



Regional Flyway Initiative · Site Study

May 2026

RFI Priority Site · Candaba Wetlands

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General Site Information

Country	Philippines		
RFI Site Name	Candaba Marsh Wildlife Sanctuary	ID122	
City/ Municipality, Province, Region	Candaba, San Miguel, and San Ildefonso municipalities, Pampanga, Central Luzon		
Geographical coordinates	15.07° N, 120.88° E	Area (has)	9,987 ha
Key species	Migratory waterbirds such as Garganey <i>Spatula querquedula</i> , Philippine Duck <i>Anas luzonica</i>		
Key habitats (biomes)	Floodplain wetlands		
Key ecosystem services	Flood hazard regulation and the provisioning of freshwater resources. Recreation and ecotourism.		
Key drivers of change	Agricultural expansion and intensification; expansion of industrial and residential areas.		
Conservation status (mark all that applies)	<input type="checkbox"/>	Protected Area	<input type="checkbox"/>
	<input type="checkbox"/>	Ramsar Site	<input type="checkbox"/>
		Flyway Network Site	
		Others _____	
IBA/ KBA name (and number) and other designations	Candaba Marsh Wildlife Sanctuary		
Management Stakeholders	PENRO Pampanga, LGUs, private landowners		
With management plan?	Yes		
Project concept themes	Watershed management, sustainable rice cultivation, payment for ecosystem services		
Length of project	8-10 years		
Sector/s	Water management, and agriculture		
No. of potential beneficiaries	Approximately 119,497		
Indigenous Peoples	<input type="checkbox"/>	No	<input type="checkbox"/>
		Yes _____	
Anticipated Implementation Risks	Reduce incomes for rice farmers under biodiversity-friendly agri-schemes. Short-term disturbance to wildlife from localized construction of infrastructure.		
Estimated Project Budget (US\$)	15,100,000 for ten years		
Potential Source/s of Financing	<input type="checkbox"/>	Loan (Loan financing, with co-financing from GEF grants.)	<input type="checkbox"/>
	<input type="checkbox"/>	Grant	<input type="checkbox"/>
		Private Sector	
		Public-Private Partnership (PES scheme, if successful, can generate additional source of finances for wetland protection.)	

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Abbreviations

ADB	Asian Development Bank
AWC	Asian Waterbird Census
CEPA	Communications, education and public awareness
CSR	Conservation Status Review
DMC	Developing Member Country
EAAFP	East Asian-Australasian Flyway Partnership
ECA	Ecologically Critical Area
IBA	Important Bird and Biodiversity Area
KBA	Key Biodiversity Area
LGU	Local Government Unit
NGO	Non-governmental Organization
OECD	Other effective area-based conservation measures
PENRO	Provincial environment and natural resources office
PES	Payment for ecosystem services
RFI	Regional Flyway Initiative
SCPW	Society for the Conservation of Philippine Wetlands
SLR	Sea Level Rise
TESSA	Toolkit for Ecosystem Services Assessment
UNESCO	United Nations Educational, Scientific and Cultural Organization
USAID	United States Agency for International Development
USD	United States Dollars
WBCP	Wild Bird Club of the Philippines

Executive Summary

The Candaba Wetlands (15.07° N, 120.88° E) is a complex of freshwater ponds, marshes alongside surrounding areas of seasonally flooded grassland, palm savanna on an extensive alluvial floodplain spanning 14,000 ha on the floodplain of the Pampanga River, Luzon's second largest. Presently, much of the wider Candaba landscape has been converted into rice fields and plantations of watermelons and while the extent of natural wetlands is a fraction of its former extent; these remnant marshland and ponds are however used by fairly large congregations of migratory waterbirds. The main area for waterbirds is an impoundment of about 300 ha, with a mixture of open shallow water, small islands, and rafts of floating vegetation, adjacent to the Pampanga River about nine km north of the town of Baliuag. This site still supports large congregations of migratory ducks, the two most abundant species being the Philippine Duck *Anas luzonica* and Garganey *Spatula querquedula*, together with smaller congregations of Northern Pintail *Anas acuta*, Eurasian Wigeon *Mareca penelope*, Northern Shoveler *Spatula clypeata*, and Tufted Duck *A. fuligula*.

Agricultural expansion and intensification for rice have transformed the middle Pampanga floodplain to mostly rice paddies and various other cash crops (e.g., watermelon), at the expense of natural stands of seasonally inundated grasslands and the waterbird populations they support. The expansion of commercial and industrial areas further poses major threats to the remaining wetlands by contributing to habitat loss, land and water pollution. Stakeholders have additionally identified fishing and little regulated harvest of aquatic resources, illegal hunting of wildlife (e.g. waterbirds), land clearance, and livestock farming to have further degraded the Candaba wetlands. While Candaba is widely recognized to be an important wetland for migratory species, there has been limited effort to conserve the site or advance management practices that benefit biodiversity; to a large extent this has been impeded by the fact that most land in the Candaba landscape, including remaining areas of wetlands, are privately owned.

To improve management and conservation of Candaba wetlands, there is considerable scope for improving water management in the wider Pampanga River floodplain. Ongoing efforts for improving flood control and management in the lower Pampanga offers a window of opportunity for synergy. In addition, there are opportunities for, (1) tourism development with a focus on agro-tourism and nature-based tourism, through the creation of new infrastructure such as a wetland center and strengthening the capacity of tourism operators, (2) establishment of a payment for ecosystem services (PES) scheme for the Pampanga River Basin to generate revenue for (upstream) wetland management and protection, (3) improved biodiversity monitoring, and (4) the establishment of biodiversity-friendly rice initiatives that has been piloted elsewhere in Southeast Asia. This may involve the use of rice cultivation practices with considerable reduction in agro-chemical usage, and the retention of strips and plots of vegetated land for biodiversity. In addition, there is a possibility of targeted restoration of disused land parcels into reedbeds and woodland that could benefit biodiversity.

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 consortium of 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 prioritized 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 the Philippines, a total of 20 wetland sites, including many Asian Waterbird Census count sites, were initially assessed through data analysis and expert consultation, of which twelve (12) 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. The majority of the RFI wetlands prioritized for the Philippines are coastal wetlands, a consequence of the country's long coastline, with the largest cluster of priority sites being North Manila Bay, which constitutes three sites across the provincial jurisdictions of Bataan, Pampanga and Bulacan. 28 EAAF species exceeded the 1% threshold at the site level, with species such as Chinese Crested Tern, Chinese Egret and the Tufted Duck.

2. Site profile of Candaba Wetlands

Location: Candaba Wetlands is in the towns of Candaba, San Miguel, and San Ildefonso, 50 km NNW of Metro Manila, in Pampanga, and Bulacan and Nueva Ecija Provinces, Central Luzon.

Area: The Candaba Wetlands RFI site has an area of 9,987 ha.

Altitude: 11 m asl.

Geographical coordinates: 15.07° N, 120.88° E

Description of site: The Candaba Wetlands is a complex of freshwater ponds, swamps and marshes with surrounding areas of seasonally flooded grassland, cultivated land and palm savanna on a vast alluvial flood plain. The entire area is usually flooded in the wet season, but most of it dries out during the dry season (late November to April) and is converted into rice fields and plantations of watermelons. The main area for waterbirds is a privately-owned, but little managed impoundment of about 300 ha, with a mixture of open shallow water, marshland, small, vegetated islands, and rafts of floating vegetation, adjacent to the Pampanga River about nine km north of the town of Baliuag.

Site administration, management and land tenure: A small part of Candaba Wetlands is state owned and has been classified as "alienable and disposable"; the remainder is privately owned agricultural and residential land, owned by many individuals.

The floodplain of the Pampanga is today among the largest rice-farming landscapes in the Philippines, much of this landscape having been converted from formerly natural wetlands such as seasonally flooded grasslands and marshes. Much of the Candaba landscape is under rice cultivation and mostly under private ownership, including remnant areas of wetlands and natural water bodies. Overtime, rice agriculture is expected to intensify, while major infrastructure is being developed to alleviate flooding.

Social and economic values: Candaba Wetlands acts as a natural flood retention basin holding wet season overflow from the Maasim, San Miguel, Garlang, Bulu and Peñaranda Rivers, and draining into the Pampanga River. It is a favorite spot for local and visiting birdwatchers and naturalists and has potential for nature oriented outdoor recreation and conservation education as there are few other places so close to the metropolitan Manila that support as much wildlife. The main area for waterbirds is used as a fishpond during the wet season and is then drained to be used for agriculture. In recent years the local people have started to grow rice instead of watermelons in the surrounding area, which entails draining the marshes in December or January instead of March or April, and as a result fewer ducks now winter at Candaba.

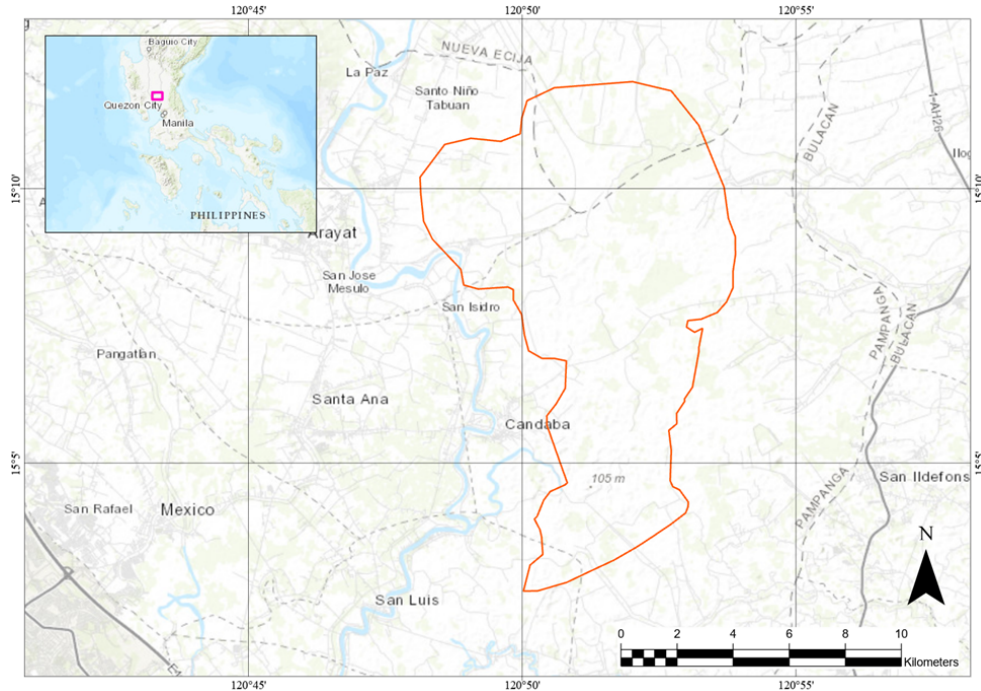


Figure 1 Map of the Candaba Marshes with the Pampanga River to the west of the site. Candaba is the most extensive freshwater wetland along the floodplain of the Pampanga River. (Map: Evelyn Covarrubias).

3. Biodiversity value of Candaba Wetlands

3.1. Key habitats

The main area for waterbirds is a privately-owned, but little managed impoundment of about 300 ha, with a mixture of open shallow water, marshland, small, vegetated islands, and rafts of floating vegetation, adjacent to the Pampanga River about nine km north of the town of Baliuag.

3.2. Importance of Candaba Wetlands for migratory waterbird species

Candaba Wetlands was, until recently, a nationally and internationally important staging and wintering area for large congregations of migratory ducks, possibly the largest in the Philippines. The site regularly supported 5,000-10,000 birds and with about 100,000 ducks observed on a single day in 1982, but their counts of migratory waterbirds has shown a dramatic decline. The two most abundant species used to be Philippine Duck *Anas luzonica* and Garganey *Spatula querquedula*, Northern Pintail *Anas acuta* was common, and other species occurring in significant numbers were Wandering Whistling-duck *Dendrocygna arcuata*, Eurasian Wigeon *Mareca penelope*, Northern Shoveler *Spatula clypeata*, Common

Pochard *Aythya ferina* and Tufted Duck *A. fuligula*. Candaba Wetlands was also important for wintering egrets. The loss of wetland habitat, including open marshy areas and ponds, and agricultural intensification for rice farming may be a cause of declines.

Waterbird count data from the 2019 and 2021 Asian Waterbird Census was used in the RFI priority sites analysis for Candaba Wetlands. The counts from these two years were averaged and then compared to the CSR1 1% population estimates to calculate a score for each species. Garganey was the only migratory waterbird found to exceed the 1% population estimates (see Table 1), and the population of this species provided the overall RFI score for this site.

Table 1 List of migratory species (based on the EAAFP list of species) with globally significant congregations in the Candaba Marsh Wildlife Sanctuary.

Scientific name	IUCN	Average count	CSR1	CSR1 score
Garganey <i>Spatula querquedula</i>	LC	7,321	1,400	5.2

Candaba Wetlands supported an important population of the globally threatened, non-migratory Philippine Duck *Anas luzonica* (VU) in the past, but its numbers have declined in recent years. The reed-beds at Candaba and in the surrounding areas are one of the few known wintering areas of the globally threatened Streaked Reed-warbler *Acrocephalus sorghophilus* (CR), a rare and little-known migratory passerine that has not been recorded in recent years.

Although the numbers of ducks and other waterbirds have declined at Candaba Wetlands, there is great potential to restore the wetland habitats there and manage them for the benefit of migratory waterbirds.

3.3. Other notable biodiversity

4. Ecosystem services

4.1. Ecosystem services provided by Candaba Wetlands

The Agusan Marsh Wildlife Sanctuary provides various ecosystem services that are crucial for the surrounding environment and communities (Figure 2). Existing studies estimating carbon sequestration just for peatlands within the Agusan Marsh alone showed that aboveground carbon varied from 1.29 Mg

C ha⁻¹ to 37.2 Mg C ha⁻¹ (Orella et al. 2022). The results from the RFI workshop¹ in the Philippines highlight the top ecosystem services provided by the site, emphasizing their essential and non-substitutable nature (Table 2). Provisioning services, such as fresh water and food, offer significant benefits to communities located within, adjacent to, and distant from the sanctuary. Regulating services, including water-flow regulation, flood hazard regulation, and water purification and waste treatment, all key services provided by freshwater wetland systems such as Agusan, are also vital for these communities at all distances.

The Candaba wetlands and the adjacent Pampanga River provide a range of essential provisioning, regulating, and cultural ecosystem services that are critical for the surrounding environment and communities (Figure 2). These services offer valuable benefits across different spatial scales, including communities within, adjacent to, and distant from the site, including the major cities of San Fernando and Angeles in Pampanga Province (Table 2). The results from the RFI workshop² in the Philippines highlighted the site’s provisioning services, such as freshwater and food, provide notable benefits for local people, especially rice farming households, its food provision benefits communities across all distances from the site, and its regulating services, particularly flood hazard regulation, are essential to local communities. During the typhoon season, the river and its surrounding floodplain captures and stores large quantities of water, which otherwise will drive major flooding. Cultural services, including recreation and ecotourism, as well as knowledge systems and education, provide significant value to communities at all distances from the wetlands.

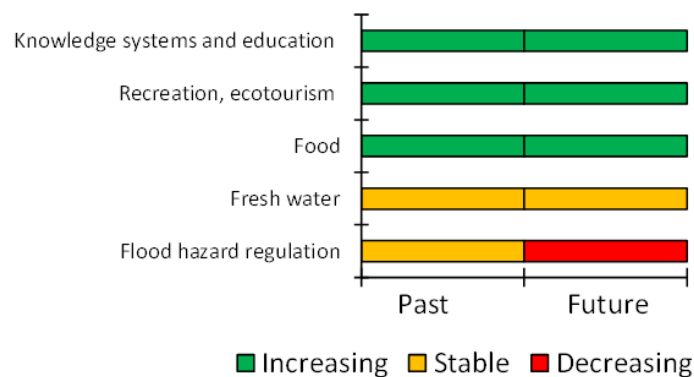


Figure 2 List of ecosystem services provided by Candaba Wetlands, as identified through stakeholder consultation at the Regional Flyway Initiative workshop.

¹ Asian Development Bank. (2023, June 27–30). *Philippines: Wetland Ecosystem Services Workshop* [Workshop]. Asian Development Bank Headquarters, Manila, Philippines. <https://events.development.asia/learning-events/philippines-wetland-ecosystem-services-workshop>

² Asian Development Bank. (2023, June 27–30). *Philippines: Wetland Ecosystem Services Workshop* [Workshop]. Asian Development Bank Headquarters, Manila, Philippines. <https://events.development.asia/learning-events/philippines-wetland-ecosystem-services-workshop>

Table 2 List of the most important ecosystem services provided by Candaba Wetlands.

Ecosystem services	Essential or non-substitutable	Benefits to communities			Change	
		Within the site	Adjacent to the site	Distant to the site	Past	Future
<i>Provisioning services</i>						
Fresh water		✓			No change	No change
Food		✓	✓	✓	Increase	Increase
<i>Regulating services</i>						
Flood hazard regulation	Yes	✓	✓		No change	Decrease
<i>Cultural services</i>						
Recreation, ecotourism		✓	✓	✓	Increase	Increase
Knowledge systems and education	Yes	✓	✓	✓	Increase	Increase

4.2. Global climate regulating services

4.3 Flood mitigation services

The flood mitigation services provided by Candaba Wetlands were assessed using biophysical values only (see Table A1 and Annex 1 for details). When compared to both the average of the three RFI inland sites and the average of all other inland wetlands in the Philippines (Table A2 in Annex 1), Candaba Wetlands show some partly mixed results in terms of benefits and beneficiaries:

(1) for the average green storage capacity per sq. km of wetland, Candaba Wetlands are consistently below average (309 Giga Liters or GL of water per km² vs. 562 GL/km² for RFI inland sites and 448 GL/km² for all other inland wetlands);

(2) for the average population uniquely benefitting from influential green storage upstream per sq. km of wetland, Candaba Wetlands are also below the average of RFI inland sites (129 vs. 165 people/km²) as well as of all other inland wetlands (129 vs. 624 people/km²); and

(3) for the average built-up area uniquely benefitting from influential green storage upstream per sq. km of wetland, Candaba Wetlands are consistently above average (6.35 ha vs. 2.97 ha/km² for RFI inland sites and 5.35 ha/km² for all other inland wetlands).

5. Drivers of change and their potential impacts on Candaba Wetlands

5.1. Current drivers of change and their level of impact

Stakeholders at the RFI workshop³ identified 18 drivers of change impacting the Candaba Wetlands. Table 3 highlights these key drivers and their corresponding level of impact on the site. High-impact drivers include commercial and industrial areas, which pose significant threats to the wetland by contributing to habitat loss and pollution. Additionally, fishing, killing, and harvesting of aquatic resources, habitat clearing, housing and settlement development, hunting of terrestrial animals, livestock farming, and grazing also substantially impact the wetland's biodiversity and ecosystem health. Freshwater aquaculture is another high-impact activity affecting the site's ecological balance. Medium-impact drivers include increased fragmentation within the wetland, which affects habitat connectivity and species movement. Infrastructure developments such as roads, railroads, utility lines, and destructive activities such as vandalism also contribute to moderate levels of change in the wetland environment.

Table 3 Drivers of change and their potential impact on the integrity of Candaba Wetlands based on consultations with stakeholders.

Driver of change	Impact
Commercial and industrial areas	High
Fishing, killing and harvesting of aquatic resources	
Habitat clearing	
Housing and settlement	
Hunting, killing and collecting of terrestrial animals	
Livestock farming and grazing	
Loss of keystone species	
Marine and freshwater aquaculture	
Increased fragmentation within the wetland site	Medium
Roads and railroads	
Utility and service lines	
Vandalism, destructive activities or threats to staff and visitors	
Activities of site managers	Low
Collecting terrestrial plants or plant products (non-timber)	
Logging and timber harvesting	
Recreational activities and tourism	
Research, education and other work-related activities	
Tourism and recreation infrastructure	

³ Asian Development Bank. (2023, June 27–30). *Philippines: Wetland Ecosystem Services Workshop* [Workshop]. Asian Development Bank Headquarters, Manila, Philippines. <https://events.development.asia/learning-events/philippines-wetland-ecosystem-services-workshop>

5.2. Potential alternative state of Candaba Wetlands under current drivers of change

Stakeholders at the RFI workshop⁴ 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 will be no changes in the current drivers of change impacting the site, and the current management regime.

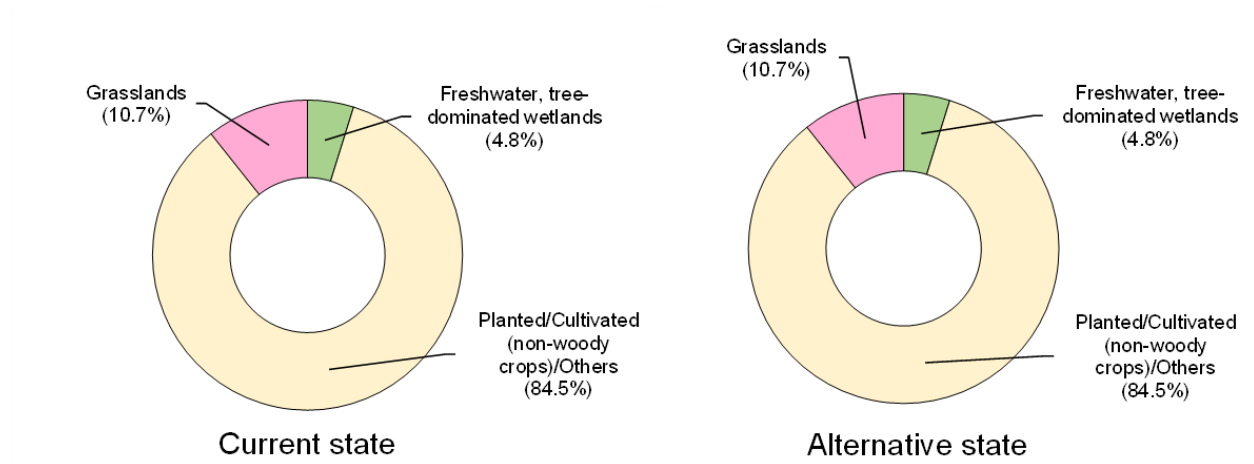


Figure 3 The proportional change in the extent of different habitat types between the current and alternative states of Candaba Wetlands.

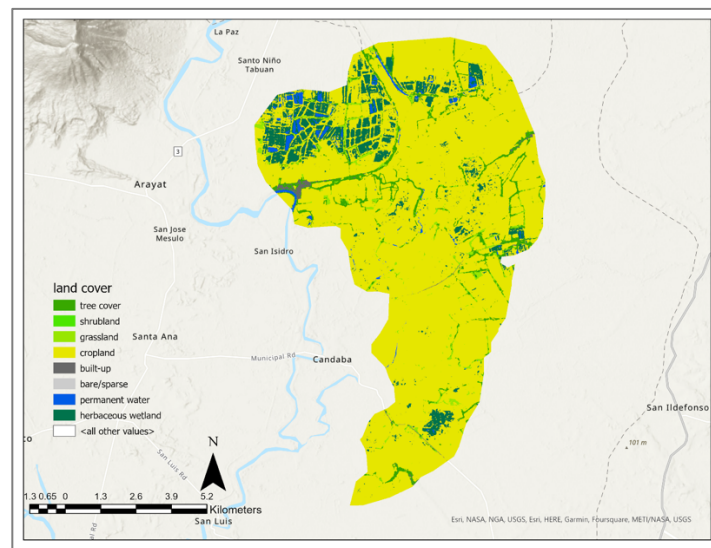


Figure 4 Land use cover (as of 2019, based on European Space Agency imagery) in the Candaba wetlands. (Map: Radhika Bharghava)

⁴ Asian Development Bank. (2023, June 27–30). *Philippines: Wetland Ecosystem Services Workshop* [Workshop]. Asian Development Bank Headquarters, Manila, Philippines. <https://events.development.asia/learning-events/philippines-wetland-ecosystem-services-workshop>

5.3. Expected changes in the ecosystem services of Candaba Wetlands

Stakeholders at the RFI workshop⁵ documented the future trends in the provision of ecosystem services in Candaba Wetlands, indicating if the ecosystem services provided by this site (to 2035) will increase, decrease, or will remain stable, assuming that the current drivers of change impacting this site will continue in their present condition, with the intervention remains unchanged.

Figure 2 and Table 2 highlight that while the provision of fresh water remains unchanged both in the past and future, food provision has seen and is projected to experience an increase, in part due to agricultural intensification. Although regulating services, particularly flood hazard regulation, have remained stable in the past, they are expected to decline in the future. Cultural services, including recreation and ecotourism, as well as knowledge systems and education, have shown an increase over time and continue to provide significant value to communities at all distances from the wetlands.

No net change in the area of green water habitats, including freshwater tree-dominated wetlands, grasslands, and planted/cultivated areas, as presented in Table A5, is expected. The composition and total area remain identical. Consequently, the green storage capacity per km² of wetland will remain unchanged at 309 Giga Liters, and no change in flood mitigation benefits for the downstream population and built-up areas is anticipated.

6. Capacity needs in Candaba Wetlands

Stakeholder consultations identified major capacity gaps for land use planning, agriculture, and local tourism development. There are also opportunities for universities and conservation organizations to support and address local capacity needs, including institutional capacity for better conservation and management of the Candaba landscape for wetland protection and biodiversity.

Table 4 Capacity needs for improved management of Candaba wetlands, identified at the stakeholder level.

Stakeholder	Current role(s) in wetland management	Future role(s) (alt state)	Current capacity	Future capacity (alt state)	Form of capacity development
Agriculture (farming organizations etc.)	Food production (+), livelihood (+), conversion of land (-)	Food production (+), Livelihood (+)	Food production-	Tour guiding Bird and wildlife monitoring	Funding support Training on key skills set

⁵ Asian Development Bank. (2023, June 27–30). *Philippines: Wetland Ecosystem Services Workshop* [Workshop]. Asian Development Bank Headquarters, Manila, Philippines. <https://events.development.asia/learning-events/philippines-wetland-ecosystem-services-workshop>

Stakeholder	Current role(s) in wetland management	Future role(s) (alt state)	Current capacity	Future capacity (alt state)	Form of capacity development
				Organic agriculture	Benchmarking visits
Research institutions	Urbanization (as landowners)(-), research (+), capacity building (+), scientific knowledge generation (+)	Research (+), cap building (+), knowledge generation (+)	Conduct of KAP surveys alongside IDC/CEPA	Provide research funds, sustain CEPA activities; additional HR/manpower	Development of IEC materials Conduct of educational seminars
Non-government organizations	Conservation, community development, CEPA	Enhanced conservation work, CEPA			
	Conservation	Enhanced conservation work			
	Funding roles for trainings	Funding source			
Government agencies, e.g. DENR	Resource management, regulation, conservation, CEPA	Resource management, regulation, conservation, CEPA		Research funds (ERDB), technology transfer	Training workshops, capacity building
NGAs - DA	Technical assistance, capacity building, CEPA	Technical assistance, capacity building, CEPA			
NGAs - DOT	CEPA, Tourism	CEPA, Tourism			

7. Opportunities for RFI interventions

7.1 Recommended Interventions

There are major gaps for wetland conservation and biodiversity, given the lack of legal protection. Therein lie opportunities to improve management by modifying water regimes for biodiversity, while reducing the environmental impact of rice-planting regimes through pollution control and better management of the rice landscapes. Water management regimes and structures can be enhanced and expanded to benefit rice production and biodiversity, including enhancing ecosystem services through improved green and blue storage capacity.

Table 5 Key interventions recommended to improve the management of the Candaba Wetlands.

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
<i>Component 1. Enhancement of wetland-based ecotourism</i>					
Develop a province-wide framework and plan on nature-based tourism, with insights from vulnerable groups.	Cohesive and inclusive nature-based tourism implementation in Pampanga Nature-based tourism strategy and plan developed with inputs from key stakeholders	A province-wide framework and plan for nature-based tourism developed and disseminated to key stakeholders in Pampanga. Number of income-generating related activities developed and tested with local communities	200,000	1.5 years	Department of Environment and Natural Resources Department of Tourism LGUs Ecotourism operators (e.g. bird tour companies)
Assess and implement income-generating activities for local communities, especially communities near to ecologically sensitive areas.	Appropriate income-generating activities have been developed and tested with local communities Nature-based tourism as a livelihood opportunity has been strengthened.	Number of people benefitting from the income-generating activities, with focus on vulnerable groups			Conservation organizations (including bird and community-focused NGOs) Provincial Government of Pampanga

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
Improve the capacity of small-scale tourism operators (targeting domestic tourists, targeting agro-tourism and wetland tourism)	<p>Training and capacity needs for agro- and wetland-based tourism assessed</p> <p>Relevant training modules developed and implemented with key stakeholders (e.g., DENR, LGUs, provincial government, DoT, local communities)</p> <p>Improved capacity of key stakeholders about agro-tourism and wetland tourism</p>	<p>Training Needs Assessment on agro- and wetland-based tourism completed and disseminated to concerned stakeholders</p> <p>Number of training modules developed based on the results of training needs assessment</p> <p>Number of capacity-building activities administered with concerned stakeholders, with focus on tourism operators and local communities</p> <p>Number of people benefitting from the capacity-building activities, especially those from the vulnerable groups</p>	100,000	5 years	<p>Concerned municipal LGUs</p> <p>local communities</p>
Establish a wetland center focused on nature interpretation and wetland ecosystem services	<p>Model wetland center (on freshwater wetland) established in the Candaba landscape, targeting domestic tourists and researchers, that</p>	<p>One wetland center constructed with associated visitor facilities such as wetland exhibits, boardwalks and viewing platforms.</p> <p>Management board and mechanism involving local</p>	500,000	2-3 years	<p>Department of Environment and Natural Resources</p> <p>Department of Agriculture</p> <p>Department of Tourism</p>

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
	<p>demonstrates agro-tourism as a strategy for conserving wetlands and migratory species.</p> <p>Increased knowledge and appreciation of local communities about wetland and migratory waterbird conservation</p>	<p>communities and LGUs established, in line with the planned province-wide plan for nature-based tourism.</p> <p>Number of visiting tours conducted in the wetland center to share about wetland and migratory waterbird conservation.</p>			<p>Provincial Government of Pampanga</p> <p>concerned municipal LGUs</p> <p>Conservation organizations (including bird and community-focused NGOs) such as SCPW, Macagatal Irrigators Association</p>
<i>Component 2. Watershed management for the Pampanga River Basin</i>					
<p>Improve watershed protection of the Pampanga River basin and watershed, across three municipalities/towns</p>	<p>Updated watershed management plan for the Pampanga River Basin.</p> <p>Capacities strengthened for selected LGUs across four municipalities on watershed management, with a focus on addressing water pollution, solid waste pollution, deforestation and waste management.</p>	<p>Watershed management plan for the Pampanga River Basin updated with the mandate of the PENRO/DENR and disseminated to stakeholders.</p> <p>Training modules on watershed management developed and implemented at four municipalities.</p>	500,000	2 years	<p>Department of Environment and Natural Resources</p> <p>Provincial Government of Pampanga</p> <p>concerned LGUs</p> <p>Conservation organizations such WBCP and SCPW</p> <p>Research institutions</p> <p>local communities</p>

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
Establish a biodiversity and wetland monitoring scheme focusing on aquatic biodiversity and waterbirds.	<p>Biodiversity and wetlands monitoring framework and mechanism for the site established.</p> <p>Improved local biodiversity and wetland information for better site management.</p> <p>Formation of a locally led conservation monitoring group led by the LGUs</p>	<p>Biodiversity and wetlands monitoring framework identified and used for site monitoring</p> <p>Number of monitoring reports on the biodiversity and wetland status generated, especially during the migration season</p> <p>A locally led conservation monitoring group organized</p>	400,000	3 years	
<i>Component 3. Establishment of a payment for ecosystem services (PES) scheme for the Pampanga River Basin</i>					
Assess the feasibility of payments for ecosystem services (for downstream cities, e.g. Angeles, San Fernando)	The PES scheme has been studied, consulted, and presented with stakeholders resulting in a cohesive and inclusive approach for implementation.	Feasibility of implementing a PES scheme for selected cities determined and presented with key stakeholders.	100,000	1 year	<p>Department of Environment and Natural Resources</p> <p>Provincial Government of Pampanga</p> <p>concerned LGUs</p>
Depending on the results of the feasibility assessment, establishing a payment for ecosystem services (PES) scheme for the Pampanga floodplain	<p>PES mechanism tested for the Pampanga River basin.</p> <p>Supporting structure, such as governance, finance, and other resources have been identified and set</p>	<p>PES framework, including supporting structures, developed and integrated into relevant plans for the Pampanga floodplain</p> <p>PES mechanism piloted and further</p>	500,000	8 years	<p>Conservation organizations (including bird and community-focused NGOs)</p> <p>Research institutions</p> <p>local communities</p>

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
	up. Lessons on testing the PES has been documented, guiding further integration of the PES mechanism into relevant plans for the Pampanga floodplain.	assessed, including revenue generated for rice farmers and landowners in the Pampanga River Basin.			
<i>Component 4. Biodiversity-friendly rice cultivation</i>					
Assess and pilot a biodiversity-friendly rice agricultural scheme, which can be used a demonstration farm for local farmers	Baseline information needed to pilot a biodiversity-friendly rice agricultural scheme has been generated. Partner communities, including private landowners, support the pilot of the biodiversity-friendly rice agricultural scheme. The demonstration farm encourages biodiversity-friendly rice farming practices from local farmers.	Baseline information generated, consulted, and presented to key stakeholders, including vulnerable groups Number of local supporters for adopting biodiversity-friendly rice agricultural scheme	500,000	10 years	Private landowners Agricultural enterprises Research institutions Conservation organizations DENR DA Provincial Government of Pampanga concerned LGUs

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
Scale up demonstration farm within the RFI site, targeting up to 200 hectares in five years	<p>A province-wide framework and plan, with possible benefits, has been developed to support the scale-up of the demonstration farm.</p> <p>Cooperatives established, in cooperation with LGUs and private landowners, to support local farmers interested in shifting to the biodiversity-friendly agricultural scheme.</p>	<p>Up to 200 ha of rice fields under cultivation using a biodiversity-friendly approach, including potentially organic varieties in five years' time.</p> <p>At least 2 cooperatives and/or enterprises established to manage production, distribution of rice to consumers in Greater Manila.</p>			
<i>Component 5. Wastewater management and pollution control for the Pampanga floodplain</i>					
Develop a province-wide framework and plan on wastewater management pollution control, with insights from key stakeholders	<p>Cohesive and inclusive plan for addressing wastewater and pollution in Pampanga</p> <p>Province-wide strategy and plan developed with inputs from key stakeholders for waste management and pollution control</p> <p>Appropriate activities have</p>	<p>A province-wide framework and plan for addressing wastewater and pollution developed and disseminated to key stakeholders in Pampanga.</p>	500,000	3 years	<p>Department of Environment and Natural Resources</p> <p>Provincial Government of Pampanga</p> <p>concerned LGUs</p> <p>Conservation organizations (including bird and community-focused NGOs)</p> <p>Research institutions</p>

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
	<p>been developed with local communities</p> <p>Wastewater and pollution are being addressed by key stakeholders for the Pampanga floodplain</p>				local communities
<p>Increase institutional capacity of key stakeholders on wastewater management and pollution control for the Pampanga floodplain</p>	<p>Training and capacity needs for addressing wastewater and pollution generated</p> <p>Relevant training modules developed and implemented with key stakeholders (e.g., DENR, LGUs, provincial government, DoT, local communities)</p> <p>Improved capacity of key stakeholders about wastewater management and pollution control</p>	<p>Training Needs Assessment on the capacity needs for wastewater and pollution control completed and disseminated to concerned stakeholders</p> <p>Number of training modules developed based on the results of training needs assessment</p> <p>Number of capacity-building activities administered with concerned stakeholders</p> <p>Number of people benefitting from the capacity-building activities, especially those from the vulnerable groups</p>			
<p>Establish infrastructure</p>	<p>Regulations and guidance for</p>	<p>Number of supported</p>			

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
to support the implementation of the plan for managing wastewater and pollution.	<p>agro-chemical disposal and wastewater management improved and better enforced.</p> <p>Compliance mechanisms for pollution control strengthened, in coordination with LGUs and PENRO Pampanga</p> <p>Infrastructure on wastewater management and pollution control established</p>	mechanisms for agro-chemical disposal, including waste disposal containers established in concerned municipalities.			
Total investment for ten years			15,100,000		

7.2 Potential Financing

The estimated project cost is USD 15,100,000 over ten years. This project budget support the development of province-wide frameworks and plans for nature-based tourism, watershed management and wastewater management, capacity-building activities for key stakeholders on nature-based tourism, wastewater management, and pollution control, the establishment of biodiversity wetland monitoring scheme with local stakeholders, the assessment and pilot of the PES scheme and biodiversity-friendly rice agricultural scheme, and the establishment of infrastructure such as the wetland center and wastewater management facilities.

• Potential for cofinancing

There is high potential for synergy and co-financing with larger project affecting the Pampanga River Basin (expected 2027 for Pampanga River project, to be supported by an ADB loan).

7.3 Proposed Institutional Arrangements

The proposed project is multi-phased over 10 years. The development of a biodiversity-friendly rice agriculture initiative/scheme is expected to take five years to set up.

7.4 Project Beneficiaries

The estimated number of project beneficiaries is based on the published population size⁶ of the Municipality of Candaba in 2020, which is 119,49 people, distributed across 33 barangays. There are significant opportunities to strengthen women's participation in the wetland management affecting their livelihoods.

7.5 Anticipated Implementation Risks

Climate: Climate-related risks include both the short-term and long-term disruption of habitat restoration and biodiversity conservation efforts due to extreme weather events, a decrease in agricultural productivity due to increasing temperatures and shifting weather conditions, and coastal/ riverine flooding can affect access to ecotourism facilities. The shifting planting season in the Candaba Wetlands is brought by strong typhoons from October to December. This results in the overlap in the land use for migratory waterbirds and farmers. Adaptive management strategies such as crop diversification and water and soil management can be further studied and integrated into the project implementation.

Political and Governance: Candaba Wetlands are mostly privately-owned lands, which may limit project movement as it requires working with multiple landowners. Change in political leaders is critical in sustaining project interventions at the site. Closely coordinating with the political leaders, LGUs, and DENR field offices will help facilitate a smooth coordination for the project interventions.

Environment: Nature-based tourism has been identified as a key project concept theme, which would involve establishing infrastructure and operating within the RFI site. Building and operating tourism facilities may induce disturbance (i.e., noise from construction) and add pressures (i.e., waste) in the area. Planning with stakeholders is critical before any infrastructure development and tourism operations take place.

⁶ Philippine Statistics Authority. <https://psa.gov.ph/classification/psgc/barangays/0305405000>

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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 WaterWorld 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 kilometer 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 Candaba 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 meters (Gigalitres/km ²)	276 – 342
Average population uniquely benefitting from influential green storage upstream per sq. km of wetland (n/km ²)	116 – 142
Average built-up area uniquely benefitting from influential green storage upstream per sq. km of wetland (ha/km ²)	5.71 – 6.99

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)
Agusan Marsh Wildlife Sanctuary	967 (±30)	186 (±6)	1.74 (±0.06)
Candaba Wetlands	309 (±33)	129 (±13)	6.35 (±0.64)
Lake Mainit	412 (±49)	181 (±18)	0.83 (±0.08)
Philippines RFI average	562	165	2.97
Philippines national average	448	624	5.35

Table A5. Key habitat types in Candaba Wetlands based on stakeholder-based assessment at the Regional Flyway Initiative workshop in June 2023.

Habitat type	Current state		Alternative state (2035)	
	Area (ha)	Cover (%)	Area (ha)	Cover (%)
Freshwater, tree-dominated wetlands	479.4	4.8	479.4	4.8
Planted/Cultivated (non-woody crops)/Others	8438.9	84.5	8438.9	84.5
Grasslands	1068.6	10.7	1068.6	10.7
Total	9986.9	100.0	9986.9	100.0