Regional Flyway Initiative · Site Study

January 2026

RFI Priority Site · Ang Tropeang Thmor (Sarus Crane Reserve)

Asian Development Bank

General Site Information

Country	Cambodia			
RFI Site Name	Ang Trapeang Thmor (Ang Tropeang Thma)			ID010
City/ Municipality, Province, Region	Phnom Srok District, Banteay Menchey Province			
Geographical coordinates	13.82 N, 103.31 E		Area (has)	12,652 ha
Key species	Sarus Crane, Black-headed Ibis, Painted Stork, Garganey, Eld's Deer.			
Key habitats (biomes)	Seasonally inundated (freshwater) grassland.			
Key ecosystem services	Provisioning services (freshwater, aquatic products), and cultural services			
Key drivers of change	Agricultural expansion and unsustainable use of fisheries			
Conservation status (mark all that applies)	■	Protected Area		Flyway Network Site
		Ramsar Site		Others _____
IBA/ KBA name (and number) and other designations	Ang Tropeang Thmor			
Management Stakeholders	Ministry of Environment, Ministry of Agriculture, Fisheries and Forestry, district and commune governments. Provincial departments			
With management plan?				
Project concept themes	Rice agriculture, nature-based tourism, small-scale fisheries, improved wetland management			
Length of project	5-10 years			
Sector/s	Agriculture, fisheries			
No. of potential beneficiaries	As of the early 2000s, an estimated 55,048 people in 11,905 households, in 99 villages (spanning 11 communes) live within Ang Trapeang Thmor. Phnum Srok District has census population of 65,945 across 15,057 households in six rural communes in 2019.			
Indigenous Peoples	■	No		Yes _____
Anticipated Implementation Risks	Uneven benefits-sharing from tourism activities. Increased pollution and disturbance to wildlife from tourism and agricultural expansion			
Estimated Project Budget (US$)	24,250,000			
Potential Source/s of Financing	■	Loan (to be identified)		Private Sector
		Grant		Public-Private Partnership

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Acronyms

ADB	Asian Development Bank
ATT	Ang Tropeang Thmar
AWC	Asian Waterbird Census
CFi	Community fishery
CPA	Community protected areas
CSR	Conservation Status Review
DoFWC	Department of Freshwater Wetlands Conservation
DoF	Department of Fisheries
DMC	Developing Member Country
EAAFP	East Asian-Australasian Flyway Partnership
FiA	Fisheries Administration
IBA	Important Bird and Biodiversity Area
IUCN	International Union for the Conservation of Nature
LCG	Local conservation group
MAFF	Ministry of Agriculture, Forestry and Fisheries
MOE	Ministry of Environment
MOT	Ministry of Tourism
MOWRAM	Ministry of Water Resources and Aquatic Management
NGO	Non-governmental Organisation
PDoE	Provincial Department of Environment
RFI	Regional Flyway Initiative
SVCC	Sam Veasna Centre for Conservation
TESSA	Toolkit for Ecosystem Services Assessment
USD	United States Dollars
WCS	Wildlife Conservation Society

Executive summary

Cambodia's floodplains along the Tonle Sap are home to some of very few untouched floodplain wetlands remaining in continental Southeast Asia. Lying on the Tonle Sap floodplain north-west of Siem Reap, Ang Tropeang Thmor is one of three key wintering (non-breeding) sites for the Sarus Crane in Cambodia and is currently designated as a Sarus Crane Conservation Area (SCCA) together with Boeng Prek Lpov and Anlung Pring with the Ministry of Environment as its management authority. Ang Trapeang Thmor is known to globally significant congregations of both migratory and resident waterbirds, the best known being the Sarus Crane - more than 16% of the regional population uses the site during the dry season, together with some of the largest congregations of the migratory Garganey, with more than 12,000 counted in recent years. Surveys have also documented regular congregations of Greater Adjutant (NT) and Spot-billed Pelican (NT). Ang Trapeang Thmor was designated as a conservation area under Government decree No. 0200/10 in 2000, and subsequently became recognised as a protected landscape, with the Ministry of Environment as its management authority. Presently, there are at least 99 villages within and along the boundary of ATT, and local communities are highly dependent on small-scale fishing and harvesting of aquatic resources such as waterlilies and snails, and dry-season rice farming as a source of livelihood, together with nature-based tourism activities.

Encroachment activities and conflicting land use and water management regimes have either created situations where grassland in ATT is either insufficiently inundated (increasing the risk of dry-season fires), or overly inundated, hampering rice growing activities. As a whole, the site is threatened by unsustainable usage and encroachment, which also increases disturbance to the wildlife using the site. To strengthen management and conservation of ATT, there is a clear need for strengthening the protection and management of the wetlands, including better zonation of key sites for livelihood and conservation activities.

Strengthening the management and protection of ATT will require targeted interventions to improve local capacity to manage and protect the site, build co-management frameworks with the local communities, whilst addressing livelihood needs of local people living within the ATT landscape. To date, communities in ATT have benefited to a large extent from nature-based tourism as a result of its relatively established tourism infrastructure and proximity to Siem Reap. There is considerable scope to continue expanding wetland and nature-based tourism at ATT through investment into maintaining or expanding existing ecotourism infrastructure, such as jetties, signage, and viewing structures. Targeted programmes, in collaboration with tourism operators and conservation NGOs, can be expanded to build local capacity to manage tourism, both domestic and international. Like many other similar landscapes in Cambodia, such as Anlung Pring and in Kampong Thom, there are also opportunities for rice agriculture transition with a focus on biodiversity-friendly rice farming approaches that have been piloted elsewhere in Cambodia, such as 'Crane Rice' and 'Ibis Rice'.

1. Background of the Regional Flyway Initiative

In July 2021, the Asian Development Bank made a commitment to develop a long-term Regional Flyway Initiative (RFI) in the East-Asian Australasian Flyway (EAAF) (Sovereign Project 55056-001) to protect and restore priority wetland ecosystems and the associated ecosystem services they provide in the EAAF, the most threatened migratory bird flyway globally. The Initiative is slated for implementation in nine ADB developing member countries (DMCs) in East, South and Southeast Asia: Mongolia, People's Republic of China (PRC), Bangladesh, Viet Nam, Cambodia, Philippines, Thailand, Malaysia and Indonesia. In 2023, the geographic scope of the RFI was further extended to two DMCs in Southeast Asia and the Pacific respectively, Lao PDR and Papua New Guinea.

The primary aim of the RFI is to enhance and expand the existing efforts in conserving and managing wetlands of the highest priority for migratory birds within the EAAF through innovative loan and grant financing, and at scale. Consultations and analyses over the development period help identify key interventions to strengthen the management of wetlands, enabling the implementation of nature-based solutions while strengthening biodiversity protection. Over time, the RFI seeks to leverage collaborative opportunities by developing partnerships among important stakeholders including national governments, civil society organizations, communities, regional organizations like the East Asian-Australasian Flyway Partnership (EAAFP), development agencies, the private sector, and other relevant entities.

Through the RFI Technical Assistance (TA) implemented over the RFI's development phase from 2021 to 2024, BirdLife International takes the lead in providing and coordinating technical support for development of the RFI. This is carried out in collaboration with the EAAFP and a consortiumof international non-governmental organizations including Wetlands International and the Paulson Institute, as well as two universities, namely the University of Southampton, UK and the National University of Singapore. Over the development phase, the TA team undertook a site selection analysis to identify priority wetland sites in all 10 countries based on recent bird data benchmarked against internationally accepted criteria under the Convention on Wetlands of International Importance (or Ramsar Convention), EAAFP Flyway Network Sites and Important Bird and Biodiversity Areas (IBAs). The team further developed ecosystem services profiles for prioritised wetlands using a multi-pronged approach used the TESSA ecosystem services assessment tool, and data-driven modelling of water based ecosystem services and stored carbon.

In Cambodia, a total of 15 wetland sites, including several Asian Waterbird Census (AWC) count sites, were initially assessed through data analysis and expert consultation, of which 12 were short-listed for assessment based on the available (recent) data. Of these pool of sites, nine (9) were defined and identified to be RFI priority sites on the basis that they support more than 1% the flyway population of at least one EAAF migratory waterbird species. Eight (8) of the RFI sites identified are inland wetlands, most notably a cluster of sites around the Tonle Sap Great Lake, such as Prek Toal, Ang Tropeang Thmor and Boeng Tonle Chhmar. A single coastal site was identified, i.e. Koh Kapik Ramsar Site where there have been extensive surveys of its biodiversity to date, including surveys led by NatureLife Cambodia. 11 EAAF species exceeded the 1% threshold at the site level in Cambodia, with species such as the Masked Finfoot,

Greater Adjutant and Sarus Crane (ssp. *sharpii*) at their highest congregations in Southeast Asia. Other species with important populations and/or congregations in Cambodia includes Spotted Greenshank, Black-headed Ibis and Painted Stork.

2. Site profile of Ang Tropeang Thmor (Sarus Crane Reserve)

Location: Ang Tropeang Thmor is a protected landscape and a crane sanctuary in northwestern Cambodia, located in Phnom Srok District of Banteay Meanchey Province, close to the border with Thailand and 70 km to the north-west of Tonle Sap Lake.

Area: Ang Tropeang Thmor (Sarus Crane Reserve) covers an area of 12,652 ha

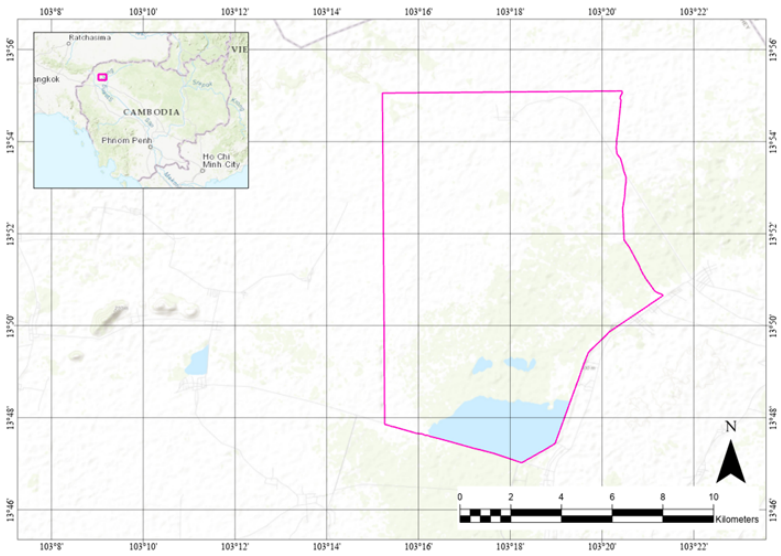

Figure 1. Map of the Ang Tropeang Thmor, showing its location in Cambodia (Map: Evelyn Pina Covarrubias)

Altitude: 14 metres asl. (GoogleEarth)

Geographical coordinates: 13.82 N, 103.31 E

Description of site: The Ang Tropeang Thmor RFI site is centred on a large reservoir built during the Khmer Rouge era. At the height of the wet season, over 80% of the site is under water, but during the dry season only the southeastern corner of the reservoir remains inundated. The areas that are seasonally inundated support wet grasslands, but the northern part of the reservoir is under water for a shorter period each year and has been extensively converted to wet rice agriculture. In the extreme north of the site, the wetland habitats grade into open deciduous dipterocarp forest typical of Cambodia's northern plains.

Site administration, management and land tenure: Ang Tropeang Thmor was first established as a Sarus Crane sanctuary in 1999 and became a Protected Landscape in 2016. The management authority for the protected area is the Ministry of Environment (UNEP-WCMC 2024; https://en.wikipedia.org/wiki/Ang_Trapeang_Thma).

Ang Trapeang Thmor was designated as a conservation area under Government decree No. 0200/10 in 2000. The wetlands captured within the boundaries of the protected area includes the Trapeang Thmor reservoir which is a body of fresh and static water (784 ha), flooded forests (156 ha), grasslands (2,453 ha), irrigated canals, creeks, and ponds (Loeung et al. 2015), and surrounded by a wider mosaic of paddy fields.

Social and economic values: Ang Tropeang Thmor lies within a densely populated and intensively cultivated region, and there has been encroachment into the northern part of the reservoir for wet rice cultivation. As of the early 2000s, an estimated 55,048 people in 11,905 households, in 99 villages (spanning 11 communes) live within Ang Trapeang Thmor, with many households relying on the aquatic habitats for fishing and harvesting other aquatic products to supplement household food and income (Kumaran 2001) although this has increased substantially since then. Sarus Cranes and other waterbirds were formerly hunted by the local communities, but this has now been largely curtailed through enforcement and awareness activities.

3. Biodiversity value of Ang Tropeang Thmor (Sarus Crane Reserve)

3.1. Key habitats

The wetlands captured within the boundaries of the protected area includes the Trapeang Thmor reservoir which is a body of fresh and static water (784 ha), flooded forests (156 ha), grasslands (2,453 ha), irrigated canals, creeks, and ponds (Loeung et al. 2015), and surrounded by a wider mosaic of paddy fields.

3.2. Importance of Ang Tropeang Thmor for migratory waterbird species

Count data from the 2022 Asian Waterbird Census (AWC) was used in the RFI analysis for Ang Trapeang Thmor. Only a single AWC count was conducted in that year, and the results of this count were compared to the Conservation Status Review (CSR1) 1% population estimates to calculate a score for each species. Five migratory waterbird species were found to exceed the 1% population estimates during the 2022 AWC, and the CSR1 scores for these species were summed to produce the overall site score (see Table 1).

Table 1 List of migratory species (based on the EAAFP list of species) with globally significant congregations in Ang Trapeang Thmor wetlands.

Species name	IUCN	Average count	CSR1	CSR1 score
Sarus Crane *Antigone antigone sharpii*	VU	32	2	16
Garganey *Spatula querquedula*	LC	13,000	1,400	9.3
Painted Stork *Mycteria leucocephala*	NT	245	70	3.5
Spot-billed Pelican *Pelecanus philippensis*	NT	152	55	2.8
Black-headed Ibis *Threskiornis melanocephalus*	NT	180	100	1.8

Sarus Cranes are only present at Ang Tropeang Thmor in the dry season (November – March) as non-breeding visitors and depart for their breeding areas in the Northern Plains with the onset of the monsoons in June. In addition to this species, the site supports several globally threatened and near-threatened bird species, including the Greater Adjutant *Leptoptilos dubius* (NT) and the non-migratory Bengal Florican *Houbaropsis bengalensis* (CR), and occasionally, White-shouldered Ibis *Pseudibis davisoni* (CR).

3.3. Other notable biodiversity

Several globally threatened mammal and reptile species occur at Ang Tropeang Thmor, including Long-tailed Macaque *Macaca fascicularis* (EN), Eld's Deer *Rucervus eldii* (EN), Smooth-coated Otter *Lutrogale perspicillata* (VU), Southeast Asian Box Turtle *Cuora amboinensis* (EN) and Elongated Tortoise *Indotestudo elongata* (CR).

4. Ecosystem services

4.1. Ecosystem services provided by Ang Tropeang Thmor (Sarus Crane Reserve)

The Ang Tropeang Thmar landscape, including the surrounding countryside, contains diverse wetland habitats, which provide valuable provisioning, regulating, and cultural ecosystem services (Figure 2). The results from the RFI workshop[1] highlights the top ecosystem services provided by the site, emphasising their essential and non-substitutable nature (Table 2). Provisioning services, such as fresh water and food provision, benefit communities both within, adjacent to, and distant from the site. Genetic resources, however, benefit only communities within the site. Cultural services, particularly recreation and ecotourism, and a sense of place, significantly benefit communities at all distances.

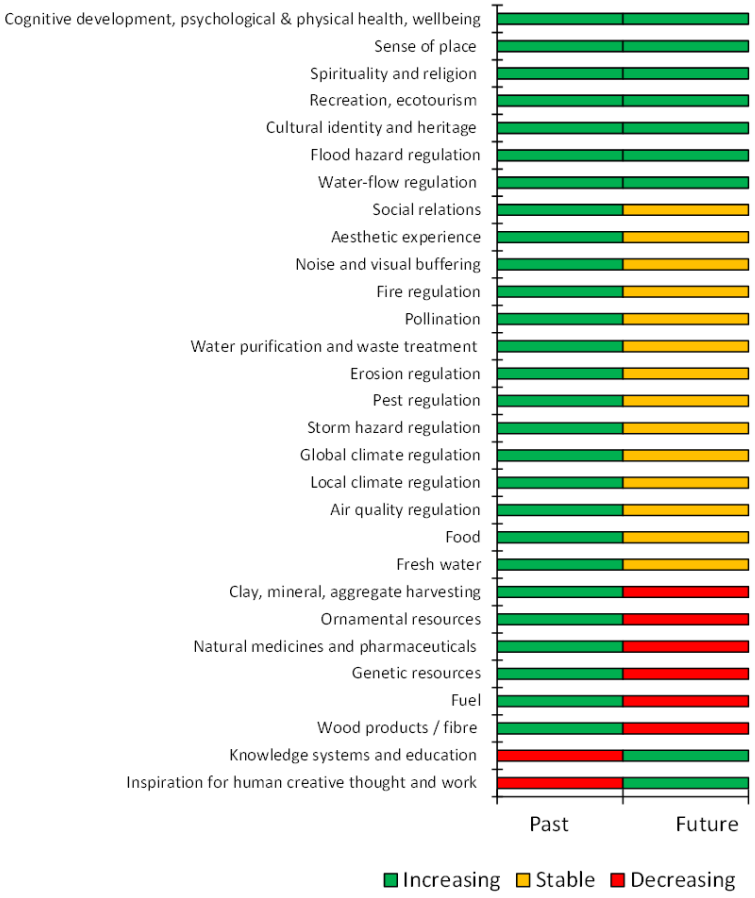

Figure 2. List of ecosystem services provided by Ang Tropeang Thmor (Sarus Crane Reserve), as identified through stakeholder consultation at the Regional Flyway Initiative workshop.

[1] Asian Development Bank. (2023, September 13-14). Cambodia: Wetland Ecosystem Services Workshop [Workshop]. Phnom Pehn, Cambodia. https://events.development.asia/learning-events/cambodia-wetland-ecosystem-services-workshop

Table 2. List of top ecosystem services provided by Ang Tropeang Thmor (Sarus Crane Reserve).

Ecosystem services	Essential or non-substitutable	Benefits to communities			Change	
		Within the site	Adjacent to the site	Distant to the site	Past	Future
Provisioning services						
Fresh water	Yes	✓	✓	✓	Increase	No change
Food	Yes	✓	✓	✓	Increase	No change
Genetic resources	Yes	✓			Increase	Decrease
Cultural services						
Recreation, ecotourism	Yes	✓	✓	✓	Increase	Increase
Sense of place	Yes	✓	✓	✓	Increase	Increase

4.2. Global climate regulating services

Based on the look-up values from a FAO report (Dondini et al. 2023) and IPCC (2006), the amount of carbon stored in Ang Tropeang Thmor is estimated to range from 169,000 to 171,000 tonnes, while the annual carbon sequestration rate is estimated at 1,830 tonnes per year.

4.3. Flood mitigation services

The flood mitigation services provided by Ang Tropeang Thmor were assessed using biophysical values only (see Table A1 and Annex 1 for details). When compared to both the average of the eight RFI inland sites and the average of all other inland wetlands in Cambodia (Table A2 in Annex 1), Ang Tropeang Thmor shows some consistent results in terms of benefits and beneficiaries:

(1) for the average green storage capacity per sq. km of wetland, Ang Tropeang Thmor is above average (411 Giga Litres or GL of water per km^2 vs. 382 GL/km^2 for RFI inland sites and 411 vs. 399 GL/km^2 for all other inland wetlands);

(2) for the average population uniquely benefitting from influential green storage upstream per sq. km of wetland, Ang Tropeang Thmor is below average (73 vs. 80 people/km^2 for RFI inland sites and 73 vs. 110 people/km^2 for all other inland wetlands); and

(3) for the average built-up area uniquely benefitting from influential green storage upstream per sq. km of wetland, Ang Tropeang Thmor is also below average (3.84 ha/km^2 vs. 4.89 ha/km2 for RFI inland sites and 3.84 vs. 3.92 ha/km2 for all other inland wetlands).

5. Drivers of change and their potential impacts on Ang Tropeang Thmor (Sarus Crane Reserve)

5.1. Current drivers of change and their level of impact

Stakeholders at the RFI workshop[2] at Ang Tropeang Thmor identified 31 drivers of change impacting the site, and their corresponding levels of impact on the wetland site (Table 3). High-impact drivers include annual and perennial non-timber crop production, which significantly modifies the land use, leading to habitat loss and degradation.

Biological resource use, such as fishing, killing, and harvesting of aquatic resources, as well as hunting and collecting terrestrial animals, poses moderate threats to biodiversity (medium impact). Livestock farming and grazing also contribute to moderate habitat degradation. Other medium-impact drivers encompass activities like the collection of terrestrial plants, which can disturb native vegetation and alter the habitat. Infrastructure development, including roads, railroads, and tourism infrastructure, affects the site's ecological balance by fragmenting habitats and introducing disturbances. Vandalism and other destructive activities further exacerbate the medium impact on the wetland's natural values.

[2] Asian Development Bank. (2023, September 13-14). Cambodia: Wetland Ecosystem Services Workshop [Workshop]. Phnom Pehn, Cambodia. https://events.development.asia/learning-events/cambodia-wetland-ecosystem-services-workshop

Table 3. Drivers of change and their potential impact on the integrity of Ang Tropeang Thmor (Sarus Crane Reserve) based on consultations with stakeholders.

Driver of change	Impact
Annual and perennial non-timber crop production	High
Collecting terrestrial plants or plant products (non-timber)	Medium
Fishing, killing and harvesting of aquatic resources	
Hunting, killing and collecting of terrestrial animals	
Livestock farming and grazing	
Roads and railroads	
Tourism and recreation infrastructure	
Vandalism, destructive activities or threats to staff and visitors	
Activities of site managers	Low
Agricultural and forestry effluents	
Air-borne pollutants	
Desertification	
Drought conditions	
Droughts	
Drug cultivation	
Erosion and siltation/deposition	
Excess energy	
Fire and fire suppression	
Garbage and solid waste	
Housing and settlement	
Logging and timber harvesting	
Loss of keystone species	
Pathogens	
Recreational activities and tourism	
Research, education and other work-related activities	
Restoration for conservation	
Shipping lanes and canals	
Storm and flooding	
Temperature extremes	
Utility and service lines	
Water extraction/diversion within the wetland site or catchment	

5.2. Potential alternative state of Ang Tropeang Thmor (Sarus Crane Reserve) under current drivers of change

Stakeholders at the RFI workshop[3] defined the most plausible future alternative state (to 2035), and how this will translate to a net change in the cover of different types of wetland habitat types within this site (current habitat cover vs future alternative cover; Figure 3). The alternative state of the site assumes there

[3] Asian Development Bank. (2023, September 13-14). Cambodia: Wetland Ecosystem Services Workshop [Workshop]. Phnom Pehn, Cambodia. https://events.development.asia/learning-events/cambodia-wetland-ecosystem-services-workshop

will be no changes in the current drivers of change impacting the site, and the current management regime.

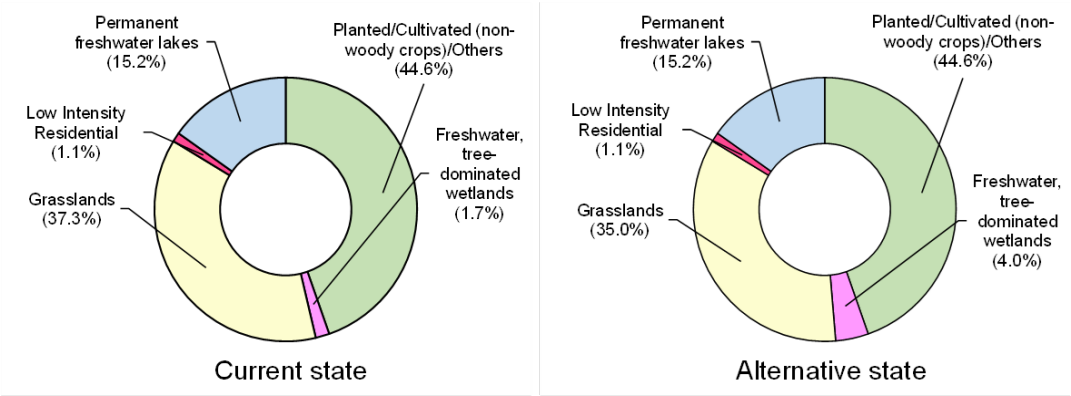

Figure 3. The proportional change in the extent of different habitat types between the current and alternative states of Ang Tropeang Thmor (Sarus Crane Reserve).

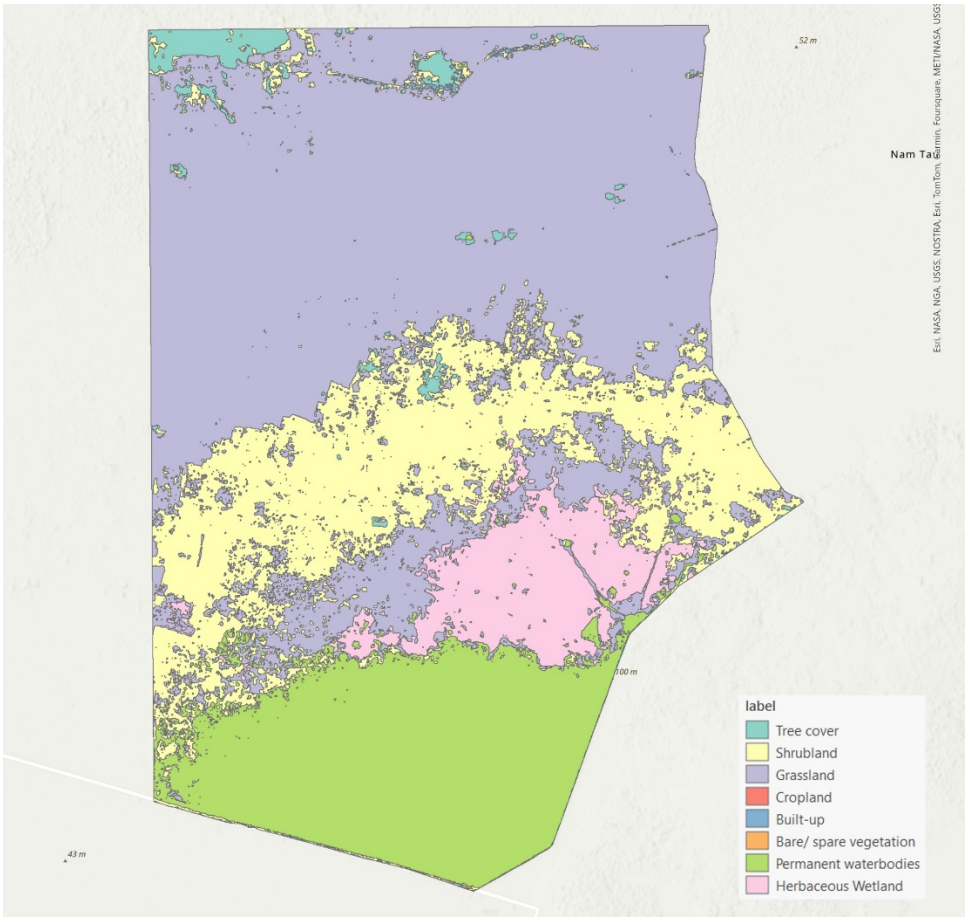

Figure 4. Major land cover types in BPL wetlands based on remotely sensed data (Map: Radhika Bhargava)

5.3. Expected changes in the ecosystem services of Ang Tropeang Thmor (Sarus Crane Reserve)

Stakeholders at the RFI workshop[4] documented the future trends in the provision of ecosystem services in Ang Tropeang Thmor (Sarus Crane Reserve), indicating if the ecosystem services provided by this site (to 2035) will increase, decrease, or will remain stable if the current drivers of change impacting this site will continue in their present condition, with the intervention remains unchanged.

Provisioning services for fresh water and food have seen an increase in the past and are expected to remain unchanged in the future (see Figure 2, Table 2). Genetic resources, however, have increased in the past but are projected to decrease in the future. Cultural services, particularly recreation and ecotourism, and a sense of place, have experienced an increase in the past and are anticipated to continue growing in importance.

In the alternative state, the 1.3-fold increase in wetland area and the loss of 6% of grassland could result in a loss of stored carbon, estimated to be between 2,670 and 5,050 tonnes, and an increase in carbon sequestration rate (carbon accumulation) by approximately 278 tonnes per year.

As presented in Table A5, a net gain of 0.1 hectares of green water habitats (a <0.01% increase in green water habitat area) is expected to result in no meaningful change to green storage capacity per km² of wetland, which will remain at 411 Giga Litres. Consequently, no change in flood mitigation benefits for the downstream population and built-up areas per km² of wetland is anticipated.

6. Capacity needs in Ang Tropeang Thmor (Sarus Crane Reserve)

The stakeholder consultation and analyses with government and civil society stakeholders identified at least 3 stakeholder groups with clear roles in the long-term sustainable management of the wetlands in the Ang Tropeang Thmor (Sarus Crane Reserve). Table 4 summarizes the current and potential roles of these stakeholder groups in relation to the management of the Ang Tropeang Thmor (Sarus Crane Reserve). There are opportunities to strengthen patrolling and law enforcement, patrolling, site management, and wildlife monitoring.

[4] Asian Development Bank. (2023, September 13-14). Cambodia: Wetland Ecosystem Services Workshop [Workshop]. Phnom Pehn, Cambodia. https://events.development.asia/learning-events/cambodia-wetland-ecosystem-services-workshop

Table 4. Capacity needs for key stakeholders involved in the management of the ATT wetlands.

Stakeholder Group	Current role in the wetland management (+/-)	Possible Future role in wetland management (in 10 years)	Current capacity for sustainable wetland management	Capacity Development support needed to improve wetland management	Form of capacity development needed
PDoE & site rangers	• Reporting • Patrols and enforcing regulations (including tackling violations) • Conducting patrols and providing first aid • Demarcation of site and land registration activities	N/A	N/A	• Provision of equipment and tools for patrols, including SMART devices, GPS, camera traps, and laptops • Zonation and development of management plan for ATT • Skill development and application of technology such as SMART Patrol, GPS and GIS software • Knowledge enhancement regarding the value of wetland and biodiversity • Wildlife (field identification) photography	• Funding support both from partners and private sectors • Training • Site visit (local & overseas) • National policy for management • Managing ecotourism activities in a sustainable manner
Local authorities (at commune level and below)	• Raising awareness • Coordinating law enforcement efforts with site-based teams •	N/A	N/A	N/A	• Training on law enforcement issues
Local communities	• Site co-management, including through participating in patrols, outreach, and consultative meetings	N/A	N/A	• Play a major role in leading/supporting the development of action plan and management plans	• Training to implement patrols, and supporting enforcement activities • Financial support from the government,

Stakeholder Group	Current role in the wetland management (+/-)	Possible Future role in wetland management (in 10 years)	Current capacity for sustainable wetland management	Capacity Development support needed to improve wetland management	Form of capacity development needed
					private sector and NGOs

7. Opportunities for RFI interventions

7.1. Recommended Interventions

Ang Trapeang Thmor is one of three key wintering (non-breeding) sites for the Sarus Crane in Cambodia and is currently designated as a Sarus Crane Conservation Area (SCCA) together with Boeng Prek Lpov and Anlung Pring with the Ministry of Environment as its management authority. There are at least 99 villages within and along the boundary of ATT, and local communities are highly dependent on small-scale fishing and harvesting of aquatic resources (Loeung et al. 2015), and dry-season rice farming as a source of livelihood, together with nature-based tourism activities. Rice is widely cultivated in the experimental and buffer zone. Encroachment activities and conflicting land use and water management regimes has either created situations where grassland is insufficiently inundated (increasing the risk of dry-season fires), or overly inundated, hampering rice growing activities, and fuelling local concerns (Pinn et al. 2012). To strengthen management and conservation of ATT there is a clear need for: (1) strengthening legal protection and management of the wetlands, including better zonation of key sites for livelihood and conservation activities catering to the needs of villages in the reserve, while addressing dry-season fires and invasive species such as Giant Mimosa.

ATT is part of the regular tourism circuit for nature-based tourism (especially international birdwatching groups visiting to observe Sarus Cranes) as a result of its proximity to Siem Reap City, and therefore presents significant opportunities for tourism development and expansion, although over time this is expected to increase pressures on the ecological integrity of the site ranging from encroachment to disturbance to wildlife. This can be supported by carefully planned investment into tourism resources, including improvement of ecotourism such as signages and viewing structures, alongside improved management of the wetlands as a whole. This then needs to be supported by targeted work to build the capacity of local communities and tourism businesses (e.g. skills-based training, hospitality training) to scale up tourism operations. There are also major opportunities for rice agriculture transition with a focus

on biodiversity-friendly rice farming using approaches trialled in elsewhere in Cambodia such as Anlung Pring, but unfavourable water regimes have impeded the expansion of rice farming.

Table 5. Summary of key RFI interventions proposed for the Ang Tropeang Thmor (Sarus Crane Reserve)

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
Component 1. Strengthening site management and protection of Ang Trapeang Thmor					
Conduct a scoping study of existing interventions and threats and disturbance at ATT, including targeted work on long-term threats (from climate change, encroachment and invasive species management).	Best practices, guidelines, and standards for proposed RFI interventions	Assessment report with key threats identified and recommendations for improved management published and disseminated to key stakeholders.	100,000	1 year	MOE and Banteay Meanchey Provincial Govenrment ATT management board Conservation organisations (WCS, SVCC) ADB
Strengthen and expand site management and ATT protected landscape, including potentially designation of a buffer zone.	Strengthened co-management of the ATT protected landscape through co-management with key stakeholders Fire risk during the dry season reduced. Measures to address and mitigate fire risk during the dry season defined and actively implemented. Reduced incidences of illegal bird hunting and land clearance due to an increased	Site management and zonation plans over short to medium-term for ATT developed, presented to key stakeholders including all villages in the boundary and within the protected area, and endorsed by MOE Number of consultations conducted to strengthen engagement of local stakeholders for participatory processes, understand local needs, and engage national stakeholders for mandates on zonation.	100,000	2 years	MOE ATT management board Banteay Meanchey provincial government Phnom Srok district government Conservation organisations Community groups (including LCGs) from communes engaged so far (e.g. Paoy Char, Phkaom)

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
	enforcement and patrol activity	Number of implemented activities in the developed site management and zonation plans. Co-management framework developed and piloted. Number of stakeholder groups engaged in the development of site management and zonation plans. Number of reported incidents of illegal bird hunting and land clearance			
Improve water management infrastructure to ensure water supply to ATT during the dry season to minimize the risk of fires.	Mitigation measures for fire risk during dry seasons are in place.	Number of water management infrastructure (including drainage canals and sluice gates) repaired and improved. Number of facilitated localized dredging works for addressing siltation and vegetation.	1,500,000	2-3 years	MOWRAM MOE Provincial Department of Water Resources ATT management board

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
Strengthen the invasive species management program with a focus on Giant Mimosa in ATT and surrounding rice farming landscape.	Invasive species, such as the Giant Mimosa, are reduced and effectively managed specifically on sections of the ATT Core Zone that are important for biodiversity and wintering cranes.	Invasive species management plan updated, with a focus on Giant Mimosa, and aligned with the site management and zonation plans. Number of activities implemented in the invasive species management plan. Area of the ATT wetlands' core zone cleared (target of at least 50 hectares) of invasive species including the Giant Mimosa. At least one experimental plot for Giant Mimosa removal established. Number of stakeholder groups involved in the implementation of the invasive species management plan.	100,000	5 years	MOE ATT management board Conservation and academic organisations (including bird and community-focused NGOs Research institutions (e.g. RUPP) Community groups
Component 2. *Wildlife protection and monitoring, with a focus on the Sarus Crane, storks and other flagship species*					
Strengthen the legal protection and enforcement in ATT	Increased wildlife protection and reduced encroachment, due to improved patrolling and enforcement efforts in ATT Strengthened co-management of the ATT protected landscape through	Number of patrol and enforcement activities implemented in ATT. Co-management framework developed and piloted. Number of stakeholder groups	200,000	3 years	MOE ATT management board Phnom Srok district government Conservation and academic organisations (including WCS and SVCC)

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
	co-management with key stakeholders	(at least two communes) engaged in the implementation of the co-management framework			
Strengthen biodiversity monitoring, with a focus on the Sarus Crane and stork species.	Increased awareness for Sarus Crane and support for large waterbird conservation amongst local people and tourists Improved large waterbird conservation through biodiversity monitoring	Number of awareness-raising activities implemented to preserve cranes and wetlands. Number of stakeholder groups engaged in the awareness-raising activities Biodiversity monitoring program developed, synergized with the management plans and frameworks, and implemented. Number of biodiversity monitoring activities implemented.	100,000	5 years	
Component 3. Strengthen the management of artisanal fisheries and other freshwater resources (e.g. snails, water plants) in Ang Trapeang Thmor reservoir					
Strengthen the management of site fisheries, with a focus on small-scale artisanal fishers.	Stronger management and protection of fish breeding areas; fish re-stocking carried out at regular, agreed intervals with commercially important catfish, knifefish and carp species, in ATT	Number of consultations on fisheries management Licensing framework for fishers established and in place.	500,000	5 years	MAFF Fisheries Administration (FiA) ATT management board

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
	through better regulated fishing activities Fishery resources are conserved through strengthened management system.	Number of stakeholders engaged in sustainable fishing practices. Number of patrol activities, using SMART approach against illegal fishing Fishery monitoring framework in place. At least two fish-breeding sanctuaries established and access managed strictly, with dredging activities to deepen sites. Number of community-led agreements on sustainable fishing practices, supported with improved storage and processing capability to increase market access.			Banteay Meanchey provincial government, including provincial department of agriculture and fisheries. Phnom Srok and relevant commune governments Fishing operators and community groups from all villages in ATT.

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
Strengthen the capacity and resilience of small-scale artisanal fishers and households harvesting aquatic resources.	Fishery resources are conserved due increased awareness of fishers (from the local communities of 12 villages) on wetland impacts, and their adoption of good fishing practices. Fishery resources are conserved through improved access to microfinance for small scale fishing communities based around sustainable practices. Increased stakeholder participation with the improved engagement of women in the workforce.	At least 100 small-scale fishing operators and fishers engaged across two districts. A capacity-building program for local fishing communities (with a representative % of women) in cooperatives established. Number of trained fisherfolk, including women on sustainable fishing practices. Small loan scheme established and piloted with small-scale fishers. Number of fishing cooperatives established and supported. Number of people who benefitted from the microfinance for small scale fishing communities	200,000	5 years	MAFF and provincial department of agriculture and fisheries Phnom Srok district governments Fishing operators Community groups Conservation organisations
Component 4. Upscaling tourism infrastructure and strengthening nature-based tourism in Ang Trapeang Thmor Conservation Area					
Improve and expand tourism infrastructure at Ang Trapeang Thmor, including signage and viewing structures	Improved protection and management of ATT, through ecotourism benefits and increased appreciation of	Number of tourism infrastructure improved and installed (target of at least three jetties and five viewing structures for tourist access)	1,000,000	2 years	MOT ATT management board Banteay Meanchey provincial government

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
	Sarus Cranes, other large waterbirds, and the wetlands.	Number of households benefiting from ecotourism (target of at least 100 households in at least two villages)			Phnom Srok district government Conservation organisations (including bird and community-focused NGOs, such as SVCC) Tourism operators in Siem Reap and Banteay Meanchey
Strengthen the capacity of local communities and businesses for nature-based tourism. Establish a development plan for nature-based tourism in ATT	Improved protection and management of ATT, through nature-based tourism benefits and increased capacity of local stakeholders to support domestic and international tourists.	Provincial and district level tourism plans and strategies updated, in coordination with MOT and relevant tourism stakeholders. An Ecotourism strategy and plan, focused on Sarus Crane and migratory waterbirds, developed and tested with tourism operators. Number of stakeholder groups engaged in the development of the ecotourism strategy and plan. A training program for ecotourism developed. Number of trained people from target communes Number of people benefitting from	200,000	3 years	

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
		ecotourism activities.			
Component 5. Strengthening sustainable and organic rice farming (on Jasmine rice, or other native Tonle Sap rice varieties) in ATT					
Improve water management infrastructure to manage inundation of rice fields (within ATT), and in the surrounding landscape.	Improved management of ATT through the repair of water management infrastructure (including sluice gates) in the Ang Trapeang Thmor reservoir	Number of wate management structures (such as drainage canals and sluice gates) established or repaired. Number of people involved in addressing water regime concerns on rice farming.	1,500,000	Up to 3 years	MOWRAM MAFF MOE Provincial Department of Water Resources Banteay Meanchey Provincial Department of Agriculture, Forestry and Fisheries ATT management board
Pilot sustainable, regenerative rice-farming in selected communes, in the ATT experimental zone (e.g. 'Crane Rice')	Improved management of ATT through sustainable and regenerative rice production	A capacity building (and training) program for organic and biodiversity-friendly rice farming developed and implemented. Number of capacity-building activities implemented. Number of trained rice farmers on biodiversity-friendly and/or organic farming At least XX% of rice farmers in and around ATT cultivating sustainable farming.	250,000	3 years	MAFF Banteay Meanchey provincial government Phnom Srok district government, and relevant district governments Conservation organisations (including bird and community-focused NGOs) Agricultural banks

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
		Number of successful rice-planting trials and experiments (on fertilizer use, soil management) in selected plots in ATT experimental zone.			
Scale up sustainable, regenerative rice-farming in the existing landscapes in ATT, using organic and/or wildlife-friendly approaches. Exchange visits to Anlung Pring and other wetlands to meet local communities involved in organic and wildlife-friendly rice production.	Organic and biodiversity-friendly rice farming expanded and upscaled in landscapes within ATT. Financing mechanism (for local loans and grants) created for local communities and supported by key lending institutions for farmers. Improved management of ATT, through the practice of biodiversity-friendly farming.	At least 30% of rice fields around ATT under organic/biodiversity-friendly cultivation. At least 20% increase in the practice of biodiversity-friendly rice-farming against baselines in ATT Number of small loans granted for marginalized communities Number of people who benefitted from the local financing mechanism.	500,000	10 years	Ministry of Agriculture, Forestry and Fisheries Banteay Meanchey provincial government Phnom Chrok district and relevant commune government Representatives from households 'Crane Rice' community groups Conservation organisations Rural development organisations Fertilizer companies
Improve the management of agrochemical waste in the rice paddies in ATT experimental zone and surrounding areas in Phnom Chrok district.	Improved management of ATT, through the reduction of agrochemical inflow into the wetlands	Agro-chemical management and disposal protocols established and communicated to all relevant villages. Metrics for agrochemical inflow	500,000	3 years	

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
	Increased biodiversity in rice fields in ATT.	established and monitored. Reduced inflow of agro-chemicals into ATT wetlands against baselines and based on set metrics. Number of biodiversity monitoring activities Number of people involved in monitoring the agro-chemical inflow and biodiversity survey			
		Total investment for	**24,250,000**		

7.2. Potential Financing

The estimated project cost is USD 24,250,000 over 5-10 years. This budget supports the development of a site management plan that addresses zonation, fire risk during the dry season, and invasive species, implementation of enforcement and patrolling activities, biodiversity monitoring, establishment of a microfinancing mechanism, improvement of nature-based tourism infrastructure, capacity-building activities on sustainable agriculture, and piloting the transition to sustainable rice farms and fishing practices. Table 5 summarizes the projected budget distribution across the proposed project components.

7.3. Proposed Institutional Arrangements

The proposed project is expected to be implemented over a period of at least five (5) years, with the main project components focusing on improved site management of Ang Trapeang Thmor and water resources management for Ang Trapeang Thmor (led by the Ministry of Environment in coordination with MOWRAM) and expanding organic and/or biodiversity-friendly rice agriculture (with the Ministry of Agriculture, Forestry and Fisheries), and strengthening livelihoods with a focus on small-scale fisheries, nature-based tourism, and rice farming. Conservation organisations and tourism operators are expected

to play a major role in the project by supporting project activities focused on biodiversity monitoring, stakeholder engagement and capacity building for better management of fisheries and rice agriculture.

7.4. Project Beneficiaries

Phnum Srok District has a census population of 65,945 across 15,057 households in six rural communes in 2019. As of the early 2000s, an estimated 55,048 people in 11,905 households, in 99 villages (spanning 11 communes) live within Ang Trapeang Thmor.

This proposed project is expected to undertake activities that promote gender inclusion and participation in livelihood activities, through capacity building activities for organic rice farming, small-scale fisheries, and nature-based tourism.

There are no indigenous communities in the project landscape.

7.5. Anticipated Implementation Risks

Stakeholder engagement: Proposed interventions rely on support from local communities, particularly in adopting biodiversity-friendly and organic farming and fishing practices, patrolling, and co-management. Establishing strong stakeholder buy-in from local leaders and community engagement will facilitate better implementation of the proposed interventions.

Environment: Most proposed interventions are relatively soft and have a low environmental impact, but it may be necessary to consider the effects of expanding tourism on Ang Tropeang Thmor, which could increase anthropogenic pressures on the wetland and lead to increased disturbance to wildlife. Planning with stakeholders to reduce noise pollution during the construction of ecotourism facilities and ongoing ecotourism activities, as well as managing waste pollution from increased tourist traffic, is essential.

It is also important to assess how major infrastructural developments in ATT resulting from the project, such as water infrastructure, may potentially impact the hydrology of the site in the long term. There is a high risk of unsustainable tourism expansion given the site's popularity, and preparatory studies need to assess the effects of increased tourism on ATT's biodiversity and hydrology.

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Annex 1. Supplementary information on flood mitigation services

To further validate the identification of the top ecosystem services by means of stakeholder consultation, an expectedly essential or non-substitutable regulating service across all RFI sites, namely coastal protection and flood mitigation (i.e., storm and flood hazard regulation), was assessed based on a combination of globally available datasets supplemented by web-based tool Co$tingNature (Mulligan, 2022). Estimates for flood mitigation were spatially inferred in QGIS from a selection of metrics expressing different biophysical values modelled online by the Water World component of this tool. Equivalent data to assess monetary values similarly to coastal protection were not available for the RFI region.

The key metrics selected for biophysical values (Table A1) were the average green storage capacity, which is the volume of water stored by each square kilometre of wetland itself as well as its soil and vegetation, and the direct influence of this storage capacity on beneficiaries found downstream of the wetland, both as the average number of people and the average built-up area that are uniquely benefitting from the resulting flood mitigation (and not from other green storage found upstream).

Table A1. Contribution of the wetland habitats to flood mitigation in Ang Tropeang Thmor based on site-level (biophysical) values inferred from Mulligan (2022) and expressed as ranges to represent the resulting uncertainty.

Influence of the wetland on flood mitigation (metrics)	**Benefit/Beneficiaries**
Average green storage capacity per sq. km of wetland in million cubic metres (GigaLitres/km^2)	372 – 449
Average population uniquely benefitting from influential green storage upstream per sq. km of wetland (n/km^2)	66 – 79
Average built-up area uniquely benefitting from influential green storage upstream per sq. km of wetland (ha/km^2)	3.48 – 4.20

Table A2. Biophysical benefits from and beneficiaries of RFI inland wetland sites (expressed as ranges to represent the resulting uncertainty) and at the national level.

Site name	**Green storage capacity (GigaLitres/km^2)**	**Downstream population (n /km^2)**	**Downstream built-up area (ha /km^2)**
Prek Toal Core Area	486 (±29)	112 (±7)	7.19 (±0.42)
Ang Tropeang Thmor	411 (±38)	73 (±7)	3.84 (±0.36)
Boeung Prek Lapouv	448 (±37)	139 (±12)	8.40 (±0.71)
Anlung Pring	264 (±63)	0 (±0)	1.22 (±0.29)

Boeng Chhmar	406 (±27)	102 (±7)	6.57 (±0.43)
Chikraeng / Stoung	206 (±23)	45 (±5)	2.84 (±0.32)
Kulen Promtep WS	456 (±6)	87 (±1)	4.20 (±0.05)
Cambodia RFI average	382	80	4.89
Cambodia national average	458	110	3.92

Table A5. Key habitat types in Ang Tropeang Thmor (Sarus Crane Reserve) based on stakeholder-based assessment at the Regional Flyway Initiative workshop in September 2023.

Habitat type	Current state		Alternative state (2035)	
	Area (ha)	Cover (%)	Area (ha)	Cover (%)
Planted/Cultivated (non-woody crops)/Others	5646.8	44.6	5646.8	44.6
Freshwater, tree-dominated wetlands	214.0	1.7	511.1	4.0
Grasslands	4724.6	37.3	4427.6	35.0
Low Intensity Residential	144.0	1.1	144.0	1.1
Permanent freshwater lakes	1922.3	15.2	1922.3	15.2
Total	12651.7	100.0	12651.7	100.0