

Appendix 1: References on threats to the Mekong Delta

General references

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Appendix 2. Remote sensing methods

Land cover maps were generated using Orfeo Toolbox (<https://www.orfeo-toolbox.org/>) implemented in QGIS (<https://qgis.org/>). An object-based analysis was used. The applications used were *Segmentation*, *ZonalStatistics*, *TrainVectorClassifier* and *VectorClassifier*. The input data for each map is listed in Table A1.

Sentinel-2 and Landsat 5 images for the study area were cloud masked using the integrated quality data. For these satellites, four images from two different orbits were required to cover the entire CLMD area. For each date, a single mosaic image was generated using the *Mosaic* application. For Sentinel-1 data, two images were required to cover the CLMD area, but these were taken from the same orbit so did not require mosaicking and could simply be joined.

Training data (9000 segments for the 2020 map, 1200 for the 1990 map) was generated using Google Earth high-resolution images plus the author's knowledge of the study area, with additional data coming from habitat surveys carried out in December 2020 at key sites.

Table A1. Input data used to generate land cover maps for the Cambodian Mekong Delta.

Image type	Image details
2020 Land Cover:	
Sentinel-1 GRD, vv polarisation	15 images were used in a regular time-series every 21 days for the entire year. Image dates were. 21 st January, 14 th February, 9 th March, 2 nd April, 26 th April, 20 th May, 13 th June, 7 th July, 31 st July, 24 th August, 17 th September, 11 th October, 4 th November, 28 th November, 22 nd December
Sentinel-2, Level 2	5 images were selected with low enough cloud cover: 21 st January, 24 th June, 9 th July, 14 th July, 18 th August
MODIS 16 day NDVI composite	23 composite images were used, each using data from 16 days. Composite start dates: 1 st January, 17 th January, 2 nd February, 18 th February, 5 th March, 21 st March, 6 th April, 22 nd April, 8 th May, 24 th May, 9 th June, 25 th June, 11 th July, 27 th July, 12 th August, 28 th August, 13 th September, 29 th September, 15 th October, 31 st October, 16 th November, 2 nd December, 18 th December
SRTM DEM	February 2002
1990 Land Cover:	
Landsat 5 TM, level 2	4 th November 1988 12 th March 1989
SRTM DEM	February 2002

Appendix 3. Comparison of 1990s and 2022 bird surveys in the Cambodian Lower Mekong Delta

A3.1. Bassac Marshes

Species recorded in 1990s: 47
 Species recorded in 2022: 19
 Species recorded in both surveys: 17

Scientific Name	Common Name	2022 Jan	Scott (1992 March)	Mundkar (1994 March)	Edwards (1996 Jan)
Ducks and grebes					
<i>Tachybaptus ruficollis</i>	Little grebe	2	4	51	18
<i>Anas poecilorhyncha</i>	Indian spot billed Duck	2			
<i>Anas acuta</i>	Northern pintail		2		
<i>Dendrocygna javanica</i>	Lesser whistling duck		190	566	31
<i>Nettapus coromandelianus</i>	Cotton pygmy goose	80	80	64	
Crakes and rails					
<i>Gallinula chloropus</i>	Common moorhen		6		4
<i>Porphyrio indicus</i>	Black-backed swamphen	1	38		2
<i>Gallicrex cinera</i>	Watercock				Present
Waders					
<i>Pluvialis fulva</i>	Pacific golden plover		1		
<i>Charadrius alexandrinus</i>	Kentish plover		4		
<i>Charadrius dubius</i>	Little ringed plover		4		1
<i>Limosa limosa</i>	Black-tailed godwit		3		2
<i>Himantopus himantopus</i>	Black-winged stilt		85		
<i>Actis hypoleucos</i>	Common sandpiper		1		
<i>Tringa stagnatilis</i>	Marsh sandpiper		2		6
<i>Tringa glareola</i>	Wood sandpiper				10
<i>Gallinago gallinago</i>	Common snipe		2		9
<i>Vanellus indicus</i>	Red wattled lapwing	1			1
<i>Metopidius indicus</i>	Bronze-winged jacana		9	6	1
<i>Hydrophasianus chirurgus</i>	Pheasant-tailed jacana		230	12	24
Gulls and terns					
<i>Chroicocephalus ridibundus</i>	Black-headed gull		1		

Scientific Name	Common Name	2022 Jan	Scott (1992 March)	Mundkar (1994 March)	Edwards (1996 Jan)
<i>Hydroprogne caspia</i>	Caspian tern		20		
<i>Sternula albifrons</i>	Little tern				1
<i>Chlidonias hybridus</i>	Whiskered tern	120	1200		54
Storks, herons, pelicans					
<i>Bubuculus ibis</i>	Cattle egret		34	6	
<i>Egretta garzetta</i>	Little egret	121	55		1
<i>Ardea alba</i>	Great egret		100	12	3
<i>Ardea cinera</i>	Grey heron		60		
<i>Ardea intermedia</i>	Intermediate egret	2	600		9
<i>Ardea purpurea</i>	Purple heron	5	50	1	
<i>Ardeola speciosa</i>	Javan pond heron	54	2000	61	80
<i>Butorides straita</i>	Little heron		5		
<i>Nycticorax nycticorax</i>	Black-crowned Night heron	1	6		
<i>Botaurus stellaris</i>	Cinnamon bittern		2		
<i>Dupetor flavicollis</i>	Black bittern	1			1
<i>Ixobrychus sinensis</i>	Yellow bittern	6	4		5
<i>Anastomus oscitans</i>	Asian openbill	1			
<i>Leptoptilos javanicus</i>	Lesser adjutant	4	1		
<i>Pelecanus philippensis</i>	Spot-billed pelican		20		
Cormorants					
<i>Phalacrocorax carbo</i>	Great cormorant		16		
<i>Phalacrocorax fuscicollis</i>	Indian cormorant		4		103
<i>Phalacrocorax niger</i>	Little cormorant	42	24	10	
<i>Anhinga melanogaster</i>	Oriental darter			2	
Raptors					
<i>Elanus caeruleus</i>	Black shouldered kite	13	2		
<i>Haliastur indus</i>	Brahminy kite				1
Kingfishers					
<i>Alcedo atthis</i>	Common kingfisher	1			4
<i>Ceryle rudis</i>	Pied kingfisher				1
<i>Halcyon smyrnensis</i>	White throated kingfisher	2			1

A3.2. Boeung Snae

Species recorded in 1990s: 12
 Species recorded in 2022: 14
 Species recorded in both surveys: 2

Scientific Name	Common Name	2022 Jan	Mundkar (1994 March)
Ducks and grebes			
<i>Anas Poecilorhyncha</i>	Indian spot billed duck	7	4
<i>Dendrocygna javanica</i>	Lesser whistling duck		1028
<i>Spatula querquedula</i>	Garganey		3400
Waders			
<i>Himantopus himantopus</i>	Black-winged stilt	1	
<i>Glareola lactea</i>	Small pratincole		1
Gulls and terns			
<i>Sterna hirundo</i>	Common tern	1	
<i>Chlidonias hybridus</i>	Whiskered tern	3	
Storks, herons, pelicans			
<i>Bubuculus ibis</i>	Cattle egret		200
<i>Egretta garzetta</i>	Little egret	66	1
<i>Ardea alba</i>	Great egret		5
<i>Ardea cinera</i>	Grey heron		1
<i>Ardea intermedia</i>	Intermediate egret	46	
<i>Ardea purpurea</i>	Purple heron		1
<i>Ardeola speciosa</i>	Javan pond heron	3	
<i>Ardeola bacchus</i>	Chinese pond heron		10
<i>Butorides straita</i>	Little heron		5
<i>Nycticorax nycticorax</i>	Black-crowned night heron	120	
<i>Anastomus oscitans</i>	Asian openbill	12360	
<i>Mycteria leucocephala</i>	Painted stork		8
<i>Threskiornis melanocephalus</i>	Black-headed ibis	2	
<i>Plegadis falcinellus</i>	Glossy ibis	890	
Cormorants			
<i>Phalacrocorax fuscicollis</i>	Indian cormorant	1006	
<i>Phalacrocorax niger</i>	Little cormorant	1817	
<i>Anhinga melanogaster</i>	Oriental darter	1	

A3.3. Boeung Veal Samnap

Species recorded in 1990s: 10
 Species recorded in 2022: 8
 Species recorded in both surveys: 1

Scientific Name	Common Name	2022 Jan	Edwards (1996 Jan)
Ducks and grebes			
<i>Anas Poecilorhyncha</i>	Indian Spot billed duck		9
<i>Dendrocygna javanica</i>	Lesser whistling duck		249
<i>Spatula querquedula</i>	Garganey		20
Crakes and rails			
<i>Gallinula chloropus</i>	Common moorhen		2
<i>Fulica atra</i>	Common coot		7
<i>Porphyrio indicus</i>	Black-backed swamphen	3	253
Waders			
<i>Tringa nebularia</i>	Common greenshank		1
<i>Vanellus duvaucelii</i>	River lapwing	1	
Gulls and terns			
<i>Sterna hirundo</i>	Common tern	3	
<i>Chlidonias hybridus</i>	Whiskered tern	8	
Storks, herons, pelicans			
<i>Egretta garzetta</i>	Little egret	5	
<i>Ardeola speciosa</i>	Javan pond heron	7	
<i>Ixobrychus sinensis</i>	Yellow bittern	3	
Cormorants			
<i>Phalacrocorax niger</i>	Little cormorant	21	
Kingfishers			
<i>Alcedo atthis</i>	Common kingfisher		10
<i>Ceryle rudis</i>	Pied kingfisher		2
<i>Halcyon smyrnensis</i>	White throated kingfisher		3

References

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Appendix 4. Fish species detected in the Cambodian Mekong Delta in eDNA surveys, March 2022

Environmental DNA (eDNA) surveys were conducted across the landscape, alongside traditional capture surveys in BPL to provide a pilot survey to increase the current paucity of data on fish species in the area. All survey methods select for different species. For example, 95 *Osteochilus melanopleurus* were caught in fyke and hoop nets, but only one in trammel nets. However, 26 *Hypostomus Plecostomus* were caught in trammel nets, but none in fyke or hoop nets. For this reason, a variety of survey methods were employed to mitigate the bias inherently present in single method surveys.

The traditional capture survey methods used in BPL included trammel, fyke, hoop, cast and seine nets. Together, they recorded the following species in addition to those identified by the eDNA surveys (Table 1): *Anabas testudineus*, *Boesemania micropis*, *Catlocarpio siamensis*, *Clarias batrachus*, *Clarias microcephalus*, *Hemibagrus nemurus*, *Hypostomus Plecostomus*, *Hypsibarbus lagleri*, *Micronema bleekeri*, *Monotretre cambodgiensis*, *Morulius chrysophekadion*, *Mystus bocourti*, *Ompok hypophthalmus*, *Osteochilus melanopleurus*, *Paralauca typus*, *Parambassis apogonoides*, *Pseudomystus siamensis*, *Puntioplites proctoysron*, *Puntius orphoides*, *Syncrossus helodes*, *Thynnichthys thynnoides*, *Trichogaster microlepis*, *Trichogaster trichopterus*, *Wallago Attu*, *Yasuhikotakia modesta*.

Future research should seek to increase the diversity of methods used, across a broader timeframe, and with an increased number of replicates and sample locations. This would serve to increase confidence in our data whilst contributing to a more comprehensive baseline survey. Other limitations include the current lack of genetic data on some of the species identified in the eDNA surveys (see Table 1). Whilst around 55% of known fish species in Cambodia can currently be identified using vertebrate surveys, fish specific assays can increase detection, which is likely to increase as additional data are collected and shared globally.

Table 1

Summary of the vertebrate species identified through the eDNA surveys conducted across 9 different sites. AP- Anlung Pring, BAM- Basaac Marshes, BK- Boeung Kadai, BS- Boeung Snae, BPL*- Boeung Prek Lapouv, BVS- Boeung Veal Somnab, KTR- Kampong Trach River, PT- Phnom Tuek, TB- Tonle Bati.

P – Species present

- Species absent

Blue – fish, Green – Amphibian,

Yellow – bird, Grey – mammal.

Sp – Insufficient data is currently available on these species to be able to identify them to species level.

Note: BPL* had 4 eDNA surveys conducted across the landscape compared to 1 each for the other sites. Therefore, a higher number of species is likely to be detected.

Species	AP	BAM	BK	BS	BPL*	BVS	KTR	PT	TB
<i>Xenentodon cancila</i>	-	-	P	-	P	P	-	P	-
<i>Dermogenys pusilla</i>	-	-	-	-	P	-	-	-	-
<i>Piaractus brachypomus</i>	-	-	-	-	P	-	-	-	-
<i>Clupeichthys aesamensis</i>	-	-	P	-	-	P	-	-	P
<i>Clupeoides borneensis</i>	-	-	-	P	P	-	-	-	-
Sp1	-	-	P	-	-	P	-	-	-
<i>Corica laciniata</i>	-	-	-	-	P	-	-	-	-
<i>Coilia lindmani</i>	-	-	-	P	-	-	-	-	-
Sp2	-	-	-	-	P	-	-	-	-
<i>Amblypharyngodon chulabhornae</i>	-	P	-	-	P	P	-	P	-
<i>Barbodes aurotaeniatus</i>	-	-	-	-	P	-	-	P	-
<i>Barbonymus gonionotus</i>	-	-	P	P	P	P	-	-	P
<i>Cirrhinus microlepis</i>	-	-	P	-	-	-	-	-	-
<i>Cyclocheilichthys enoplos</i>	-	-	P	-	P	-	-	-	-
<i>Esomus metallicus</i>	-	-	-	-	P	P	-	-	-
<i>Hampala dispar</i>	-	-	-	-	P	P	-	-	P
<i>Hampala macrolepidota</i>	-	-	P	-	P	-	-	-	-
<i>Henicorhynchus siamensis</i>	-	P	P	-	-	P	-	-	-
<i>L.leptocheilus/L. lineatus</i>	-	-	-	-	P	P	-	-	-
<i>L. siamensis/L. leptocheilus</i>	-	-	P	-	P	P	-	-	-
<i>Osteochilus vittatus</i>	-	-	P	-	P	P	-	-	-
<i>Parachela siamensis</i>	-	-	-	-	P	-	-	P	-
<i>Puntius brevis</i>	-	-	P	-	P	P	-	P	P
<i>Rasbora borapetensis</i>	-	-	-	-	P	P	-	P	-
<i>Rasbora dusonensis</i>	-	-	P	-	-	-	-	-	-
<i>Rasbora paviana</i>	-	-	-	-	-	-	-	P	-
<i>Systemus orphoides</i>	-	-	-	-	P	P	-	-	-
<i>Aplocheilus panchax</i>	-	-	-	-	-	-	P	P	-
<i>Notopterus notopterus</i>	-	-	-	-	P	P	-	P	-
Sp3	-	-	P	-	P	P	-	-	P
<i>Parambassis ranga</i>	-	-	P	-	-	-	-	-	-
<i>Anabas testudius</i>	-	P	P	-	P	P	-	P	-
<i>Selaroides leptolepis</i>	-	-	-	-	P	-	-	-	-
<i>Channa micropeltes</i>	-	-	-	-	P	-	-	-	-
<i>Channa striata</i>	-	P	P	-	P	P	-	P	-
<i>Oreochromis niloticus</i>	-	-	-	-	P	P	-	-	-
Sp4	-	-	-	-	P	P	-	-	-
Sp5	-	-	-	-	P	P	-	-	-
Sp6	-	-	-	-	P	-	-	P	-
<i>Trichopodus microlepis</i>	-	-	P	-	P	P	-	-	P
<i>T. trichopterus/T. microlepis</i>	-	P	P	-	P	P	-	P	P
<i>T. vittata</i>	-	P	-	-	P	P	-	P	P
Sp7	-	-	-	-	P	-	-	-	-
Sp8	-	-	-	-	-	P	-	P	P
<i>Polynemus dubius</i>	-	-	-	P	-	-	-	-	-
<i>Pristolepis fasciata</i>	-	P	-	-	P	P	-	P	-
<i>Sillago sihama</i>	P	-	-	-	-	-	P	-	-
Sp9	-	-	-	-	P	-	-	-	-
<i>H. wyckii/H. wyckioides</i>	-	-	-	-	P	-	-	-	-
<i>Hemibagrus spilopterus</i>	-	-	-	-	P	-	-	-	-
<i>Mystus albolineatus</i>	-	-	-	P	P	-	-	-	-
<i>Mystus atrifasciatus</i>	-	-	P	-	P	-	-	-	-
Sp10	-	-	-	P	P	-	-	P	P
<i>C.batrachus/C. macrocephalus</i>	-	-	-	-	P	P	-	P	-
<i>Heteropneustes fossilis</i>	-	-	-	P	P	-	-	-	-
<i>P. disjunctivus/P. pardalis</i>	-	-	-	-	P	-	-	-	-
<i>P. hypophthalmus/P. bocourti</i>	-	-	-	-	P	-	-	-	-
<i>Ompok siluroides</i>	-	-	-	-	P	P	-	-	-
<i>Phalacronotus bleekeri</i>	-	P	-	-	-	-	-	-	-
<i>Macrognathus siamensis</i>	-	-	-	-	P	-	-	-	-
Sp11	-	-	-	-	P	-	-	-	-
<i>P. leiurus/P. abei</i>	-	-	-	-	P	P	-	-	P
<i>Fejervarya limnocharis</i>	-	-	-	-	-	-	-	P	-
Sp12	-	-	P	-	P	-	P	P	-
Sp13	-	-	-	-	P	-	-	-	-
Sp14	-	-	-	P	-	-	-	-	-
<i>Taphozous melanopogon</i>	-	-	-	-	-	-	-	P	-
<i>Rousettus leschenaultii</i>	-	-	-	-	-	-	-	P	-
<i>Bandicota indica</i>	-	-	-	-	P	-	-	-	-
<i>R.rattus/R. tanezumii</i>	-	-	-	-	P	-	-	-	-
Number of species detected	1	8	20	8	53	29	3	22	11

Appendix 5. Ecosystem services site profiles.

5.1. Boeung Snae

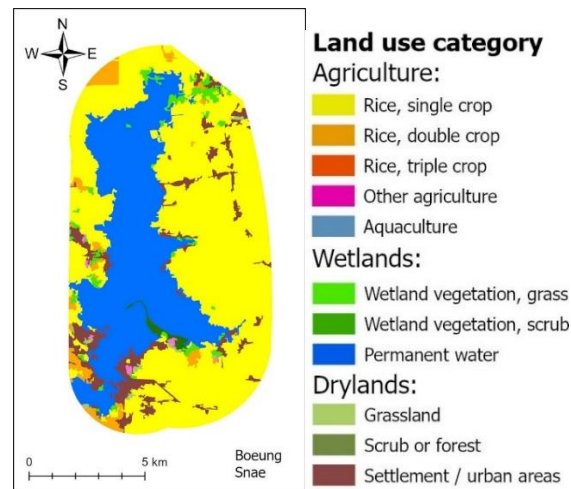


Figure 5.2. Habitat types in Boeung Snae

Boeung Snae is a large permanent lake in Prey Veng Province, south-east of Phnom Penh. The lake is surrounded by agriculture, with some natural forest remaining and some limited tourism to the area. There is little natural vegetation remaining at the lake, but a forested peninsula in the south of the lake is home to a large waterbird roost, mainly consisting of Open-bill storks (*Anastomus oscitans*).

The main livelihood of communities around these wetlands are from keeping livestock including cows and some buffalos. The wetland is an important source of food for communities, through the provision of fish, shrimp and snails. There is mainly subsistence fishing that occurs in the lake. During the dry season, fish production decreases (in comparison to the wet season), and during this time fishers find alternative jobs in construction and other sectors. Boeung Snae is seen as a public lake, with open access fishing and no boundaries for different uses. This is perceived very favourably by the local community, who feel as though they have freedom to fish in the lake and benefit from these ecosystem services.

The lake is also an important source of freshwater for household consumption (drinking, cleaning and cooking). Before it is used for drinking, the water from the lake is treated through a water treatment system locally. The water from the lake is also important as a drinking source and bathing location for livestock, as well as a source of irrigation for surrounding rice fields. There is active water management in the area (conducted by the Ministry of Water Resource and Meteorology), consisting of a gate management system to manage the water levels and distributing water from Boeung Snae to other areas for agricultural purposes.

The wetland was also described by workshop participants to have very good air quality due to the variety of habitats around the wetland (including flooded forest), which leads to the area also having cooler weather compared to nearby cities. The areas around the wetlands were also described as having less air pollution and noise from the lower levels of traffic compared to nearby cities.

Another key ecosystem service provided by the wetland is flood regulation: community members perceive that the wetland habitats protect the area from flooding, as the area does not experience yearly flooding compared to other locations such as Boeung Prek Lapouv. Fires have occurred in the flooded forest area, but these were man-made, and community members do not see this as a particular issue as they can prevent the fires. The community actively protects the flooded forest because it is seen as an important habitat for the waterbird species in the area.

The wetland is seen as an important location for recreation and tourism. Boeung Snae is well-known throughout Cambodia, and therefore there is a lot of national and international tourism to see the waterbirds and enjoy the wetland landscape. Due to its high bird diversity and related conservation value, this is also why community members gave a high ranking for the wetland providing important genetic resources. Because of its value for tourism, the protection of Boeung Snae wetland has been promoted by the local fishery community, as they benefit from tourism income from taking tourist on boat tours of the area, selling food and providing other amenities to tourists. The local community is therefore also very supportive of Boeung Snae having a Protected Area status, and for conservation activities to take place in the area. There is also a lot of interest in receiving further training to support tourism activities (such as becoming guides in the area and setting up homestays); which is also why the community members ranked the wetland as being very valuable for aesthetic and educational/research values. The Ministry of Environment does provide some training programs in the area (such as identifying bird flu and other avian diseases), and there are plans to continue these training opportunities for both wetland protection (including the training of rangers) and for communities to provide services to support tourism.

Table 5.4: Ecosystem service ratings for Boeung Snae wetland. Shade of green represents how 'significant' the positive benefit was assessed as (the darkest green = significant positive benefit). A rating of 0 (with white background) indicates 'negligible benefit'.

	Services	Forest/ shrub	Open water	Agricultural
PROVISIONING SERVICES	Fresh water - people	0.6	1.0	1.0
	Fresh water - livestock	0.3	0.7	0.5
	Freshwater - irrigation	0.4	0.7	1.0
	Food	1.0	1.0	1.0
	Fuel	0.0	0.0	0.0
	Fibre	0.0	0.0	0.0
	Genetic resources	1.0	0.9	1.0
	Natural medicines or pharmaceuticals	0.0	0.0	0.0
	Ornamental resources	0.0	0.0	0.0
	Clay, mineral, aggregate harvesting	0.0	0.0	0.0
	Energy harvesting from natural air and water flows	0.0	0.0	0.0
REGULATING SERVICES	Air quality regulation	0.8	1.0	1.0
	Local climate regulation	0.2	0.7	1.0
	Global climate regulation	0.0	0.0	0.0
	Water regulation	1.0	1.0	1.0
	Flood hazard regulation	1.0	1.0	1.0
	Storm hazard regulation	1.0	-1.0	0.0
	Pest regulation	0.0	0.0	0.0
	Disease regulation - human	0.0	0.0	0.0
	Disease regulation - livestock	0.0	0.0	0.0
	Erosion regulation	1.0	0.4	0.5

	Water purification	0.2	0.1	0.2
	Pollination	0.0	0.0	0.0
	Salinity regulation	0.0	0.0	0.0
	Fire regulation	0.1	0.7	0.0
	Noise and visual buffering	0.9	0.9	0.5
CULTURAL SERVICES	Cultural heritage	0.0	0.0	0.0
	Recreation and tourism	1.0	1.0	1.0
	Aesthetic value	1.0	1.0	1.0
	Spiritual and religious value	0.0	0.0	0.0
	Inspiration value	0.8	0.9	0.5
	Social relations	0.6	0.7	1.0
	Educational and research	1.0	1.0	1.0
SUPPORTING SERVICES	Soil formation	0.0	0.0	0.0
	Primary production	0.0	0.0	0.0
	Nutrient cycling	0.0	0.0	0.0
	Water recycling	1.0	1.0	1.0
	Provision of habitat	1.0	1.0	1.0



Figure 5.3. Boeung Snae wetland (top left), the large waterbird roost (top right) and another view of the roost from the waterside (left)

5.2. Boeung Kadai

Boeung Kadai is a small permanent lake north of Phnom Penh, surrounded by a large area of seasonally inundated wetlands. These wetlands are an important source of freshwater for local communities, with people using it for everyday use (including drinking and washing). Main sources of livelihood in the area include keeping livestock (mainly cows and some buffalo) and fishing. Due to the importance of subsistence fishing in the area, the wetland is

ranked highly for food provisioning services. There is also agriculture in the area, predominantly from rice fields and industrial farming of corn, mung bean, green bean, tobacco, cashew and rubber. The wetlands are therefore also an important source of water for crop irrigation. The forest around the wetland is an important source of fire wood for local communities, and some households also use the forest timber for house and boat construction.

Boeung Kadai has recently recovered from conflict between the local communities and a migrant fishing community that moved into the area which was seen as harming the wetland resources and biodiversity. Community members reported that during their presence in the area the wetland suffered from overfishing. Following negotiations, the migrant community has now moved to another area away from the wetland. Boeung Kdei was given Protected Area status in 2021, and the initial proposal for granting this status was predominantly driven by the local communities. Now there are efforts to restore the fish population in the lake. The main ornamental provisioning services, and also important cultural services are provided by the water lily that grows in the wetland. Water lotus leaves are used to wrap around and store traditional food, and the fruit is also eaten and used as a sweetener. It also has important religious uses and meanings for Buddhists across the country. Other important aquatic plants found in the wetlands is the water hyacinth which is used for its edible flower.

Parts of the wetlands were ranked highly for their provision of genetic resources: mainly due to being habitats for the Giant carp, and various bird species. There have been recent reports of fishers catching the Giant carp in the wetland, and normally fishers will release this species as they are aware of its endangered status. Due to the presence of this species, local community members are also hopeful for more conservation activities and ecotourism in the area, which they perceive will be beneficial for their livelihoods (by setting up homestays, restaurants and other services for tourists). Currently there is no tourism in the area, but community members feel like there is a high potential for ecotourism (and therefore also give high scores for the aesthetic value of this wetland). This is also why the wetland received high ranking for educational and research values: community members feel like there is a need for more research on the biodiversity in the area (e.g. to explore tree, bird, fish and mammal species diversity), with hopes that this would also attract visitors. There is one species of tree commonly found in the area which is notable: the '*Char-Leguminosae-Papilionoideae* or *Butea monosperma*. It is used for multiple purposes including furniture making, house building and traditional medicine. Tourists come to the area for these trees as well.

The area also has an important livelihood initiative which includes the promotion of handicrafts made with bamboo and rattan. This scheme promotes local community products, creates local jobs and allows participants to generate income from products which are sold.

Participants of the workshop reported that the wetlands are predominantly in a good state, and therefore the air quality in the area is also good. The flooded forests are perceived to protect the area from floods, storms and erosion (none of these were considered issues in the area). Likewise, water purification was a highly rated ecosystem service for the wetland, due to the abundant aquatic vegetation which is understood to absorb pollutants and provide the good water quality of the lake.

While there are no fires reported in the area, community members reported a negative provision of fire regulation for the grassland and agricultural area due to these areas being at

higher risk of fire. If fires would occur here, they would spread quickly and be more difficult to control.

The forests also provide important spiritual and cultural values, as community members report that spirits live in these houses. It is therefore common to come across spirit houses in the forest.

Table 5.5: Ecosystem service ratings for Boeung Kadai wetland. Shade of green represents how 'significant' the positive benefit was assessed as (the darkest green = significant positive benefit). A rating of 0 (with white background) indicates 'negligible benefit'.

	Services	Forest	Grassland	Open water	Aquatic Vegetation	Agricultural
PROVISIONING SERVICES	Fresh water- people	0.8	0.0	1.0	0.5	0.0
	Fresh water - livestock	0.5	0.0	1.0	0.5	0.0
	Freshwater - irrigation	0.3	0.0	1.0	0.5	0.0
	Food	1.0	0.8	1.0	0.8	1.0
	Fuel	1.0	0.0	0.0	0.0	0.0
	Fibre	0.5	0.0	0.0	0.5	0.0
	Genetic resources	1.0	0.0	1.0	0.0	0.0
	Natural medicines or pharmaceuticals	0.3	0.3	0.0	0.0	0.0
	Ornamental resources	0.5	0.0	1.0	0.5	0.0
	Clay, mineral, aggregate harvesting	0.0	0.0	0.0	0.0	0.0
	Energy harvesting from natural air and water flows	0.0	0.0	0.0	0.0	0.0
REGULATING SERVICES	Air quality regulation	1.0	0.8	1.0	1.0	0.8
	Local climate regulation	1.0	0.0	1.0	0.8	0.8
	Global climate regulation	0.0	0.0	0.0	0.0	0.0
	Water regulation	0.0	0.0	0.0	0.0	0.0
	Flood hazard regulation	1.0	0.0	0.8	0.0	0.0
	Storm hazard regulation	1.0	0.0	0.8	0.0	0.0
	Pest regulation	0.0	0.0	0.0	0.0	0.0
	Disease regulation - human	0.0	0.0	0.0	0.0	0.0
	Disease regulation - livestock	0.0	0.0	0.0	0.0	0.0
	Erosion regulation	1.0	1.0	0.0	0.8	0.0
	Water purification	1.0	0.8	1.0	1.0	0.0
	Pollination	0.5	0.5	0.5	0.5	0.0
	Salinity regulation	0.0	0.0	0.0	0.0	0.0
	Fire regulation	1.0	-0.3	1.0	1.0	-0.5
	Noise and visual buffering	1.0	0.5	0.0	0.3	0.0
CULTURAL SERVICES	Cultural heritage	0.0	0.0	0.0	0.0	0.0
	Recreation and tourism	1.0	0.8	1.0	1.0	0.0
	Aesthetic value	1.0	1.0	1.0	1.0	0.5
	Spiritual and religious value	0.8	0.0	0.0	0.0	0.0
	Inspiration value	1.0	0.5	1.0	1.0	0.8
	Social relations	0.8	0.5	1.0	0.8	1.0

	Educational and research	1.0	1.0	1.0	1.0	1.0
SUPPORTING CAPABILITY	Soil formation	0.5	0.0	0.0	0.5	0.0
	Primary production	0.5	0.0	0.5	0.5	0.0
	Nutrient cycling	0.3	0.0	0.0	0.5	0.0
	Water recycling	0.0	0.0	1.0	1.0	0.0
	Provision of habitat	1.0	1.0	1.0	1.0	0.0



Figure 5.4. Boeung Kadai wetland

5.3. Boeung Veal Samnap:

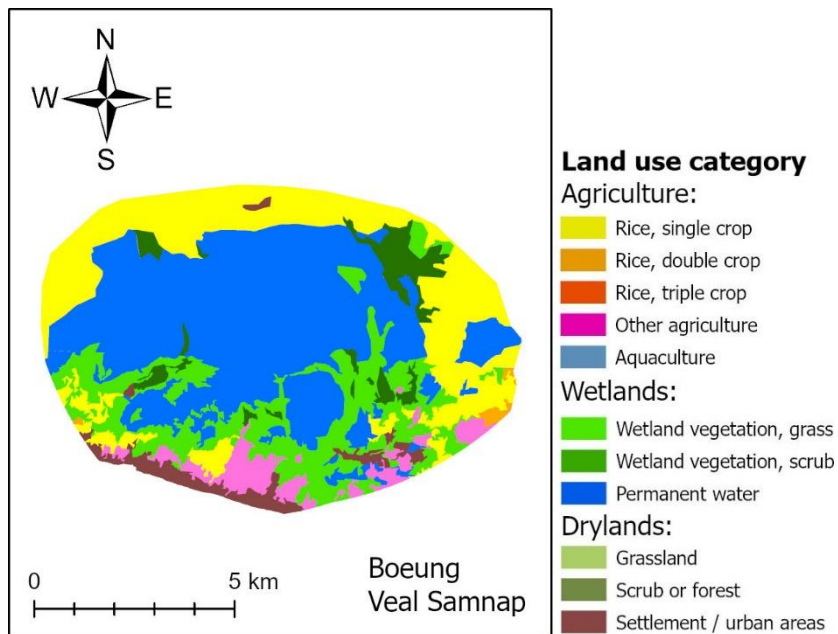


Figure 5.5. Habitat types in Boeung Veal Samnap.

This wetland is located near to Phnom Penh city (approximately 7 km away). The lake is about 5,000 hectares and currently about 1,000 hectares of this belongs to the state. There are many communities living around the lake, and villages who mainly rely on the lake resources such as fishing. There is still a high dependence on fishing, but this has

decreased over time as more people are finding jobs in the city and expanding areas. Some people raise fish using nets close to their houses. People use the wetland directly as their source of drinking water. During the dry season people also grow some fruit and vegetable (such as cucumber, peas, salad and corn). Water from the wetland is used to irrigate these crops. Rats and snakes are also hunted for food in the wetland area. Ornamental resources collected from the wetland include water lotus which are sold locally for religious uses.

The wetland was rated highly for genetic resources due to it being an important source of fish locally. There are also numerous bird species in the area. Other fauna of interest that were reported were snakes (species detail not provided), fishing cat (*Prionailurus viverrinus*), Crab-eating macaque (*Macaca fascicularis fascicularis*) and the giant carp (*Catlocarpio siamensis*).

The air quality is good in the area, and the local climate is also considered good (with temperatures not being too extreme). There is concern around water (regulation services and quality) as the government has allocated a large area for development, which is expected to impact the area and surrounding communities. The area floods in the rainy season but this is part of the natural fluctuation of the water level and does not cause issues for the surrounding communities. The flooded forest and aquatic vegetation are seen to protect the area from erosion, and support good water quality. There are also no problems with noise pollution because the lake is large and also far from the road.

There is a big area of flooded forest, which community members want to be protected to also support ecotourism activities in the area. They see this as a livelihood opportunity as they could provide services (such as food and working as guides).

For cultural ecosystem services, there are temples and pagodas in the wetland area and it is believed that spirits inhabit the flooded forest. People therefore bring offerings and pray in these areas. The wetland therefore also supports important spiritual and religious values. There is currently no tourism to the area and few recreational activities happening. However, the aesthetic value of the wetland was rated highly, also indicating the potential here for ecotourism development which is wanted by local community members. There has been limited research conducted in the area, mainly on fisheries and social economic surveys done by governmental bodies and an NGO.

For regulation services, the wetland ecosystem processes are seen to be functioning well, with good air, soil regulation and nutrient cycling. The water quality is reportedly still good with little pollution in the area.

Table 5.6. Ecosystem service ratings for Boeung Veal Samnap wetland. Shade of green represents how 'significant' the positive benefit was assessed as (the darkest green = significant positive benefit). A rating of 0 (with white background) indicates 'negligible benefit'.					
		Forest	Open water	Aquatic Vegetation	Agriculture
PROVISIONING SERVICES	Fresh water- people	1.0	1.0	1.0	0.0
	Fresh water - livestock	1.0	1.0	1.0	0.0
	Freshwater - irrigation	0.7	1.0	0.3	0.5
	Food	1.0	1.0	0.8	0.7
	Fuel	0.3	0.0	0.0	0.0
	Fibre	0.5	0.0	0.5	0.0
	Genetic resources	0.5	0.5	0.5	0.0
	Natural medicines or pharmaceuticals	0.0	0.0	0.0	0.0

	Ornamental resources	0.0	0.0	0.5	0.0
	Clay, mineral, aggregate harvesting	0.0	0.0	0.0	0.0
	Energy harvesting from natural air and water flows	0.0	0.0	0.0	0.0
REGULATING SERVICES	Air quality regulation	1.0	0.8	0.7	0.5
	Local climate regulation	1.0	0.7	0.7	0.0
	Global climate regulation	0.0	0.0	0.0	0.0
	Water regulation	1.0	1.0	1.0	0.0
	Flood hazard regulation	1.0	1.0	1.0	0.0
	Storm hazard regulation	1.0	0.0	0.0	0.0
	Pest regulation	0.5	0.5	0.5	0.0
	Disease regulation - human	0.5	0.5	0.5	0.0
	Disease regulation - livestock	0.5	0.5	0.5	0.0
	Erosion regulation	0.7	0.0	0.5	0.0
	Water purification	1.0	1.0	1.0	0.0
	Pollination	0.0	0.0	0.0	0.0
	Salinity regulation	0.0	0.0	0.0	0.0
	Fire regulation	1.0	1.0	1.0	0.0
	Noise and visual buffering	0.5	0.5	0.5	0.0
CULTURAL SERVICES	Cultural heritage	0.5	0.5	0.5	0.5
	Recreation and tourism	0.0	0.0	0.0	0.0
	Aesthetic value	1.0	0.8	0.5	0.5
	Spiritual and religious value	0.7	0.5	0.5	0.5
	Inspiration value	0.7	1.0	0.5	0.5
	Social relations	1.0	1.0	1.0	1.0
	Educational and research	0.7	0.5	0.5	0.5
SUPPORTING SERVICES	Soil formation	0.5	0.5	0.5	0.0
	Primary production	0.5	0.5	0.5	0.0
	Nutrient cycling	0.7	0.5	0.5	0.5
	Water recycling	0.8	1.0	1.0	0.0
	Provision of habitat	0.5	0.5	0.5	0.5





Figure 5.6. Boeung Veal Samnap, showing fishing activities (top) and wetland community (bottom)

5.5. Bassac marshes:

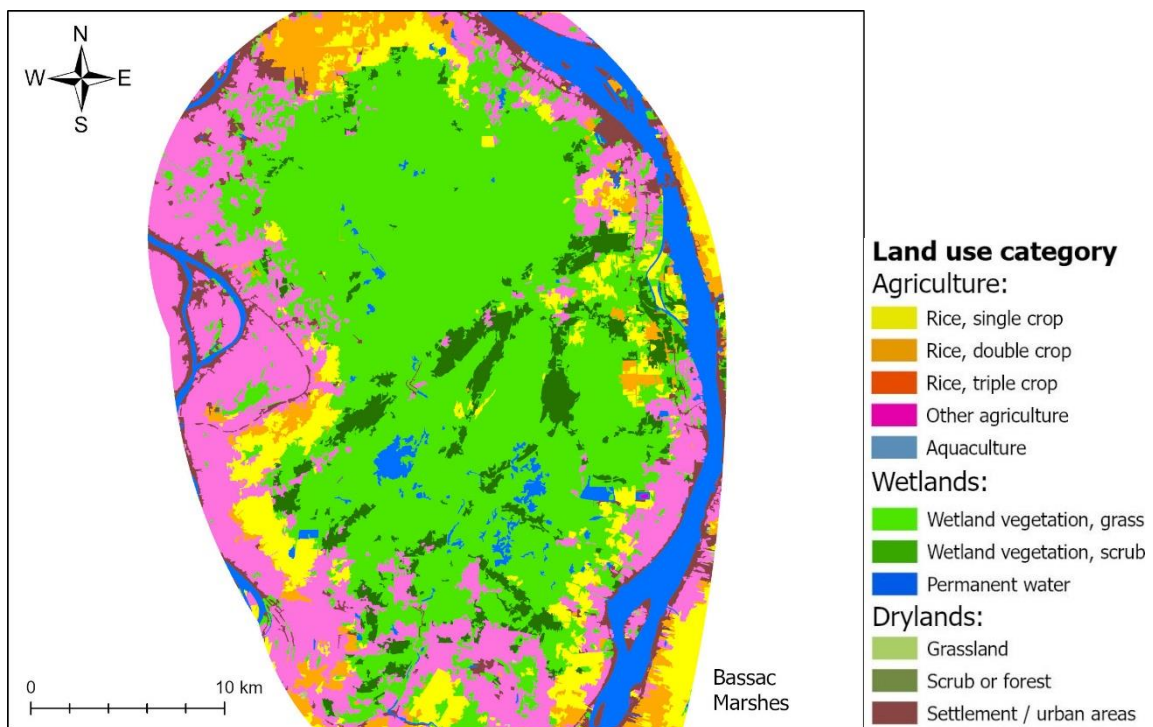


Figure 5.7. Habitat types in the Bassac Marshes

This is a large wetland area stretching across four different districts: Ken Svay, Lerk Dek, Saang and Koh Thom. Two of the districts, Saang and Koh Thom have stilted villages right on the wetlands (see Figure 5.8). The main source of livelihood here is fishing, with some people also involved in small scale businesses, construction work and factory work. The communities are very dependent on the wetland ecosystem. The Bassac marshes are not under any legal protection, with some parts under state ownership and other areas belonging to private owners.

The marshes are an important source of drinking water for some of the population in the area, with some others buying water from elsewhere but still using the water from the wetlands as their main source of water for cleaning and for keeping animals. In terms of food provision apart from fishing, people raise chickens and cows, and some people are also growing fruits and vegetables (such as corn, sweet potato, cucumber and watermelon). Crops are grown depending on seasons. People also hunt rats in the wetlands, especially in the Ken Svay district. Therefore food provision is an important ecosystem service provided by the Bassac marshes. Other materials collected from the wetland include wood (for firewood, building chicken huts), materials for fishing, fruit, water morning glory, water mimosa, hyacinth, Sasbenia flower, grasses and water lotus (an ornamental resources used in Buddhist prayer practices). Genetic resources was ranked highly as an ecosystem service due to the importance of the wetlands as a fishery (incl. Giant snakehead, *Channa micropeltes*; Giant barb, *Catlocarpio siamensis*), various snake species, snails, rats, fishing cat (*Prionailurus viverrinus*) and water bird habitat. Some water birds, such as the Asian openbill (*Anastomus oscitans*) migrates from other parts of the country to the Bassac marshes. There are also natural medicines collected from the wetlands. People use various plants as treatments for fever, stomach pain and other ailments.

Workshop participants reported that the air quality was very good in this area, and the flooded forests contribute to regulating the air quality and local climate. As it's a large wetland it also contributes to maintaining the global climate, as it plays an important role in carbon sequestration and storage. The water quality is still good in this wetland, as there are no industrial activities or factories in the area contributing to pollution. The Bassac marshes receive water from the Bassac river, and these waterbodies regulate water levels effectively. Communities are adapted to higher water levels, and flooding does not pose any serious problems. While the wetland has many mosquitoes, people say that there are low levels of dengue and malaria, and so they believe that the wetland processes are controlling mosquito levels effectively. With erosion regulation, the forest and grassland protect wetland soils from erosion, and this is therefore not a problem in the area. Likewise, the flooded forest, aquatic vegetation and grassland are also seen as being important in absorbing pollutants and contributing to the good water quality experienced by local communities. This highlights the importance of maintaining these habitats in a good condition.

There are no issues with fires, and any fires in the area tend to be controlled burning for clearing land which do not tend to spread. The negative scores for fire regulation indicate that these habitats, grassland and agricultural areas, are more vulnerable to fire than other areas.

As the Bassac marshes are far from urban areas there are no significant issues from noise or visual pollution. There is some noise pollution from boats, but workshop participants reported that they are used to this, and the forest and large area of the wetland can at times help with the noise from the boats.

When discussing cultural heritage people tended to link this to the old temples or other buildings of importance, such as Korng Chak Bak Kam Phloeung, which was important during Pa'chum Bun festival. There are many pagodas in the wetlands, which is why they were rated positively in terms of spiritual and religious benefits. There is no tourism or recreational activity in this area. However, community members expressed that they felt there is a strong potential for eco-tourism and related recreational activities (such as swimming, boat tours, etc.), as the aesthetic value of the Bassac marshes is very high. People living in and around the Bassac marshes are interested in providing services

supporting tourism, particularly as fish catches are decreasing yearly (this is happening reportedly as there are more people fishing in the area, with some people even travelling from Vietnam to fish). As communities, particularly those in Saang and Koh Thom fully rely on the wetland and its ecosystem services, people are also interested in the wetland gaining protected status of some sort.

Table 5.7. Ecosystem service ratings for Bassac marshes. Shade of green represents how 'significant' the positive benefit was assessed as (the darkest green = significant positive benefit). A rating of 0 (with white background) indicates 'negligible benefit'.

	Services	Forest	Open water	Aquatic Vegetation	Grassland	Agriculture
PROVISIONING SERVICES	Fresh water- people	0.8	1.0	0.7	0.6	0.0
	Fresh water - livestock	0.8	1.0	0.7	0.6	0.0
	Freshwater - irrigation	0.8	1.0	0.7	0.6	0.5
	Food	1.0	1.0	1.0	1.0	0.9
	Fuel	0.8	0.0	0.0	0.0	0.0
	Fibre	0.5	0.0	0.5	0.0	0.0
	Genetic resources	0.5	0.5	0.5	0.5	0.5
	Natural medicines or pharmaceuticals	0.5	0.0	0.5	0.0	0.0
	Ornamental resources	0.5	0.5	0.5	0.5	0.0
	Clay, mineral, aggregate harvesting	0.0	0.0	0.0	0.0	0.0
	Energy harvesting from natural air and water flows	0.0	0.0	0.0	0.0	0.0
REGULATING SERVICES	Air quality regulation	0.9	0.6	0.9	0.9	0.7
	Local climate regulation	0.8	0.5	0.5	0.5	0.0
	Global climate regulation	0.4	0.4	0.4	0.1	0.0
	Water regulation	0.9	1.0	1.0	1.0	0.0
	Flood hazard regulation	1.0	1.0	1.0	1.0	0.0
	Storm hazard regulation	0.8	0.0	0.0	0.0	0.0
	Pest regulation	0.5	0.5	0.5	0.5	0.0
	Disease regulation - human	0.5	0.5	0.5	0.5	0.0
	Disease regulation - livestock	0.5	0.5	0.5	0.5	0.0
	Erosion regulation	0.7	0.0	0.7	0.5	0.0
	Water purification	0.8	0.5	0.5	0.5	0.0
	Pollination	0.5	0.5	0.5	0.5	0.0
	Salinity regulation	0.0	0.0	0.0	0.0	0.0
	Fire regulation	0.8	1.0	0.5	-1.0	-1.0
	Noise and visual buffering	1.0	0.0	0.2	0.5	0.0
CULTURAL SERVICES	Cultural heritage	0.0	0.0	0.0	0.0	0.0
	Recreation and tourism	0.0	0.0	0.0	0.0	0.0
	Aesthetic value	0.7	0.8	0.5	0.8	0.7
	Spiritual and religious value	0.5	0.5	0.5	0.5	0.5
	Inspiration value	0.7	0.7	0.5	0.5	0.7
	Social relations	1.0	1.0	0.8	0.7	1.0
	Educational and research	0.5	0.5	0.5	0.3	0.5
SUPPORTING SERVICES	Soil formation	0.5	0.5	0.5	0.5	0.5
	Primary production	0.5	0.5	0.5	0.5	0.0
	Nutrient cycling	0.5	0.5	0.5	0.5	0.0
	Water recycling	1.0	1.0	1.0	1.0	0.0
	Provision of habitat	0.5	0.5	0.5	0.5	0.5



Figure 5.8. Bassac marshes community (left) and landscape (right)

5.6. Boeung Prek Lapouv

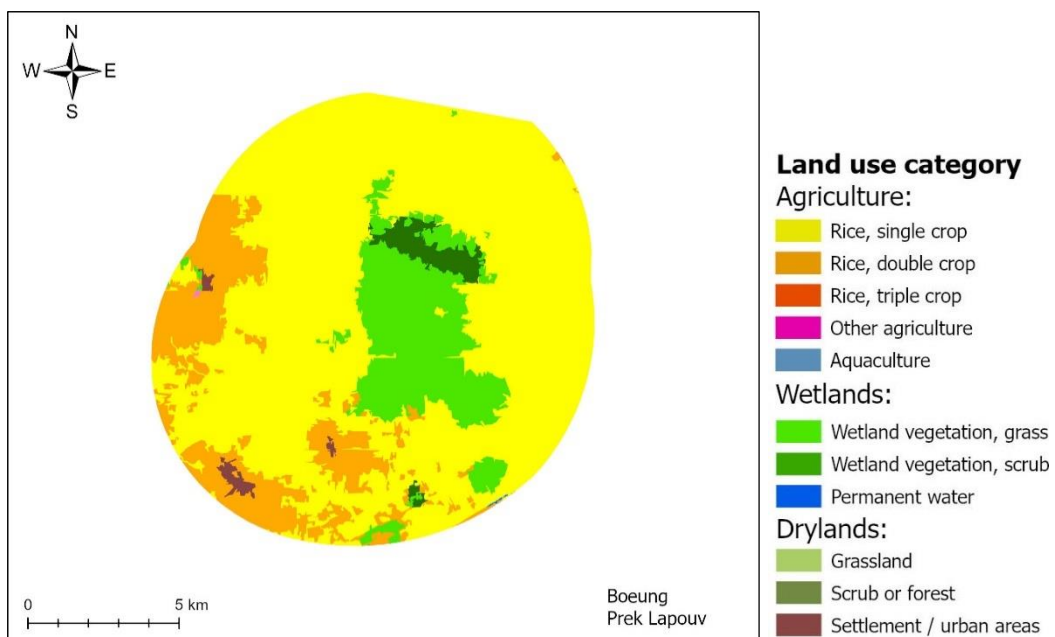


Figure 5.9. Habitat types in Boeung Prek Lapouv.

Boeung Prek Lapouv is protected area, under the management of the Ministry of Environment. Along with the surrounding non-protected wetland, it comprises a large wetland site of 8,305 hectares, with numerous villages surrounding it, providing important ecosystem services to almost 2,500 families. Most people in this area rely directly on the wetland resources, through agricultural and fishing activities. The wetland also provides the only source of freshwater for these communities, used for drinking, livestock and irrigation.

The wetland is a vital source of food with its populations of wild fish, crab and shrimp. Rice is the main source of food, which is grown around the wetland. Aquatic vegetation is also harvested for food, such as morning glory, the flowers of the water hyacinth and a species of

lotus called 'Rumchong' locally (រំចង់, ព្រៃលិត). Ducks are also raised in the area surrounding the wetlands, along with some Buffalo and chickens. Rats are commonly hunted in the rice paddy and grasslands as a food source. These are eaten locally as well as exported to nearby Vietnam.

Fuelwood is collected from the forested areas in the wetland (as the wetland has protected status this does not involve cutting down trees). Water hyacinth is collected to weave mats to dry rice during the harvesting process. Other resources collected from the wetland include natural medicines, such as *Passiflora foetida* which is used to treat fevers and headaches. The lotus flower which grows in BPL is also collected for religious purposes as an ornamental resource.

The wetland is rated highly for genetic resources due to its important biodiversity including species of conservation priority such as the Giant barb (*Catlocarpio siamensis*), Sarus crane (*Aves antigone*) and Asian openbill (*Anastomus oscitans*). Yellow-breasted bunting (*Emberiza aureola*) are also found in this area and there are more than 200 water bird species; making BPL an important wetland for bird conservation. There are also mammals of conservation interest such as the fishing cat (*Prionailurus viverrinus*), and over 100 fish species, many of which are important for local community livelihoods.

The air quality is considered very good as the wetland is far from urban areas. The wetland is also important to the global community for its climate regulation and carbon storage. As loss of this wetland would lead to significant carbon dioxide emissions, community members consider it important to protect and conserve BPL to avoid carbon and biodiversity losses. Water regulation services are also rated highly for BPL, with workshop participants saying that the water levels are supportive of their livelihoods and that in the dry season they regularly have enough water to grow their rice. The wetland is seen as also being protective against floods and erosion in the area, with these not causing issues currently for local communities. The wetlands are also seen as important for pest regulation as there is low instance of dengue fever (mosquito-borne) in the area.

Water is used directly from the wetland by many people, and the various habitat types (e.g. aquatic vegetation, grassland and flooded forest) are seen as being able to trap pollutants which keep the water quality good.

Fire regulation was deemed as a dis-benefit for the grassland and agricultural habitat types of the wetland. This is because there are fires in these areas, particularly during dryer seasons. These fires are mainly from accidental burns, and can spread to other areas. There are firefighting services who can control fires in the area.

Several of the cultural ecosystem services were rated highly for BPL. This includes aesthetic values, inspiration values, social relations and educational and research benefits. The workshop participants reported that the BPL wetland have a good view and good quality landscape which is also beneficial for tourists. There are hopes to increase tourism to the area, with community members interested in providing services to support eco-tourism such as working as guides, setting up homestays and restaurants. There are many international and local NGOs and Universities conducting research in the area, and there has been efforts to mainstream information about the Sarus Crane into the school program locally.

Table 5.9. Ecosystem service ratings for Boeung Prek Lapouv wetland. Shade of green represents how 'significant' the positive benefit was assessed as (the darkest green = significant positive benefit). A rating of 0 (with white background) indicates 'negligible benefit'.

	Services	Forest	Grassland	Open water	Aquatic Vegetation	Agriculture
PROVISIONING SERVICES	Fresh water- people	0.7	0.0	0.8	0.6	0.0
	Fresh water - livestock	0.7	0.0	0.8	0.6	0.0
	Freshwater - irrigation	0.0	0.0	0.8	0.6	0.0
	Food	1.0	0.5	1.0	1.0	0.8
	Fuel	0.6	0.0	0.0	0.0	0.0
	Fibre	0.5	0.0	0.5	0.5	0.0
	Genetic resources	1.0	0.7	0.9	1.0	0.6
	Natural medicines or pharmaceuticals	0.5	0.0	0.0	0.0	0.0
	Ornamental resources	0.5	0.0	0.5	0.5	0.0
	Clay, mineral, aggregate harvesting	0.0	0.0	0.0	0.0	0.0
	Energy harvesting from natural air and water flows	0.0	0.0	0.0	0.0	0.0
REGULATING SERVICES	Air quality regulation	0.9	0.8	0.7	0.6	0.8
	Local climate regulation	0.7	0.6	0.6	0.6	0.5
	Global climate regulation	0.5	0.5	0.5	0.5	0.0
	Water regulation	1.0	0.5	1.0	1.0	0.0
	Flood hazard regulation	1.0	0.5	1.0	0.0	0.0
	Storm hazard regulation	1.0	0.0	0.0	0.0	0.0
	Pest regulation	0.5	0.5	0.5	0.5	0.0
	Disease regulation - human	0.5	0.5	0.5	0.5	0.0
	Disease regulation - livestock	0.5	0.5	0.5	0.5	0.0
	Erosion regulation	1.0	0.6	0.5	0.5	0.0
	Water purification	1.0	0.5	0.6	1.0	0.0
	Pollination	0.5	0.0	0.5	0.5	0.0
	Salinity regulation	0.0	0.0	0.0	0.0	0.0
	Fire regulation	1.0	-1.0	1.0	1.0	-1.0
	Noise and visual buffering	1.0	0.5	0.0	0.5	0.0
CULTURAL SERVICES	Cultural heritage	0.0	0.0	0.0	0.0	0.0
	Recreation and tourism	0.5	0.5	0.5	0.5	0.0
	Aesthetic value	1.0	1.0	1.0	0.8	0.5
	Spiritual and religious value	0.5	0.5	0.5	0.5	0.5
	Inspiration value	1.0	1.0	1.0	0.8	0.5
	Social relations	1.0	1.0	1.0	1.0	1.0
	Educational and research	1.0	0.6	1.0	1.0	0.5
SUPPORTING SERVICES	Soil formation	0.5	0.5	0.5	0.5	0.0
	Primary production	0.7	0.5	0.5	0.5	0.0
	Nutrient cycling	0.5	0.5	0.5	0.5	0.1
	Water recycling	1.0	0.5	1.0	1.0	0.0
	Provision of habitat	1.0	1.0	1.0	1.0	0.7



Figure 5.10. Boeung Prek Lapouv wetland, showing Sarus crane (top left), Asian openbill (top right), buffalo farming (bottom left) and a landscape view (bottom right)

5.7. Tonle Bati

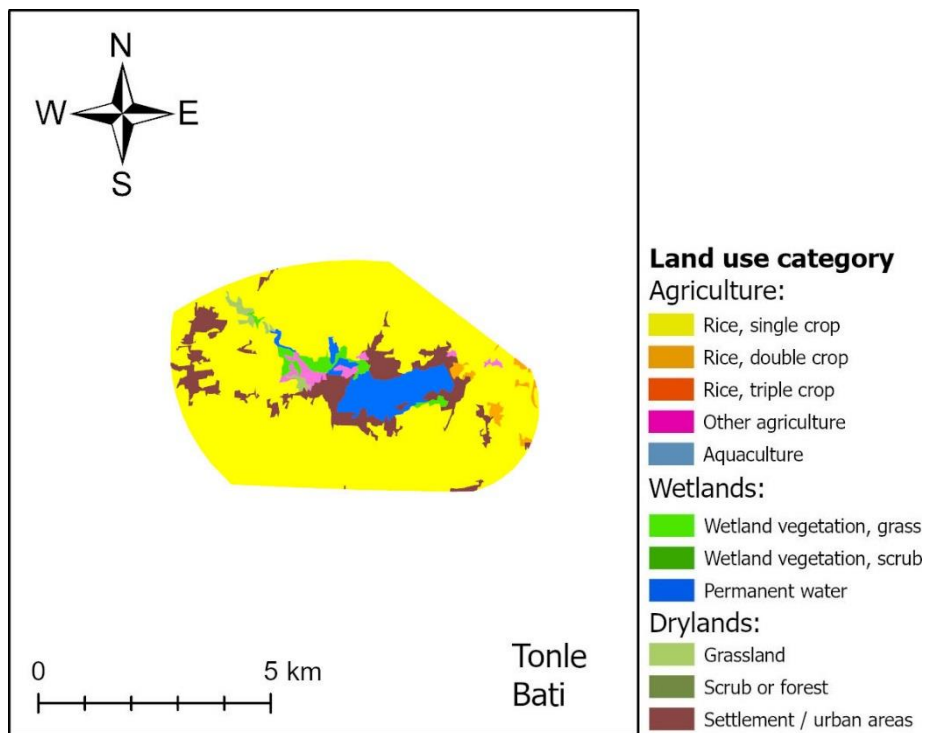


Figure 5.11. Habitat types in Tonle Bati

Tonle Bati is a National Wetland, but is not currently protected. This is an area with mainly open water, a few flooded forests and some grassland. Surrounding the wetland there are settlements which are experiencing rapid development due to their proximity to the new airport which is near to completion. This is also a site for local tourism, mainly coming from the city which is also nearby (approximately 40km away). There is one temple and numerous pagodas in the surrounding area. This area is therefore seen as being important for cultural heritage (and cultural ecosystem services). This area is considered important for research related to the history of Cambodia.

Communities living in this area are involved in rice growing, and various fruit and vegetables depending on the season (e.g. cucumber, salad). People also raise cattle, duck and chickens, and use the water from the wetlands for their livestock. People also fish as a source of livelihood, and collect shellfish and hyacinth flower for food from the wetland as well. Water lotus is collected as an ornamental resource (used in Buddhist prayer).

Workshop participants reported that the air quality is very good in this area, which is why it's also a tourist destination. Tourists come from other parts of the country, and there are also some international tourists as well to visit the lake and nearby temples and other important heritage sites (see Figure 5.12). The ecotourism in the area provides services such as boat rides around the lake to visitors, along with restaurants by the water (Figure 5.12). Visitors are often people from the city coming to the area during the weekend to relax and enjoy the wetland scenery.

There are no issues from flooding or erosion in this area due to the good condition of the wetland and its various habitat types (including grassland, rice paddy fields and flooded forests). The water quality is also considered good, as there healthy fish and bird populations. There are research groups who come to the area to conduct bird surveys and agricultural research (the latter from a nearby University of Agriculture).

Table 5.10. Ecosystem service ratings for Tonle Bati wetland. Shade of green represents how 'significant' the positive benefit was assessed as (the darkest green = significant positive benefit). A rating of 0 (with white background) indicates 'negligible benefit'.

		Forest	Grassland	Open water	Aquatic Vegetation	Agriculture
PROVISIONING SERVICES	Fresh water- people	0.5	0.0	0.5	0.0	0.0
	Fresh water - livestock	0.5	0.0	0.5	0.0	0.0
	Freshwater - irrigation	0.5	0.0	0.5	0.0	0.0
	Food	0.5	0.5	1.0	0.5	0.6
	Fuel	0.1	0.0	0.1	0.0	0.0
	Fibre	0.0	0.0	0.0	0.5	0.0
	Genetic resources	0.3	0.2	0.5	0.0	0.0
	Natural medicines or pharmaceuticals	0.0	0.0	0.0	0.0	0.0
	Ornamental resources	0.0	0.0	0.5	0.0	0.0
	Clay, mineral, aggregate harvesting	0.0	0.0	0.0	0.0	0.0
Energy harvesting from natural air and water flows	0.0	0.0	0.0	0.0	0.0	
REGULATING SERVICES	Air quality regulation	1.0	0.9	1.0	1.0	1.0
	Local climate regulation	0.8	0.5	0.8	1.0	1.0
	Global climate regulation	0.2	0.0	0.2	0.2	0.0

	Water regulation	0.5	0.0	0.0	0.9	0.0
	Flood hazard regulation	0.6	0.4	0.6	0.0	0.0
	Storm hazard regulation	0.5	0.4	0.5	0.0	0.0
	Pest regulation	0.0	0.0	0.0	0.0	0.0
	Disease regulation - human	0.0	0.0	0.0	0.0	0.0
	Disease regulation - livestock	0.0	0.0	0.0	0.0	0.0
	Erosion regulation	1.0	0.9	1.0	0.5	0.0
	Water purification	1.0	1.0	1.0	1.0	0.0
	Pollination	0.0	0.0	0.0	0.0	0.0
	Salinity regulation	0.0	0.0	0.0	0.0	0.0
	Fire regulation	0.6	0.2	0.5	0.0	-1.0
	Noise and visual buffering	0.9	0.8	0.9	0.0	0.0
CULTURAL SERVICES	Cultural heritage	1.0	1.0	1.0	1.0	1.0
	Recreation and tourism	1.0	1.0	1.0	0.5	1.0
	Aesthetic value	0.5	0.3	0.3	0.5	0.3
	Spiritual and religious value	1.0	0.5	0.5	0.0	0.5
	Inspiration value	0.9	0.9	0.9	0.5	0.9
	Social relations	1.0	1.0	1.0	1.0	1.0
	Educational and research	0.5	0.5	0.5	0.5	0.5
SUPPORTING SERVICES	Soil formation	0.0	0.0	0.0	0.0	0.0
	Primary production	0.2	0.0	0.2	0.0	0.0
	Nutrient cycling	0.0	0.0	0.0	0.0	0.0
	Water recycling	0.8	0.5	0.8	1.0	0.0
	Provision of habitat	0.5	0.5	0.5	0.5	0.5

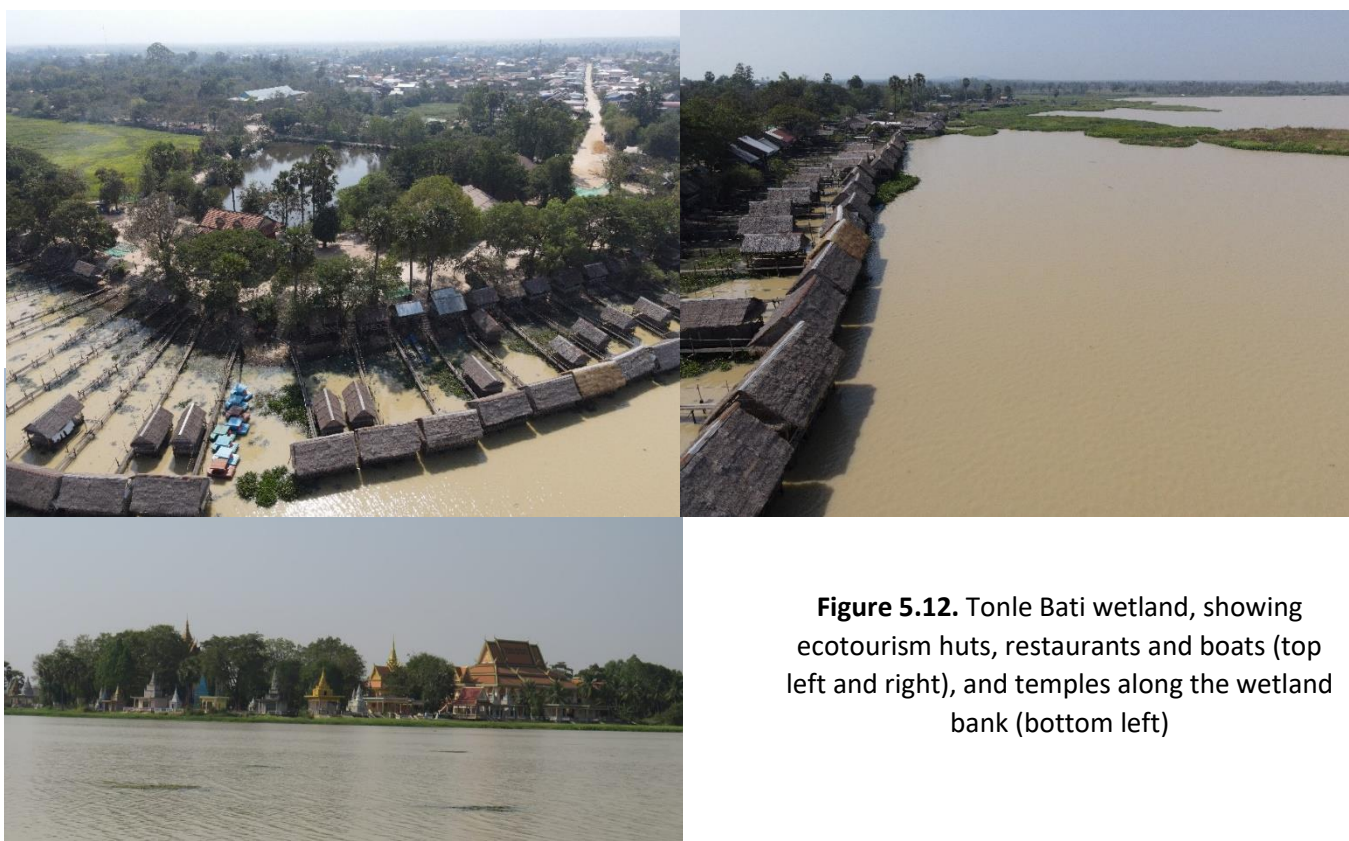


Figure 5.12. Tonle Bati wetland, showing ecotourism huts, restaurants and boats (top left and right), and temples along the wetland bank (bottom left)

5.8. Phnom Tuek

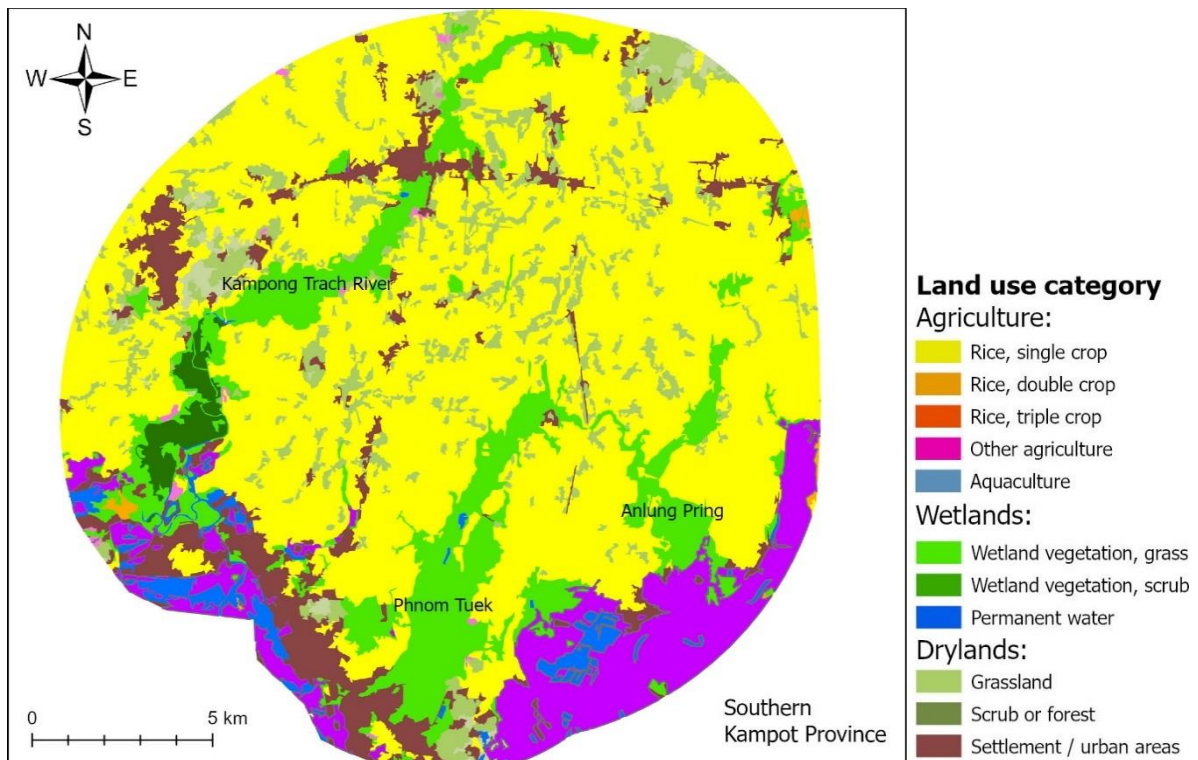


Figure 5.13. Habitat types in southern Kampot Province, showing three sites of interest.

Phnom Tuek is a small area of seasonally inundated grasslands which is currently unprotected. It is close to the Protected Area of Anlung Pring, and Sarus crane (*Grus antigone*) are found in both locations. The presence of the *G. antigone* is also why these wetlands are ranked high for provision of genetic resources and habitat. The main livelihoods for local communities in the area are from agriculture (but not in the vicinity of the wetlands), fishing, livestock raising (buffalo) as well as small home shop businesses and construction work.

The wetland is important for subsistence fishing, particularly in the wet season. During the dry season the wetlands become more acidic and the salinity of the water increases. During this time people also have to use alternative water sources (from neighbours and wells) for their household uses and livestock. People do use the wetlands as a source of water for everyday use, but they boil this before drinking.

Workshop participants reported that the air quality is good in the area, due to the good environmental condition of the wetlands. The forest is perceived to protect the area against floods, and storms are also not an issue for the communities as there are mountains nearby. The high ranks for cultural service provision in the area is due to the tourism activities that exist here. Due to the wetlands proximity to Anlung Pring, tourists tend to visit both locations. Activities include sightseeing and boat tours, accompanied by rangers. WWT already has a presence in the area through Anlung Pring, and there is also a nearby crane resort which provides tourism experiences around Phnom Tuek wetlands. The community is very supportive of ecotourism in the area, as they feel that they get benefits from providing services (e.g. homestays) which support their livelihoods. This is also why the workshop participants ranked the inspirational, educational and research cultural services particularly

highly, as there is a high hope that this area can become a more established destination for ecotourism.

Table 5.11. Ecosystem service ratings for Phnom Tuek wetland. Shade of green represents how 'significant' the positive benefit was assessed as (the darkest green = significant positive benefit). A rating of 0 (with white background) indicates 'negligible benefit'.

	Services	Forest	Grassland	Open Water	Aquatic Vegetation
PROVISIONING SERVICES	Fresh water - people	0.5	0.0	0.0	0.0
	Fresh water - livestock	0.5	0.0	0.0	0.0
	Freshwater - irrigation	0.0	0.0	0.0	0.0
	Food	0.8	1.0	0.0	0.0
	Fuel	0.8	0.0	0.0	0.0
	Fibre	0.3	0.0	0.0	0.0
	Genetic resources	1.0	1.0	0.0	0.0
	Natural medicines or pharmaceuticals	0.3	0.0	0.0	0.0
	Ornamental resources	0.5	0.0	0.3	0.0
	Clay, mineral, aggregate harvesting	0.0	0.0	0.0	0.0
Energy harvesting from natural air and water flows	0.0	0.0	0.0	0.0	
REGULATING SERVICES	Air quality regulation	1.0	1.0	1.0	1.0
	Local climate regulation	1.0	0.0	1.0	0.8
	Global climate regulation	0.0	0.0	0.0	0.0
	Water regulation	0.0	0.0	0.0	0.0
	Flood hazard regulation	1.0	0.0	0.0	0.0
	Storm hazard regulation	0.8	0.0	0.0	0.0
	Pest regulation	0.0	0.0	0.0	0.0
	Disease regulation - human	0.0	0.0	0.0	0.0
	Disease regulation - livestock	0.0	0.0	0.0	0.0
	Erosion regulation	1.0	1.0	0.0	0.8
	Water purification	1.0	0.0	0.0	1.0
	Pollination	0.5	0.0	0.0	0.0
	Salinity regulation	0.0	0.0	0.0	0.0
	Fire regulation	1.0	-0.5	1.0	1.0
Noise and visual buffering	1.0	0.5	0.0	0.3	
CULTURAL SERVICES	Cultural heritage	0.0	0.0	0.0	0.0
	Recreation and tourism	1.0	1.0	1.0	1.0
	Aesthetic value	1.0	1.0	1.0	1.0
	Spiritual and religious value	0.8	0.0	0.0	0.0
	Inspiration value	1.0	1.0	1.0	1.0
	Social relations	1.0	1.0	1.0	0.8
Educational and research	1.0	1.0	1.0	1.0	
SUPPORTING SERVICES	Soil formation	0.0	0.0	0.0	0.0
	Primary production	0.0	0.0	0.0	0.0
	Nutrient cycling	0.0	0.0	0.0	0.0
	Water recycling	0.0	0.0	1.0	0.0
	Provision of habitat	1.0	1.0	1.0	1.0



Figure 5.14. Phnom Tuek wetland

5.8. Kampong Trach River

This river contains brackish water, with most people relying on fishing as their main source of livelihood. This wetland area also includes mangrove forest, where people also collect crabs, fish and firewood from. There are also Nipah palms (*Nypa fruticans*) which have multiple uses: from house roofing (using the leaves) to also traditional medicine (the root is used against fever and for treatment of some skin allergies). *Ochna inegerrima* is also collected (a flower) as an ornamental resource, which is used in Chinese New Year celebrations to bring luck and prosperity.

The wetland is habitat to fish and birds of conservation interest, and therefore the wetland was rated highly for genetic resources. Workshop participants reported that the area has good water quality, air quality and temperature regulation. There are no issues experienced locally from flooding, fires or erosion, with the mangrove and Nipah palm protecting communities from this. As the area has mangroves which play important role in carbon storage, the wetland is also considered as contributing to global climate regulation.

There is an interest in developing tourism in the area, as currently there are no international visitors, and some local tourism. Workshop participants viewed this as a potential additional source of livelihood for the local communities. Tourists from elsewhere in Cambodia come and use local boat ride services and swim in the wetland area. These local tourists mainly come as weekend visitors and for special events and holidays. There are some universities, and the Ministry of Environment that conduct research in this area, mainly around birds and peatland.

Table 5.12: Ecosystem service ratings for Kampong Trach River. Shade of green represents how 'significant' the positive benefit was assessed as (the darkest green = significant positive benefit). A rating of 0 (with white background) indicates 'negligible benefit'.

	Services	Forest	Open water
PROVISIONING SERVICES	Fresh water- people	0.0	0.0
	Fresh water - livestock	0.0	0.0
	Freshwater - irrigation	0.0	0.0
	Food	1.0	0.8
	Fuel	0.5	0.0
	Fibre	0.8	0.0
	Genetic resources	0.6	0.0
	Natural medicines or pharmaceuticals	0.5	0.0
	Ornamental resources	0.6	0.0
	Clay, mineral, aggregate harvesting	0.0	0.0
	Energy harvesting from natural air and water flows	0.0	0.0
REGULATING SERVICES	Air quality regulation	0.9	0.9
	Local climate regulation	0.8	0.9
	Global climate regulation	0.5	0.3
	Water regulation	0.9	1.0
	Flood hazard regulation	0.9	0.9
	Storm hazard regulation	0.5	0.5
	Pest regulation	0.5	0.0
	Disease regulation - human	0.5	0.0
	Disease regulation - livestock	0.5	0.0
	Erosion regulation	1.0	0.5
	Water purification	0.9	0.0
	Pollination	0.5	0.0
	Salinity regulation	0.0	0.0
	Fire regulation	0.6	0.9
	Noise and visual buffering	0.8	0.9
CULTURAL SERVICES	Cultural heritage	0.0	0.0
	Recreation and tourism	0.6	0.9
	Aesthetic value	0.5	0.6
	Spiritual and religious value	0.8	0.8
	Inspiration value	0.9	1.0
	Social relations	1.0	1.0
	Educational and research	0.6	0.8
SUPPORTING SERVICES	Soil formation	0.0	0.0
	Primary production	0.0	0.0
	Nutrient cycling	0.1	0.0
	Water recycling	0.6	1.0
	Provision of habitat	0.5	0.5



Figure 5.15. Kampong Trach River, showing the river (left) and agricultural activity (right)