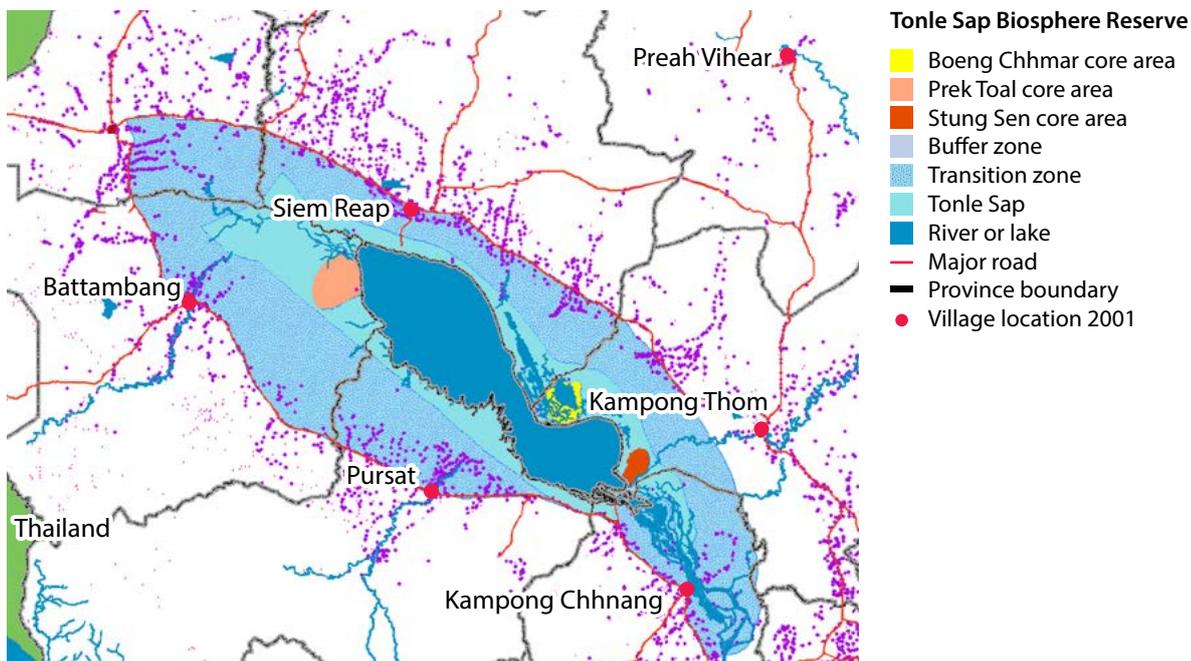


Figure 7. Tonle Sap ecozone situation map. Source: Map of the Tonle Sap Biosphere Reserve, SCW 2006.

The communities around the lake fall into three classes: floating, stand-stilt and farming-cum-fishing communities (Mak 2011). The livelihoods of the floating and stand-stilt communities depend entirely on fishing, while farming-cum-fishing communities have more diversified livelihoods. Keskinen (2012) integrates urban livelihoods into that classification and divides the Tonle Sap area into three distinct entities: the fishing zone (5% of the population), the agricultural zone (60%) and the urban zone (35%).

The lowlands are characterized by a high population density, a dense road network and relatively wealthy communes, as opposed to the mainstream ecozone. Figure 8 shows that the lowlands are very densely populated; trade is active in that zone, which is characterized by a dense road network (Figure 3) and a relatively wealthy population (Figure 4). These aspects distinguish it from the Mekong mainstream

ecozone, which features the opposite characteristics. The latter zone, which is resource-poor and isolated, is highly dependent upon fish resources (Figure 6).

The Tonle Sap combines high rice production and intensive fisheries; the lowlands are characterized by high rice production but relatively limited fisheries; the Mekong mainstream ecozone is characterized by important fisheries but low rice production. This pattern is visible in Figure 9, which shows that the main rice production areas are found around the lake and in the lowlands, while community fisheries (detailed on page 26) are concentrated around the lake and along the Mekong mainstream but are not very developed in the lowlands. Figure 6 confirms that dependency on fisheries in the lowlands is limited to the vicinity of the river.

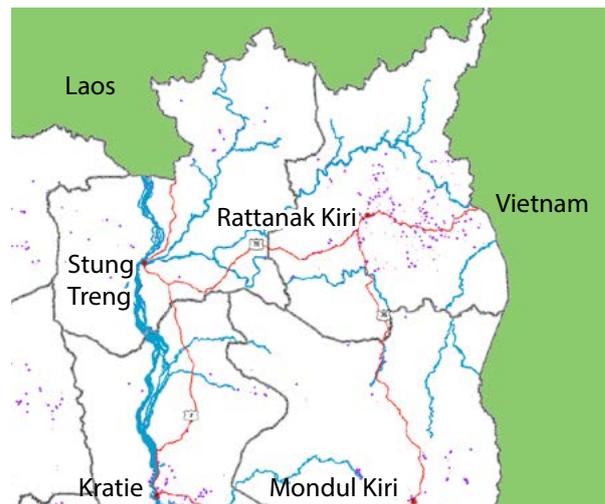


Figure 8. Lowlands and Mekong mainstream ecozone situation maps. Source: SCW 2006.

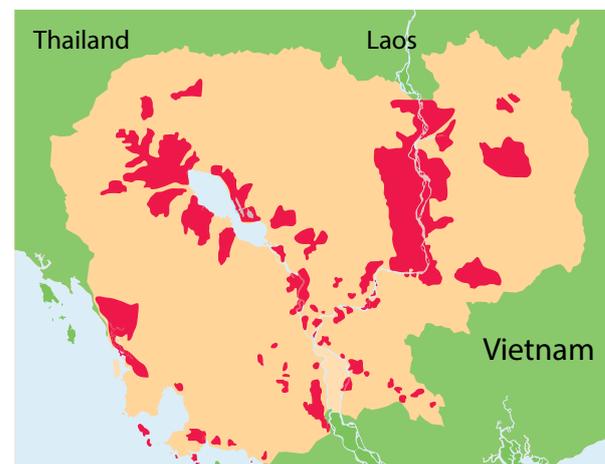


Figure 9. Main rice production areas (left) and extent of community fisheries (right). Source: Open Development Cambodia (www.opendevdevelopmentcambodia.net/maps).

In the three hubs, rural livelihood activities are very dependent on natural resources and are timed to coincide with the availability of water, fish, and other animals and plants. Rural livelihoods are organized around the cultivation of rice, fishing and the collection of wild products. Products from the wild—fish, aquatic animals and plants, and non-timber forest products—are essential to household food strategies and play an important role in terms of nutritional and income security (James 2006; Friend 2007; Allen et al. 2008; Chhoun et al. 2009). Rural livelihood strategies are characterized by multiple occupations and diversified income-generating activities based on agriculture, natural resource use, sale of labor and small business enterprises (see Table 1 in Annex.)

Population and socioeconomic trends

The population of Cambodia is resource-poor, growing fast and, on average, moving out of poverty. The population of Cambodia was estimated to be 13.4 million in 2008, with an average population density of 84 people per km² (NIS 2008).¹ Of the total population, 48.6% were male and 51.4% were female, with an annual population growth rate of 1.54% (NIS 2008).¹ Given the annual growth rate, the population is expected to reach 20 million by 2030 (IFReDI 2013).

In 2010, the life expectancy at birth was 62 and 68.3 years old for men and women respectively (RGC 2010). The adult literacy rate for people older than 15 was 85% for men and 71% for women (NIS 2011). The child mortality rate under 5 years old was 54 per 10,000 live births, and the percentage of children under 5 classified as underweight was 28% (NIS 2011). The Human Development Index (HDI) of Cambodia rose from 0.444 in 2000 to 0.543 in 2012 (1 is the highest), ranking 138th out of 186 countries in the world (UNDP 2013). This change in HDI reflects the improved access to some public services, such as education and health.

Over the last decade, Cambodia has enjoyed rapid economic growth. During the 2000–2008 period, the average annual growth in the country was around 10%, reaching 13.3% in 2005 (see Figure 10). Economic performance started to slow down in 2008, and it declined severely in 2009 compared with previous years as a result of the global financial crisis. The economy recovered in 2010, and since then, growth has stabilized and resumed, with annual growth around 7% (www.mef.gov.kh). According to the Ministry of Economy and Finance, the gross domestic product (GDP) in 2011 reached USD 12.9 billion; almost 10% (USD 1.2 billion) of the GDP originates from development assistance.

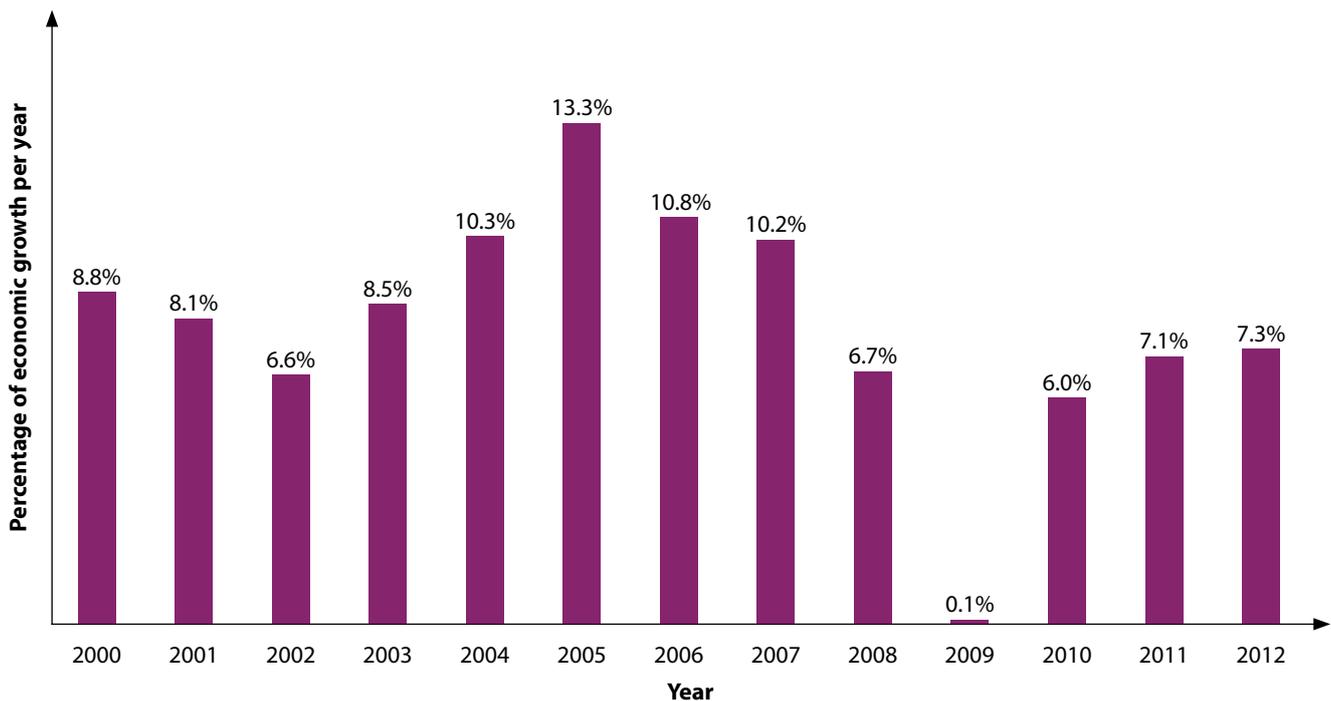


Figure 10. Cambodia's economic growth, 2000–2012. Source: Data from the Ministry of Planning and the Ministry of Economy and Finance (www.mef.gov.kh).

The poverty line was at KHR 2470 per person and per day in 2007. According to UNDP (2011), the national poverty line in 2007 was KHR 2470 per person and per day, with a difference between rural areas (KHR 2,367/ person/day) and Phnom Penh (KHR 3,093/ person/day). See Figure 11.

Although overall poverty has decreased over the last decade, growing inequality is an issue for rural Cambodians. Poverty was reduced from 47% in 1993 to 35% in 2004 and 24.5% in 2011 (MoP 2012a; www.mef.gov.kh). However, in 2012, 22.7% of the population still lived below the national poverty line (Figure 12).

Ninety percent of these resource-poor people live in rural areas (World Bank 2009a; MAFF 2010). Thus, the average rural poverty rate is 26% higher than in Phnom Penh (MoP 2012a). The increasing economic gap and inequality between rural and urban areas is measured with the Gini index (UN Cambodia 2009). Thus, if inequality has gone down in Phnom Penh, it has increased not only in rural areas but also in the country as a whole (Figure 12). This implies that the country has become more affluent on average, but with more rich people and more resource-poor people than in the past, the resource-poor people being concentrated in rural areas.

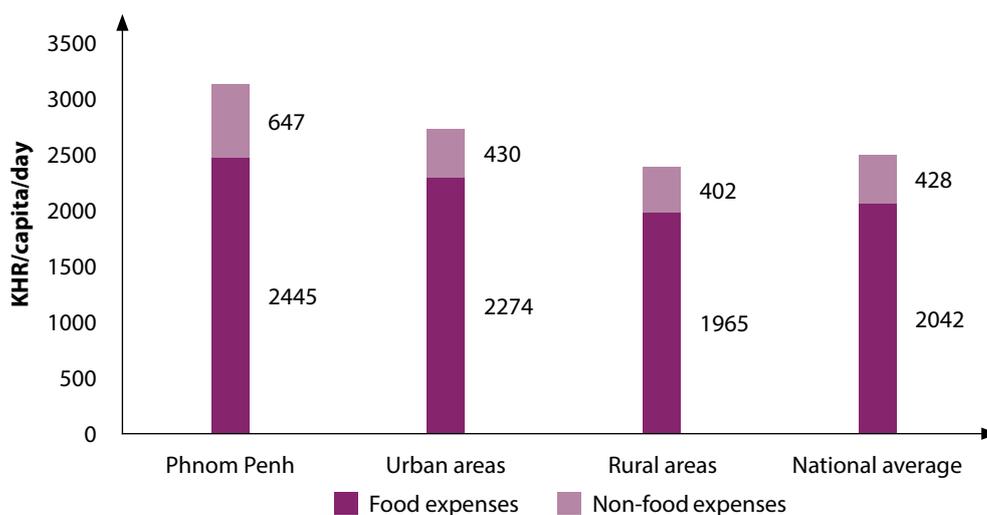


Figure 11. National poverty lines by domain in 2007, in Cambodian riels per capita per day. Source: UNDP 2011.

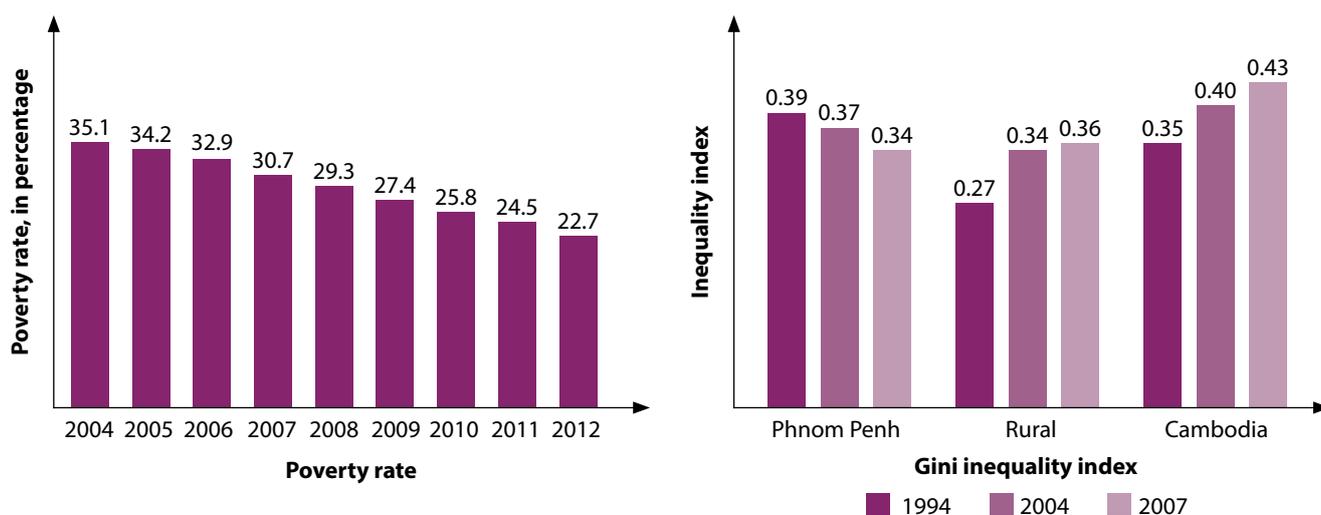


Figure 12. Poverty rate (left) and Gini inequality index (right) in Cambodia. Sources: MoP 2012a (left) and UN Cambodia 2009 (right).

Defining poverty in Cambodia

The National Poverty Reduction Strategy (2003–2005) includes in its definition of poverty lack of opportunities, lack of capacity, social exclusion, vulnerability and gender disparities. Lack of opportunities refers to limited access to resources, to extension, and to opportunities in the secondary and tertiary sectors (CSD 2002). Lack of capacity in the Cambodian poverty context refers to reduced or no access to health care, education and basic infrastructure (CSD 2002). Social exclusion refers to barriers preventing the resource-poor from fully participating in mainstream society due to illiteracy, limited access to decision-making and law, discrimination on the basis of gender and ethnicity, and corruption (CSD 2002). The Cambodian Poverty Reduction Strategy also recognizes that poverty cannot be reduced unless policies and programs address the situation of Cambodian women.

Practically, the National Poverty Reduction Strategy uses consumption-based measures to monitor progress in reducing poverty over time. The “poverty line” is defined in Cambodia as the income required for a person to consume a food basket that provides at least 2100 calories of energy per day with a small allowance for nonfood items such as shelter and clothing (CSD 2002). The poverty line is the tool commonly used by the government to measure poverty (CSD 2002; UNDP 2011).

The United Nations Development Programme (UNDP) defines poverty by focusing both on people’s assets—physical, natural, financial, human, social and political—and the ways in which people can access and convert assets into tangible benefits. The UNDP reckons that poverty has many dimensions; it is not simply a matter of income, although income is centrally important (UNDP 2011). Since the poverty line is focused on income and consumption, the UNDP has developed human development indicators combining income and non-income parameters to better define poverty. These parameters include types of assets (land, labor and livestock), access to natural resources (forests and fisheries), credit, health services, safe drinking water and sanitation, food and nutrition, knowledge and information, and skills (UNDP 2011). The UNDP approach also examines how people can (or cannot) convert these assets into benefits. In Cambodia, the National Human Development Reports apply the human development approach to specific development challenges that Cambodia faces. The Cambodian Human Development Report (MoE and UNDP 2011) presents the Human Development Index (HDI) as an index measuring livelihood assets and vulnerability at the provincial level.

There is contradictory information about poverty around the Tonle Sap Lake. According to some sources, poverty around the lake is higher than at the national level, despite the abundance of fish resources and of fertile agricultural lands. The national poverty rate was 29.3% in 2008 and 22.7% in 2012, while that of the Tonle Sap provinces reached 35% and 28% respectively for these years. The poverty of five large communes around the Tonle Sap, namely Kampong Phluk, Chnok Tru, Phat Sanday, Kampong Luong and Koh Chiveang was as high as 41% in 2008 and 36% in 2012. In line with that analysis, and based on a comparison of 2004 and 2012 commune databases, Blomley et al. (2010) report that poverty rates among surveyed households whose primary income is derived from fishing is as high as 45%. All indicators show that the average poverty rate

around the Tonle Sap Lake is between 6% and 18% higher than the national poverty rate.

In contrast, commune poverty scores (MoP 2006 data) show that communes in Siem Reap, Battambang, Kampong Chhnang, Kandal, and Takeo provinces are relatively affluent compared to those of hilly areas and in dry plains (see Figure 4). This apparent contradiction probably reflects the weight of wealthy urban areas in the *average* national poverty rate (rural communes being significantly poorer), together with the relative affluence of *agricultural* communes and the relative poverty of *fishing* communes around the lake.

A typology of rural households is proposed in the Annex (Table 2).

The recent economic growth has not responded to food insecurity and malnutrition. In past years, 12% of households or 1.7 million individuals were still food insecure, and most of these households were affected by increases in food prices (Chan 2008). With 28% of its children under 5 classified as underweight, Cambodia remains one of the 33 “alarming” countries in the world for its levels of hunger and malnutrition (UN Cambodia 2009). The prevalence of malnutrition and

micronutrient deficiencies, such as iodine deficiency disorder, vitamin A deficiency and iron deficiency anemia, in rural Cambodia is among the highest in the Asia-Pacific region, hampering the full use of human potential for development. Although the nutrition status of children and women has improved considerably in recent years, further targeted investments are needed to sustain and accelerate these achievements.

The Cambodian diet

The Cambodian diet is a combination of rice, fish and vegetables, reaching 955 grams (g) per person per day. Aquatic resources are the second largest dietary component at 173 g per person and per day, accounting for 18% of the total food intake. Aquatic resources are also the major contributor to animal intake (76%, of which half is freshwater capture fish).

Inland fish consumption amounts to 110 g/person/day or 40.3 kilograms [kg] per person per year, while that of marine fish reaches 16.2 kg/person/year. The consumption of other aquatic animals (marine + freshwater) is 5.1 kg/person/year. The smallest contribution to the diet comes from the aquaculture sector, with 1.3 kg/person/year only (2%). These results are consistent with the results of the previous fish consumption studies in Cambodia.

Of the inland fish, floodplain resident fish (i.e. black fish) comprise 30% of total fish intake, followed by long-distance transboundary migrants (white fish) very sensitive to dam development (25% of total fish intake). The overall per capita consumption of floodplain resident fish is relatively higher than other fish categories due to their availability throughout the year.

In the Cambodian diet, rice is the major energy contributor (60% of the total energy intake), followed by aquatic resources (12% of the total energy intake). Fish and other aquatic animals contribute 37% of total protein intake per person, 28% of total fat intake per person and 37% of total iron intake per person. As the overall intake of fat in the Cambodian diet is very low, the fat and protein contributed by fish is very important. The survey results also show that only 25% of the population have the necessary levels of energy and only 19% have the required levels of iron.

Across all ecological zones, fish and fish products are generally eaten more than any other of the body building foods such as meat or poultry. Higher consumption of fish is observed in the coastal and Tonle Sap ecological zones, while the lowest consumption is observed in the mountains and plateaus.

In terms of gender, the consumption of fish and fish products by men and women is similar.

Disaggregation by age group shows that the consumption pattern is the same for all age classes; only the quantity consumed varies. Proportionately, preschool children have their fish intake dominated largely by inland fish and fish products. Adolescents and pregnant women are also relatively more dependent on the availability of inland fish for their overall food security.

Source: IFRDI. 2013. Food and nutrition security vulnerability to mainstream hydropower dam development in Cambodia. Excerpt from the executive summary.

Food security in Cambodia is dependent on freshwater capture fisheries. Multiple studies have highlighted the dependency of Cambodia upon capture fish (e.g. Kristensen 2001; Kaing et al. 2003; Nom 2005; Hortle 2007; WorldFish Center 2009; Ziv et al. 2012), and the government itself acknowledges that fish and aquatic resources contribute 81.5% of the

annual protein intake per person and per year in Cambodia (FiA 2008). A project led by the Inland Fisheries Research and Development Institute (IFReDI 2013) provided new insights about the exceptional dependency of the population on fish resources (see boxes “The Cambodian diet” and “Assessment of fish catches based on fish consumption”).



Photo Credit: Eric Bann/Woodfish

Rice fields produced 9.3 million metric tons in 2012.

Status of the agriculture and fisheries sectors

Agriculture and fisheries are essential to the domestic economy of Cambodia, and most of the population relies on them for livelihoods and food security. More than 85% of the population lives in rural areas (World Bank 2009a). The livelihoods of most rural people are based on agriculture and fisheries for food security, employment and income (MAFF 2012); 64% of all rural households are engaged in fishing (FAO 2010). The contribution of the agricultural sector to the total GDP is about 33.5%, and the sector employs over 70% of the population (RGC 2010; MAFF 2012). The contribution of agriculture to GDP has declined annually due to the growth in industrial and service sectors, and job opportunities in this sector have also declined since 1997 (World Bank 2009c). However, the agricultural sector still serves as an important source of economic growth and takes up the largest share of employment in Cambodia. Data from MAFF 2012 shows that crops make up the biggest share of agricultural production, followed by fisheries (Figure 13).

Since 2000, rice production has substantially increased and has helped Cambodia achieve national rice self-sufficiency. Rice production increased by about 355,000 metric tons each year between 1999 and 2009 (Theng and Koy 2011), and production keeps growing by 7.4% per annum (MAFF 2010). The increase in production has resulted from a 26% expansion over 15 years in land used and from an increase in productivity from 1.31 metric tons per hectare (ha) in 1993 to 2.49 in 2008 (Kem et al. 2011; Figure 14). The increase in total rice production resulted in Cambodia becoming an exporter of rice (from 12,613 metric tons in 2009 to 332,009 metric tons in 2013), and the government has set a target to export 1 million metric tons of milled rice by 2015 (www.cambodiariceexporters.org). However, the country's rice yields are still among the lowest in the region (FAO 2011b). The still relatively low rice yield results from the small amount of inputs used, the insufficient irrigation facilities, and the limited extension services to farmers (Kem et al. 2011).

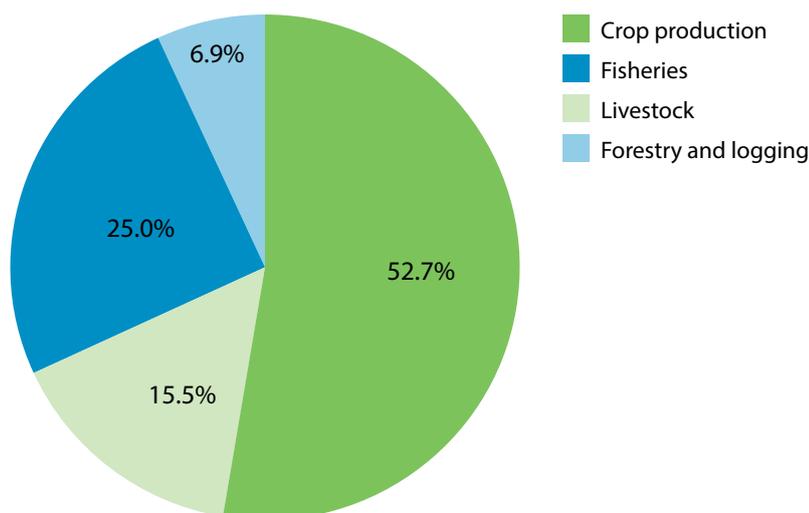


Figure 13. Relative contribution of each subsector to the value of the agriculture sector in 2008. Source: MAFF 2012.

The lack of farmland is a major challenge in the agriculture sector, especially for resource-poor households. Trends and processes in land occupation and changes in land use have resulted in 21% of households being landless

and another 45% being land-poor, owning less than 1 hectare (Chan 2008). This means that two-thirds of farmers live with less than 1 hectare of land (see Figure 15.)

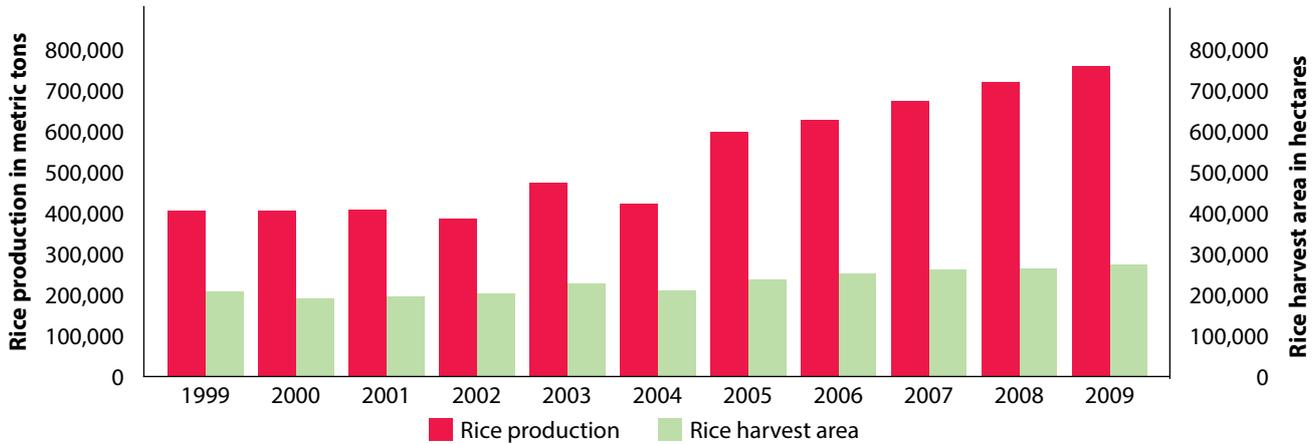


Figure 14. Rice production and rice harvested area. Source: MAFF 2010.

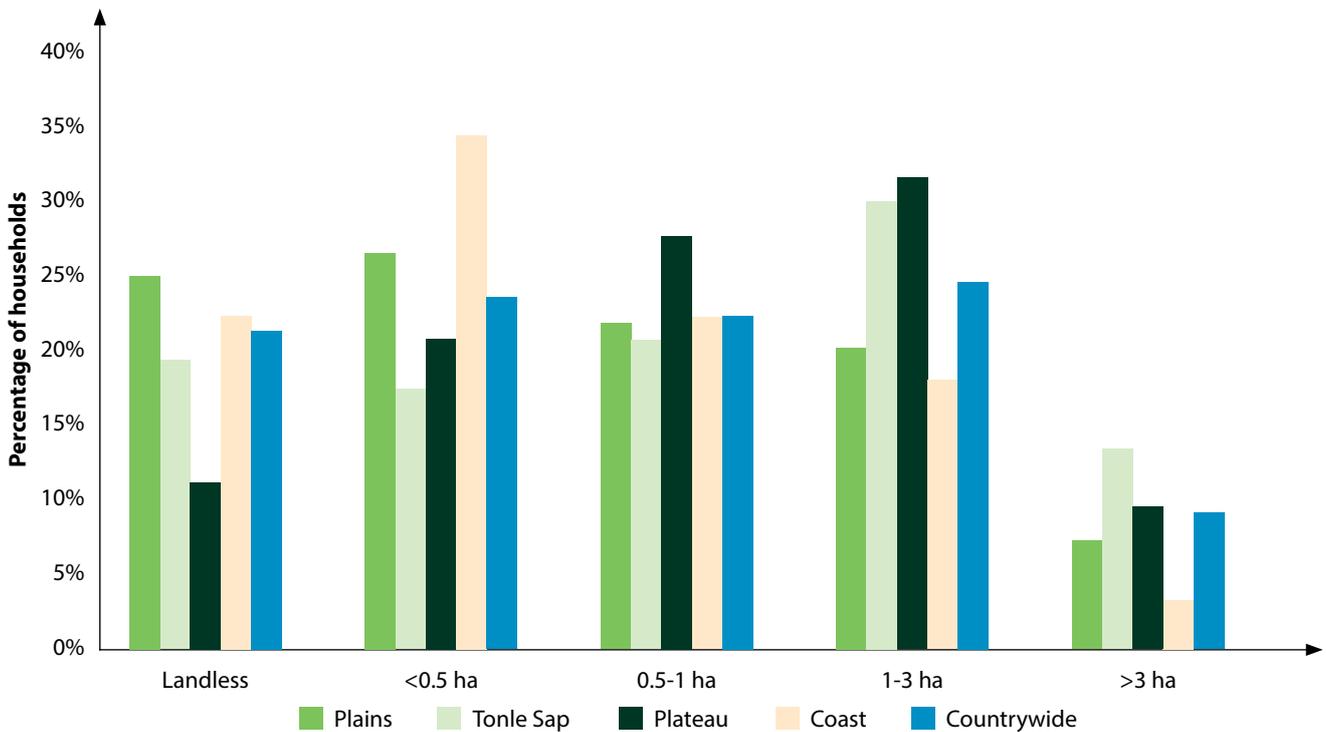


Figure 15. Percentage of households by landholding size and agro-ecological zone. Source: Chan 2008 (information based on a national survey of 2235 households in June 2008).

In Cambodia, fisheries significantly contribute to the employment and livelihoods of the resource-poor, to food security, and to the country's GDP. Cambodia's fisheries provide full-time, part-time and seasonal employment for up to 6 million people; i.e. about 50% of the population is employed on a part-time basis in the fisheries sector (FiA 2009; FAO 2011a). Fisheries harvesting, processing and trade contributes 8%–12% of the total GDP (UNDP 2007; FiA 2009; Blombley et al. 2010; FAO 2011a). Fisheries hold the second largest share in the agriculture sector after crop production (Figure 13). Fish forms a critical component of national food security, as up to 80% of all animal protein consumption in Cambodia comes from fish and other aquatic animals (Hortle 2007). Fisheries production is estimated by the Fisheries Administration to be worth around USD 200–300 million per year at the point of landing (FiA 2009), but according to the International Monetary Fund, that value reached USD 608 million in 2007 (IMF 2009). Actually, the value of capture fish production is not well known, since there is no systematic assessment of the price of fish per kilogram or of the value added along the trade chain, which results in an undervaluation of the fishery sector.

Fish production in Cambodia has substantially increased over time, and comes mainly from capture fisheries. Most of the fish produced in Cambodia is freshwater fish. According to official statistics, freshwater fish catches have increased significantly over recent years, from 250,000 metric tons in 2004 to 390,000 metric tons in 2009 (Figure 16). Marine catches increased from 55,000 metric tons in 2004 to 75,000 metric tons in 2009; aquaculture production also increased from 25,000 metric tons in 2004 to 50,000 metric tons in 2009 (FiA 2009). Most of the fish production in Cambodia is from inland capture fish (64% according to IFRoDI 2013). With only 2.1% of the fish production, aquaculture is not yet a common alternative source of fish in the country (FiA 2009; Joffre 2012; IFRoDI 2013). Of all rural households, only 3% are engaged in aquaculture (FAO 2010). In this context, ecosystem changes caused by infrastructure development, in particular damming for hydropower and irrigation infrastructure, are a major concern (FiA 2009). For example, proposed mainstream hydroelectric dams in Cambodia alone could reduce the availability of inland fish to 34% of the 2011 baseline (IFRoDI 2013).

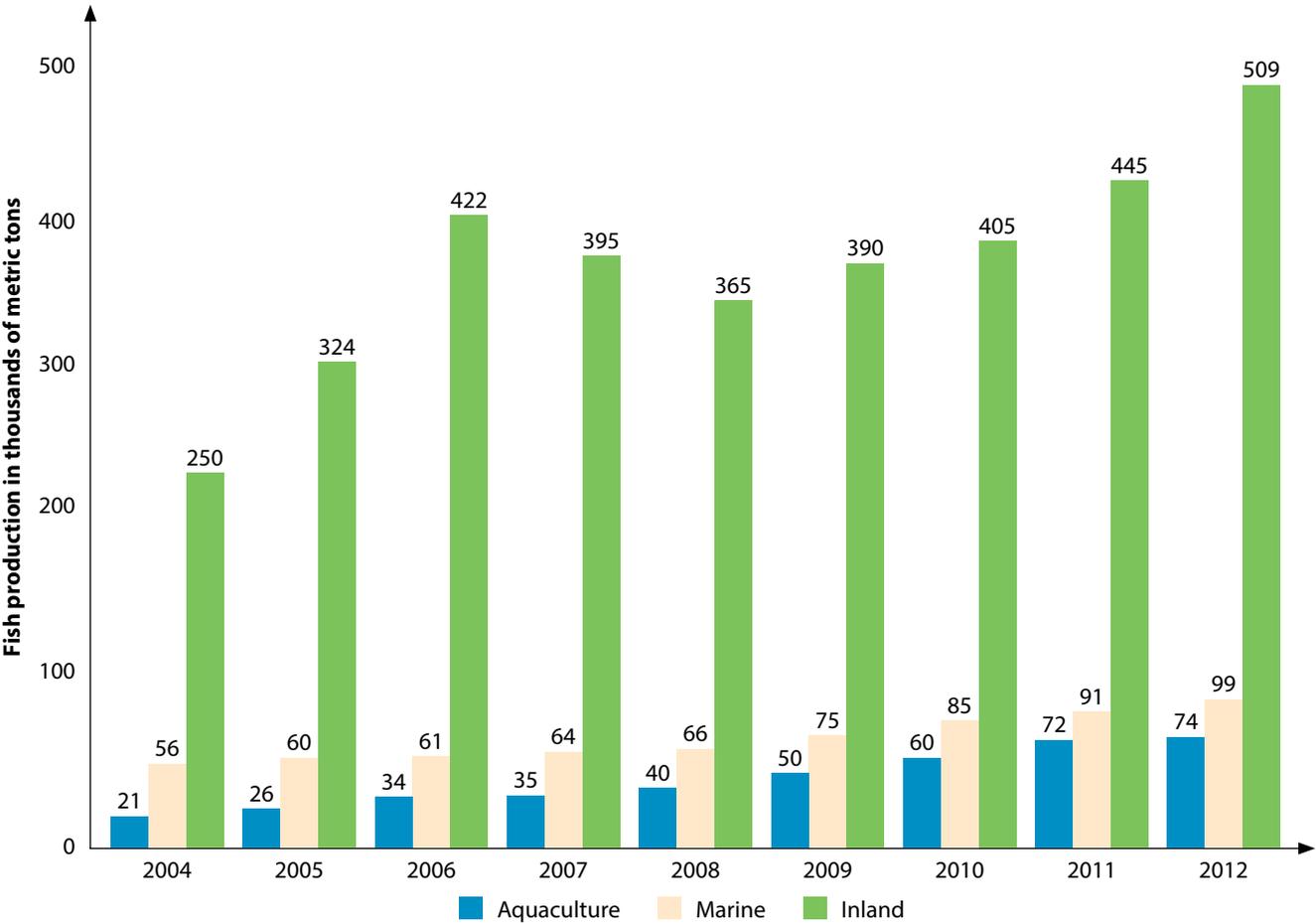


Figure 16. 2004–2012 fisheries production (thousands of metric tons). Source: FiA data.

Assessment of fish catches based on fish consumption

Individual fish consumption figures multiplied by the current Cambodian total population (i.e. 14,100,000 persons) indicates that the yield of inland fish amounts to 570,000 metric tons per year. When complemented by other aquatic animals, this amounts to 625,000 metric tons of inland capture resources harvested each year. These results are consistent with previous estimates.

Marine resources amount to 254,000 metric tons per year (more specifically, 229,000 metric tons of fish and 16,000 metric tons of other marine aquatic animals).

This brings the figure for capture fisheries to 870,000 metric tons per year, and the grand total for aquatic resources in Cambodia to 889,000 metric tons per year (including 19,000 metric tons of aquaculture products).

IFReDI. 2013. Food and nutrition security vulnerability to mainstream hydropower dam development in Cambodia. *Excerpt from the executive summary.*

Women play a major role in agriculture; however, they are subject to specific poverty constraints and vulnerability. The 2011 UNDP report shows that 75% of women's wage labor derives from agriculture (the percentage from the industrial sector remains very low). Women comprise 51% of the primary workforce in subsistence agriculture and 57% of the workforce in market-oriented agriculture (MoWA 2009). Furthermore, economic opportunities for women are still largely constrained, with most credit, training, extension and support programs not sufficiently tailored to their needs (MoWA 2009; UNDP 2011).

Governance, policies and institutions

The Royal Government of Cambodia developed a "Rectangular Strategy" to be implemented through the National Strategic Development Plans. For the 2003–2008 Third Legislature, the Royal Government of Cambodia developed a "Rectangular Strategy" as a successor to the Triangular Strategy. The Rectangular Strategy synthesized the key elements from the Cambodia Millennium Development Goals, the Socio-Economic Development Plan 2001–2005 and the Cambodia National Poverty Reduction Strategy 2003–2005. The Rectangular Strategy was to be implemented through the National Strategic Development Plan 2006–2010. With the Fourth Legislature (2008–2013), the Royal Government of Cambodia announced its "Rectangular Strategy Phase II" and its National Strategic Development Plan Update 2009–2013. In Rectangular Strategies I and II, agriculture was one of the four strategic growth rectangles,

with enhancement of the agricultural sector as a top priority (RGC 2006; RGC 2008; RGC 2010). This covered four areas, including two that are relevant to this study: (i) improving agricultural production and diversification, and (ii) fishery reform.

In the third Rectangular Strategy, fisheries reform is not a priority any longer, but the importance of fisheries is recognized. In the third Rectangular Strategy adopted in September 2013 (Fifth Legislature, 2013–2018), it is the *promotion* of the agriculture sector that is considered as one of the four strategic priorities (RGC 2013). This covers four areas, including (i) improved productivity, diversification and commercialization; (ii) promotion of livestock farming and aquaculture; and (iii) sustainable management of natural resources (Figure 17). Thus, livestock production, aquaculture, improved commercialization and environmental management appear as new priorities.

Fisheries reform itself is not a priority any longer, but fisheries remain important and are addressed through (i) management and conservation in accordance with the Strategic Planning Framework for Fisheries 2010–2019 and the Declaration on the National Policy for Fisheries Sector (RGC 2013), and (ii) sustainable management of natural resources, including suppression of violations of laws, rules and regulations related to fisheries, strengthened management of fishing gears and periods, elimination of overfishing, and strengthening of community fisheries.

The National Strategic Development Plan (NSDP) 2006–2010 and the NSDP Update 2009–2013 have resulted in strategic planning at the Ministry of Agriculture, Forestry and Fisheries. The National Strategic Development Plan highlighted the need for detailed strategic planning of activities by line agencies in ministries. In response to this policy, the Ministry of Agriculture, Forestry and Fisheries developed and adopted plans to promote agricultural growth, food security and poverty alleviation in collaboration with sectoral and development partners.

The Agriculture Sector Strategic Plan 2006–2010 is another driver of agricultural development. In order to achieve the development objectives, the Agriculture Sector Strategic Plan 2006–2010 focused on the following:

- improving agricultural productivity and diversification by investing substantially in agriculture and promoting intensification and diversification;
- creating a favorable environment conducive to private sector participation in the agriculture sector by accelerating land distribution and the issuance of security land titles, especially in rural areas;

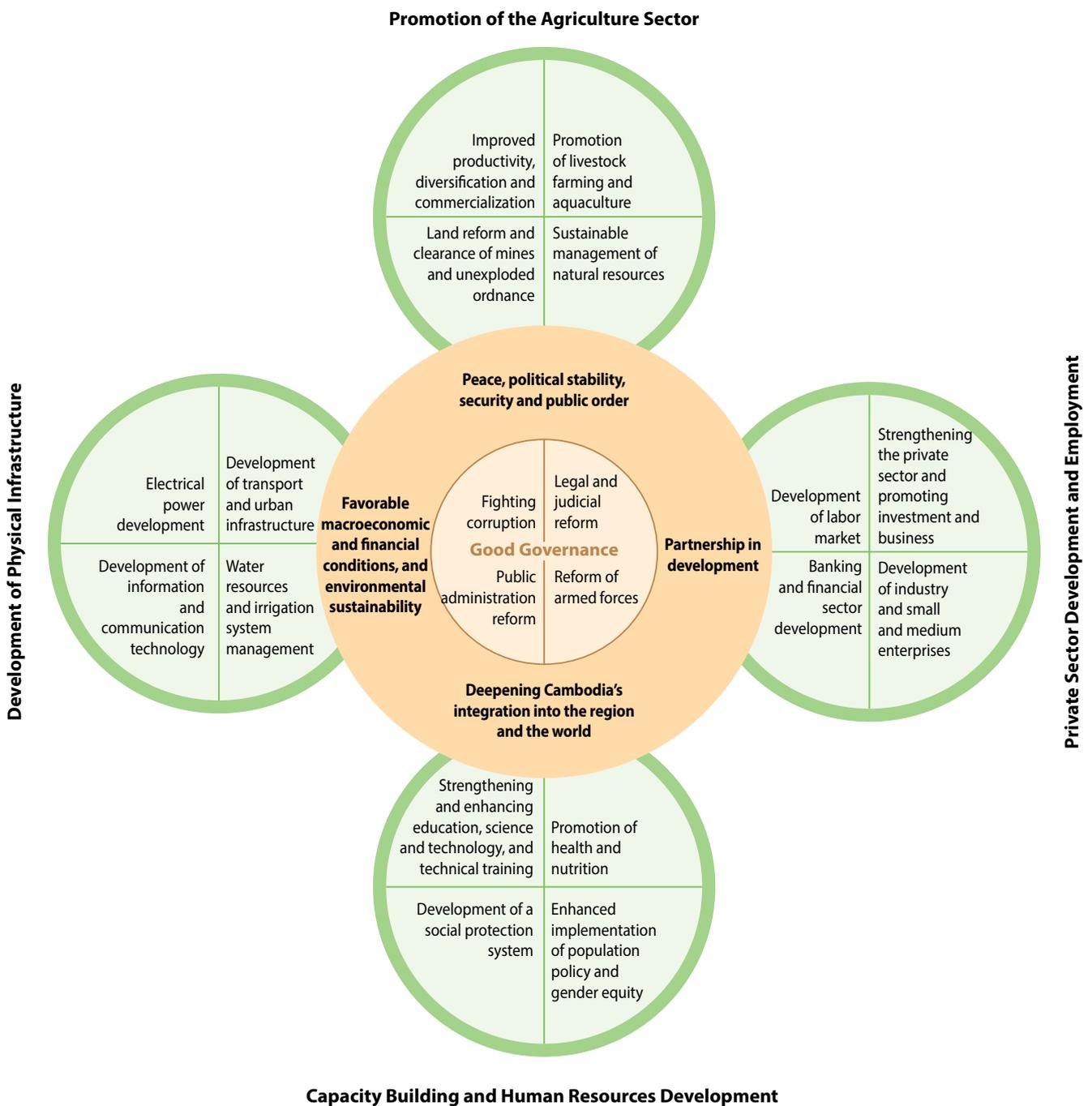


Figure 17. Rectangular Strategy Phase III. Source: RGC 2013.

- promoting support services in the agriculture sector, such as agricultural research and extension, market development for agricultural products, and distribution of input supply, including seeds, fertilizers and rural credits;
- promoting the “one village-one product” movement by finding the suitable production type for village contexts and market needs; providing opportunities, market access and credit; and transferring technology and input supply.

The Royal Government of Cambodia also has a vision for the long-term and sustainable development of the fisheries sector. That vision is “management, conservation and development of sustainable fisheries resources to contribute to ensuring people’s food security and to socioeconomic development in order to enhance people’s livelihoods and the nation’s prosperity” (www.fia.maff.gov.kh). The strengths, gaps and weaknesses of this vision and its implementation are detailed in the following sections.

Specific policies and strategies relevant to the agriculture and fisheries sectors

The “Agriculture Sector Strategic Development Plan: 2006–2010” of the Ministry of Agriculture, Forestry and Fisheries identified actions required to achieve the government’s strategic goals. The goals of the Agriculture Sector Strategic Development Plan 2006–2010 of the Ministry of Agriculture, Forestry and Fisheries are “to ensure food security, increase incomes, create employment and improve nutrition status for all people by improving the productivity and diversification and commercialization of agriculture” (MAFF 2005). Seven strategic objectives were identified: (i) food security, productivity and diversification; (ii) improved and strengthened agricultural research and extension systems; (iii) market access for agricultural products; (iv) institutional and legislative development framework; (v) land reform—land market development and pro-poor land access; (vi) fisheries reform—sustainable access; and (vii) forestry reform—promote sustainable conservation and management of forests, and ensure better management of natural protected areas (MAFF 2005).

A Strategy for Agriculture and Water 2006–2010 was also adopted in 2007 by the Ministries of Agriculture, Forestry and Fisheries and of Water Resources and Meteorology. The goal of this strategy was “to contribute to poverty reduction, food security and economic growth through enhancing agricultural productivity and diversification and improving water resources development and management” (MAFF and MoWRAM 2007). To achieve this goal, the strategy focused on (i) increasing food security and income of rural communities and households; (ii) reducing vulnerability of rural communities and households; (iii) increasing surpluses of agricultural products for processing and export; and (iv) sustainable management and development of the nation’s land and water resources (MAFF and MoWRAM 2007). That 2006–2010 strategy was updated to the Strategy for Agriculture and Water 2009–2013 in line with the National Strategic Development Plan 2009–2013. All programs, frameworks and concepts of the updated Strategy for Agriculture and Water reflect the previous version (MAFF and MoWRAM 2010).

In 2006, the Ministry of Agriculture, Forestry and Fisheries developed a Gender Policy and Strategy in Agriculture. The Ministry of Agriculture, Forestry and Fisheries set four strategic objectives to be achieved by 2010: (i) increased gender awareness of ministry staff at every level of the agricultural sector; (ii) integration of gender analysis and sex disaggregation targets and data into agricultural sector planning; (iii) increased management opportunities and a larger number of women with adequate skills and qualities for leadership roles in the ministry; and (iv) increased ability of rural women to access and manage resources and agricultural services.

Strategic plans and guidelines relevant to aquatic agricultural systems were also adopted in accordance with the National Strategic Development Plan 2009–2013. These include (i) the National Program for Household Food Security and Poverty Reduction 2007–2011; (ii) the Strategic Framework for Food Security and Nutrition in Cambodia 2008–2012; (iii) the government policy to promote investment for agricultural development; and (iv) the National Adaptation Program of Action to Climate Change. The Strategic

Development Plan for Water and Meteorology 2009–2013 of the Ministry of Water Resources and Meteorology should also be mentioned. This plan presents the goals, objectives and activities of the Ministry of Water Resources and Meteorology to be accomplished by 2013. The most important of these goals that contributes to agricultural development is to increase irrigation system capacity by 1% (i.e. 25,000 ha each year) and to expand irrigation coverage to 1.24 million ha by 2013 (Theng and Koy 2011).

The management of fisheries resources is now largely devolved to community fisheries. This move started after the government decided to reduce the area of commercial fishing lots by 56% in 2000. The decommissioned areas were transferred to small-scale local fishers progressively organized into community fisheries with the help of the Fisheries Administration (Kurien et al. 2006). All remaining fishing lots were abolished in 2012 (with the exception of the bagnet [*dai*] fishery) and the areas transferred to community fisheries or designated as fishery conservation zones. In total, more than 1 million hectares of private concessions were transferred to community fisheries, which constitutes a radical shift in the management approach, from centralism and private ownership to decentralization and community-based management (Ratner 2006; SCW 2014). So far, 516 community fisheries have been established, including 358 that have been officially registered (SCW 2014). In order to support community fisheries, the government has formulated policies and a regulatory framework, set up institutional mechanisms, promoted capacity building, and contributed to stock enhancement initiatives operated by community fisheries (e.g. conservation zones and crab banks). Community fisheries have achieved a lot, but according to SCW (2014), they function well primarily when backed by external organizations or donors; without such support they are prone to failing. This is mainly due to the limited capacity of members, the lack of sources of income to carry out their activities, and the lack of personal incentives for members to participate in management activities.

At the national level, technical working groups were created to work on improving agricultural productivity, diversification and fisheries reforms. Within the Ministry of

Agriculture, Forestry and Fisheries, two technical Working Groups were created: the Technical Working Group on Agriculture and Water and the Technical Working Group on Fisheries. These groups are facilitators between stakeholders of the fisheries and agriculture sectors and development partners. There are also two important research institutions relevant to aquatic agricultural systems in Cambodia: (i) the Cambodian Agricultural Research and Development Institute (CARDI), which is a semi-autonomous research institute studying and providing technical support to rice production; and (ii) the Inland Fisheries Research and Development Institute (IFReDI), which produces scientific information on and technical support to fisheries in Cambodia. At the provincial level, the Department of Agriculture is responsible for implementing agriculture-related strategies and programs, and the Regional Administration Inspectorate and the Provincial Cantonment are in charge of implementing other fisheries-related strategies and programs.

In 2010, the Fisheries Administration adopted the Strategic Planning Framework for Fisheries 2010–2019, detailing the main objectives for fisheries development. According to this framework, key interventions should aim to (i) protect and maintain the ecosystem in order to support wild capture fisheries at levels that are both sustainable and sufficient to support demand; (ii) increase rice field fisheries; (iii) support the growth of small-, medium- and large-scale freshwater aquaculture; (iv) develop marine fisheries and marine culture; (v) make improvements in postharvest processing; (vi) promote fish and fisheries products in both national and international markets; and (vii) support livelihood diversification away from capture fisheries, especially for resource-poor, disadvantaged and vulnerable people in order to help them out of poverty.

The Strategic Planning Framework for Fisheries 2010–2019 also identifies key fisheries development targets to be reached. According to the strategic framework, the targets for capture fisheries are (i) at least 1200 communes (75% of the total) with a sustainable and effective fish refuge by the end of 2019; (ii) 470 community fisheries officially registered and operating effectively by the end of 2019;

(iii) fishing lot catches maintained at sustainable levels throughout the period; (iv) scientifically based plans for the sustainable exploitation of marine fisheries implemented by the end of 2014; (v) at least 35% of the area of inland flooded forest and at least 75% of the area of coastal flooded forest protected through physical demarcation by the end of 2019; and (vi) at least 40 of the 97 Upper Mekong deep pools effectively protected and conserved and at least 80% of Tonle Sap Lake fish sanctuaries improved through boundary demarcation, protection and public awareness by the end of 2019.

In the aquaculture sector, development targets include: (i) at least 85,000 trained fish farmers actively engaged in aquaculture by the end of 2019; (ii) fish seed production increased to 250,000,000 per year by the end of 2019; (iii) a surveillance, monitoring and control system for fish disease outbreaks developed and implemented by the end of 2014; and (iv) research and development to identify commercially viable production of indigenous species in cooperation with regional partners such as the Mekong River Commission.

Interventions in agriculture and fisheries by development partners

There are currently more than 20 development organizations supporting projects in agriculture and rural development in Cambodia. These include United Nations (UN) agencies such as the Food and Agriculture Organization (FAO), World Food Program (WFP), International Fund for Agricultural Development (IFAD), United Nations Development Programme (UNDP) and United Nations Environment Programme (UNEP), international financial institutions such as Asian Development Bank (ADB) and the World Bank, and bilateral donors such as the European Union (EU) or its member countries (mainly the United Kingdom, Denmark, France, Spain and Finland), as well as other bilateral aid organizations from Japan, Australia, the United States, Canada and New Zealand (MAFF and FAO 2010; Figure 18). The ADB Water Resources Sector Development Program 2013 also provides an extensive review of development activities directly related to agriculture, rural development and natural

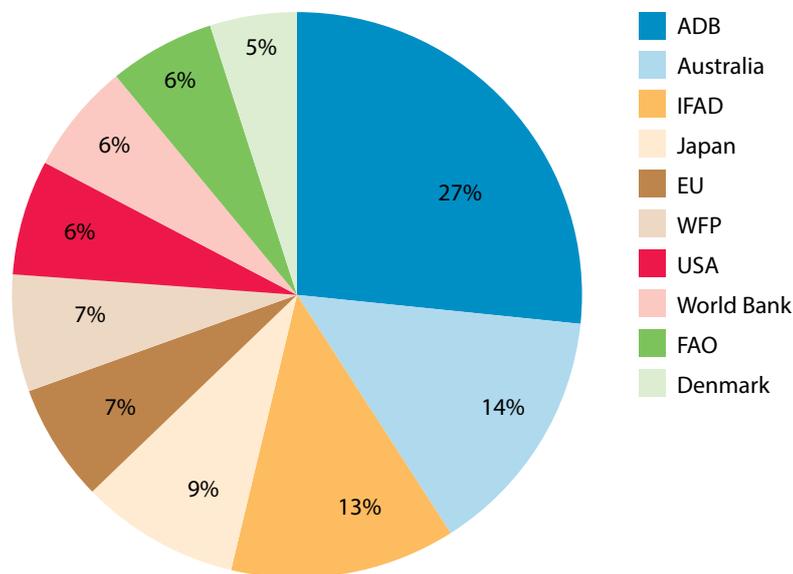


Figure 18. Relative aid contribution to agriculture and related sectors in Cambodia, among the 10 largest donors. Source: Council for the Development of Cambodia (CDC), Cambodia Official Development Assistance Database (www.cdc.khmer.biz).

resources in Cambodia (Table 3 in Annex). Overall, three main strategies can be identified among donors: (i) social safety net approaches by improving on-farm productivity and home consumption; (ii) business and enterprise development approaches to improve the cash income of producers; and (iii) the creation of an enabling environment through improving access to land and water bodies, rehabilitating infrastructure, and increasing investments in safe water and sanitation, better education, and health services.

Agriculture is one of the main targets of the ADB-Cambodia partnership strategy.

The ADB's Cambodia Country Partnership Strategy 2011–2013 prioritizes five sectors: (i) transport; (ii) water supply, sanitation and urban development; (iii) agriculture and natural resources; (iv) education; and (v) finance (ADB 2011). The ADB provided grants and loans for various projects related to agriculture and national resources during the 2000–2010 decade, namely the Tonle Sap Initiative, Tonle Sap Environmental Management, Tonle Sap Sustainable Livelihoods, Tonle Sap Rural Water Supply and Sanitation, and Tonle Sap Environmental Database projects. The last project of the series, the Tonle Sap Lowlands Rural Development Project (TSLRDP), was approved in December 2007 (ADB 2013). The TSLRDP is intended to improve the livelihoods of 68,000 households with a population of about 354,000 persons in the lowland area of the Tonle Sap Basin in Kampong Chhnang, Kampong Thom and Pursat provinces.

In the agriculture and natural resources sectors, the ADB states that it will prioritize agricultural commercialization and support for irrigation (ADB 2011). In January 2013, the Royal Government of Cambodia and the ADB signed grant and loan agreements worth USD 230 million to reduce poverty and promote inclusive growth in Cambodia (www.adb.org/news/cambodia). About 36% of the loan (i.e. USD 82.3 million) will be used for upgrading irrigation systems and improving access to basic services, including health and sanitation, rural road rehabilitation, and agriculture expansion. The ADB's strategy towards agriculture is based on (i) a market-driven approach with greater commercialization of farming; (ii) development of rural infrastructure

(such as roads and irrigation) that will support agriculture; and (iii) a greater role for the private sector, within a broader emphasis on private sector development.

The Australian Agency for International Development (AusAID) has supported agriculture in Cambodia for over 20 years and has recently shown specific interest in fisheries research studies.

AusAID has supported agricultural programs that combine support to irrigation, agricultural businesses and Cambodian government institutions. More recently, AusAID introduced the Cambodia Agricultural Value Chain Project (CAVAC). CAVAC started in March 2010 and will be in operation until December 2015. The aim of the project is to promote modern farming practices and a better business environment for improved food security, increased income and reduced vulnerability of resource-poor farmers (www.cavackh.org). The project promotes market-oriented agricultural development and product diversification, with an initial focus on rice, vegetables and fruit. The project focuses on three provinces: Kampong Thom, Takeo and Kampot. Through the Agricultural Center for International Agricultural Research (ACIAR), AusAID supports CARDI, IFReDI and WorldFish to conduct agricultural and fisheries-related valuation studies. Through ACIAR and regional programs, AusAID has also funded various agriculture programs, including the CARDI Assistance Project, Cambodia Australia Agricultural Extension Project, Agriculture Quality Improvement Project, and ACIAR Research to Support Better Agriculture (www.cdc-crdb.gov.kh).

The International Fund for Agricultural Development (IFAD) is the third largest donor to the agriculture sector in Cambodia.

Since 2001, IFAD has funded several large-scale projects aimed at reducing poverty by increasing agricultural productivity through intensified and diversified crop and livestock production, increased food production, enhanced farming capacity, and improved access to markets in the agriculture sector (IFAD 2007). According to the Council for the Development of Cambodia (CDC; www.cdc.khmer.biz), ongoing and completed projects relevant to agriculture and rural development initiated and funded by IFAD since 2001 are

(i) the Community Based Rural Development Project in Kampong Thom and Kampot (USD 11.80 million, 2001–2009); (ii) the Rural Poverty Reduction in Prey Veng and Svay Rieng (USD 15.90 million, 2004–2011); (iii) the Tonle Sap Poverty Reduction and Smallholder Development Project (USD 18.80 million, 2010–2017); (iv) the Rural Livelihoods Improvement Project in Kratie, Preah Vihear and Ratanakiri (USD 15.60 million, 2007–2015); and (v) the Project for Agricultural Development and Economic Empowerment (USD 39.30 million, 2012–2018).

Japan supports the rehabilitation and development of irrigation facilities in the western and southern parts of Cambodia.

Japan International Cooperation Agency (JICA) recently initiated the Agricultural Productivity Promotion Project in the West Tonle Sap (USD 4.5 million, 2010–2014; JICA 2012). This project mainly focuses on productivity improvement and marketing of agricultural products. JICA is also funding the West Tonle Sap Irrigation and Drainage Rehabilitation Improvement Project in Kampong Chhnang and Pursat (USD 44 million, 2011–2016; JICA 2012). JICA has also funded other agriculture- and fisheries-related activities focusing on agricultural policy planning, capacity building for the quality standard control of agricultural materials, reform of fisheries systems, and freshwater aquaculture improvement and extension (JICA 2012).

The Delegation of the European Union (EU) has replaced DANIDA in coordinating fisheries-related development aid in Cambodia.

Between 2006 and 2010, the EU funded the EUR 25 million Economic and Social Relaunch of Northern Provinces (ECOSORN) Program in Siem Reap, Battambang and Banteay Meanchey provinces. The project included 40 out of the 96 communes of these provinces and covered farming system interventions in agriculture, livestock and fisheries. Components of the project addressed small-scale irrigation, land mine clearance, linking farmers to markets (especially through the improvement of tertiary roads), and developing integrated farms to diversify cropping and encourage year-round agricultural production (www.ec.europa.eu). Since 2011, the EU also replaced DANIDA as coordinator of fisheries-focused foreign aid; it

supports the Fisheries Administration (policies, planning, etc.) and became chair of the Technical Working Group on Fisheries in 2011. According to the CDC's Official Development Assistance Database, the latest EU project in agriculture is Promotion of Inclusive and Sustainable Growth in the Agricultural Sector: Fisheries and Livestock (USD 33.80 million, 2013–2020).

The main focus of the World Food Programme (WFP) in Cambodia is the improvement of food security for vulnerable households and the sustainability of agriculture.

The WFP supported two main projects: Assisting People in Crisis (USD 46.85 million, 2005–2007) and Reducing Chronic Undernourishment of People in Cambodia (USD 10.00 million, 2002–2007; www.cdc.khmer.biz). The Assisting People in Crisis project was aimed at improving food security of 1.3 million people through food aid intervention, protecting and developing community assets, and promoting sustainable livelihoods to mitigate the effects of natural disasters. The Reducing Chronic Undernourishment of People project was aimed at alleviating poverty through improving household food security of the target population through more sustainable agriculture.

The United States (US) government awarded USD 56 million to improve Cambodia's food security through enhanced agricultural development and better management of natural resources.

In 2011, the US government, through the US Agency for International Development (USAID), provided USD 56 million in development aid to start a 5-year program called Helping Address Rural Vulnerabilities and Ecosystem Stability (HARVEST). HARVEST seeks to reduce poverty and malnutrition by diversifying and increasing food production and income for up to 70,000 rural Cambodian households around the Tonle Sap Lake (www.cambodiaharvest.org). The overarching goals of HARVEST are to improve food security, strengthen natural resource management and resilience to climate change, and increase the capacity of the public and private sectors and civil society to support agricultural competitiveness.

The World Bank has invested substantially in agriculture and rural development projects in Cambodia. As of 31 December 2011, World Bank loans and grants to Cambodia totaled over USD 369.9 million, concentrated in governance, transportation, electricity, water supply, rural development, human development, trade facilitation and public expenditure management (www.worldbank.org/en/country/cambodia/project). In particular, the World Bank funded the Agriculture Productivity Improvement Project (USD 35.1 million, 1997–2005), whose objective was to develop activities covering rice and other crops, livestock, and fisheries and to address knowledge acquisition, technology adaptation and human resource management in the Ministry of Agriculture, Forestry and Fisheries (World Bank 2006). Other rural development projects funded by the World Bank were (i) the Northeast Village Improvement Project (USD 6.3 million, 1999–2004); (ii) the Provincial and Rural Infrastructure Project (USD 23.3 million, 2003–2011); (iii) the Smallholder Agriculture and Social Protection Support Operation (USD 13 million); and (iv) the Land Management and Administration Project (USD 33.9 million, 2002–2009). According to the CDC's Official Development Assistance (ODA) database, the World Bank has also initiated a USD 15 million project called Community-Based Agricultural Productivity aimed at improving productivity and diversification of smallholder rice-based production systems in southeastern provinces of Cambodia. The World Bank's strategy for agriculture is reflected in the Agriculture Action Plan 2010–2012 (World Bank 2009b). In that plan, the focus is on improving the productivity of primary agriculture, the stability of food markets, agriculture-led growth and poverty reduction, and targeting emerging opportunities for agricultural exports (World Bank 2009b).

The Food and Agriculture Organization (FAO) promotes sustainable vegetable and fruit crop production and protection, farmer extension and education, fisheries management, and policy and strategy formulation. The FAO is implementing agriculture- and fisheries-focused projects that include the National Census on Agriculture (USD 3.8 million, 2013–2015), the Regional Fisheries Livelihoods Program for Southeast Asia (USD 16.5 million, 2009–2013), and Improving Food Security and Market Linkages for Smallholders in Oddar

Meanchey and Preah Vihear Provinces (USD 5.2 million, 2012–2015; <https://extranet.fao.org>).

The Danish International Development Agency (DANIDA) and the UK Department for International Development (DFID) supported the agriculture sector in Cambodia through the Natural Resource Management and Livelihoods Program. The Natural Resource Management and Livelihoods Program in Cambodia was a 4.5-year initiative (July 2006 to December 2010), covering 707 communes mostly in areas outside the main rice-producing provinces (DANIDA and DFID 2006). The program was funded jointly by DANIDA and DFID with a total of USD 60 million (USD 36.7 million from DANIDA and USD 23.3 million from DFID). The immediate objective of the program was to reduce the vulnerability of resource-poor rural people whose livelihoods are dependent on natural resources. The project had three components: (i) natural resource management in decentralization and deconcentration; (ii) civil society and pro-poor markets; and (iii) sector and policy development. In the sector and policy development component, the project was committed to two subcomponents related to the agriculture sector, namely lands and fisheries. In the lands subcomponent, the project focused on land titles, land access and user rights, and in the fisheries subcomponent, the project aimed at improving access to aquatic resources for the rural resource-poor and at improving service delivery.

Regional organizations complement the action of bilateral development partners. In addition to the above development partners, several intergovernmental organizations provide assistance to Cambodia. Among these are the Southeast Asian Fisheries Development Center (SEAFDEC), the Network of Aquaculture Centres in Asia-Pacific (NACA) and the Mekong River Commission. As part of the SEAFDEC, Cambodia participates in departmental programs on aquaculture, in the promotion of mangrove-friendly aquaculture, in the regionalization of the Code of Conduct for Responsible Fisheries, and in the compilation of fisheries statistics. Through NACA, Cambodia is involved in the promotion of rural development through sustainable aquaculture at the farmer level. Currently, specific projects include community-based "culture-based fisheries development" and "thematic

studies on gender in aquaculture.” Through the Mekong River Commission, Cambodia is involved in the regional activities and has access to the information resources of several management programs, in particular in terms of agriculture and irrigation, fisheries, environment, climate change, flood management and mitigation, drought management, and information knowledge management.

Women in agriculture and fisheries

Women in agriculture

Women outnumber men in agriculture and play a significant role in agricultural production. Of the agricultural population, 48% are male and 52% are female (FAO 2010); 80% of the agricultural households are male-headed, while 20% of them are female-headed (FAO 2010). The 2011 UNDP report shows that 75% of women’s wage labor derives from agriculture, wages from the industrial sector remaining uncommon. Women comprise 51% of the primary workforce in subsistence agriculture and 57% of the workforce in market-oriented agriculture (MoWA 2009). The burden on Cambodian women is heavy: female farmers are also in charge of housework, childcare and meal preparation in 80% of cases. Kaing and Ouch (2003) detail the way household labor is divided by gender, and highlight the above points. Female children, in particular, are found to contribute more to household chores than their male siblings (IFM 2007). In addition to the above responsibilities, women also are increasingly in charge of small trading activities, with recent estimates indicating that over 80% of fruit and vegetable traders, for example, are women (CAVAC 2010).

In rural Cambodia, women are more exposed than men to poverty and vulnerability.

Access of women to improved knowledge and technology and to productive resources such as financial services is limited due to their unrecognized social role, to socio-cultural traditions and to a low literacy rate (MAFF 2006; MoWA 2009; UNDP 2011). Thus, among all female farmers, half are illiterate or have less than an elementary level of education (MAFF 2006). Women also experience financial discrimination: at the same age and education level, women’s wages are only 75% of men’s wages (UNIFEM et al. 2004). Female-headed households working in agriculture also tend to

have smaller landholdings, be more vulnerable to losing their land (FAO 2010), be more isolated due to constraints on their mobility and time, and be excluded from male-dominated community networks (CAVAC 2010). Thus, the ADB’s Tonle Sap Lowland Rural Development Project, for instance, showed that women are rarely active at the commune or village decision-making level. More generally, women are not equally represented in positions of power, and do not have much influence over decisions concerning key issues (MAFF 2006).

Agricultural extension does not respond well to women’s specific issues and constraints. In Cambodia, few extension efforts in agriculture have addressed gender differences in issues and options (MoWA 2009). More generally, women have not been able to benefit from agricultural extension services due to childcare, time and mobility constraints, lower education levels, and socio-cultural barriers (MAFF 2006). The many hours of household work have been women’s major constraint to accessing training, community activities, and other opportunities to improve their management skills and leadership roles.

Women in fisheries and aquaculture
Women account for more than half of the primary workforce in subsistence and market-oriented fishing activities. Women contribute about 75% of the activity around fisheries, especially in processing- and marketing-related activities (MAFF 2006). Women in fishing areas are particularly engaged in fish-related activities such as *prahok* (fish paste) processing, boat rowing, bait preparation, and making of fishing gears such as gill nets, shrimp traps and long lines (Resurreccion 2006; IFM 2007; Gatke 2008). Half (51%) of female-headed agricultural households are directly involved in catching fish, shrimp, crab and other aquatic species (FAO 2010). Among women, widows are often subsistence fishers, relying on common property resources such as water bodies and the inundated forest (Resurreccion 2006; IFM 2007). Women heading such households are usually less educated than men and live in houses or shelters of much lower adequacy than men (Resurreccion 2006; FAO 2010).

Women in Tonle Sap fisheries: A critical perspective

Complex clientelist alliances and networks of male businessmen, state officials, military and loyal henchmen persistently engage in “shadow state” transactions, commandeering almost exclusive rights to fishery resources, even through violent means.

Women in [community fishery] programs, by contrast, legitimize their presence through their close ties with powerful men in the community—a practice that re-enacts patronage ties in fishing lots and in the region as a whole. Apart from nurturing kinship ties with influential men, they align themselves with the powerful by way of creating a social identity for themselves that affirms their conventional roles in “money making,” instead of associating themselves with the task of patrolling lake areas that marks the masculine stereotype in this conflict-ridden region. They also comply with tendencies of development programs to retraditionalize women’s roles by involving them in microfinance projects for poverty alleviation.

Women who are less involved in [community fisheries] are usually less well off, shoulder heavier workloads in farming, and are not related to influential men. Female heads of households for their part are compelled to access resources for their subsistence in the Great Lake’s marginal areas that are not under the control of the region’s influential networks. They are the least resourced and do not have influential male relatives who can broker their needs with the powerful networks, either within community fisheries councils or among private fishing lot owners’ henchmen. [...]

Both women and men in this study “inserted” themselves into newly created formal development institutions through simultaneous backstage and public means: the “shadowy” mélange of male patronage alliances that meshes the state with private resource interests, and women’s open compliance with retraditionalized identities and use of kinship ties to legitimize their presence in these development institutions.

Excerpt from

Resurreccion. 2008b. Gender, legitimacy and patronage-driven participation: fisheries management in the Tonle Sap Great Lake, Cambodia.

Women have been neglected in national fisheries policies and programs. Despite their important role in the sector, women have historically been neglected in fisheries policies and programs in Cambodia (IFM 2007), based on the assumption that women are physically weak and that innovations in fisheries are not for them (Lebel et al. 2011). This trend is evolving, with more emphasis being placed on gender issues in the Fisheries Administration (FiA 2007), but gender mainstreaming in the line agency in charge of fisheries does not constitute gender mainstreaming in fisheries themselves (Resurreccion 2008a).

Women face constraints in community fisheries, but are successful in establishing and managing savings groups. In community fisheries, women face specific constraints. They have limited time because of home duties and chores, lack consideration from

the men of the community fisheries (e.g. due to non-involvement in patrolling), face rules that they perceive as overly formal and rigid (Resurreccion 2006; IFM 2007; Gatke 2008), and lack self-confidence (Learning Institute 2009). These constraints result in a limited role of women in fisheries management through community fisheries. However, women have been active and effective in other informal areas of their own, in particular in savings groups (Learning Institute 2009). Women have been successful at collecting money, negotiating, enforcing and abiding by informal rules, and disseminating information (MAFF and CBNRM 2008; Learning Institute 2009).

Women are also involved in aquaculture, in particular subsistence-oriented aquaculture, which in this region is considered an extension of household maintenance work and thus part of women’s work (Kusakabe 2003). However,

Lebel et al. (2011), reviewing studies from the late 1990s, found that women's involvement and division of labor in aquaculture varied significantly depending on the province considered.

There is significant potential for research to improve gender-based approaches in fisheries and aquaculture. The World Bank (2008) and Lebel et al. (2011) note that in socioeconomic and technical research, (i) the frequent emphasis on the household as a unit of analysis results in gender relations and women's interests being overlooked; (ii) most studies have focused on fishing, and very few of them on processing, marketing or distribution, missing the specific roles of women in these fields (with the exception of Ham 2006); (iii) no study in Cambodia has analyzed how fishing and aquaculture development would serve women's and men's respective interests; and (iv) most studies have not adequately addressed the intersection of gender with other social differentiation factors such as ethnicity and wealth. Arenas and Lentisco (2011) provide practical guidelines to address gender in development projects in fisheries.

Challenges and options identified in national policies

Despite significant progress in agricultural development, aquatic agricultural systems are still subject to major challenges in Cambodia.

These challenges include the following:

- weak production infrastructure
- land tenure and land grabbing issues
- national budget shortages
- lack of market information
- limited diversification
- limited alternatives to capture fish production.

Each key challenge is detailed in this section.

Lack of irrigation infrastructure, low use of fertilizer and limited technical assistance to farmers still weaken agricultural production.

The government and Ministry of Agriculture, Forestry and Fisheries recognize in their strategic plans that irrigation infrastructure is still insufficient, with only 31.6% of rice cultivation land being irrigated at the end of 2008 (MoWRAM 2010), the rest being dependent on rainfall and producing only one

crop per year. Fertilizer use in Cambodia is the lowest among the neighboring countries at 5 to 6 kg/ha (Theng and Koy 2011). The agricultural sector also faces technical challenges such as the lack of modern technology, a shortage in skills and limited access to credit (Kem et al. 2011). Limited access to agricultural extension services is also an issue (MAFF 2010).

Landlessness, insecure land rights and land grabbing in rural areas disharmonize Cambodia's agriculture sector. The government is committed to reforming land tenure by distributing land and ensuring land titles in the rural areas. However, many farmers are still landless or own less than 1 hectare (21% and 45% respectively, Chan 2008), and the majority of farmers do not have secure land titles (MAFF 2010). One objective of the Agriculture Sector Strategic Plan 2006–2010 is to review the existing economic land concessions and make them consistent with the guidelines of the subdecree on land concessions. However, land grabbing, caused both by powerful entrepreneurs and by the development of economic land concessions, has become one of the most controversial social justice issues in Cambodia.

The national budget allocated to the agriculture sector suggests that agricultural development is not given the high priority stipulated in strategic policies.

The Rectangular Strategy is clear about the importance to be given to agricultural development, and in development policies the government is also committed to increasing investment in this sector. However, the budget allocation for this sector has been very low, just below 2% of the total budget or less than 1% of the agricultural GDP per annum (Theng and Koy 2011). This has become a challenge when it comes to implementing the recommended development policies in agriculture.

Agriculture and fisheries development has been hampered by a lack of access to updated market price data. One of the objectives of the Agriculture Sector Strategic Plan 2006–2010 is to strengthen and improve agricultural information systems in Cambodia. However, farmers and fishers selling their products to local collectors or to middlemen are often paid less than the actual market price (Mak 2011).

Few channels are available to communicate and disseminate information to farmers and fishers. The weak linkages between producers and markets have resulted in most farmers and fishers having difficulty in getting a reasonable price for their surplus products (MAFF 2010).

Cambodian agriculture relies heavily on rice production, while nonrice crops are limited. Rice remains the most secure and favored crop, while diversified agriculture is very limited (MAFF 2010). Traditionally, it is perceived that rice is nonperishable and can be stored for sale when prices are higher or kept for home consumption if it is not sellable. Farmers are exposed to much higher risks with nonrice crops in both domestic and international markets (MAFF 2010). Diversification has been prioritized by the government (Agriculture Sector Strategic Plan 2006–2010), but practical considerations limit the diversification of agricultural products in Cambodia.

Capture fisheries are, by far, the major source of animal protein in Cambodia, and alternatives remain limited. Aquaculture, although growing fast, is not yet a common source of fish in Cambodia, and there has been

insufficient effort and resources to support aquaculture extension and expansion (MAFF 2010). For example, the capacity of national and provincial hatchery farms is inadequate.

Cancellation of fishing lots is the latest reform in the fisheries sector, and the overall outcome of this reform is uncertain. The Tonle Sap has been the region most targeted by fisheries reforms, the last one being the cancellation of 35 commercial fishing lots in March 2012 and the ban on middle-scale commercial fishing gear. This policy reform has been welcomed by local communities, but its success depends on whether the newly released areas are effectively managed (Keang et al. 2004; Norman-Lopez 2004), management implementation being a critically challenging task for the administrations and line agencies in charge (Allebone-Webb and Clements 2010).



Women on the Tonle Sap Lake grow and harvest morning glory (*Ipomoea aquatica*), an edible aquatic plant beneficial to children's nutrition.

In this section, we focus on significant transformational processes at the national level that are most likely to influence the success or failure of AAS in addressing the development challenge in the medium to long term.

Population growth

Population growth and the recent “baby boom” are a major challenge to Cambodia. In that context, job creation is a clear requirement. By the year 2050, the population of Cambodia will have increased by 69% (UN 2010; Figure 19). The changes in the population age structure are such that the proportion of the population active in the workforce (15–59 years old) is growing rapidly and will increase by over 54% in the next few years (US Census Bureau, www.census.gov/ipc/www/idbpyr.html), while in all neighboring countries it is the number of people older than 60 that is

increasing fastest (with negative growth in younger people in China and Myanmar). This demographic transition will drive people in Cambodia to migrate abroad to meet the labor demand in neighboring countries. This issue also feeds the policy debate around natural resources exploitation, employment, food security and health.

The 2014–2018 National Strategic Development Plan (MoP 2012b) argues that population growth can generate a “demographic dividend”—human capital, labor supply, savings, etc. However, this gives no guarantee of prosperity: if demographic growth is not matched by increased employment opportunities, the country may then face social and political instability (Bloom et al. 2003). In that context, job creation is a clear requirement.



Figure 19. Expected growth in population (left) and per age group (right) in Cambodia. Source: United Nations 2010.

Regional integration and emergence of labor migration

Regional integration will be a strong driver of change in the coming years, resulting in substantial transformations among rural communities. Economic development and moving out of the least-developed-country status presents both opportunities and challenges. The country will not automatically qualify for grants or highly concessional loans any more, and exports will face both tariff and nontariff barriers. Association of Southeast Asian Nations (known as ASEAN) economic integration will also lead to a free movement of capital and labor across boundaries, beginning in 2015. This fact, combined with the perception of unsafe and undesirable work conditions in Cambodian factories, will encourage more Cambodian workers to go across borders in search of jobs, which may result in labor shortages in the country. Similarly, a free inflow of capital into Cambodia would imply large demands on land. As land is the most attractive asset, contentious issues may arise (MoP 2012b). Increasing levels of urbanization are also anticipated given the “pull” of urban opportunity. This will intensify the trend of in-migration away from rural livelihoods. Thus, the simultaneous processes of urbanization, regional integration and globalization are a challenge in the current governance context (ADB 2002).

Rice export policy

Cambodia, as a rice-exporting country, has been promoting irrigation, which may have an impact on landless or resource-poor farmers and fishers. Cambodia has recently re-entered the world market as a rice-exporting nation. In 2003, the Cambodian Prime Minister promoted the Royal Government as an “irrigation government,” and the government has mobilized funds to rehabilitate existing and build new irrigation schemes. Bilateral and private developers have actively supported irrigation systems and reservoirs in Cambodia, in particular over the last few years (see Table 3 in Annex). The Approach Paper for the National Strategic Development Plan 2014–2018 (MoP 2012b) reaffirms the ambition to turn Cambodia into a rice-exporting country. Irrigation development as a top priority for public investment in Cambodia (CDRI 2011)

may have an impact on the 21% of landless and 45% of land-poor households of the country. Social issues regarding access to irrigation have been underlined, in particular by Ratner et al. (2007), and focusing on monoculture is somewhat contradictory in light of the recommendations for livelihood diversification in the context of climate change (Rahut et al. 2007; CDRI 2011; USAID 2013). The results of a Cambodia Development Resource Institute (CDRI) simulation underline the fact that input intensification alone might not be an effective way to boost rice production and that better farming practices are also required. Given the estimated elasticity, fertilizer use might not be profitable for farmers if world prices for fertilizer stay at the current high level. On the positive side, cultivation techniques using fewer inputs and inexpensive planting methods in relatively dry areas could result in an average yield of 3.6 metric tons/ha compared with the current 2.4 metric tons/ha (CEDAC 2007; CDRI 2011).

Irrigation development in floodplains is also likely to impact capture fisheries productivity, since there is a tradeoff between farming and fish productivity in floodplains (Baran et al. 2007a; Baran et al. 2007b). This tradeoff is illustrated by the destruction by authorities of irrigation reservoirs in the Tonle Sap floodplain (Cambodia Daily 11 March 2010; Cambodia Daily 7 April 2010; Phnom Penh Post 9 July 2010).

Land privatization, land grabbing and logging

Changes in land use are driven by multiple factors often independent from rural considerations. Agricultural land has been increasing at the expense of forest land, but the growing population is just one of the causes of deforestation. The analysis of the long-term trends in temporal population (UN 2005) and cropping area changes in Cambodia during the 1960–2004 period (FAO online database) shows, for instance, that the cropping area is largely disconnected from population growth (Figure 20). Changes in land use actually also result from logging, urbanization, industrial and infrastructure development, land tenure policies, national and international investment, and technological factors (ADB 2000; BDP 2002).

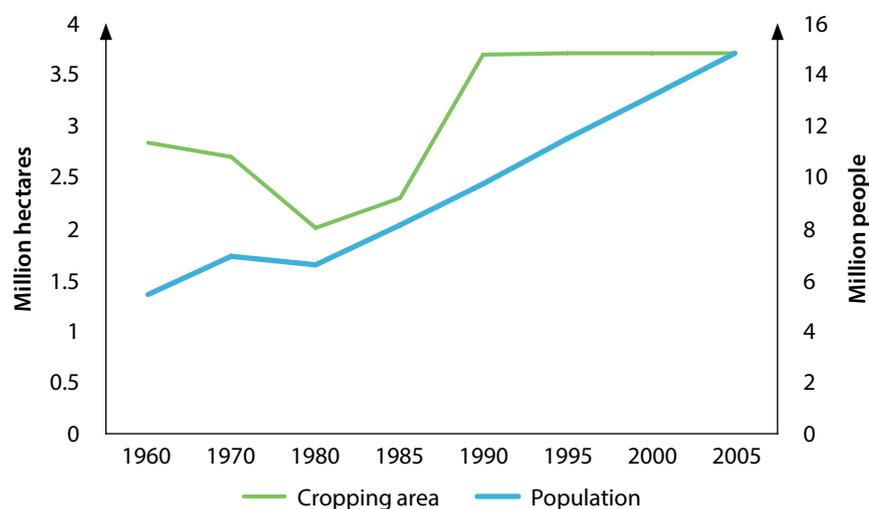


Figure 20. Trends in cropping area and population growth. Source: UN 2005 and FAO online data.

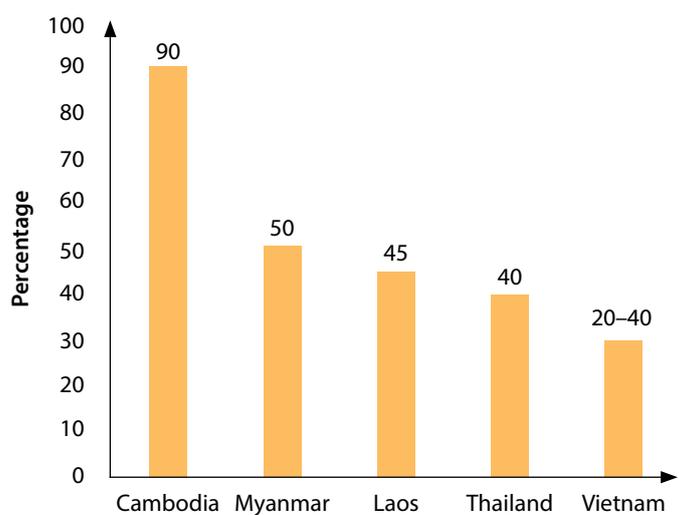


Figure 21. Illegal logging as percentage of the total log production. Source: World Bank 2006.

Logging and official concessions are important drivers of change for rural communities. Illegal logging results from the market demand from within and outside the basin (ADB 2000; Lang 2001). In Cambodia, 90% of the log production is illegal (Figure 21). The government’s own policy about allocating land concessions has also contributed to rapid deforestation and changes in land use. In 2010, 40% of the total area of the country was allocated as land concessions (UNDP 2010), and as of 2013 this percentage has increased substantially (Figure 22). The proposed activities of AAS will have to be designed in a way that reflects this context, in particular in the Mekong River hub.

Hydropower development

Hydropower development will be a major driver of change, with heavy impacts on river fish yields. With 77 to 88 dams expected in the Lower Mekong Basin by 2030 (ICEM 2010), compared to just 16 in 2000, and 227

dams either in operation or planned for the Mekong Basin as a whole by 2030 (E. Baran, personal communication, 2014), hydropower development is one of the large-scale development initiatives that will have a major influence on the future of the basin’s natural resources. Dam development will impact three main environmental factors: water flows, fish migrations and sediment supply. According to Baran (2010), who reviewed multiple hydrological modeling studies, in Cambodia (i.e. south of Khone Falls) the dry season discharge of the Mekong will increase by 13% to 22%, while the flood level will decrease by 30 centimeters (cm), resulting in a loss of floodplains amounting to 250,000 hectares by 2015 compared to 2000 (Figure 23). It is often said (e.g. BDP 2006; MRC 2008) that increased flows in the dry season due to dam-driven hydrological changes will benefit irrigation in the basin, but this may be fallacious, since water availability in the Mekong mainstream has never hampered irrigation so far even in the

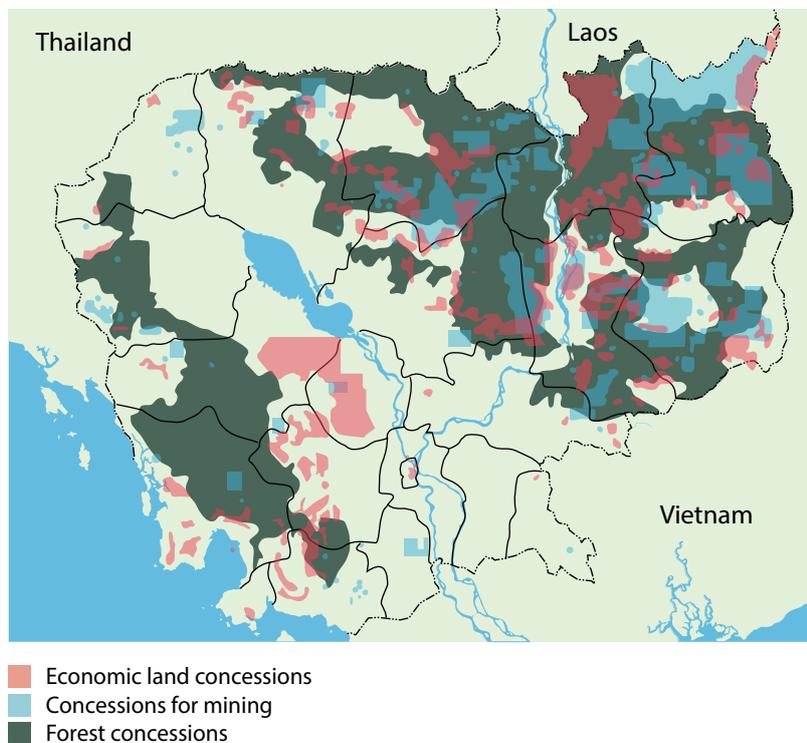


Figure 22. Economic, mining and forestry land concessions in Cambodia. Source: Open Development Cambodia (www.opendevdevelopmentcambodia.net/maps) 2012 data.



2015	Dry season discharge: +41% to +45% Wet season water level: -50 cm to -60 cm
2030	Dry season discharge: +53% to +65% Wet season water level: -50 cm to -70 cm
2015	Dry season discharge: +32% Wet season water level: -30 cm
2030	Dry season discharge: +31% to +33% Wet season water level: -40 cm to -50 cm
2015	Dry season discharge: +13% to +22% Wet season water level: -30 cm Floodplains: -251,000 ha
2030	Dry season discharge: +13% to +28% Wet season water level: -30 cm to -60 cm Floodplains: -309,000 ha

Figure 23. Summary of hydrological changes forecasted by different predictive studies. Source: Baran 2010.

dry season. It is the lack of infrastructure and the associated structural and financial reasons that have not allowed such development and that remain the main conditions for irrigation development (Tanji and Kobayashi 2006).

Convergent studies predict significant losses in fish production following dam development. Two main analyses provide insights about the impact of dams on fish resources. According to the Strategic Environmental Assessment of Mekong

mainstream dams (ICEM 2010), the construction of 11 mainstream hydropower projects is expected to reduce the fish production in 2030 by 550,000 to 880,000 metric tons (i.e. 26%–42% less than the 2000 baseline). This would also correspond to a loss of approximately 340,000 metric tons compared to the situation in 2030 without mainstream dams. Such a loss represents 110% of the current cumulated annual livestock production of Cambodia and Laos and would have critical consequences for food security in Cambodia and Laos.

According to a study led by the IFRDI (IFReDI 2013), the construction of the Sambor and Stung Treng mainstream dams in Cambodia is predicted to reduce the supply of inland fish and other aquatic animals by between 34,000 and 182,000 metric tons. The uncertainty range depends mainly upon the hypothesized distribution of long-distance migrants' spawning habitat, and highlights the importance of new research on spawning areas. Such losses in fisheries yields would result in fish consumption dropping from 63 kg/person/year in 2011 to 29–41 kg/person/year. The impact on fish production of large hydropower dams located on Mekong tributaries is also expected to be very significant: a study by Ziv et al. (2012) predicts that the Lower Sesan 2 dam is going to reduce the fish production basinwide by 9.3% (i.e. 195,000 metric tons).

Dams are also going to retain sediments and nutrients, resulting in substantially clearer and less productive waters. The ICEM (2010) study forecasts a total loss of sediments due to retention reaching 75% of the total sediment load. In Cambodia, Halls et al. (2010) conclude that the rate of sedimentation is the best single predictor of fish biomass in the Tonle Sap, explaining 95% of the variation in fish biomass available for exploitation. Sarkkula and Koponen (2010) estimate that if sediment retention reaches 80% this will result in a 36% reduction of the fish stock compared to the year 2004. In addition to its impact on fish resources, this water clarification and substantial loss of nutrients is likely to have a significant impact on floodplain agricultural productivity, but this impact has not been quantified so far. Another consequence would be the increased erosion downstream of dams ("hungry water" phenomenon; Kondolf 1997; Kondolf et al. 2014) with consequences for riverbank gardening and subsequent socioeconomic impacts at the village level.

Other drivers of change

Large-scale investment from foreign countries is a major driver of change. The sudden groundswell of hydropower and irrigation projects by private power producers and of private financing from Thailand, Vietnam, China, Malaysia, Korea, Kuwait, Qatar, India and Russia are major drivers of change. Moreover, there

are significant vested bureaucratic, political and business interests behind the hydropower industry and large-scale irrigation (Pech 2013). Economically, China deliberately creates opportunities for economic development by promoting direct investment, cross-border trade, food and energy production, hydropower, and transport, in particular in Cambodia and Laos. In a context of large-scale investment, the socially and environmentally negative impacts of some proposed projects tend to be overlooked in the receiving countries (Pech and Sunada 2008).

Deforestation is a driver of community vulnerability. A recent study (Ashwell et al. 2011) shows that the most important driver of community vulnerability and ecosystem instability in the Tonle Sap Basin is the deforestation of the upper catchment areas and of the flooded forests around the lake. The steady decline of forested area caused by illegal logging, charcoal production and large-scale commercial agriculture results in increased flood risk in the wet season, fluctuating dry season water flows and reduced groundwater availability. Currently, local communities are so dependent on natural resources that it is vital to protect forests, wood and non-timber forest products, and to regulate runoff. Failing to ensure a smooth transition out of this dependency will increase vulnerability to climate change.

In the coming years, climate variability will be a substantial driver of change. As a primarily agrarian country, Cambodia is particularly vulnerable to climate change (MoE 2005, 2006, 2010; UNWFP 2008; MoE and UNDP 2011; UNDP 2012). Climate change is likely to accelerate the degradation of forests; increased rainfall and increased frequency of extreme weather events are expected to increase soil erosion; and changes in rainfall patterns have implications for forest productivity (MoE and Hatfield 2013). Changes in rainfall will also affect the survival of seedlings and change cropping calendars and crop varieties.

GAPS IN STRATEGIES AND PLANS

A number of inconsistencies or contradictions still affect the government's various sectoral plans. While the National Strategic Development Plan is the lead instrument reflecting the national development vision, the government is still struggling with inconsistencies among various sectoral plans at the national and subnational level (MoP 2012b). Limited coordination between ministries and departments and between national and subnational levels has also been observed in terms of implementation and accountability (MoP 2012b). The monitoring and evaluation system is in an early stage of development. Effort is also required to identify more indicators for assessing outcomes, such as indicators about inclusive growth and better governance. In terms of the environment, Cambodia faces a multitude of issues in the implementation of its environmental impact assessment process, including (i) vague stipulations for public consultations and insufficient allocation of time for these; (ii) lack of transparency and limited information disclosure; (iii) inadequate identification of

project monitoring requirements; and (iv) difficulties in coordination between ministries (World Bank 2006). Lastly, national policies and strategies are not always responsive to recent developments or to challenges such as contentious land allocation and land reforms.

Land has been largely privatized, but mechanisms for ensuring farmers have secure land ownership are not in place. Land reform has been included in the National Strategic Development Plan; however, plans for land titling have not been considered by the government. Land privatization is going on and agricultural land trade is active, but the number of landless households is increasing from year to year. The challenges of and interactions between landlessness, food insecurity and vulnerability remain unaddressed. Land distribution for landless households is mentioned in the land reform policy; however, specific measures for these groups have not been detailed and no significant action has been taken.



Plots of aquatic vegetables (morning glory, *Ipomoea aquatica*) grown in ponds in Cambodia.

Knowledge gathering and long-term planning regarding groundwater management have not been initiated. Groundwater has potential for irrigation, but its management in a context of heavy exploitation (e.g. the Siem Reap urban area), river sand mining, and subsequent deepening of riverbeds and water tables, along with arsenic contamination, has not been planned or documented.

The shift from human labor to mechanization and the emergence of high levels of emigration in rural areas have not been accounted for in government policies. Specific policy responses to the social phenomenon of large-scale migration patterns described on page 12 have not been detailed. At the same time, agricultural production practices are shifting from human labor to mechanization, and the consequences of this shift for labor opportunities have not yet been taken into account.

Most policy and donor interventions in Cambodian aquatic agricultural systems do not integrate farming and fishing. Farming and fishing have usually been considered separate subsectors in policies and in practice. For example, extension in farming and fishing is usually conducted separately by different line agencies, although most farmers are also

fishers. Some communities are subject to two or three different community organizations (e.g. community fisheries, collective farmers communities, farmers' water use communities); these organizations work separately, though most of their members are the same persons.

Cambodian agricultural products are exposed to competition in open markets without being backed by national support. The agricultural sector in Cambodia is young and weak, but its products face competition from mature and cost-efficient Thai and Vietnamese products. In the context of open markets promoted by international finance institutions, there are no subsidies or policy protections able to defend specific domestic agricultural products until they can establish themselves on the market.

The role of women in primary production has been recognized, but specific development strategies have not been articulated to assist women in the agriculture and fisheries sectors. As recognized in the Neary Rattanak III (MoWA 2009), women play a major role in agriculture and fisheries, but agricultural extension techniques targeting women or specific projects aimed at empowering women are still very limited.



A typical aquatic agricultural system landscape in Cambodia.

Aquatic agricultural systems management is faced with a number of specific gaps and weaknesses. Key gaps and challenges hampering the potential of aquatic agricultural systems to benefit the resource-poor and vulnerable in Cambodia include the following:

- neglect of common-property resources (such as land, water, fish and forests) in agriculture planning, despite their importance in rural livelihoods;
- emphasis on technological interventions, while social and institutional issues (e.g. local capacity, power dynamics and market access) remain less addressed;
- narrow sectoral objectives and approaches;
- scattered efforts by many uncoordinated players;
- insufficient extension and lack of effective mechanisms to enhance women's roles in aquatic agricultural systems.

However, multiple opportunities can also be identified in terms of institutional approaches, technical interventions and social approaches.

Institutional approaches

Improved governance, decentralization and deconcentration reforms, and private-public partnerships are promising. Both improved governance and decentralization and deconcentration reforms are beginning to show results in the form of enhanced law enforcement and social order, rural development, and poverty alleviation. There is also an opportunity for partnerships between private and public stakeholders, in particular around access to credit, improved technologies and business services. Increased involvement of the various stakeholders, in particular in water-related sectors, is also a chance to introduce more transparent and accountable decision-making, as well as better assessment of opportunities and risks in development planning.

The 500 community fisheries already established are an important asset for the management of fisheries resources. AAS could in particular examine how community fisheries can be promoted and strengthened for multiple objectives (natural resource management,

food security, income generation and poverty alleviation) and for better integration with other community groups (e.g. farmers' communities, water use communities, etc.). It is important to improve the dialogue between community fisheries, communes, districts and provinces to ensure that needs, capacities and constraints at the village level are better covered in policy and planning processes. From the same perspective, putting in place a strategic framework for aquaculture development is also recommended.

Technical interventions

Decreasing the pressure and dependence on fisheries is essential. Decreasing dependence on capture fish is the key to relieving pressure on inland fisheries. One of the options for doing this consists of putting the emphasis on aquaculture development while offering solutions for (i) improved supply of hatched fingerlings; (ii) improved supply of protein feed content that is not based on capture fish; (iii) support for the development of different kinds and scales of aquaculture; and (iv) promotion of and extension support for indigenous species rather than exotic species. However, aquaculture development requires substantial investment and knowledge, which implies that this option is not accessible to many of the rural resource-poor.

In fisheries, there are opportunities in the creation and management of protected areas. The "one village-one protected area" policy is promising, but its systematic implementation faces obstacles that still need to be addressed.

It may take decades to build a livestock sector able to replace the protein currently provided by capture fish. The new policy supporting livestock development is an opportunity for replacement of fish protein, but experience shows that it takes decades to build a new competitive sector, and the meat produced will be much more costly than capture fish in terms of production costs and land requirements. Orr et al. (2012) show that in order to replace fish protein lost due to mainstream dam development with protein from livestock products, Cambodia would have to increase its

pasture land area by 3751 km² to 19,373 km², which is a 25% to 129% increment compared to the 2005 pasture land area. Meanwhile, proposing livelihood alternatives to rural households is an activity that remains central to the development and resilience-building agendas in Cambodia.

Increased agricultural productivity and diversification are central to rural development. Increased productivity can be achieved not only through irrigation and fertilization, but also—and importantly—through better farming practices resulting from improved extension. AAS needs in particular to focus on rice cultivation techniques that do not require extensive use of modern inputs and that use inexpensive methods of planting in relatively dry areas. Identifying cost-efficient communication methods to ensure farmers' adoption of new practices is another important contribution to development.

Significant potential lies in the diversification and improvement of value chains. The concept of “one village-one product” does not help in coping with climate change and shocks. Rather, diversified agricultural products and sources of income would strengthen resilience and adaptive capacity. There is also considerable potential in the improvement of processing and subsequent value chains (income improvement and diversification, job creation, etc.). Such improvements must in particular ensure that the benefits derived from enhanced postharvest and marketing are more fairly distributed, socially and regionally (e.g. Gesellschaft für Internationale Zusammenarbeit [GIZ] Green Belt Project in Siem Reap). From that perspective, improving information about markets would greatly improve the efficiency of and overall returns from surplus production systems.

There is room for improvement in agricultural and irrigation planning. Agricultural management would substantially benefit from more systematic agricultural land use zoning, soil productivity potential mapping, water use efficiency analyses, and vulnerability mapping (ADB 2011). As for irrigation, the conditions of and options for large public investment need to be seriously and openly debated. The deliberation should integrate perspectives in the global food market, requirements for improved supply of the

nutrient sources currently deficient at the national level (vegetables rich in vitamins, nonfish animal protein, etc.) and expected impacts of climate change. The prospective analysis should also discuss the best ratio of large-scale versus small-scale irrigation projects, without necessarily prioritizing large scale (since smallholder irrigation responds better to local markets and needs). Finally, optimizing irrigation also requires a detailed analysis of the costs and benefits of water infrastructure development on landlessness, resettlement, livelihood options, fish production, loss of natural resources, groundwater and biodiversity (Pech 2013).

Social approaches

Landlessness and land poorness are critically challenging issues among rural communities. From this perspective, AAS could work at better understanding the main risks and challenges faced by households with little or no land, the approaches that would reduce risks and food insecurity among landless households, and ways of promoting social land concessions for landless and near-landless householders.

Development and management opportunities should be explored outside formal groups. Many community fisheries have been legally empowered, but a number of them remain idle or ineffective, this being perceived by villagers as an obstacle to community participation. In contrast, the efficiency of informal (often women-driven) savings groups shows that community groups not structured or endorsed by line agencies can also contribute effectively to local development. Further exploring the options provided by informal groups could be very productive.

There is clearly a need to engage women on their own terms and to create realistic options for their participation. AAS could be very influential in identifying the conditions for enhanced participation of women in decision-making. In that regard, less formal institutions and the support of households are keys to ensuring female participation.

Capacity building and learning by doing remain central to development. Learning by doing is an approach that has proven effective; furthermore, this approach promotes adaptation, flexibility and openness to change. Such learning by doing should be considered in the context of partnerships between civil society and the private sector. Lastly, capacity building should integrate cross-departmental linkages in the targeted areas.



Photo Credit: Eric Barany/WorldeFish

Traders buying fish around a bagnet fishery on the Tonle Sap River (Cambodia).

NOTE

- ¹ Recent population estimate: 14.9 million in 2012 (www.indexmundi.com/cambodia/demographics_profile.html).

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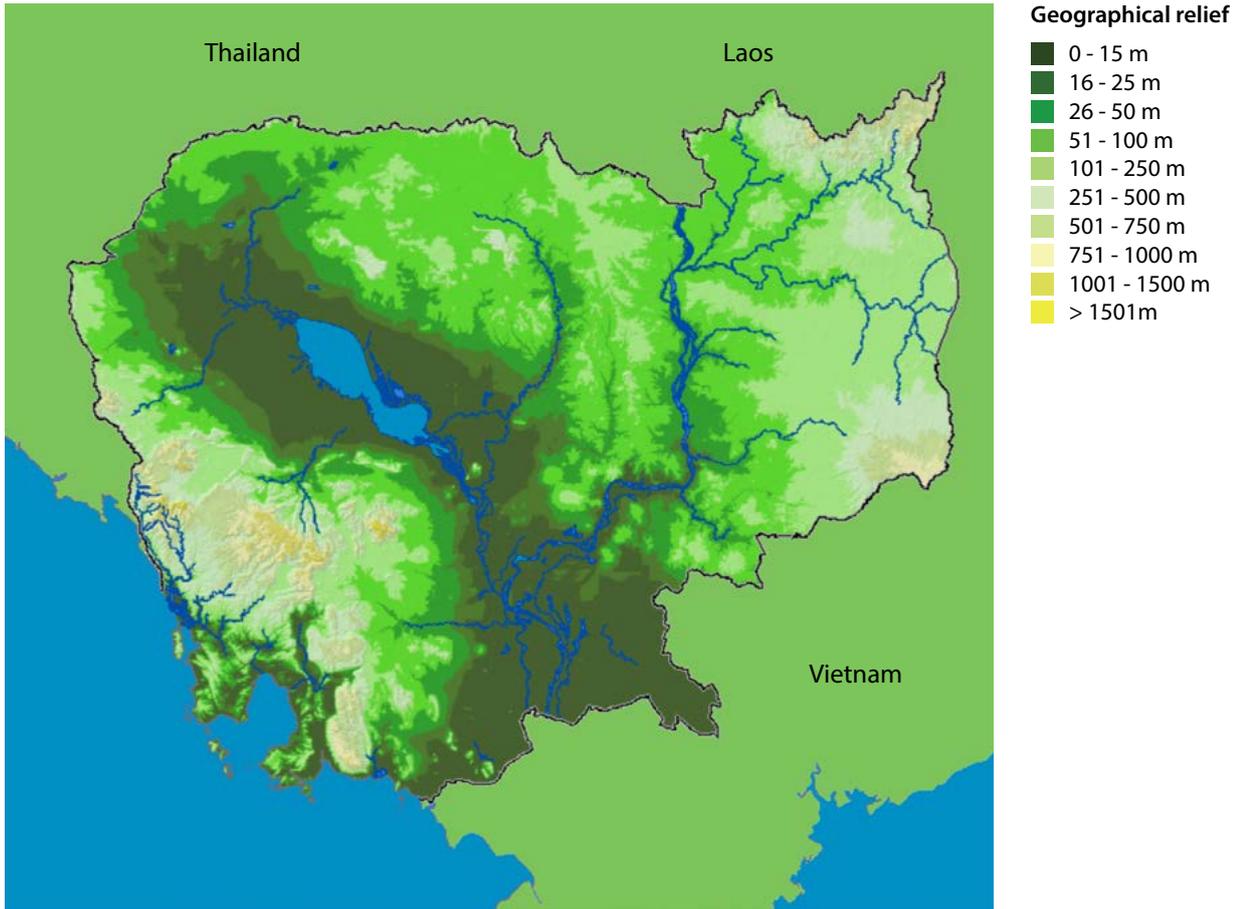


Figure 24. Relief in Cambodia. Source: SCW 2006.

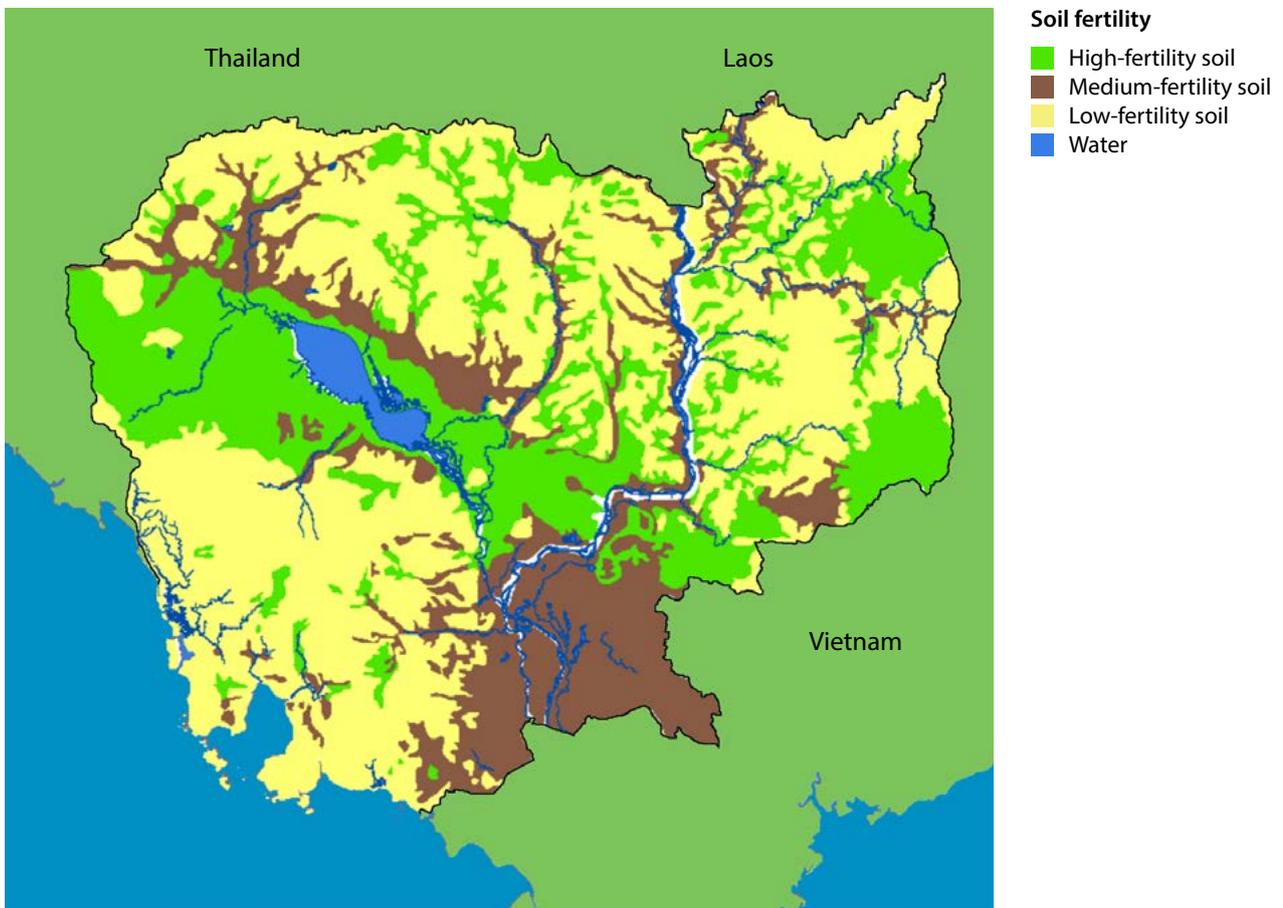


Figure 25. Relief and soil fertility in Cambodia. Source: SCW 2006.

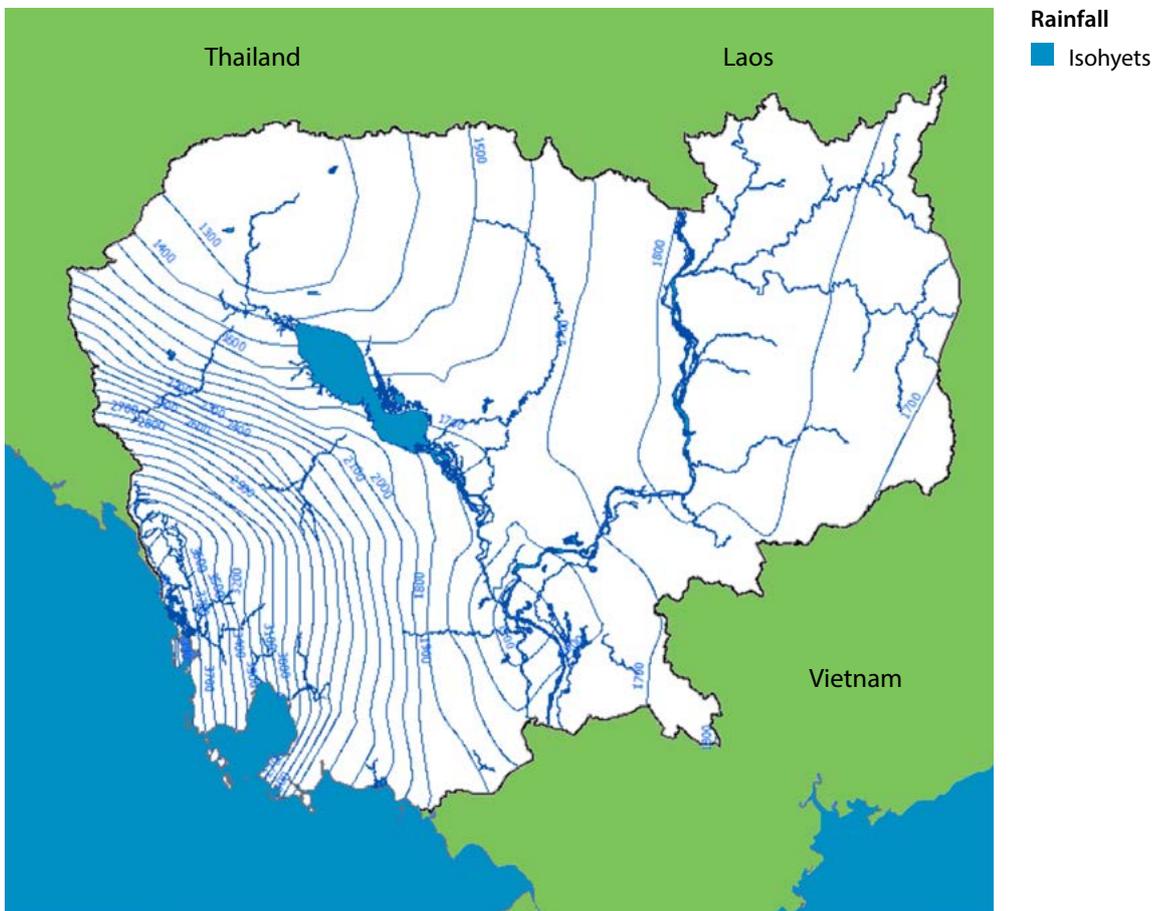


Figure 26. Rainfall in Cambodia. Lines are rainfall isohyets. Source: SCW 2006.

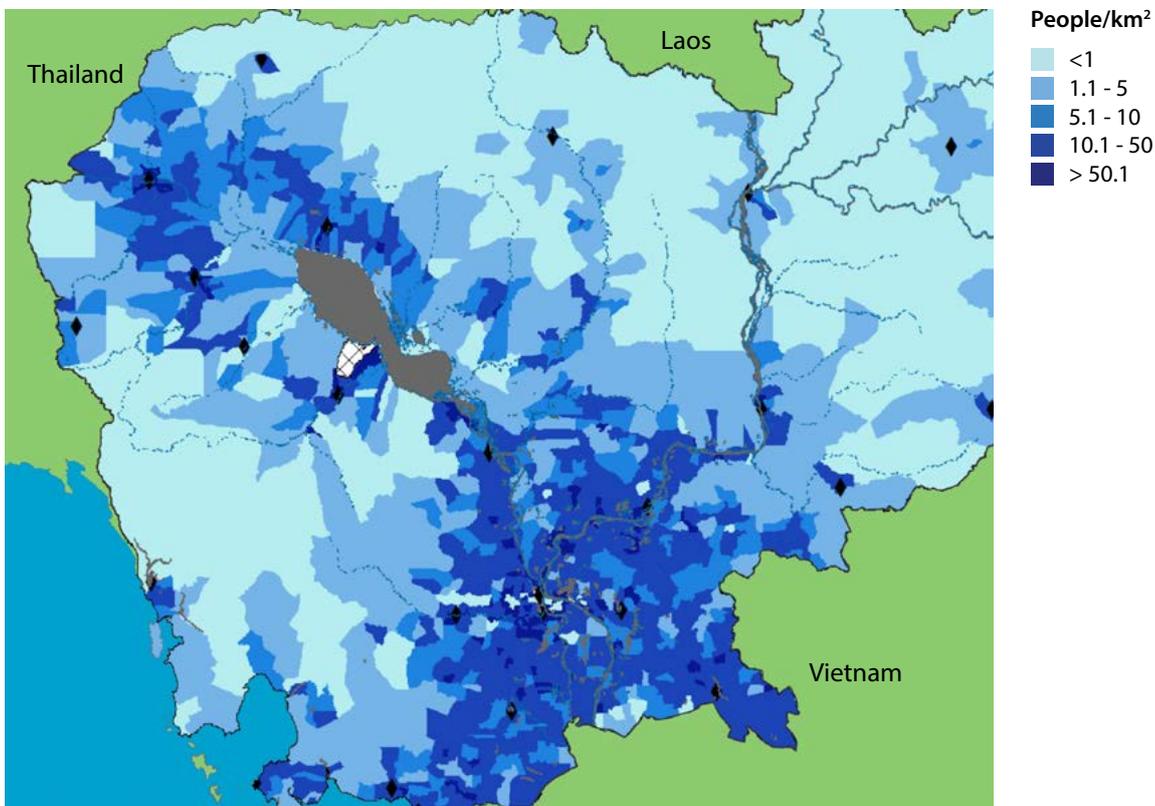


Figure 27. Population density in Cambodia. Source: 1999 data from the Cambodia Reconnaissance Survey Digital Data, MPWT and JICA.

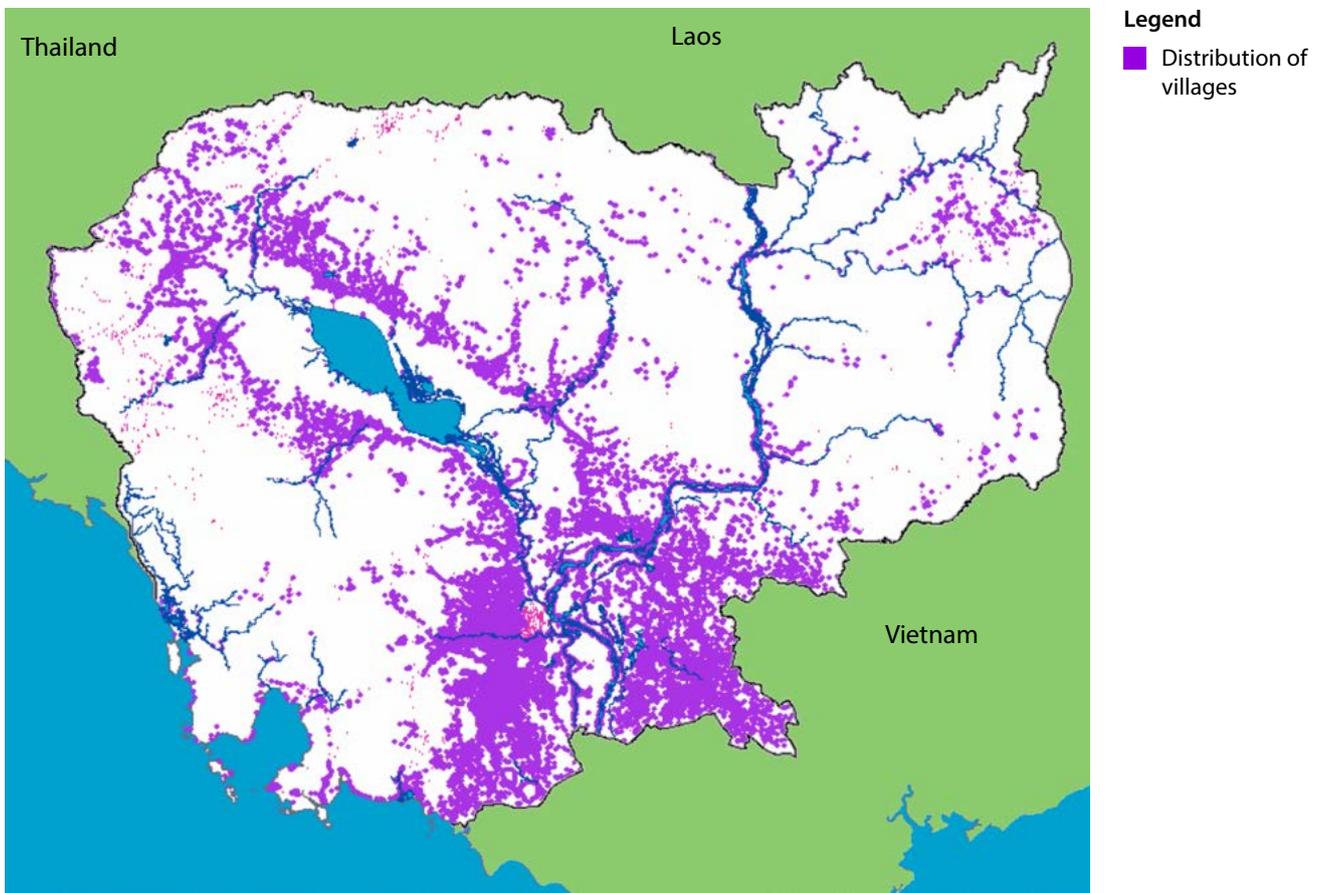


Figure 28. Distribution map of villages. Source: SCW 2006.

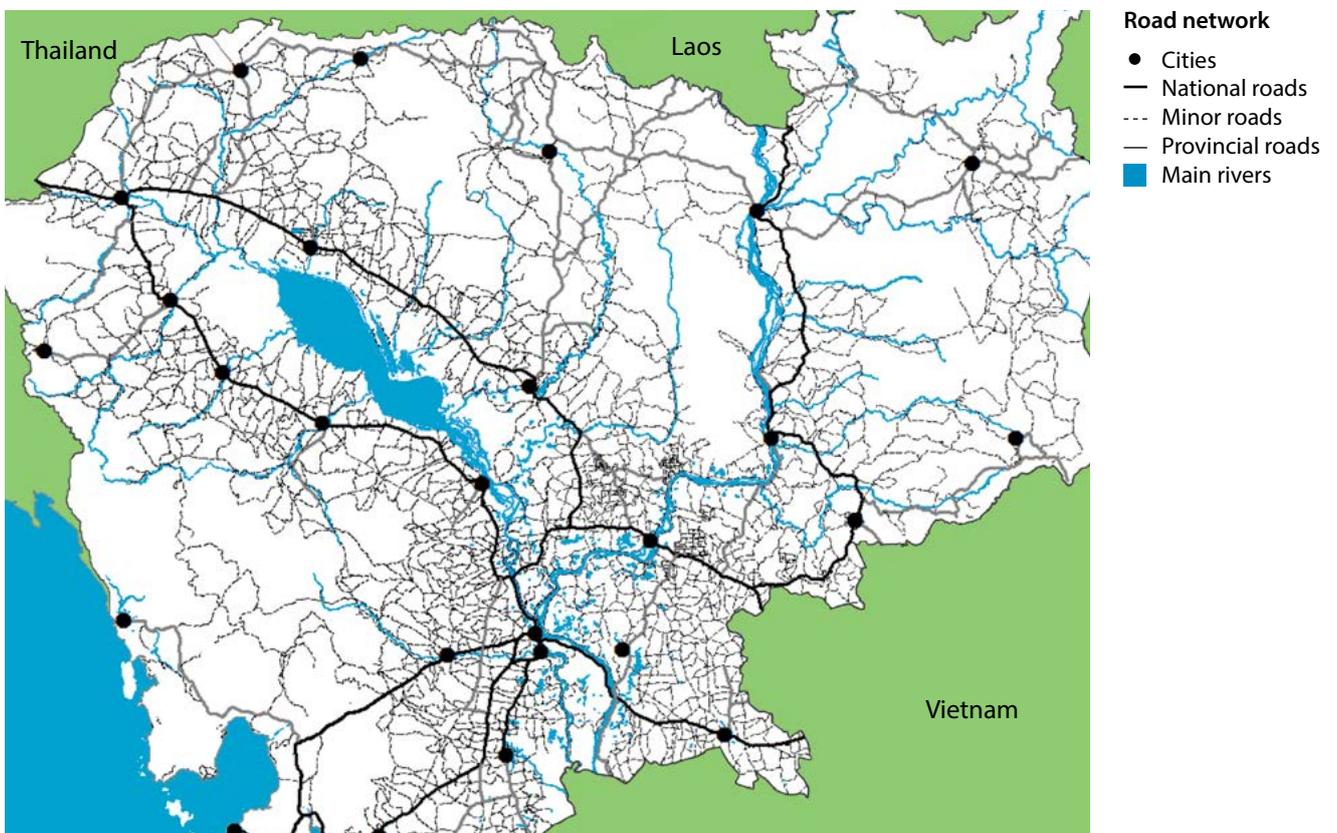


Figure 29. Road network. Source: MPWT and SCW 2006.

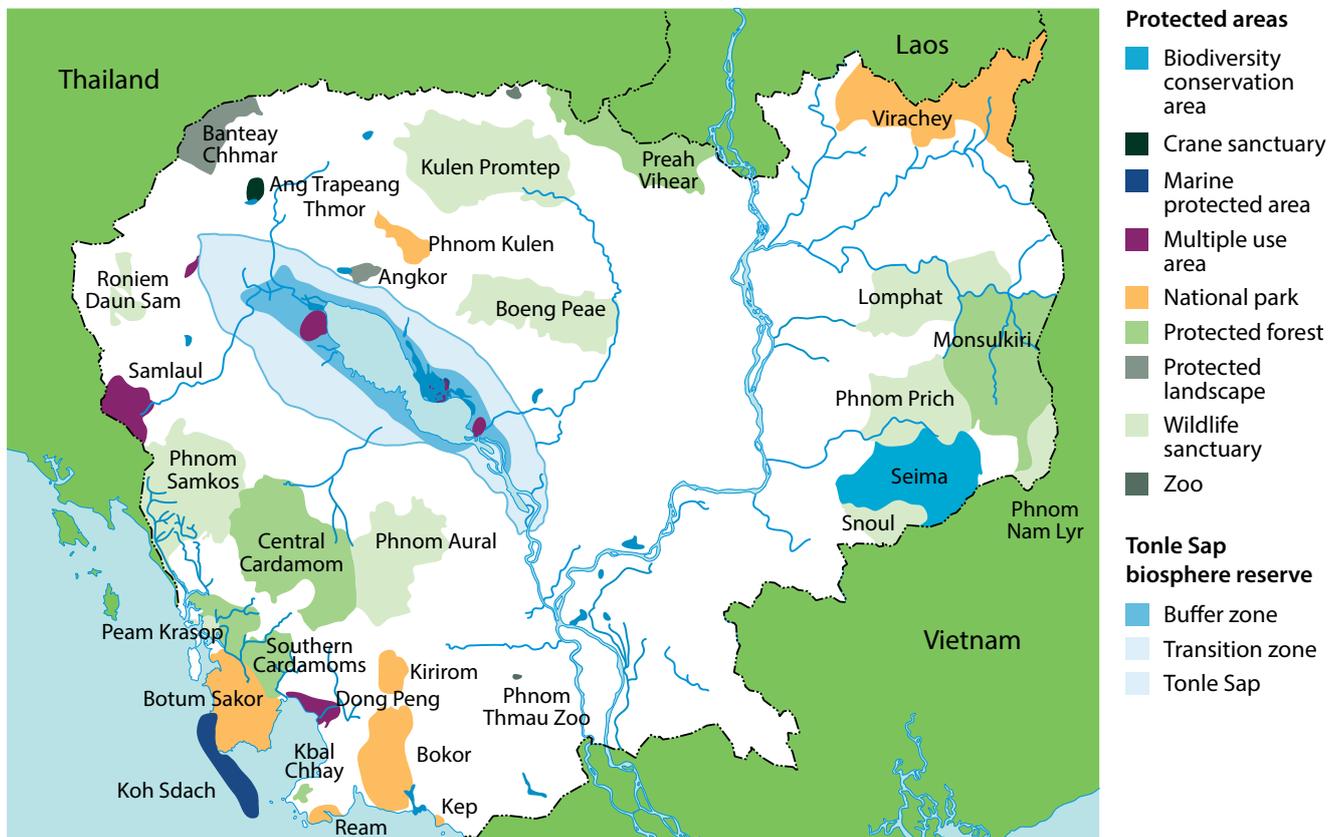


Figure 30. Map of protected areas in Cambodia. Source: SCW 2006.

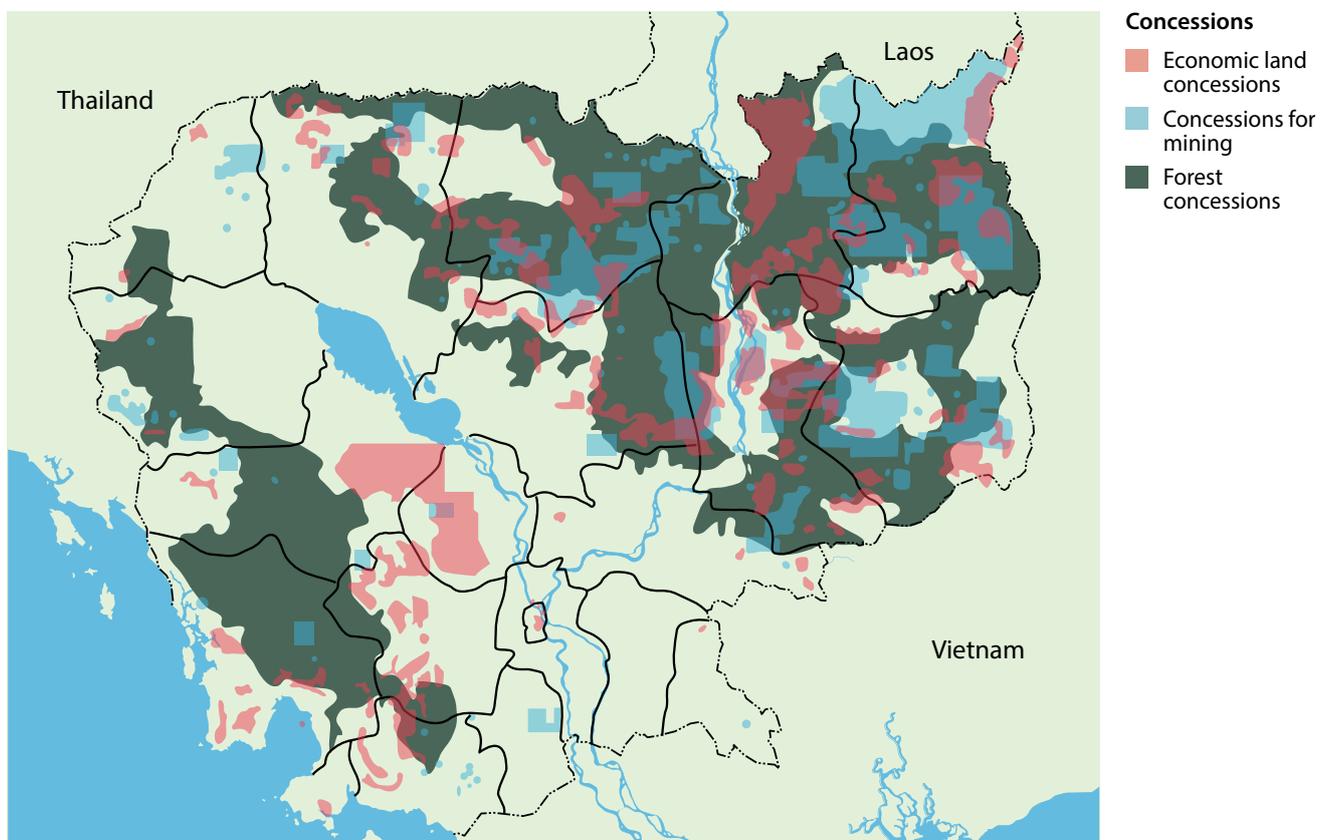


Figure 31. Map of land concessions in Cambodia. Source: Open Development Cambodia (www.opendevelopmentcambodia.net/maps).

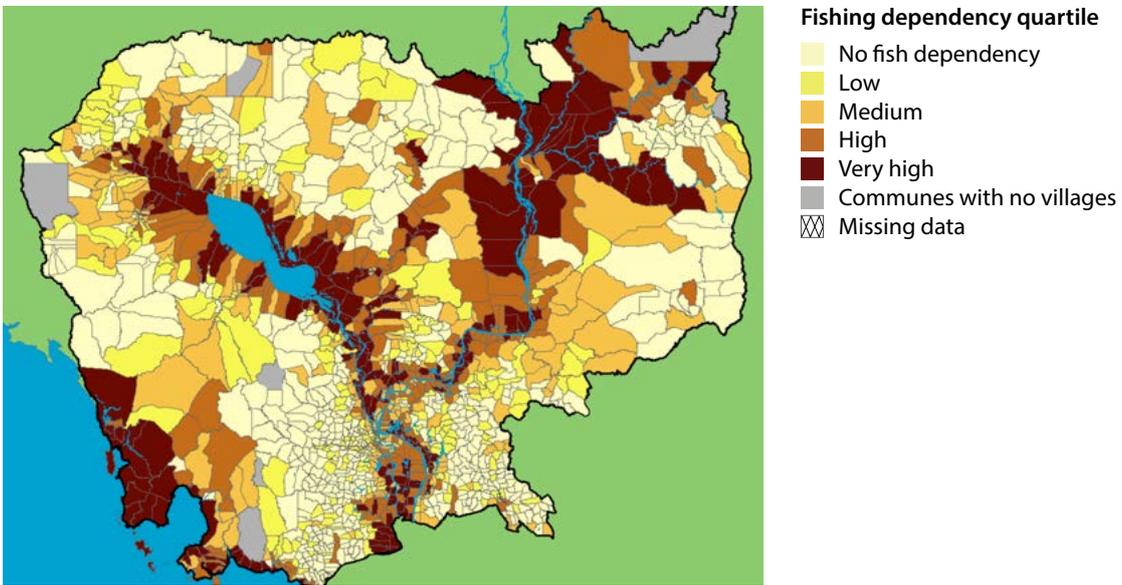


Figure 32. Fishing dependency by commune in Cambodia. Source: Nasielski et al. 2013.

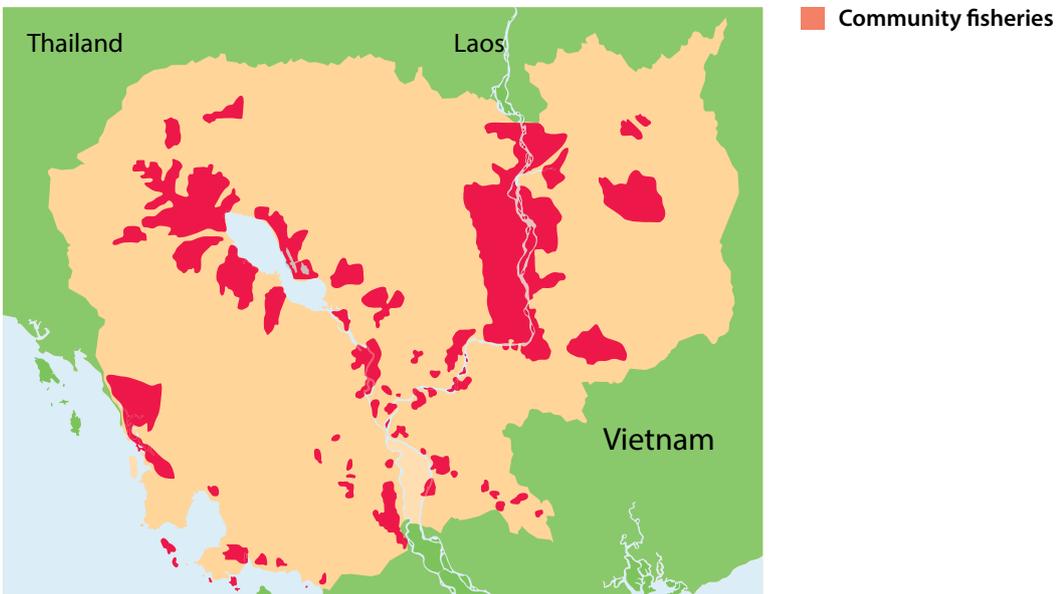


Figure 33. Community Fisheries in Cambodia. Source: SCW 2006.



Figure 34. Community fisheries and rice production zones. Source: SCW 2006.

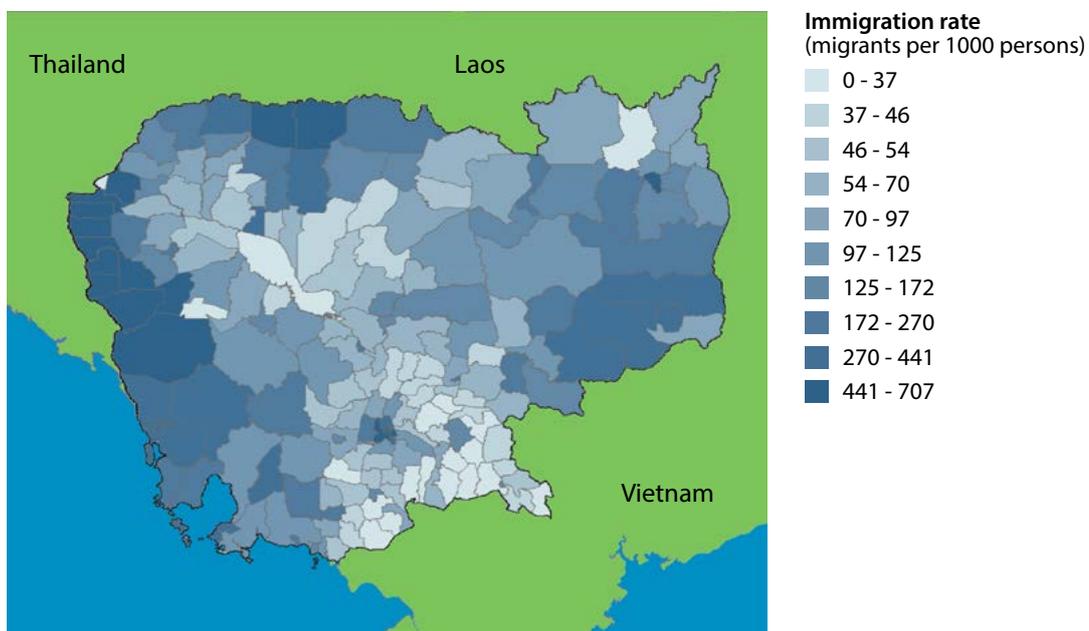
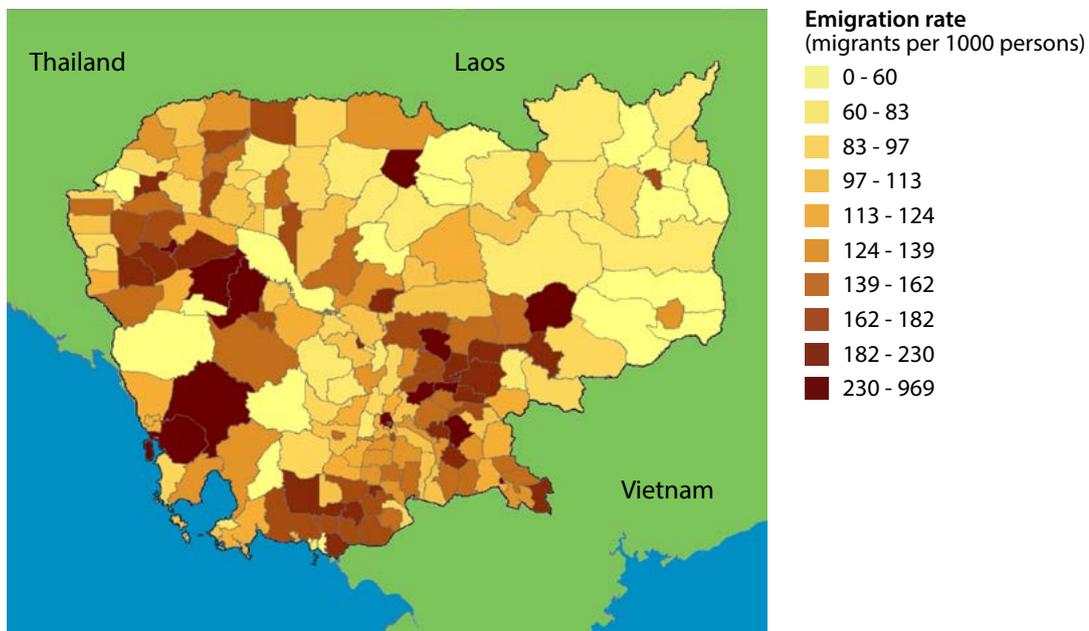


Figure 35. Migration rates in Cambodia. Source: SCW, personal communication, 2014.

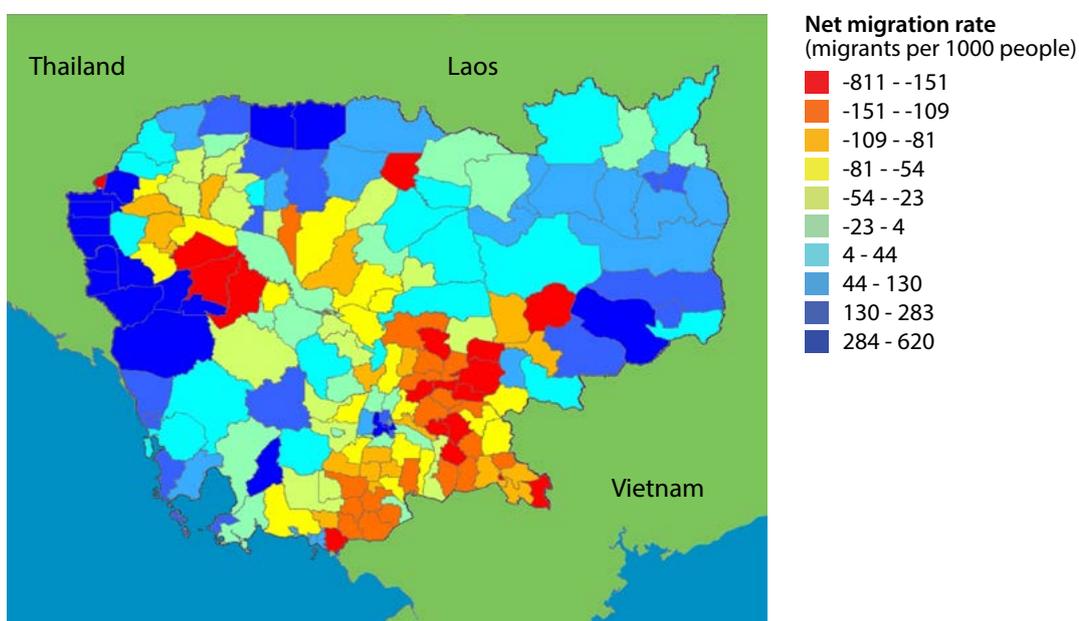


Figure 36. Net migration rate in Cambodia. Source: SCW, personal communication, 2014.

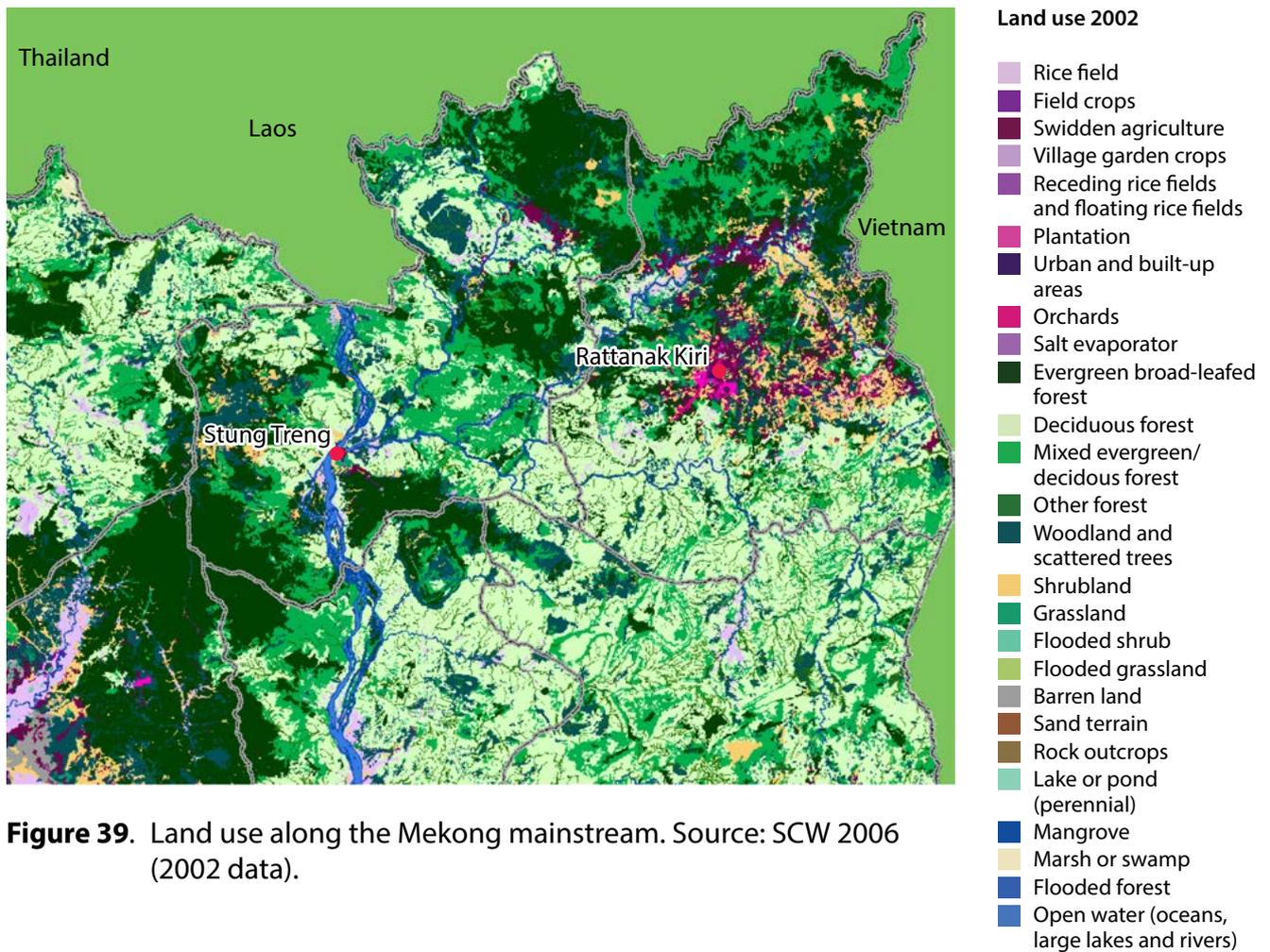


Figure 39. Land use along the Mekong mainstream. Source: SCW 2006 (2002 data).

Activities	When											
	January	February	March	April	May	June	July	August	September	October	November	December
Wet season rice												
Upland rice (<i>chamkar</i>)												
Cultivation of other crops												
Corn												
Beans												
Watermelon												
Other (chili, tobacco, sesame, etc.)												
Fishing												
<i>Wet season</i>												
<i>Dry season</i>												
Livestock-keeping												
Forest product collection												
Resin collection												
Hunting with dogs												
Chick collection												
Frog hunting												
<i>Wet season</i>												
<i>Dry season</i>												
Cricket collection												
Mollusk collection												
Wild fruit collection												
Wild vegetable collection												
Laboring												
Motor-taxi												
Other work												

Table 1. Timing of rural livelihood activities in the Mekong River hub. Source: WorldFish internal report, Challenge Research Program 1.3: Proposed Approach for Cambodia; adapted from Allen et al. 2008.

<p>Poorest households</p> <ul style="list-style-type: none"> • Little or no land. Perhaps one draft animal but no farming instruments. • Housing made of thatch in very poor condition. Few household utensils. • Live on hand-to-mouth basis (food shortages for up to 8 months). • Much reliance on natural resources to meet subsistence needs. • Accumulated debts and inability to repay or borrow additional amounts. • No kinship support; large families with 5–12 children.
<p>Poor households</p> <ul style="list-style-type: none"> • Have land of less than 2 ha in unfavorable locations (slopes, no water source). • Usually have at least a pair of draft animals and at least some farming instruments. • Houses made of thatch, sometimes with tile roofs and bamboo walls. • Limited number of household utensils; food shortages of 3–6 months duration. • Able to borrow money for rice farming and family.
<p>Lower medium income</p> <ul style="list-style-type: none"> • Have land of less than 3 ha. Draft animals and farming instruments. • Houses made of bamboo or wood, thatched roofs and walls, and tile roofs. • Food shortages of 3–4 months duration; able to borrow money for rice farming.
<p>Middle income</p> <ul style="list-style-type: none"> • Landholding of up to 6 ha; 2–4 draft animals, some livestock, and all farming instruments. • Houses made of wood with either bamboo or wooden floors and tile roofs. • Reasonable number of household utensils. • No food shortages, except when major crisis (illness) or ritual (wedding) occurs. • Limited cash savings. Small-scale business, old motorbike or boat.
<p>Non-poor</p> <ul style="list-style-type: none"> • Having more than 1 ha of very productive agricultural land. • At least two draft animals and many other livestock and farming instruments. • Houses made of permanent building materials, including corrugated iron and tiles. • Full food security with limited surplus for lending, sale or labor exchange. • Well-furnished households, often with television sets. • Able and willing to lend money to other villagers.

Table 2. Typology of farming households in Cambodia. Source: ADB 2005.

Development partner	Development activity or project name	Duration	Amount
Water resources management policy and institutional capacity building			
ADB	Agriculture Sector Program	1996–2000	USD 30 million (loan)
France (AFD)	Support for the Development of Agriculture and Water Sector Policies	2006–2009	USD 1.5 million (grant)
France (AFD)	Northwest Irrigation Sector Project	2004–2010	EUR 4 million
Australia	Water Resource Management Research Capacity Development Program	2006–2011	AUD 2.99 million
FAO	Strengthening the Participatory Irrigation Management and Development Strategy	2007–2009	USD 0.375 million
Japan (JICA)	Technical Services Centre for Irrigation Systems, Phases I and II	2001–2005; 2006–2009	USD 5 million
Republic of Korea (KOICA)	Master Plan of Water Resources Development in Cambodia	2006–2008	USD 1.5 million
UK (DFID)	Natural Resource Management and Livelihoods Program	2006–2010	GBP 13.6 million
UNDP, Global Environment Facility, the Netherlands	Mekong River Basin Wetland Conservation and Sustainable Use Program	Ongoing	USD 31.5 million
Projects (including preparation studies) in integrated water resource management, irrigation, flood control, water supply and sanitation			
ADB	Tonle Sap Environmental Management Project	2003–2008	USD 19.3 million
ADB	Emergency Flood Rehabilitation Project (including rural infrastructure and irrigation and flood control)	2001–2003	USD 10.8 million + USD 6.4 million
ADB	Project Preparatory Technical Assistance Second Rural Water Supply and Sanitation Sector Project	2008–2009	USD 0.6 million
ADB	Project Preparatory Technical Assistance Water Resources Management Sector	2007–2010	USD 1.56 million

Development partner	Development activity or project name	Duration	Amount
ADB	Tonle Sap Lowland Rural Development Project (three provinces)	2008–2015	USD 24 million
ADB	Water Resources Management Sector Development Program	2011–2018	USD 31.9 million
ADB, France (AFD)	Stung Chinit Irrigation and Rural Infrastructure	2001–2006	USD 23.8 million
ADB, France (AFD)	Northwest Irrigation Sector (NWISP)	2005–2013	USD 30.87 million
France (AFD)	Rehabilitation of Prey Nup Polders	2002–2008	EUR 3.8 million
Australia (AusAID)	Cambodia Agriculture Value Chain Program (CAVAC)	2007–2012	AUD 45 million
China	Stung Staung Water Resources Development	2012–2015	USD 52 million
China	Kanghot Irrigation Development Project in Battambang Province	2010–2014	USD 61 million
China	Stung Pursat Dam No. 3 and No. 5 Development Project in Pursat Province	2011–2014	USD 80 million
China	Sreng River Water Resources Development Project in Siem Reap, Banteay Meanchey and Oudor Meanchey Provinces	2011–2015	USD 65 million
China	Kampong Trabek River Flood Control Project in Prey Veng Province	2010–2014	USD 31 million
China	Vaico Irrigation Development Project – Phase I in Kampong Cham, Prey Veng and Svay Rieng Provinces	2011–2015	USD 130 million
China	Vaico Irrigation Development Project – Phase II in Kampong Cham, Prey Veng and Svay Rieng Provinces	2013–2015	USD 130 million
China	Prek Stung Keo Water Resources Development Project (Kampot)	2011–2015	USD 52 million
India	Rehabilitation West Baray Irrigation Scheme	2005–2008	USD 5 million

Development partner	Development activity or project name	Duration	Amount
India	Stung Tasal Storage Reservoir Development Project	2011–2014	USD 19 million
India	Stung Sreng Reservoir Rehabilitation	2010–2012	USD 5 million
International Monetary Fund	Eastern Rural Irrigation Development Project (ERIDP)	2007–2011	USD 33.8 million
Japan	Project for the Rehabilitation of the Kandal Stung Irrigation System	2005–2008	JPY 1740 million (grant)
Japan	Study – Comprehensive Agricultural Development of Prek Thnot River Basin	2003–2008	JPY 423.35 million
Japan	The Basin-Wide Basic Irrigation and Drainage Master Plan Study	2007–2009	JPY 147.91 million
Japan	Rehabilitation of Small Irrigation Rehabilitation Projects in Kampong Cham Takeo, Kandal, Pursat and Kratie Provinces	2008–2009	USD 0.35 million
Japan	Improvement of Agricultural River Basin Management and Development Project (TSC3)	2009–2014	USD 0.72 million
Japan	Project for Rehabilitating Boeung Veam Irrigation System in Kampong Cham Province	2010–2011	USD 0.10 million
Japan	Project for Rehabilitating Kbal Tonsoung Irrigation System in Kampong Cham Province	2008–2009	USD 0.09 million
Japan	Project for Rehabilitating Portasu Irrigation in Takeo Province	2009–2011	USD 0.18 million
Japan	Project for Rehabilitating Thanal Cham Reservoir in Kandal Province	2008–2009	USD 0.09 million
Japan	Project for Rehabilitation of Toul Kou Irrigation in Pursat Province	2007–2008	USD 0.08 million
Japan	The Project of Rehabilitation of Bos Leave Irrigation System in Kratie Province	2007–2008	USD 0.09 million
Japan	West Tonle Sap Irrigation and Drainage Rehabilitation and Improvement Project (six subprojects)	2011–2016	USD 54.5 million

Development partner	Development activity or project name	Duration	Amount
Japan, Republic of Korea	JICA/KOICA Joint Program for the Rehabilitation of Irrigation System and Rural Community Development in Cambodia	2009–2009	USD 0.3 million
Japan (JICA), Italy (<i>Associazione per la Partecipazione allo Sviluppo</i>), WFP	Kamping Pouy Irrigation Rehabilitation and Rural Development	1998–2006	USD 5.6 million
Republic of Korea	Tamauk Irrigation Rehabilitation Project	2002–2004	USD 1.9 million
Republic of Korea	Multipurpose Dam Development, Battambang	2006–2007	Not applicable
Republic of Korea	Krang Ponley Water Resources Development Project	2006–2010	USD 27 million
Republic of Korea	Multipurpose Water Resources Development, Krang Ponley	2008–2012	USD 29.51 million
Republic of Korea	Construction of Irrigation System in Batheay District	2009–2010	USD 2.5 million
Republic of Korea	Dauntri Multipurpose Dam Development Project (Battambang)	2009–2013	USD 45.96 million
Republic of Korea	Mongkol Borey Dam Development Project (Battambang)	2009–2013	USD 24.3 million
Republic of Korea	Surrounding Bayong Kouv Reservoir Improvement Project (Takeo)	2010–2013	USD 3.01 million
UNDP	Promoting Climate-Resilient Water Management and Agriculture in Rural Cambodia	2009–2013	USD 4.09 million
World Bank	Emergency Flood Rehabilitation Project (EFRP)	2002–2005	USD 11.91 million
World Bank	Provincial and Peri-Urban Water Supply and Sanitation Project	2003–ongoing	USD 23 million
World Bank	Mekong-Integrated Water Resources Management Project – Component 2: Water Resources Management in East Mekong Delta	2010–2012	USD 0.33 million

Table 3. Development projects related to agriculture, rural development and natural resources. Source: ADB Water Resources Sector Development Program 2013.



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About the CGIAR Research Program on Aquatic Agricultural Systems

Approximately 500 million people in Africa, Asia and the Pacific depend on aquatic agricultural systems for their livelihoods; 138 million of these people live in poverty. Occurring along the world's floodplains, deltas and coasts, these systems provide multiple opportunities for growing food and generating income. However, factors like population growth, environmental degradation and climate change are affecting these systems, threatening the livelihoods and well-being of millions of people.

The CGIAR Research Program on Aquatic Agricultural Systems (AAS) seeks to reduce poverty and improve food security for many small-scale fishers and farmers depending on aquatic agricultural systems by partnering with local, national and international partners to achieve large-scale development impact.

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