CAMBODIA COMPONENT FINAL REPORT

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With the support of
AFD AGENCE FRANÇAISE DE DEVELOPPEMENT

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ACRONYMS

CFI:	Community Fishery
MoWRAM:	Ministry of Water Resources and Meteorology
MRC	Mekong River Commission
PDoWRAM	Provincial Department of Water Resources and Meteorology
PDA	Prek Development Area
PMP	Prek Master Plan
PMU	Project Management Unit
TA	Technical Assistance
WAT4CAM	Water Resource Management and Agro-Ecological Transition in Cambodia

1. INTRODUCTION

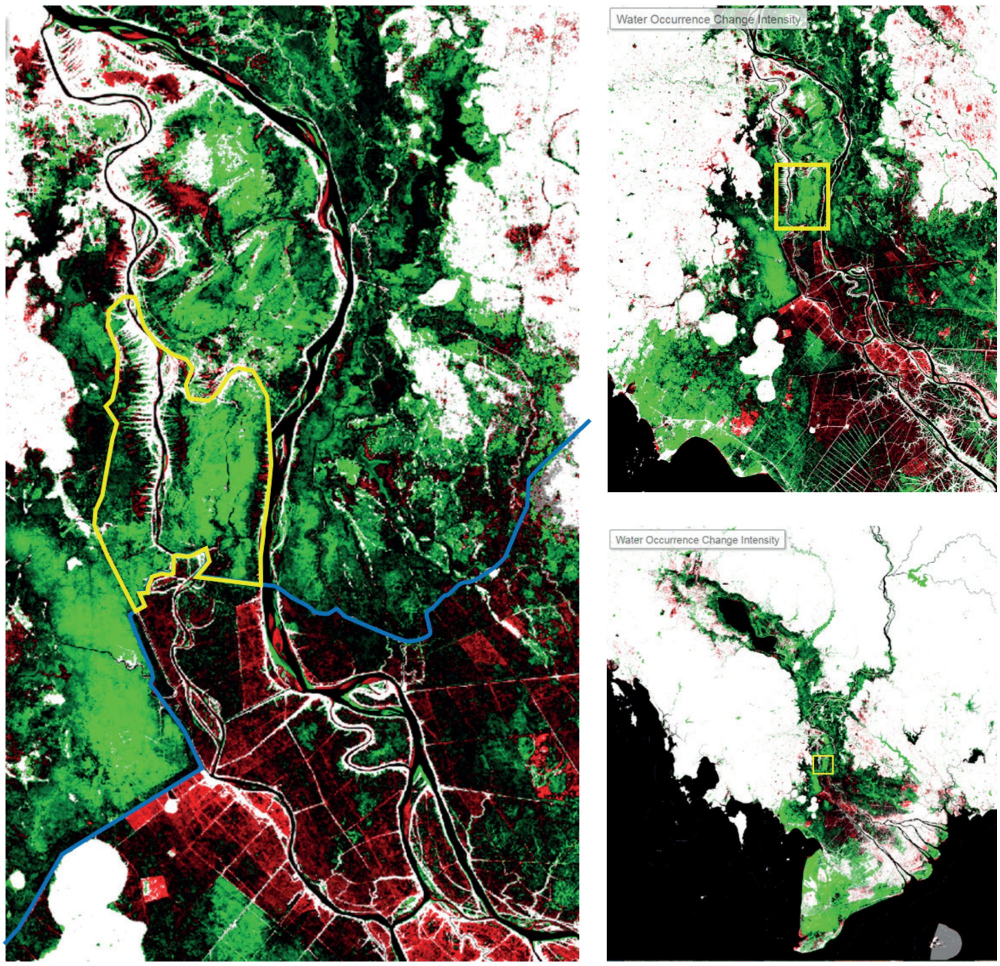
COSTEA identified the issue of irrigation development and management in large floodplains as being important and funded an "Structuring Action" on the topic. Large floodplains are among the most densely populated areas of the world but also the most vulnerable to climate change. They also support intensive irrigated agricultural systems that are central to local and global food security but whose sustainability is increasingly being questioned on social (land concentration), economic (high levels of smallholder farmers indebtedness), environmental and health (over-reliance on chemical inputs) grounds.

Since the 1960s, floodplain development and management has been envisioned through the lens of infrastructure construction for flood protection and agricultural intensification. However, this approach is increasingly being questioned (e.g. Wesselink et al., 2015) due to its ever-increasing costs and mounting evidence that it merely consists in "dodging the issue" as climate change means more frequent yet hardly predictable extreme events. Notions of environmental engineering and nature-based solutions (WWAP, 2018) that recognize the multiple services populations derive from ecosystems (MEA, 2005) have taken center stage in international debates; they provide possible entry points to explore alternative development pathways for irrigated agriculture in floodplains.

This "structuring action" primarily aimed at contributing to these debates by generating new knowledge and was implemented in three countries, Ecuador, Morocco and Cambodia. The present report synthesizes the results of the activities implemented in Cambodia by a consortium bringing together the French National Research Institute for Sustainable Development (IRD), the CIRAD, the ECOLAND research center of the Royal University of Agriculture (RUA) in Phnom Penh, Cambodia, the Institute of Technology of Cambodia (ITC), as well as the Irrigation Service Center (ISC) a Cambodian NGO that specializes in strengthening irrigators' capacity.

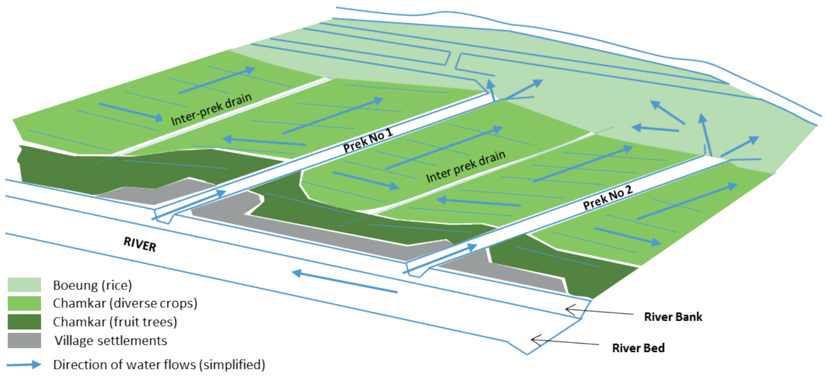
Though financially separate from other AFD interventions in Cambodia, COSTEA activities were thought in relation to these and most particularly in relation to the WASP and WAT4CAM projects that aimed at supporting sustainable irrigation development in Cambodia. There were frequent interactions between COSTEA team members and individuals involved in the design and implementation of the WASP and WAT4CAM projects to discuss whether and how knowledge generated in COSTEA could inform projects implementation. Among others, these discussions catalyzed around the development of participatory approaches to explore modalities of water infrastructure development in the Upper Mekong delta. The structure of the report reflects this ambition to generate knowledge for practical action. The next section describes the case study area – the Cambodian Upper Mekong delta; we then describe the hydrological changes this

Figure 1. Change in water occurrence in the Upper Mekong delta: Contrasting views from Vietnam and Cambodia (Source: Adapted from Pekel et al., 2016).



NB. In red, mostly in the upper part of the Vietnamese Mekong delta, are areas where flood occurrence has decreased over the last 40 years due to the widespread construction of dikes; in green are areas where flood occurrence has increased over the same period. The blue line shows the border between the two countries; the yellow line indicates the area where the COSTEA project has been implemented.

Figure 2. A Schematic representation and a drone image of the prek mosaic landscape (Left: adapted from SOFRECO, 2018; right: credit C. Orieschnig).



area has witnessed over the last twenty years (section 2) before describing the trade-offs between agricultural intensification and capture fisheries that characterize the current development path (section 3). The last section has a more operational tone: we present the outcomes of the participatory activities that were implemented and contributed to the elaboration of a "master plan" in the context of the Wat4CAM project.[1]

2. THE CASE STUDY AREA: PREK CHANNELS IN A MOSAIC LANDSCAPE

2.1 Setting the stage: The Upper Cambodia Delta

The Cambodian Mekong delta stands in stark contrast with its Vietnamese counterpart that has witnessed large scale water infrastructure development and agricultural intensification (Biggs, 2008; Molle and Tuân, 2006). It is an area with still relatively little water control and, from a bird's eye view (Figure 1), whose dynamics are closely attuned to the hydrology of its main rivers: the Mekong and the Bassac that branches out in Phnom Penh.

2.2 A mosaic landscape and an iconic infrastructure

Though less intensively used and built than Vietnam, and flooded for 4 to 6 months every year, the Cambodian Upper Mekong delta is not the wilderness area that it may once have been. The area is crisscrossed by hundreds of earthen drainage canals that also provide irrigation water for cultivation during the summer season and it is home to thousands of smallholder farmers and rural entrepreneurs. Some of these canals, dating back to the early 19th century, are called "preks". 10 to 50 meters wide, several meters deep, and somewhat regularly spaced at 500m to 1 km intervals, the preks diverge perpendicularly from the main rivers (the Mekong and the Bassac) connecting the latter to low-lying floodplains where other canals, mostly excavated during the Khmer rouge period in the late 1970s, can be found (Venot and Jensen, 2021).

The preks result from joint (1) man-made interventions in the form of breaches in the levees of the main rivers and (2) hydrological dynamics as floods further widened the breaches and sediments deposited progressively raising adjacent land, hence forming the long canals and landscape that can be observed today (Figure 2).

The preks structure a mosaic landscape made of a multitude of geometric fields where farmers cultivate a variety of crops once the flood recedes. In terms of agriculture, a gradient of cultivation can be observed along the length of each prek. Close to the main river levees, where village settlements have been built so they are seldom flooded, small fields run perpendicular to the preks (hence parallel to the main rivers). In this area, called chamkar, farmers cultivate a diversity of fruit trees, sugarcane, beans, and vegetables, mostly for the urban markets of Phnom Penh. To supplement rainfall, farmers place small diesel pumps on the edge of the preks to pump water for their chamkar fields. Further away, in the low-lying areas called boeung that support small scale capture fishery when flooded for several months every year, they cultivate less regularly patterned rice fields twice a year, after the flood recedes (Venot and Jensen, 2021; Figure 3).

Initially called "sedimentation canals" (canal de colmatage in French; a term still used today), the initial purpose of the preks was to guide the heavily-loaded flood waters towards the low-lying floodplain so as to progressively raise land and extend cultivation.[2] The fact that they can serve multiple purposes (sedimentation, soil fertility replenishment, groundwater recharge, irrigation and drainage, support to fishing grounds, transportation, flood protection and retention, wetland preservation, and more broadly contribute to the identity of local inhabitants) has long been recognized and repeatedly highlighted in development project reports (JICA, 1998; SOFRECO, 2018).

1. For the sake of brevity we do not present the approach followed and tools used in details – as these can be found in other publications

2. Barthelemy (1915) recounts that the first prek was excavated on the right bank of the Mekong River by a Cham leader in the early 1800s to carry a large boat from the river to harvest the natural vegetation growing in the Boeung located "behind" its village. The narrow breach in the river levee quickly widened when the river flood entered. Unexpectedly, the deposition of sediments significantly increased the size of land that could be cultivated.

Figure 3. Preks diverse agricultural landscapes

In the 1990s, international development organizations rediscovered preks through the lens of their agricultural productivity. A JICA (Japanese International Co-operation Agency) report for instance characterized the mosaic landscape as "the most productive farming system [...] in the whole of Cambodia" and stressed that it is "adapted for the natural conditions and utilizes them for agricultural production" (JICA 1998: 58). Since then, the Cambodian government, with support from several aid agencies including the French Agency for Development (AFD), invested in their re-excavation (they had become silted-up) and in the construction of water control infrastructures (mainly sluice gates) to increase water availability in the dry season with the view to enhance crop diversification and intensification, mostly in the Chamkar (Venot and Jensen, 2021; Figure 4).

Figure 4. Example of sluice gates build under the AFD funded WASP project (Left: June 2017; right: September 2017; Credit: Jean-Philippe Venot)

Focusing on AFD initiatives that constitute the backdrop of COSTEA activities in the Upper Mekong Delta, involvement in the prek area started in the early 2000s with the PADAP project (2000-2002) then continued as part of the NWISP project (2007-2011; with feasibility studies being conducted between 2002 and 2008) in the context of which a small polder was built between two preks. The WASP project (2015-2019) consisted, among others, in the excavation of 25 preks and the construction of related water control infrastructures (Figure 4). In 2019, the WAT4CAM project was launched with further intervention being foreseen in the prek area – some being under way at the time of writing.

3. CHANGES IN HYDROLOGY AND FLOOD PATTERNS

3.1 Changes in the hydrology of the Mekong

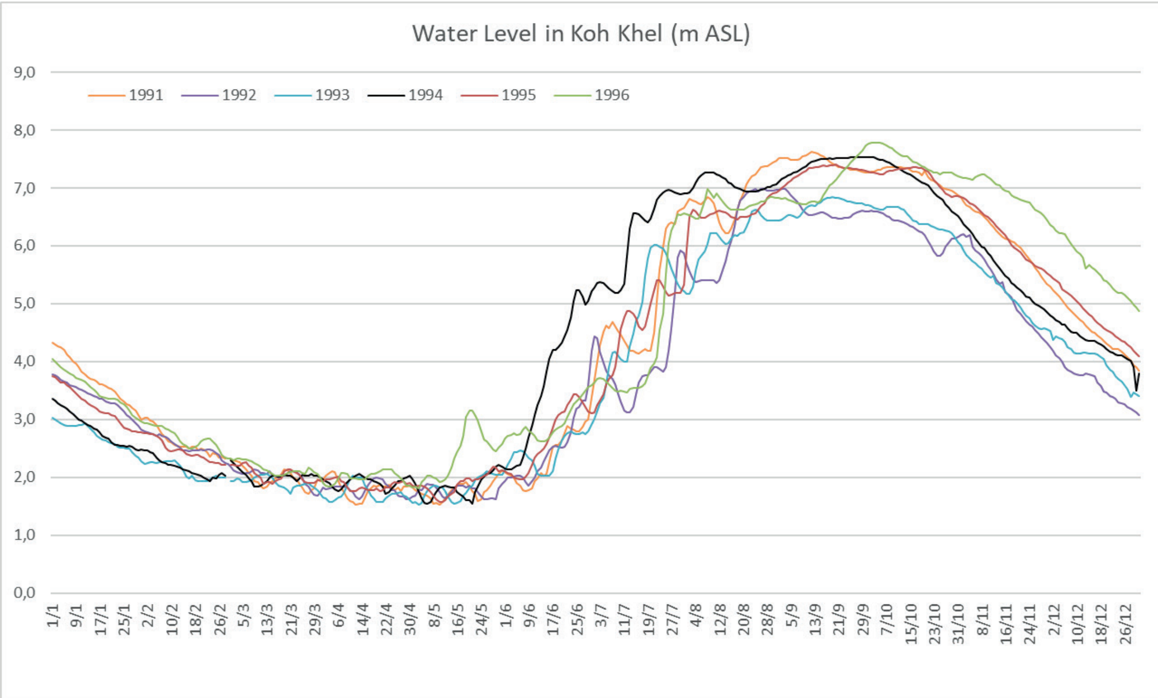
The hydrological analysis we conducted at regional level is based on historical water level data from the Mekong River Commission (portal.mrcmekong.org/home). Figure 5 shows changes in the hydrograph measured at Koh Khel, the MRC-managed hydrological station that is the closest to the COSTEA case study area.

It shows significant inter-annual variability in flow regimes in recent years (see bottom panel), confirming results from studies conducted for the Mekong river basin as a whole that point to an increased in flow variability after 2008 when dam construction on the Mekong mainstream and its affluent accelerated (e.g. Han et al., 2019; Yun et al., 2020).

Detailed results of the hydrological analysis can be found in Orieschnig et al. (2022). We focus here on the main results of the study: (1) flood duration has decreased by an average of 19 days when comparing the 1991-2008 and 2009-2021 periods[3] and (2) flood extent is mostly determined by river water level and until now recent hydraulic works (such as the excavation of preks and the construction of sluice gates) have changed this relationship little; (3) the onset of the flood has been delayed significantly with flood incidence in early August being 21% lower for the 2009-2021 period than for 1991-2008.

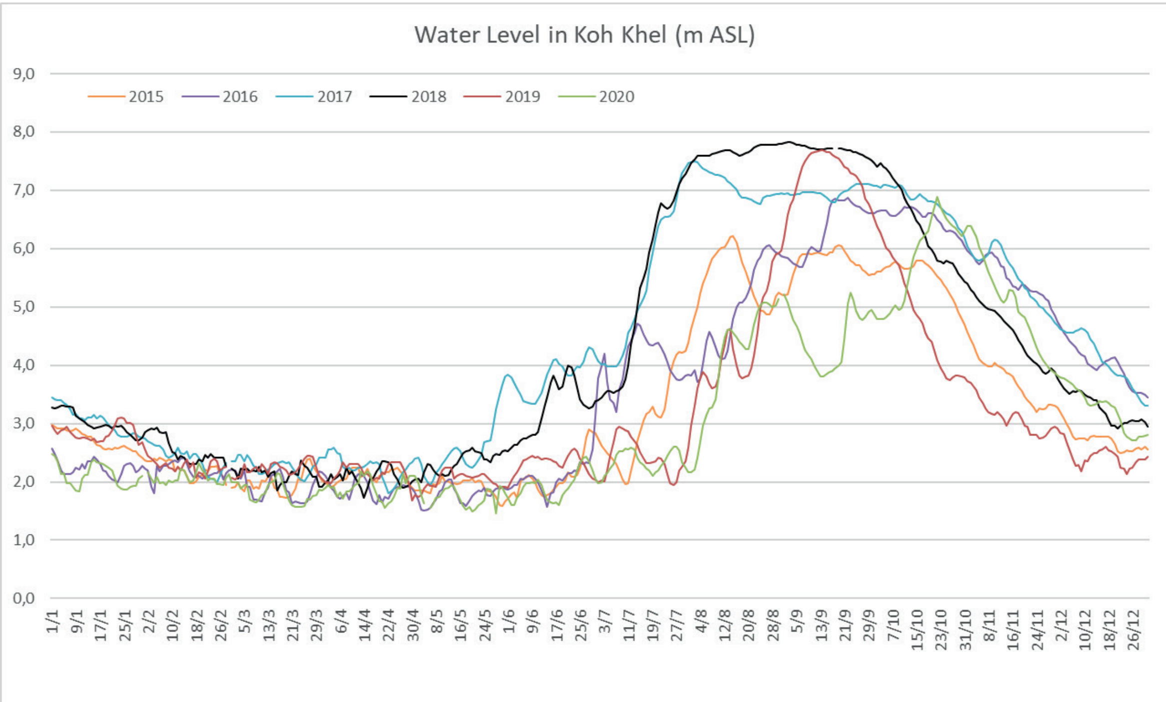
3. 2008 has been identified as a "breakpoint" in the hydrological time series. This is when construction of large hydroelectric dam in the upper Mekong Basin accelerated in pace.

Figure 5. Illustrating high variability in flow patterns in Koh Khel station, Cambodia (Source: based on MRC Data; portal.mrcmekong.org/home)



Early 1990s	Flood inception (date)	Flood duration (days)	Flood End (date)	Max water level (mASL)	Date Max
Min	13-juil	68	22-oct	6,85	26-août
Max	16-août	136	08-déc	7,78	02-oct
Median/average	31-juil	106	14-nov	7,36	17-sept

Flood inception/end considered for water level = 6 m



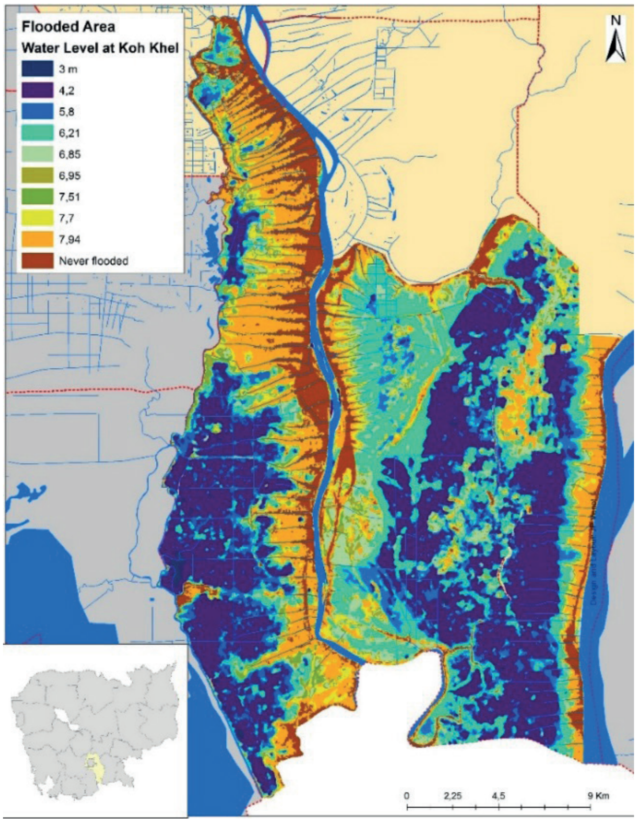
Late 2010s	Flood inception (date)	Flood duration (days)	Flood End (date)	Max water level (mASL)	Date Max
Min	19-juil	22	21-sept	6,21	02-août
Max	15-oct	105	05-nov	7,82	22-oct
Median	31-août	61	13-oct	7,16	07-sept

Flood inception/end considered for water level = 6 m

3.2 Changes in flood patterns

An analysis of satellite imagery (landsat) over the last 20 years provided the basis to link water levels in the main river streams (the Bassac and the Mekong) and flooded areas (Figure 6). The detailed methodology and results are presented in Orieschnig et al. (2022). The map derived can be used to predict when specific areas are likely to be flooded and can serve as a basis to discuss the relevance and possible impacts of further water control.

Figure 6. Assessing "flood levels" in the case study area
(Credit: Analysis by Christina Orieschnig; Mapping by Jean-Philippe Venot)



3.3 An attempt at local-level modelling

The COSTEA study ambitioned to acquire a detailed understanding of the hydrological functioning of the preks as rehabilitation projects were under way with little visibility on their hydrological impacts at local and regional level. This involved establishing a pilot observation site of circa 25 km2 on the right bank of the Bassac (Figure 7), whereby water levels were monitored in several points and meteorological data collected.

Such data then served to calibrate an eco-hydrological model that calculates provisioning ecosystem services (i.e. agricultural production) on the basis of water accounting and provides some preliminary assessment of flood related environmental services such as pest regulation, sediment and nutrient deposition, and flood mitigation. The model represents the case study area as a "patchwork" of spatial units that have been defined according their elevation and land use type over a year (right panel, Figure 8) coupled with networked water storage units (to represent preks and canals in the boeung).

Illustrative of the difficulty and time required to acquire an in-depth knowledge of the hydrological functioning of regions as complex as floodplains, at the end of the project, the model remains a prototype that needs further development to assess the impacts of different rehabilitations scenarios on agricultural production and ecosystem services. Notably, further work is needed (1) to model interactions between surface water and groundwater as the latter is likely to contribute to dry season water flows significantly; (2) adjust scenarios regarding the provision of flood related environmental services based on more realistic water levels[4] and (3) model changes in land use in relation to changes in water availability on the basis of a better knowledge of farmers' decision making.

Figure 7. COSTEA Monitoring site on the right bank of the Bassac
Point 1 to 6 and 8 are pressure loggers allowing to measure water levels. Point 7 is a weather station (Temperature, rainfall, wind)

4. Currently, scenarios draw from basin-wide hydrological analysis conducted in the 2000s that have underestimated changes in the hydrology of the Mekong. For instance, these studies projected floods much longer than observed for the year 2020.

Figure 8. Representig the pilot observation site as a networked mosaic (Source: Orieschnig, 2022).

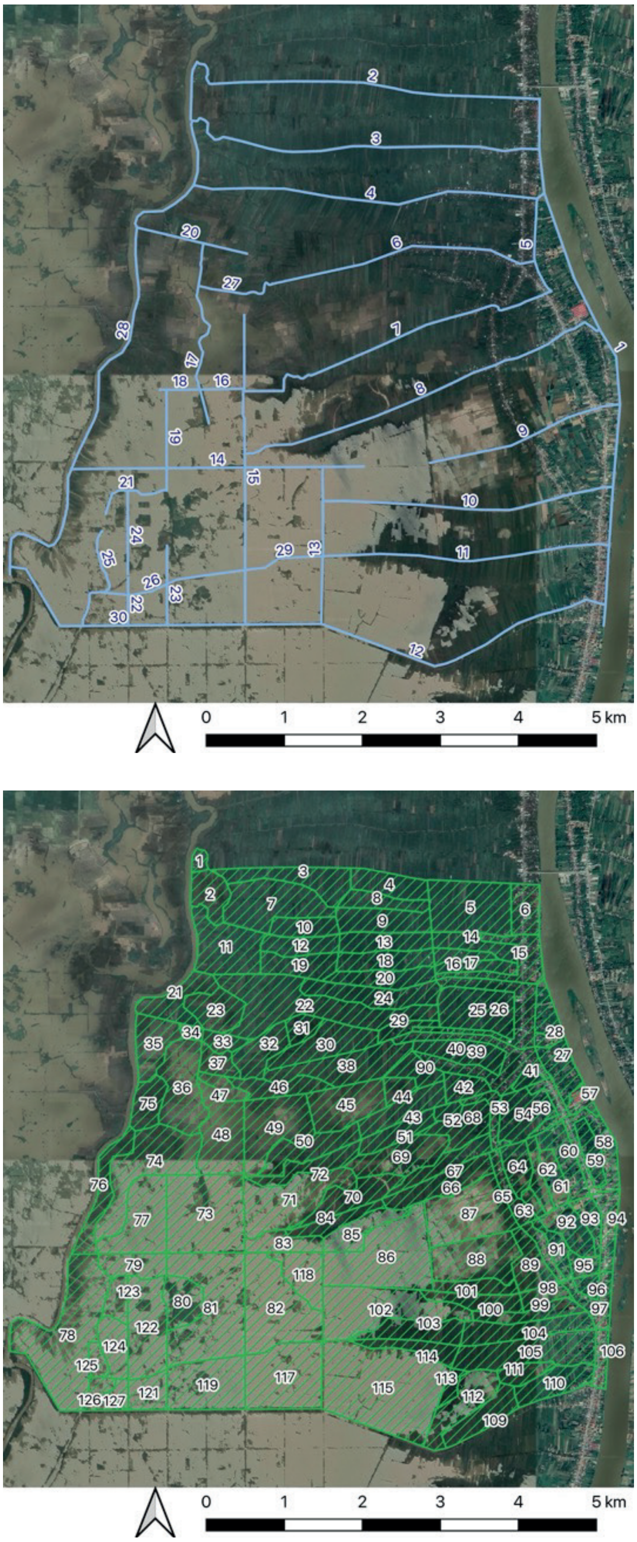
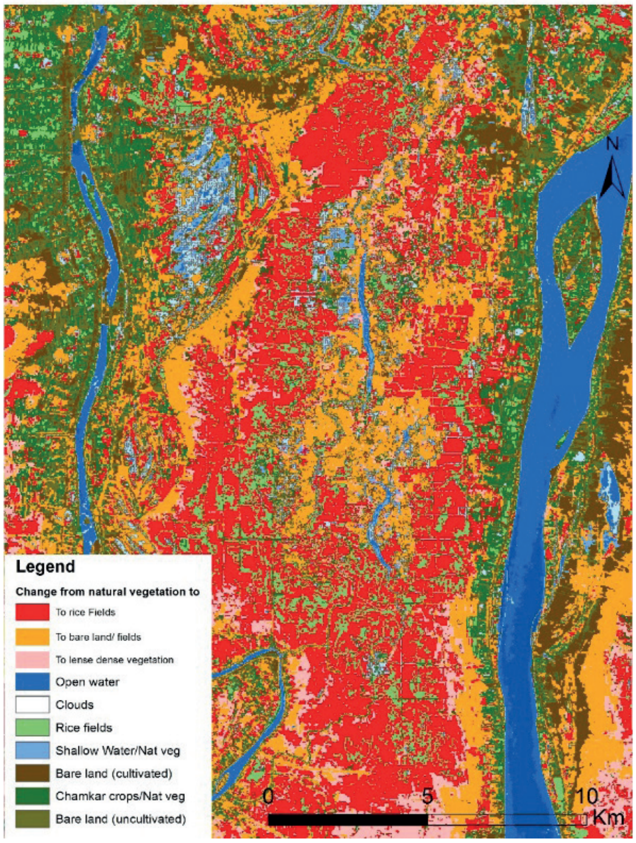


Figure 9. Land use changes over the last 20 years in the Cambodian Upper Mekong delta (Credit: Analysis by Christina Orieschnig; Mapping by Jean-Philippe Venot)



4. TRADE-OFFS BETWEEN AGRICULTURAL INTENSIFICATION AND FISHERIES

4.1 Recent large-scale land uses changes

Remote sensing analysis allowed assessing the extent of land use change witnessed between the Bassac and the Mekong over the last 20 years (see Figure 9; red and orange areas are zones that have been converted from 'natural vegetation' to cultivated fields). In this area about 30,000 hectares of land have been reclaimed over the last 20 years (including 10,000 hectares of dense flooded vegetation); two third of the changes occurred in the 2000s. The main agricultural trend is an increase of early wet season rice cultivation (May-July), the area of which has been multiplied by 3 (+~15,000 ha; orange on the graph). This is likely linked to improve water storage though water availability remains a constraint according to farmers. At the same time, wet season rice cultivation (July-November) has decreased, likely replaced by fruit trees.

4.2 A diversity of farming systems: intensification and differentiation

Two agrarian diagnosis were conducted to characterize farming systems both on the left and right bank of the Bassac River, where most projects to rehabilitate water control infrastructures are

Figure 10. Per capita net revenues of rural households in the Bassac/Mekong floodplains (Source: adapted from Sinh, 2022)

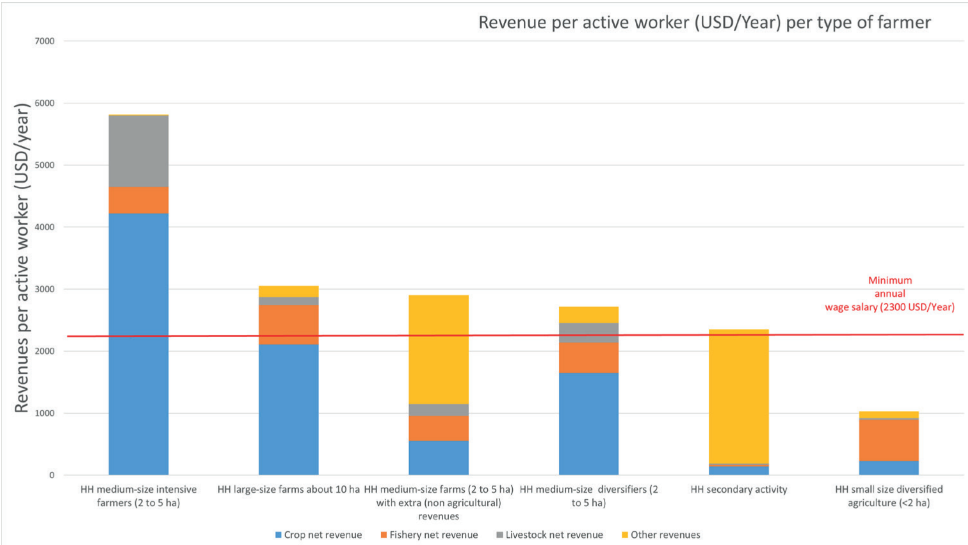
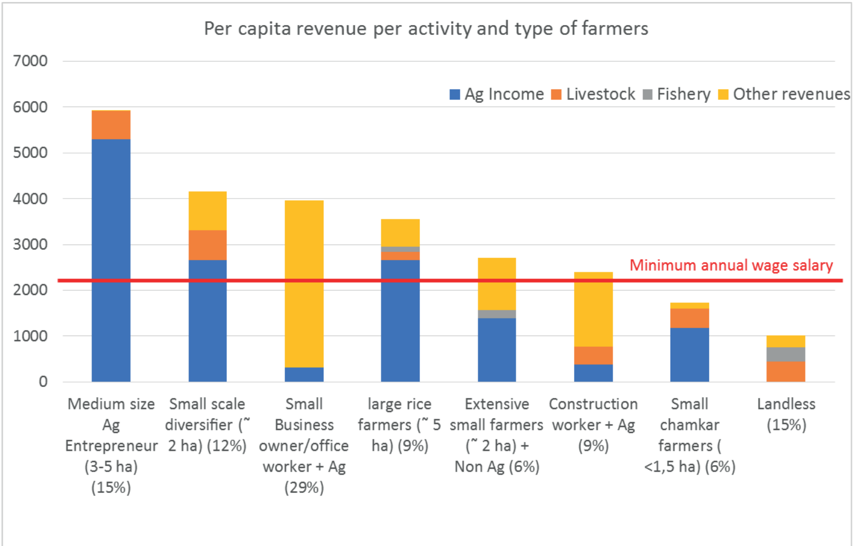


Figure 11. Per capita net revenues of rural households on the right bank of the Bassac river (Source: adapted from Vandome, 2020)



implemented. There are significant differences between the two areas, which, taken together, provide a representative picture of the diversity of farming systems in the Cambodian Upper Mekong delta. The area studied on the left bank is dominated by rice farming systems while the right bank is dominated by a diversified cropping pattern (fruit and vegetables). Results of the studies are summarized in Figure 10 and Figure 11.

On the left bank of the Bassac, the study describes the agricultural systems found in the floodplain, around the village of Chroy Snou. Rice and maize cultivation (early wet season and recession) dominates the landscape but most households who have between 2 and 5 hectares of land do not derive descent revenues from this activity.[5] Out of the 6 types of rural households the study identified (see Figure 10), only two types derive revenues from their cultivation activities that are above the minimum annual wage salary: (1) medium size intensive farmers who have their own light agricultural equipment and who cultivate rice in the low-lying parts of the landscape and maize or fruit trees in the slightly more elevated Chamkar and (2) large farmers who own more than 10 hectares of rice in the low lying areas. Livestock and fishery activities constitute important safety nets for the poorest households[6] while a significant part of the villagers (25-30%) engage in non-farm activities to make a living. The study also unravelled a process of land concentration, facilitated by local brokers, which leads to increased heterogeneity and inequalities within villages. Social and economic differentiation is highly path dependant, with households who managed to secure access to land in the early 2000s by clearing the natural vegetation that dominated the area at the time, progressively acquiring more land from other households with high level of debt - and sometimes renting it back to the people they purchased the land from.

5. Farmers tend to cultivate short term High Yielding Variety rice variety. Most of the production is exported as paddy to Vietnam where transformation take place. Profitability is low and negatively affected by low water availability and high pumping costs.

6. Chheng et al. (2006) evaluates that flooded rice fields can yield up to 113 kg of fish per hectare. In monetary terms and at a first-sale price of 1,1 USD/kg, this represents half the added value of one rice cropping season.

Figure 12. Occurrence of pesticides use in the prek area (Source: adapted from Frick, 2020)

On the right bank of the river, the situation is slightly different with a higher diversity of crops being cultivated and notably more intensive vegetable production – which allows some farmers to derive decent revenues even on small areas. Still, there is about 30% of the interviewed households who earn less than the minimum wage salary (Figure 11) The study also highlights that farmers remain vulnerable to drought notably in the 'transition area', that is, the area, that is flooded only some years (and others not) and where residual soil moisture and water storage in low lying areas or canal is key –and constraining- for cultivation between February and June (Vandome, 2020).

4.3 A focus on pesticides: Environmental and health challenges to come

If intensive cultivation of vegetables (and, to a lesser extent, fruits) allows farmers to derive decent revenues on small areas, this comes hand in hand with widespread use of chemical products, which raises significant health and environmental concerns (Figure 13). Interviews with selected input sellers and farmers allowed identifying more than 350 products and 140 active compounds used in the area. Figure 12 lists the most commonly found molecules in the products sold by input sellers, many of which are classified as moderately hazardous and banned or not registered in Europe but allowed in Cambodia.

Figure 13. Common practice: a farmer mixing pesticides in his spraying tank and some of the many packaging found in farmer's fields (Pictures credit, left side: Jean-Philippe Venot; right side: Sreytouch Heourn)

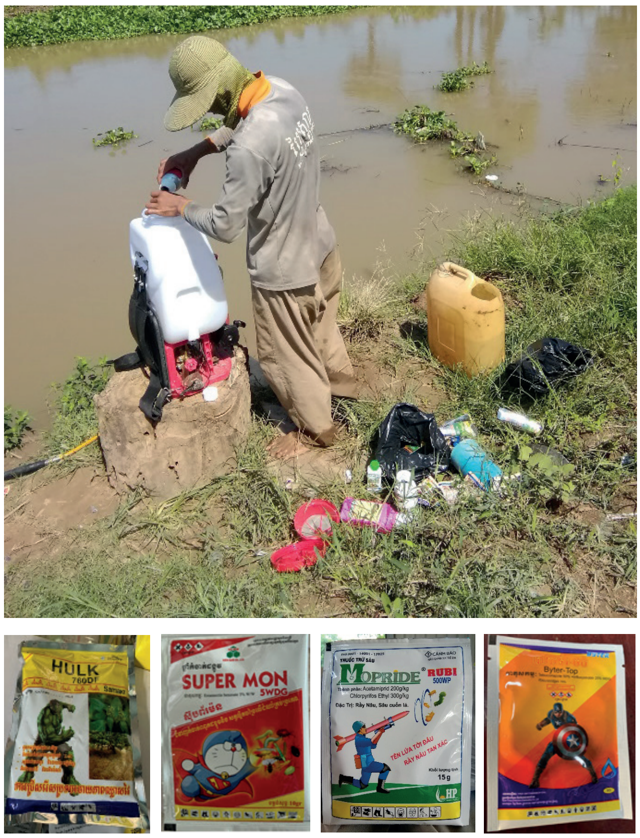
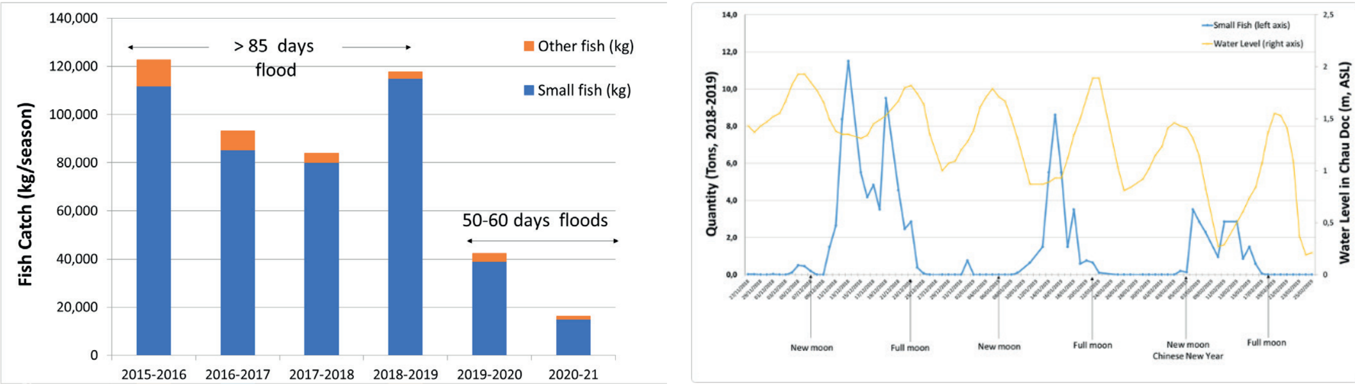


Figure 14. Fish Catch and flood dynamics in the Bassac/Mekong floodplain (Source: The Authors)



4.4 The forgotten dwindling resources: Capture fisheries

The agrarian diagnosis that were conducted highlighted the importance of small-scale capture fisheries, especially for the most vulnerable households – both in terms of protein intake but also economics. A study on fishing practices was conducted in the floodplain located between the Bassac and the Mekong. This included interviews with individual fishermen–(cum-farmers), representatives of collective fishing groups (called Community Fisheries – CFi) and agents of the fishery administration at national, provincial (Kandal) and district (Koh Thom and Leuk dek) levels. Of particular interest is the existence of Cham (Muslim) and Vietnamese communities fishing in the area. Large scale land use change and the development of rice cultivation (see above) has decreased the "open" space used for fishing, particularly affecting the Cham community now also engaged in daily agricultural work. The study clearly shows that fishing productivity is influenced by the duration of the flood (see top panel of Figure 14). It also fluctuates alongside water level in the floodplain, itself influenced by the tide (see bottom panel of Figure 14).[7]

Collective fishing groups (CFi) who have been entrusted the responsibility for resource (fishery and natural vegetation) preservation and control over fishing practices (Ratner, 2006) in areas that were under private management until 2012 are exceptionally allowed to sell fish on the market due to their proximity to Vietnam. Some of these groups have devised innovative institutional arrangements based on a system of quota and rotation to deal with catch variability within a given season and share fishing benefits equitably among their members (Venot et al., 2021). Yet, changing flood patterns that lead to declining fish catch, compounded by the use of a significant part of the revenues derived from fish sales for donations to village funds or pagodas or as "incentives" (to use a local euphemism) to local media and administrative staff, threaten the sustainability of such arrangements.

5. EXPERIMENTING WITH PARTICIPATORY APPROACHES

Participatory approaches implemented in the COSTEA project draw from earlier experimentation conducted collaboratively by IRD, CIRAD, ISC and RUA in the context of the DOUBT research project funded by the French National Research Agency (ANR). A detailed account of the approach followed and the serious games developed – designated under the generic term Dai Prek- within the context of the DOUBT project can be found at deltasoutheastasia-doubt.com/cambodia/ as well as in Venot et al. (2022).

The DOUBT project mostly had an "exploratory dimension" in the sense that the serious games developed largely aimed at unravelling local knowledge of the preks as well as local concerns and priorities regarding the modalities of their rehabilitation under the WASP and WAT4CAM projects. In the context of COSTEA, further linkages with AFD interventions -namely the WAT4CAM project- were sought with a dual objective: (1) increase the legitimacy of local knowledge and priorities in the eyes of project's staff so these could be mainstreamed into project activities and (2) steer the project towards a "territorial" intervention strategy envisioning preks as elements of a broader sociohydrological system.

This means that the intervention strategy that underpins the COSTEA activities, and the tools developed, were co-produced with staff directly involved in the design and implementation of the WAT4CAM project. In other words, COSTEA supported the implementation of some activities planned under WAT4CAM, making using of serious games because we hypothesize that these allow more effective, active and meaningful participation from a variety of stakeholders, as compared to approaches such as rapid rural appraisal or focus group discussion that are more commonly used in development projects.

7. Between 2006 and 2019 (the latest date for which data is available), fish production in Kandal province has decreased by half down from over 70,000 Tons to 35,000 Tons. Though fishery statistics are reportedly little reliable, the trend is clear and the decline is likely to be linked to large scale land reclamation. In monetary terms and at a first-sale price of 1,1 USD/kg, this represent a value of USD 38,5 Millions equivalent to the gross production of about 45,000 hectares of rice.

Overall, a series of 7 workshops, making use of different versions of the Dai Prek serious game were implemented over the three years of the project. These sessions lasted 2 or 3 days, and each day, 10 to 20 people participated. Participants included farmers-cum-fishermen, village chiefs, local elected representatives, administrative and ministry staff at district and province level, ministry staff at national level, staff from engineering and consulting companies involved in WAT4CAM and of development agencies and researchers.

5.1 Identifying local concerns and priority interventions with farmers and project's team

A first series of meeting was organized between March and August 2020. In March, the meeting brought together staff from with the Technical Assistance (TA) teams of the WAT4CAM project and the Project Management Unit (PMU) of MoWRAM and the primary objective was to showcase the type of tools that could be used to elicit people's viewpoints and priorities regarding prek rehabilitation. The workshop triggered some interest among TA and PMU staff but the "qualitative and process orientation" nature of the tools, which are not devised to yield a practical road map for infrastructure construction, appears to be an impediment to their mainstreaming in WAT4CAM project. Yet, a second meeting (of two days) was organized with farmers and local (village/commune) decision makers living and cultivating in the area located in the "cluster" (i.e. group) of preks considered for rehabilitation under WAT4CAM "Batch1" due to be completed by the end of 2023. This meeting took place as the feasibility study for prek rehabilitation had already been initiated by the TA teams. Discussions held during the workshop largely confirmed the diagnosis made by the WAT4CAM project team: that low water availability in the dry season was a significant constraint to agricultural production. In addition to prek excavation, farmers insisted that canals located in the boeung should be excavated and called for the construction of small bridges and culvert to facilitate transport in the boeung, some of which was considered in the detailed feasibility study and later implementation.

5.2 Towards the elaboration of a regional "prek master plan"

In 2021, infrastructure development in the prek area under the WAT4CAM project was put on hold and the Technical Assistance (TA) team engaged in the elaboration of a "Prek Master Plan" (PMP) whose objective was to elaborate a long-term strategy for the development of the prek area. The definition of the PMP involves defining "prek development areas" (PDA) on the basis of hydraulics/hydrology as well as land use; these will constitute the "spatial unit" at the level of which future WAT4CAM interventions will be designed and implemented - a significant shift from earlier projects.

In that context, COSTEA provided methodological support to the team in charge of elaborating the Prek Master Plan. Most noticeably, a series of 4 workshops was organized to prioritize future WAT4CAM intervention areas, on the basis of the delineation and characterization done by the TA team that identified 36 PDA according to 4 main criteria: (1) their level of development mostly in relation to existing infrastructure, population density and the types of housings; (2) the importance of agriculture - in relation to the share of the PDA that is cultivated; (3) their environmental status - in relation to the frequency of flooding and the share of the PDA still covered with natural vegetation and (4) the potential hydraulic works to support sustainable agricultural intensification. On the basis of the characterization done by the team in charge of the development of the PMP, an "abstract" map was designed so as to discuss the general principles behind the prioritization of PDA (as opposed to discussing the specifics of the delineation done and/or avoiding that each participant choses the PDA s/he lives in) (Figure 16). A first workshop brought together staff based in Phnom Penh from the Ministry of Water Resources and Meteorology (MoWRAM), the Ministry of Agriculture, Forestry and Fishery (MAFF), the Ministry of Rural Development (MRD), the Fishery Administration as well as staff involved in the different technical assistance teams of the WAT4CAM project. The three other workshops brought together representatives of sectoral ministries at provincial level, district administrations, as well as commune chiefs.

The discussions allowed identifying 5 potential target areas for future intervention under the WAT4CAM project and to broadly characterize the issues at stake in these.

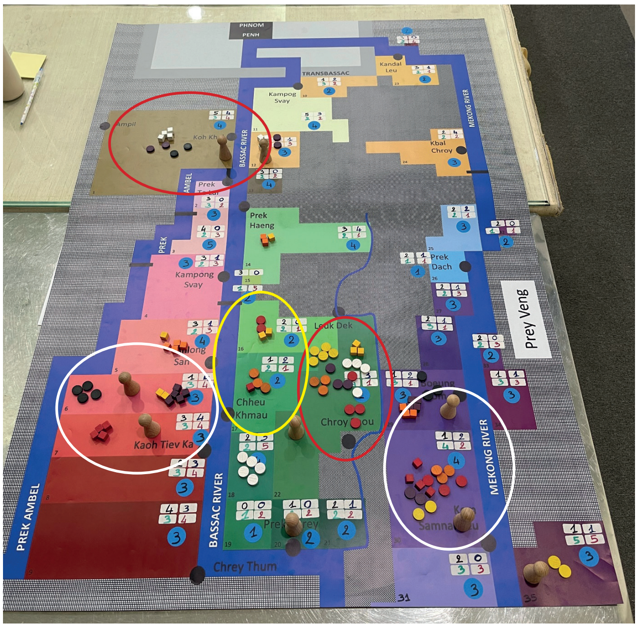
Figure 15. Showcasing serious games and identifying local concerns (Pictures credit: JP. Venot)

Figure 16. Stakeholder discussing priority PDA around an abstract map of the prek area (Pictures Credit: left, Jean-Philippe Venot and right, Pitou Ly).

Two relatively "undisputed hotspot" were identified by all participants (see the white circles in Figure 17):

- PDAs along the southern part of the right bank of the Mekong though there were differences regarding the exact places the project should focus on (this is likely to be linked to the fuzziness of the PDA border in the maps used). This was mostly justified on the ground that little investment has been done there and the area has significant agricultural potential and. Similarly to Prek Ambel that constitutes the western limit of PDA alongside the right bank of the Bassac, there is a river (known, among others, by the name of Steung Chroy Snou) that constitutes the western limit of the PDA located along the right bank of the Mekong. Deepening and extending the preks up to that river - as mentioned by local stakeholders- may indeed significantly improve water availability. This is also likely to accelerate the currently observed extension of (rice) cultivation in an area that is now still covered by natural vegetation and serves as fish spawning grounds and meant to be managed for conservation by Community Fisheries (CFi). Though the central part of the floodplain is not considered as a project intervention area, it will be impacted by any interventions in the PDA located on the southern part of the Mekong right bank (as well as those located on the left bank of the Bassac in Koh Thom district).

Figure 17. Result of the collective prioritization exercise done in Phnom Penh (Credit: JP. Venot).



- PDA along the right bank of the Bassac where agriculture is already intensive and prek rehabilitation projects have already been implemented but there is still some potential for development according to participants. The area identified partly overlaps the WAT4CAM "Batch 1" clusters and the need for intervention is often justified on the ground of "territorial consistency" – indirectly supporting the territorial approach promoted by COSTEA and adopted by WAT4CAM.

Two other areas (red circles in Figure 17) were identified but intense debates regarding the relevance of intervening there took place and no consensus emerged:

- PDA along the northern part of the Bassac river. Debates revolved around the relevance of investing to intensify agriculture in areas where agriculture was already quite intensive and that were close to Phnom Penh, subject to urban development in the near future with raising land prices.
- PDA located in the central zone between the Bassac and the Mekong that are flooded for a significant part of the year and where rice cultivation dominates. The debate related to differences in the way the agricultural potential of the area was evaluated by different actors, to questions around who will derive benefits from investments given the existing trend towards informal land concentration, to the potential negative impacts of (rice) agriculture intensification on capture fisheries, and to the risks or opportunities the proximity to Vietnam represented

Finally, a fifth area (yellow circle in Figure 17) that had not emerged as a priority action-area during the workshop in Phnom Penh, was clearly identified as holding a lot of potential during discussions with local actors – thus confirming some preliminary analysis done by the team in charge of developing the prek master plan. This area, along the left bank of the Bassac, share many similarities with the area on the right bank of the Bassac with diversified cropping systems: vegetables and fruit trees in the chamkar and rice in the boeungs. Delineated by a dike-road on its east-side, this area also constitutes a coherent hydraulic unit even though water flows further into the floodplains would need to be accounted for – not only for cultivation but also transport and fish migration.

6. PERSPECTIVES

COSTEA activities had an explicit objective: generating knowledge on the dynamics of the Upper Mekong Delta that would inform and feed into development interventions aimed at supporting irrigated agriculture along the preks. For this, COSTEA engaged in establishing different participatory arenas for knowledge co-production. Results of participatory activities were presented in November 2022 to the MoWRAM staff responsible for the management of the WAT4CAM project and further discussed. At this stage, no final choice has been made regarding where WAT4CAM will next intervene but it seems a "soft consensus" tends to emerge towards selecting the area along the left bank of the Bassac.

This choice seems grounded in a shared impression that intervening in this area is the more "feasible" option given the framework of the project and that lessons learned from past projects might be easier to transfer there than in other areas, though the shift from designing interventions at territorial level (and not any more at prek level) remains a challenge and is likely to require changes in project's implementation modalities (and notably the time and scope of feasibility studies). Another reason for that choice might also be related to an underpinning willingness "to minimize risk and do do no harm" as no acute issues were identified during discussions on this area as opposed to other areas where questions of land concentration, international security, deforestation and negative impacts on fisheries had emerged – still this would need to be confirmed.

Overall, the activities implemented in Cambodia as part of the structuring action on floodplain development and management are illustrative of the potential of COSTEA to inform on-going and future irrigation projects but also on the intense relational work that is required to make this happen in practice. It is also important to recognize that articulation between knowledge and action takes a long time, is progressive, and happens often on an ad-hoc basis making it necessary to have a long-term strategy that offers enough room for adaptation to make use of opportunities when they may occur. And unsurprisingly but important to stress again: "it takes two to tango". Interest and willingness to collaborate is essential for initiatives such as COSTEA to yield usable knowledge and, as such, contribute to sustainable irrigation management.

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