

Appendix

Study sites

Village A

Situated in a highly flood-prone area on the Mekong River floodplain, Village A is home to 1341 people, living in 334 households. In addition to residential areas located on artificial hills built over many generations, the landscape of the village consists of paddy fields, creeks, and lakes connected to the Mekong tributary Tonle Touch. The lakes are filled each year by the seasonal Mekong floods between August and October, making this a highly flood-prone area in which upper and lower land are used and inhabited differently. For example, there are two different forms of paddy fields: the village fields, *Srear Phum*, and the low-lying fields, *Srear Kroum* or *Sreak Bueng*. Traditionally, farmers grew rice varieties that are susceptible to seasonal floods: 6-month varieties usually grown at the beginning of the rainy season, from late May or early June to November or December. While some farming households still cultivate these varieties primarily for household consumption, most farmers now cultivate dry-season rice two to three times per year, starting from September until June.

Given its regular propensity to flood, as well as the presence of irrigation systems and groundwater wells, droughts have not been a critical issue in Village A in recent years. Floods, by contrast, can be understood in two ways: seasonal floods linked to the Mekong and floods due to heavy and repeated rainfall. The impact of the Mekong floods depends on the location and topography of the land. In most years, the lowland *Srear Kroum* is flooded during the wet season. Major Mekong floods can also flood the upland *Srear Phum* paddy fields, but major floods from the Mekong have not occurred in over 10 years. Nevertheless, given the risks of being affected by the Mekong major floods, those farmers possessing upland *Srear Phum* avoid cultivating short-term dry-season rice during the most flood-prone period, between July and September. Lowland paddy fields by contrast are more prone to seasonal floods as well as pests and rats, meaning that farmers don't cultivate rice during the wet season and Mekong flooding season. Despite these precautions, rainfall and flooding patterns have become the key issues leading to crop losses in Village A. Dry-season rice – with stems that are less than one meter high – is highly sensitive to irregular climate variations such as rainfall and excess heat. At the same time, 57% and 58% of participants reported a major increase in the intensity of rainfall and the overall temperature respectively compared to 10 years ago. In addition, the successful cultivation of dry-season rice is also dependent upon market prices which tend to fluctuate significantly.



Figure 3. Rice land in the Srear Kroum (December 2021) Photo by Sopheak Chann

Village B

Village B contains a population of 1,222 people, living in 254 households. Located in the outskirts of Phnom Penh, the village is relatively urbanised and its population density is much higher than that of Village A. The village's total area of paddy fields encompasses 30 hectares of land, whilst alternative crops, including both seasonal (sesame, corn, and beans) and long-term (fruit trees such as mango and monkey apples) crops, cover approximately 15 hectares of land. The major livelihoods in the village remain farming and out-migration work. However, given the relatively small amount of land possessed by villagers, people in Village B depend to a greater extent on non-farm activities than the other two study villages.

Located on the Mekong floodplain, agriculture in Village B is largely defined by seasonal wetland lakes, Mekong tributaries, and irrigation systems. Three types of land forms can be observed, low-lying *Srear Kroum* rice land near lakes, higher *Srear Phum* rice land, and cash-cropping *Chamkar* land along the creek. *Srear Phum* covers the majority of the Village B land area, extending from the Northeast to the Southeast while *Srear Kroum* is located in the low-lying seasonally flooded area, Southwest of the village.

Irrigation systems in Village B are generally unreliable. The system was built during the Khmer Rouge and abandoned until the early 2000s. The pumping station and the major canals have been rebuilt multiple times but have remained largely non-functional due to uncoordinated water governance and the extensive cost of pumping the water from the Mekong River into the canals (see Figure X). Consequently, only a small proportion of farmers in Village B are able to reliably access irrigation. While only 9% of participants in Village B reported a minor increase in the size of the irrigated area they hold compared to five years ago, just 1 out of 301 reported a major increase. Inspired by some successful stories of other farmers despite these challenges, many farmers in Village B have recently turned to practice dry-season rice, leaving them prone to environmental variations and market fluctuations in rice prices as well as agricultural inputs such as fertilisers.



Figure 4. Pumping water from the largely non-functioning canal (January 2021), photo by Sopheak Chann

Village C

Home to 1458 people living in 369 households, Village C is located at the intersection of the Tonle Sap flood plains and a local river catchment, generating a dual pattern of land use. Similar to the other two villages, there are two forms of land, the low-laying Tonle Sap flood plains *Srear Kroum* and the *Srear Phum* village land. Most upland *Srear Phum* land is used for wet-season and a little dry-season rice. Farmers cultivate different varieties of wet-season rice, partly depending on the geographical location of their land plots and water access. Lowland *Srear Kroum*, on the other hand, has a more complex history. Traditionally, farmers of this land grew floating rice in which farmers start casting their rice at the beginning of the rainy season and harvest when the flood has ended in November and December. However, the diminished prominence of seasonal floods has induced some farmers to grow short-term, dry season rice, starting during the period when floods recess in October or November.

Yet, very limited farmland in Village C has access to irrigation systems, with most paddy fields depending wholly on rainfall. Only 5% of participants in Village C reported a minor increase in the irrigated area they hold compared to 5 years ago. None reported a major increase. In recent years, farmers have been faced with drastic environmental changes, particularly linked to changes in land uses, flooding dynamics, and severe droughts. While records indicate that in the last decade the village faced frequent and severe droughts which have damaged rice on more than one occasion, in the last three years, rice production has also been damaged by floods due to unseasonal flooding of the river.