Food and Agriculture Organization of the United Nations

Beje aquaculture and inland fishery in tropical peatland of Indonesia

Source	Mitigation of Climate Change in Agriculture (MICCA) Programme of FAO
Keywords	Fisheries, aquaculture, fish production, ponds
Country of first practice	Indonesia
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Sustainable Development Goals	No proverty and life below water

Summary

For many tribes in the tropics (e.g. the Kutai and Banjar tribes in East Kalimantan, Indonesia), fishing in peatland catchments is their main livelihood. Peatlands are their main resources area. They traditionally catch fishes and reptiles, and collect fuel wood and grass in peatlands. In January and February, fishes migrate into the waters in the peat forest for mating and breeding. During this season fishermen have relatively little catch since most fishes are in the shallow inland waters far inside the peat forest. Fishers using these artificial ponds, called beje, take advantage of fluctuations in the movement of water or overflow of river water during the rainy season from November to March to trap the fish in artificial ponds or special containers. Fish come into the beje by themselves since they follow the water flow from the river to the peatland.

Description

The traps allow fish to breed in the pond. Once caught, the fish will stay in the beje through the year. The fish are later harvested, without any selection considering the sex or size of the fish, during the dry season when the water recedes from April to October. A schematic representation of the beje practice in peatlands is illustrated in Figure 2. Usually, the peat is laid down between two rivers, and thanks to the soil properties, it forms a kind of water tower or peat dome (Figure 3), with fully diverse vegetation on the top of it. That is why in the Figure 2, the peatland is higher than the level of the river. In the rainy season it collects water and in the dry season water is slowly released (compare Figure 3).

Figure 1. Fishing in a peat swamp forest

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1. Costs of establishment of a beje

Trapping fish using the beje method requires no additional feed and makes use of natural processes. The investment cost of developing the beje fishing method for a size of 812 m², is 7 800 USD / 78 000 000 IDR. One USD is equivalent to roughly 10 000 Indonesian Rupiah.

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One beje can be used for a period of more than 10 years. Table 1 shows the costs of establishment of a beje.

Figure 2. Representation of beje system in peatlands of Indonesia, cross section view. (1) Fluctuation and overflow of the river during the rainy season (Nov-Mar). (2) Fish migrate themselves, by following the flow, from the river bank to the beje (in the back swamp). (3) During the dry season (Apr-Oct), the caught fish stay in the beje where they reproduce and are later harvested

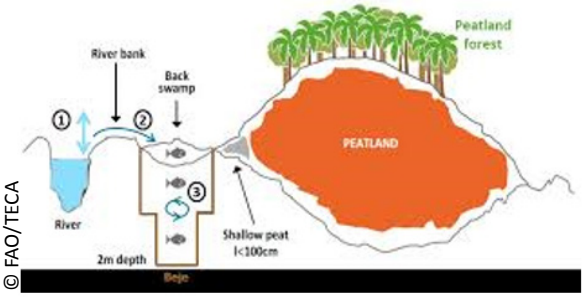

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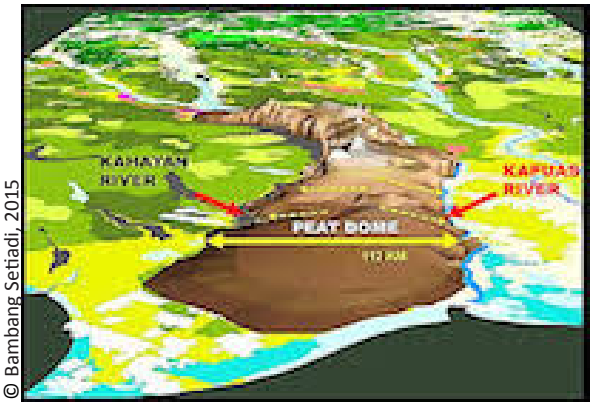
Figure 3. 3D representation of the peat dome located between Kahayan and Kapuas rivers, Central Kalimantan, Indonesia



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2. Fish production

An overview of the composition of fish species caught in a beje, ranges between 5 to 12 types and is dominated by marsh fish (black fish) from the family *Anabantidae* and *Nandidae*. Other types of fish caught in beje are: Sepat siam (*Trichogaster pectoralis*), Sepat rawa (*Trichogaster trichopterus*), Gabus (*Channa striata*), Betok (*Anabas testudineus*), Tambakan (*Helostoma temminckii*), Baung (*Mystus nemurus*), Singgaringan (*Mystus nigriceps*), Lundu (*Mystus Gulio*), Lais lampok (*Cryptopterus limpok*), Lele (*Clarias spp.*), Singgaringan (*Mystus nigriceps*), Lundu (*Mystus Gulio*) Kakapar (*Peristolepis fasciatus*).

Also, because it is highly adaptable and can live in waters with low levels of dissolved oxygen and low pH levels, patin or pangas catfish (*Pangasius pangasius*) is a fish species that has been selected to reinvigorate the aquaculture sector in Indonesia's peatlands. This species is known to have a high content of omega-three fatty acids, which are important for nutrition.

Figure 4. Illustrated description of a beje aquaculture system

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To cultivate the catfish, ponds are dug 2.5 m deep into the peat until the clay layer is reached. The bottom of the pool is treated with lime to reduce the acidity and avoid fish diseases. Manure, urea and N-P-K (containing

nitrogen, phosphorus and potassium) fertilizers are then added to promote plankton growth. For the past two years, the cultivation of tilapia fish (*Sarotherodon galilaeus galilaeus*), which has also shown commercial promises and success, has been developed in various peatland areas in Indonesia.

Based on data observed in 70 beje locations, the results showed that annual fish production in beje fisheries declined sharply from 500 to 2 000 kilograms per beje before the swamp land reclamation in 1996 to 5 to 150 kg per beje. The tremendous decline in production (94.6 percent) was mainly due to changes in water fluctuations caused by the construction of irrigation canals and damage to fish habitat.

Table 1. Costs of establishment of a beje

Source: FAO 2016

3. Patin or pangas catfish (*Pangasius pangasius*)

The beje fishing method contributes to the livelihood and income of communities around peatland areas in Indonesia. Based on identifications by the Ministry of Marine and Fishery of Indonesia, there are 300 potential areas to develop beje in Kalimantan.

In addition, the beje system also indirectly plays a role in reducing carbon emissions by functioning as a buffer and inhibiting the spread of fires in peatlands, keeping peat wet, thus preventing fires in peat. Furthermore, the beje system also accelerates the development of natural vegetation.

Figure 5. Patin or pangas catfish (Pangasius pangasius)

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4. Validation of the practice

This practice has been tested during two years in the natural tropical peat swamp forest of the East Kalimantan – Indonesia and Rupawan (2004) conducted research in 40 beje sites, randomly chosen from 176 beje located in South Kalimantan. In these regions bogs-peats have a depth of over 300 cm with an acidic pH of water (pH = 3.7 to 4.4).

5. Further reading

- Setiadi B., Limin S., 2014, Aquaculture and tropical peatland fishery, In: Biancalani, R. and Avagyan, A (eds). Towards climate-responsible peatlands management. FAO. Rome. pp. 58-60. URL
- Online fact sheets collection about cultured aquatic species: URL

6. Agro-ecological zones

- Tropics, warm

7. Related/associated technologies

- Peatland restoration in China: 8278.
- Sago plantations on undrained peatland in Indonesia: 8281.
- Illipe nut plantation on undrained peatland in Indonesia: 8284.
- Rattan oil curing, bleaching and preservation, Malaysia, Philippines, Indonesia: 3884.

7. Objectives fulfilled by the project

7.1 Resource use efficiency

This technology reduces carbon emissions by preventing the spread of fires in peatlands because it keeps peat wet. It also accelerates the development of natural vegetation.