Local potential of mangrove Pangkal Babu Kuala Tungkal Jambi Province as a source of learning biology

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Abstract: Mangrove forest in Indonesia one of which is located in West Tanjung Jabung District Kuala Tungkal Jambi Province is the ecosystem of mangrove Pangkal Babu. This ecosystem is one of the local potentials of this area. Many mangrove ecosystem provide benefits. The many benefits of this mangrove ecosystem cause the ecosystem to suffer damage so there is an effort to overcome it. The solution is a local potential based education. Local potential based education is an education based on the surrounding environment so it can create more meaningful learning. Biology is a subject that can be developed to improve environmental knowledge and a good attitude for the environment. The method used is an exploratory descriptive method with data retrieval techniques in the form of interviews and observations. Data processing techniques carried out descriptively. These results are seen from the condition of abiotic, biotic, adaptation, and interaction. Observed abiotic conditions are temperature, salinity, pH, and DO/dissolved oxygen. The abiotic condition found 19 species of mangrove plants and several types of animals. This local potential can be used as a source of learning biology, especially on ecosystem material.

1. Introduction
Almost all islands in Indonesia have mangrove forests, especially in coastal areas. Mangrove forest around the world has an area of about 16,530,000 ha. Indonesia has an area of mangrove forest more than 3,735,250 ha which means that almost 25% of mangrove forests in the world come from Indonesia [1]. Areas that have mangrove forests in Indonesia one of them in Jambi Province in the regency of West Tanjung Jabung with the capital of the regency of Kuala Tungkal has a vast mangrove forest area and the ecological conditions are quite good. Pangkal Babu Mangrove forest is a natural mangrove forest area. Since the year 2003 based on the decree of the Minister of Forestry Number: 14/Kpts-II/2003 dated 7 January 2003, the area of Pangkal Babu mangrove forest of 82 ha was set to be Conservation Area [2].

The Mangrove ecosystem is a coastal resource that has an important role physically, economically and ecologically. The ecological role of mangrove forests can be seen from the environmental conditions and interactions [3]. Mangrove plants usually live in muddy and marshy areas this is what makes this ecosystem different from other ecosystems when the ecosystem is well managed so that it can be used as tourism potential of Ecology will certainly be a natural laboratory for living creatures in it.

The function of mangrove forests can be used as a protected area of the habitat of rare animals and plants such as the Tong-Tong Crane (Leptoptilos javanicus) and Pedada (Sonneratia ovata). Besides mangrove forests can benefit coastal communities by selling plants and animals [4]. Thus, mangrove
forests can be used as a characteristic of local potentials of the area. Local potentials can be defined as the potential owned by a particular region. Local potentials can evolve through the wisdom or traditions of the culture of society [5]. However, many benefits of mangrove forests can be damaged. Damage to mangrove forests can be caused by the existence of mangrove logging activities for charcoal raw materials, construction of buildings carried out by the Community, and the existence of land functions into ponds and agriculture hence degradation occurs [6].

One effort to mitigate the damage of the mangrove ecosystem is by local potential-based education. Local potential-based education is an education based on the potential of the environment. The mechanism of the utilization of local potentials in learning can be seen from the planning, implementation, evaluation, and development phases [7]. The utilization of local potentials in education by providing a very close example of everyday life can pose a caring environment so that the learning process is more civilization [8]. Almost all subjects can be reconstructed. Biology is a subject that can be developed to enhance environmental knowledge and the attitude of maintaining its environment. Furthermore, this initial knowledge is in the same with the material taught in school [9]. Therefore, it is important to know the potential of the mangrove ecosystem of Pangkal Babu Kuala Tungkal as a source of biological learning.

2. Method
The method used in this research is using an exploratory descriptive method. Data collection techniques with observations and interviews to find out the potential owned by the mangrove ecosystem of Pangkal Babu as a source of biological learning. Data processing techniques carried out descriptively. The population in this research is all potential of the mangrove ecosystem of Pangkal Babu Kuala Tungkal which can be used as a source of learning biology. The sample in this research is abiotic, biotic conditions and interactions that occur within the Pangkal Babu mangrove ecosystem.

3. Results and Discussion
The mangrove ecosystem of Pangkal Babu has a total area of 82 ha. This area designated as marine protection, areas are divided into core zones, economies, and buffer zones. The mangrove ecosystem has a very important function in life. The function can ecologically withstand large waves, winds, and high waves directly into the mainland, preventing the occurrence of abrasion on rivers or beaches and is a place where the sea is located. Economically, it can help coastal communities as regions capture marine creatures and produce boards or firewood. In-field observation results are presented in Table 1.

| Observation | Field observations |
|-------------|-------------------|
| Abiotic     | Animals           | Plant              | Adaptation     | Interaction                          |
| 1. Water temperature | This type of animal found in the mangrove ecosystem of Pangkal Babu Kuala Tungkal is the Snail (telescopium telescopium) of the Crab Uca (Uca dussumieri), crabs (sesarma sp.), Snail (Terebralia palustris), Cassidula angulifera, Terebralia sulcata, Geolina ceylonica. Fish of Glocok (Periophthalmodon sp.), fish, Big white heron, long tail monkeys, Langur, Tongtong crane and Lizard. | Types found in the location of 19 types of mangrove plants | Adaptation of plant morphology is breath roots or pencil roots of Api-api (Avicennia alba and Avicennia marina), Perapat (Sonneratia alba, and Pedada (Sonneratia caseolaris and Sonneratia ovata). The root board or buttress of manyirih (Xylocarpus granatum) The root of support mangrove (Rhizophora apiculata and Rhizophora apiculata), and The root of knee is Tumu (Bruguiera gymnorrhiza). | 1. Interaction between biotic components and abiotic components |
| 2. Salinity  | 3. Dissolved Oxygen (DO) | 4. pH              |                 | 2. Interaction between biotic components and biotic components. Examples of symbiosis, predation and competition |

Table 1. The observation was done in the field.
Based on results Table 1 found many facts and phenomena from the ecosystem of mangrove Pangkal Babu Kuala Tungkal. This fact and phenomenon will be selected and processed to be a source of biological learning that can be used as the development of teaching materials based on potential local and biological learning resources. From table 1 can be used as a source of biological learning:

### 3.1 Condition abiotics Mangrove Pangkal Babu ecosystem

Abiotic conditions are a state of lifelike components that can impact the biotic component in its interactions. Observed abiotic components are water temperature, dissolved oxygen salinity, and water pH. Also, mud and tides are characteristic of the land in the mangrove ecosystem. This abiotic component affects the form of adaptation and the diversity of living creatures that compose the mangrove ecosystem with other ecosystems. Results obtained from observation showed the atmosphere of the pH of sufficient water acid is 6. Acidic conditions in the mangrove area are caused by the decomposition of mangrove litter [10]. These events show the energy cycles that occur in the ecosystem. The range of pH 6.7 and 8 is good enough for the life of aquatic organisms [11].

Observed abiotic components were other than The pH of salinity. Salinity acquired in this region is 10%. The state of salinity indicates the level of salt in the water. Salinity in the mangrove area can vary based on environmental conditions such as rainfall and season [12]. Mangrove plants can grow in diverse salinity. One plant that can grow with a high salinity tolerance level is *Rhizophora apiculate* [13]. The relationship of salinity is not only to the growth of the propagation of mangrove plants, but salinity can have an impact on the process of the exposition due to elevated levels of salt [14]. This process can be used as a source of learning biology on ecosystem material about biogeochemical cycles.

Temperature conditions in the mangrove area of Pangkal Babu range between 32°C-35°C. Besides it obtained also the rate of DO is 2 mg/L. The water temperature in the mangrove area varies depending on the region. Temperatures in shallow water can reach 34°C, while on muddy plains more than 34°C [15]. Based on the results of the observed temperature indicates that the condition of the mangrove ecosystem Pangkal Babu includes areas with shallow and muddy waters. Phytoplankton can tolerate a temperature of 16°C-35°C, so that in the water in the ecosystem of mangrove Pangkal Babu There are microalgae that are food for fish [16]. With the occurrence of eating events and eaten in the water, it can be made as a source of learning biology specialty food chains that occur in the water (aquatic). Dissolved oxygen is the amount of oxygen dissolved in water, this is derived from the results of photosynthesis and diffusion from the air. The presence of oxygen is required by water biota to support the sustainability of its life.

### 3.2 Biotic Condition

The results of observations and interviews with Pangkal Babu villagers found 19 types of plants that make up the mangrove ecosystem. This plant in between *Acanthus ebracteatus* (White Jeruju), *Acanthus ilicifolius* (Black Jeruju), *Acrostichum aureum* (Sea spikes), *Acrostichum speciosum* (Sea spikes) *Avicennia alba* (Api-api), *Avicennia marina* (Api-api), *Bruguiera cylindrica* (Lindur/ White tanjang), *Bruguiera gymnorrhiza* (Tundur/ Tumu), *Bruguiera parviflora* (Lengadai), *Excoecaria agallocha* (Buta-buta), *Lumnitzeria racemosa* (Truntun), *Nypa fruticans* (Nipah), *Rhizophora apiculata* (Mangrove), *Rhizophora mucronata* (Elephant mangrove), *Sonneratia alba* (Perepat), *Sonneratia caseolaris* (Pedada), *Sonneratia ovata* (Pedada), *Xylocarpus granatum* (Nyirih), and *Xylocarpus moluccensis* (Nyirih).

Many types of plants found in the ecosystem of Pangkal Babu Kuala Tungkal can be used as supporting facts to serve as a source of learning especially biology. The characteristic of the plant of the mangrove ecosystem can give understanding to the students about the mangrove ecosystem is one of the ecosystems that are important to be maintained because it has plants and animals that are distinctive or different from other ecosystems. One characteristic of the mangrove ecosystem that has zoning. The zoning is divided into several zones. These zones are grown in different types of mangrove plants.

Many mangrove plants that infiltrated this ecosystem. Found rare species in the mangrove ecosystem of Pangkal Babu namely *Sonneratia ovata*. This species includes five species of mangrove plants that
are common to the local but rare globally [4]. Therefore, it is important to know and preserve the sustainability of this plant. Besides, it is found a blind type of plant. This plant has a rubber that hurts humans. The rubber of the plant *Excoecaria agallocha* when about human skin can irritate even when exposed to the eye it will cause blindness [17]. The two species can be seen in Figure 1.

**Figure 1.** A. *Sonneratia ovata*, b. *Excoecaria agallocha*.

Mangrove plants have many functions. Physically the mangrove ecosystem can withstand the wind, the waves, holding particles from the ground into the estuary or the sea can even prevent the breach of seawater to the ground caused by the root morphology of each plant. Economically, the mangrove ecosystem can benefit coastal communities as a place to capture marine biota and produce firewood [18]. The people of Pangkal Babu have several mangrove plants to fulfill their food and board needs.

Besides mangrove plants that are quite a lot, in mangrove forest is also found some animals such as long-tail monkeys, snail, birds, fish, gastropods even reptiles that can be found in the mangrove forest area of Pangkal Babu. The following types of animals that can be found in the mangrove forest area of Pangkal Babu can be seen in Figure 2.

**Figure 2.** a. Fish, b. A large white heron, c. Long tail monkey, d. Langur, e. Crane of Tongtong and f. Biawak

Tong-Tong Cranes (*Leptoptilos javanicus*) are found to be one of the rare and endangered birds in Indonesia. This crane is included in 200 species which relies heavily on mangrove forests as the habitat of the birds [4]. Other animals that can be found in this mangrove forest depend on the existence of mangrove forests as a place to make nests, food sources, and shelter from predators. Besides, several types of gastropods can be seen in Figure 3 below.

**Figure 3.** A. *Cassidula angulifera*, b. *Terebralia sulcata*, c. Snail (*Geolina ceylonica*)

Gastropoda in the mangrove ecosystem has a very important ecological function that is as detrivora so that it can accelerate the decomposition process. Mangrove forests are ecologically a habitat of many types of aquatic biota because of the function of mangrove forests as an orphanage and spawning areas and places to find food for the water biota. Mangrove forests are instrumental in providing food and shelter from predators [19]. Decomposition can occur well when environmental
conditions as well as living beings that play a role in it interact with each other, resulting in a reciprocal relationship in the environment. These events are commonly referred to as ecosystems.

Availability Mangrove plants play a role in the food chain in the ecosystem. All components in the mangrove ecosystem are related therefore, it is important to keep the ecosystem from occurring the extinction of the animals and plants involved in it. The relationship of mangrove forests in biological learning is from ecosystem material. This ecosystem material contains interactions that occur in it such as food chains, food nets, etc. Furthermore, it is not only interaction but in this ecosystem, there are also different biotic and abiotic components in other ecosystems.

3.3 Adaptations of living creatures in the mangrove ecosystem of Pangkal Babu
The abiotic factor in the mangrove ecosystem has an impact on the living creatures in the ecosystem, especially the animals and their growth. As a result of these abiotic factors, the animals and their growth are adapting or self-adjusting. One example is found in the field of mangrove root adaptation. The mangrove roots have different forms depending on the type. Mangrove roots have different roots from other plants due to abiotic conditions such as the medium of growth in the mud and the ecological function of hold the wave [20]. Also, this root makes the mangrove plants do not collide when struck by waves and strong winds [21]. Mangrove root type such as breath, support, knee, and board or buttress. This root type can be seen in Figure 4.

Figure 4. a. Supported root, b. Root board/Buttress, c. Root breath, d. Knee roots.

3.4. Interaction

3.4.1. Interaction between biotic components with abiotic components. The mangrove ecosystem of the existence of abiotic components greatly affects the biotic components and otherwise. Examples of interactions that occur between biotic components and abiotic components such as mud, tides, salinity, and sunlight and mangrove plants. Mangrove plants need mud as the media grows and requires tidal water to make the mangrove saplings grow and need sunlight for the process of photosynthesis. A special mangrove Habitat, causing the formation of zoning from mangrove plants. Zoning is caused by several factors namely soil type, sunlight, wave slip, salinity, and Tide [22].

3.4.2 interactions between biotic components and biotic components. Interactions that occur in the ecosystem can be interactions of other living beings. The interaction will be a form of balance in the ecosystem. This interaction will form a certain pattern. Interaction patterns require two or more organisms. There are some interaction patterns in the mangrove ecosystem, symbiosis, predation, and competition. Symbiosis is an interaction that occurs between two types of living beings in an ecosystem. There are some symbiotic types of mutualism symbiosis, commensalism, and parasitism. Examples found in the field are mutualism symbiosis is monkeys eat fruit (Xylocarpus granatum), Api-api (Avicinnea alba), and Pedada (Sonneratia alba). The main food of the long tail monkey in the mangrove forest of Pangkal Babu is the fruits of the type bruguiera Gymnorhiza, Xylocarpus granatum, Sonneratia caseolaris and Sonneratia alba [23]. This process resulted in the spread of the seeds of the plant and monkeys get food and plants benefit from seeds spread by monkeys so the monkey helps in the conservation process. Such as Lichen's commentary on the mangrove tree, it is a place where the mangrove trees have no loss or profit. Predation can also be interpreted as a form of interaction between
organisms in which one of the organisms eats other organisms. Examples of predation in the mangrove ecosystem such as fish feeding. Competitors in this interaction can occur among individuals of similar kind or individuals of different types. Examples in the mangrove ecosystem of fire-flames with plants of *Avicennia sp.* are competing against the sunlight, so that it grow upward towards the sun and few have branches.

Subjects that can be applied with the data obtained such as applying it in the biodiversity material in Indonesia, not only examples of tropical forests but can be given examples of biological diversity in the mangrove forest. Pangkal Babu mangrove forest is one example that can be used as a learning resource that is close to the students in Kuala Tungkal. Besides, material that can be developed through the local potential is about the material of the ecosystem. Developing competence for more meaningful learning can be adjusted with the characteristics and potential of the area, including the benefits of the region can be inserted into the learning materials [24].

The utilization of local potential in learning will facilitate students in understanding the lesson. This is because it is more familiar, known, and close to the student environment. Local potential based education is an education that is not only academic-oriented but can be oriented based on the potential of the environment. The mechanism of the utilization of local potentials in learning can be seen from the planning, implementation, evaluation, and development phases [25]. Teaching materials written based on conditions that are appropriate to the region can contribute to the conservation of good diversity for the ecosystem and the environment [26]. The utilization of local potentials as a learning resource can provide a relationship between the knowledge that students have with their application in life [27]. These teaching materials can be developed by teachers based on local potentials around the region. One that can be developed to be a source of learning biology in the form of teaching materials is the potential that is owned by the mangrove ecosystem of Pangkal Babu.

4. Conclusion
Based on the results of the study it can be concluded that local potential can be used as a source of learning biology in ecosystem material. Some several facts and phenomena can be used as a source of biological learning, namely the abiotic condition of the mangrove ecosystem that is observed, namely temperature, pH, salinity, and dissolved oxygen. The biotic condition found 19 types of mangrove plants that can be met in the mangrove ecosystem of Pangkal Babu Kuala Tungkal. There is one type of mangrove plant that is rare *Sonneratia ovata*. Animals that can be found in the mangrove ecosystem of Pangkal Babu Kuala Tungkal which are birds, fish, monkeys, gastropods, and reptiles, of this animal was discovered Tongtong strok (*Leptoptilos javanicus*) which is a species of rare and endangered birds in Indonesia adaptation of mangrove.

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