

Carbon Stock Of Seagrass In Karang Tirta's Coastal Area, Padang

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Abstract. The seagrass beds are the spawning, nursery, and the feeding ground for some oceanic biota. It's also can trapped the sediment and stabilized the substrate so the waters looks clear. Beside those abilities, seagrasses are also can store the carbon. The research was conducted in karang tirta's coastal area, Padang city to analyze the carbon stock of seagrass that stored within their biomass. The biomass was analyzed by harvesting the seagrass at transect 25x25 cm, while the carbon stock was analyzed by using walkley & black method. Seagrass beds in karang tirta's coastal has 14.1 ha (142.546.36 m²) distribution area and it's stored 18.05 tons of carbon. based on these result the seagrass beds in karang tirta's coastal area has stored 1.2 tons C/ha. the highest carbon stock has found in the below ground, especially in their rhizomes.

Keywords : *Seagrass, carbon stock, Thalassia, Enhalus, Biomass*



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INTRODUCTION

The seagrass are flowering plants that thrive in shallow oceanic and estuarine waters (Bjork *et al.*, 2008). It has leaves, stems, rhizome and roots. Seagrass are more closely related to terrestrial lilies and gingers than to true grasses (McKenzie *et al.*, 2003). The leaves form a canopy structure to protect the habitat in seagrass beds from the sun burn (Nybakken & Bertness, 2004) and also decrease the sea current.

The leave are generally associate with epiphyte that is a food for some shrimp and fry (Hokum & Pelasula, 2012). Fish use the seagrass shoots as a protective nursery were they and they fry hide from predator (Bjork *et al.*, 2008) because of their function the average of fish abundance was higher in a vegetated area than unvegetated area (Rahmawati *et al.*, 2012)

The waters in seagrass beds are generally looks clear because seagrass leaves act as a trap for suspended materials that are brought to the seagrass meadows with the current (Bjork *et al.*,2008) and also the rhizome and roots systems stabilize the sediment (Kennedy & Bjork, 2009). As a carbon absorbent, seagrasses capture the atmospheric carbon dioxide (CO²) through photosynthetic progress for the growth and stored as biomass that's known as blue carbon (Rustam *et al.*, 2013)

Seagrass meadows are reported stored the carbon almost three times more than terrestrial forest, about 83,000 metric tons of carbon per square kilometer annually (CEC, 2016). Seagrasses are responsible for about 15% of total carbon storage in the ocean (Kennedy & Bjork, 2009).

Karang tirta also known as nirwana's beach, located in district lubuk begalung, south padang city. It's located near of Teluk Bayur harbour. Karang tirta's has three main zone that based on the used, such as a magrove zonation, a tourism destination and also a residence of the fisher man who daily fishing in this coastal. In 2011, there are two species of seagrasses has found in this coastal area, *Thalassia hemprichii* and *Enhalus acoroides*, *whitch Thalassia hemprichii dominating the seagrass meadow* with appearance frequency value 100% (A.A Purnama., I.J Zakaria., J Nurdin, 2014). By this fact, this research's aim to discover the potential of seagrass beds in karang tirta's coastal area to store the carbon.

MATERIALS AND METHODS

This research was conducted from October 2015 until February 2016 in Karang tirta's coastal area.The study area was divided into three station by the zone, the zone near residence as station I, the zone near tourism area as station II and the zone near the mangrove forest as station III. The mapping of seagrass distribution are doing by walk along the beach and tagged the location where seagrass has found with GPS (Global Positioning System) and analyzed with GIS (Geographic Information System).

The biomass of seagrass was analyzed by following methods, harvest the sample from a 25x25 cm square quadrat, then make it dried (Rahmawati, 2011). The sample was washed from substrate and attached material then separate it into leave (above ground), rhizomes and roots (below ground). Dried the sample using oven and weighted (g). Carbon from a dry mass are analyzed using walkley and black method, to known the potential of seagrass to store the carbon (C) (Kiswara, 2010). Total area of the seagrass meadows (m²) can be analyzed by GIS. The relationship between seagrass density and biomass can be used to predict seagrass biomass in all sampling points of density (Supriadi *et al.*, 2014).

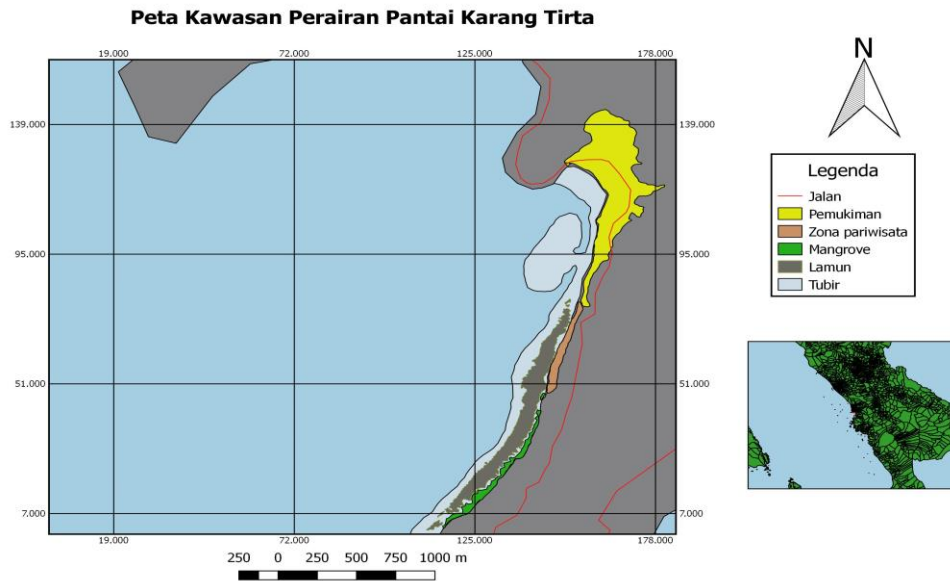


Figure 1. The Main Zone in Karang Tirta's Coastal Area. Source: Privat collection (Made using the GIS)

To get the dry weigh, first, sample are separated into leaves, rhizomes, and the roots. Then, dried by oven with the temperatures around 40-50 °C until its constant (English *et al.*, 1994). carbon stock in every part of seagrass are knowing by multiply the dry weigh (g/m²) and carbon content of seagrass (%C) (Wawo *et al.*, 2014). total carbon stock of seagrass beds was calculated using the following formula:

$$Ct = \sum (L_i \times c_i)$$

Where Ct = Carbon total (tonnes); L_i = covered area by seagrass i(m²); c_i = Carbon stock of seagrass i (ton/m²) (Supriadi *et al.*, 2014).

RESULTS AND DISCUSSION

Seagrasses in karang tirta's coastal area are distributed from the shore line to the sea chasm, most of them has found near the mangrove forest area and tourism area where residence area have the least vegetated area of seagrass. *E. acoroides* only found in station III, near the mangrove forest ecosystem ± 234.19 m² while *T. hemprichii* distributed in all of the reaserch station ± 141.312 m². total distributed area of seagrass in karang tirta's coastal area ± 141.546.36 m² (14.1 ha).

There were two seagrass species found in karang tirta's coastal area i.e., *Thalassia hemprichii* and *Enhalus acoroides*. *Thalassia hemprichii* was dominated the seagrass beds in the study area. *Enhalus acoroides* was only found in the area near to mangrove forest

(station III) because the depth of water can protect the leaves where the other station has a really shallow water, even dry during tidal period. The substrates in the seagrass beds are dominated by sand and dead corals, sand and mud substrate was found only in station III.

Analysis of carbon content indicated variability among these species and parts of seagrass. The percentage of carbon content in every species and part of seagrass can be seen in the table 1.

Table 1. Carbon content of seagrass in karang tirta's coastal area (% of dry weight)

Species	Leaves			Rhizomes			Roots			Carbon total (gC/m ²)
	C (%)	DW (g/m ²)	Total (gC/m ²)	C (%)	DW (g/m ²)	Total (gC/m ²)	C (%)	DW (g/m ²)	Total (gC/m ²)	
<i>Thalassia hemrichii</i>	40	33.52	13.40	55.5 5	173.1 2	96.16	26	69.52	18.07	127.63
<i>Enhalus acoroides</i>	30.88	92.16	28.45	75.4 4	90.72	68.43	16.88	44.64	7.53	104.41

Where : C = Carbon (%); DW= Dry weight (g/m²).

Table 2. Above and below ground carbon content of seagrass

Species	Belowground (Rhizomes & roots)	Aboveground (Leaves)
<i>Thalassia hemrichii</i>	114.23 (gC/m ²)	13.40 (gC/m ²)
<i>Enhalus acoroides</i>	75.96 (gC/m ²)	28.45 (gC/m ²)
total	190.19 (gC/m ²)	41.85 (gC/m ²)

Based on the result, a higher carbon stock from the both species of seagrasses in karang tirta's coastal area was found in their rhizomes and leaves (30.88-75.44%), where the roots have a lowest amount of carbon (16.88-26%). The highest carbon percentage of seagrasses part in pari's island also found in their rhizome (41.53-50.63%) where the lowest is found in the roots (26.79-37.77%) (kiswara, 2010).

Biomass in the below ground was 6-10 times higher than the above ground (Nienhuis *et al.*, 1989. In: kiswara, 2010). In this research the below ground of *T. hemprichii* was 7.2 times higher than the above ground, while the below ground of *E. acoroides* was 2.6 times higher than the above ground.

Same as the biomass, the belowground (rhizomes and roots) carbon stock was higher than the aboveground (leaves). It's also found in the monospecific seagrass beds of

Enhalus acoroides in pari's island, where the carbon stock in the below ground was 2 times higher than the above ground (rahmawati & kiswara, 2012) it's because the carbon fixation in seagrass leaves usually exceed their immediate metabolic needs (Duarte & cebrian, 1996. In: Lyimo, 2016) hence a large proportion of excess carbohydrates organic carbon is transported to the roots and rhizomes where it is stored (Lyimo, 2016). Rhizomes has a long turnover time, it can persist for millenia (two weeks to 5 years for leaves and roots) (kennedy & bjork, 2009).

Build upon the result, the amount of seagrasses carbon's stock depend on the appearance of the seagrass itself as its stock in their biomass. That's why we have to protect the seagrass meadow, so the seagrass will decreasing carbon in the environment and store them in the rhizomes, roots and the leaves.

The highest carbon stock in karang tirta's coastal area are stored by *T. hemprichii*, about 18.03 ton carbon, while *E. acoroides* stored 0.20 ton carbon. total carbon stock of seagrass in karang tirta's coastal area was 18.05 ton carbon with 141.1 ha distribution area. The average of carbon stock of seagrass community at karang tirta's coastal area was 1.2 ton C/ha. It's lower than the carbon stock in pari's island that also formed by *T. hemprichii* and *E. acoroides*, about 2.005 tons C/ha (Rahmawati,2011). The data show that seagrass beds are a good carbon reservoir, but we still have to protect it because with the loss of seagrass, carbon storage in underlying soils is released back in circulation, some portion eventually reburied but some portion released into the atmosphere (Laffoley, 2013).

CONCLUSION

Seagrass beds in karang tirta's coastal area has $\pm 141.546.36$ m² (14.1 ha) distributed area with carbon stock potency 18.05 tons. It's means In 1 hectare area was stored 1.2 tons carbon. the highest carbon stock has found in the below ground, especially in their rhizomes. These result indicate importance of seagrass ecosystem in the carbon mitigation.

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