

# Fluctuation of Daytime Air Humidity in The Mangrove Forest Edges

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## Abstract

Humidity is a microclimate parameter that contribute the existence of mangrove and its ecological functions. Research on diurnal fluctuation of air humidity in the edge of mangroveforest, describe the characteristic of mangrove humidity and its role to control the surroundings humidity. The resultsshow that mangrove forest in the studied area is effective to keep air humidity at the tolerable level for biological processes.

**Keywords:** mangrove, humidity, gradient

## 1. Introduction

Mangrove forests have the economic, social and ecological functions and it significantly affects the human life. Utilization of mangrove forests for the economic benefits often leads to disruption of ecological functions. The conversion of mangrove forests become the aquaculture farm (prawns, fishes, salt and others), resulting in a disruption of the natural organism which have adapted in the mangrove forests. Disruption of this biodiversity can affect certain types of biodiversity losses. Ecological impacts arising is the increase of waves and wind effects on the coastal settlements, the comfort air is changes into the uncomfortair (Bosire. *et al.*, 2008; Medellu. *et al.*, 2008; Londa. *et al.*, 2009).

Ecological functions of mangrove forests was controlling micro-climate and ensuring biodiversity of its organisms, absorb the carbon dioxide for the air, thus reducing the rate of any global warming effects. Mangrove forests absorbing half of the carbon dioxide produced by human-life (Anonymous, 2009; Jin,1995; Snedaker, 1995). Mangrove forests are roled in governing the food chain for the tidal organisms, locations for egg-laying and hatching, became a shelter for mangrove birds and habitats for reptiles and mammals (Anonymous, 1999; Giri and Muhlhausen, 2008). Snedaker (1995), stated that 67% of the overall fishes species are relied on mangrove forests.

Air humidity is important for the sustainability of mangrove forest ecosystems. Air humidity influence the amount of mangrove litter in forms of leaves, twigs and other biomass, it is a food source for the aquatic biota and the nutrientsreleased determining productivity of waters. Logging and opening of mangrove forests impacted on decreasing air humidity, increasing evaporation and encourages the occurrence of soil moisture deficit and drought (Hatcher. *et al.*, 2012; Yan. *et al.*, 2007)

Research on diurnal fluctuations of air humidity in the mangrove forests and mangrove forest edge suggest the characteristics of air humidity in the mangrove forests. Information of air humidity in the mangrove forests can explain the existence of organisms in the mangrove forests, as well as ecological processes in the mangrove forests.

## 2. Research Method

Field research was carried out in the Tatapaan Village, Subdistrict of Arakan, South Minahasa District. The mangrove forest in this location is good (no significant conversion) with the dense canopy. The measurement of air humidity are performed simultaneously on the six points of observations. Point-1 is located in the sea surface at a distance of 50 m from the boundaries of mangrove, Point-2 at the forest edge toward the sea, Point-3 in mangrove forests (under canopy), Point-4 at the boundary of mangrove forest and land; Point-5 in the tidal limit of the sea water, Point-6 above the land surface (vegetation shrubs).

The measurement of air humidity are performed synchronously on a six point of observation, from 07.00 a.m. until 16.00 p.m., the measurement interval is one hour. To analyze fluctuations in air humidity in the mangrove forest edges are used the transect system. Transect-1 includes the observation points of 1, 2, and 3. Transect-2 includes the observation points of 3, 4, 5 and 6.

### 3. Results and Discussion

#### 3.1 Air Humidity in the Mangrove Forest and its Surrounding

Air humidity during the daytime in the mangrove forests are more stable and higher than the air humidity at the sea surface level. During the daytime, air humidity in the mangrove forests (Figure 1a) fluctuates between 22% and 49%. The lowest humidity 22% is occurred at 11: 15 a.m., and the highest humidity 49% is occurred at 14.00 p.m.

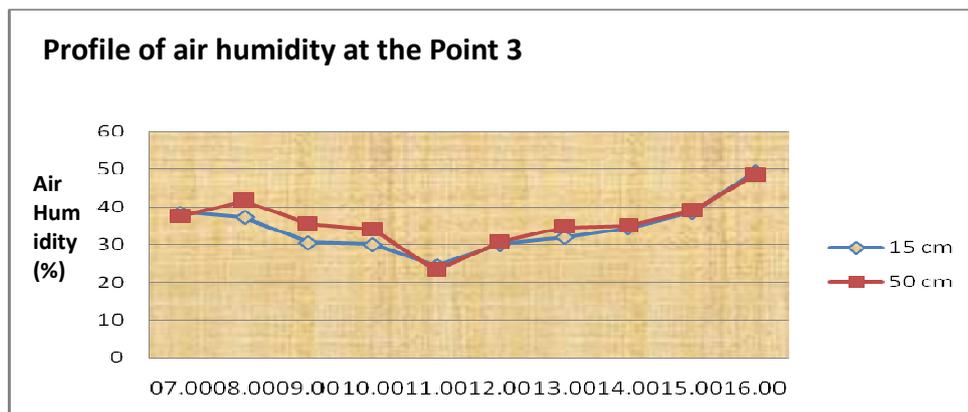


Figure 1a. Air Humidity in the mangrove Forest

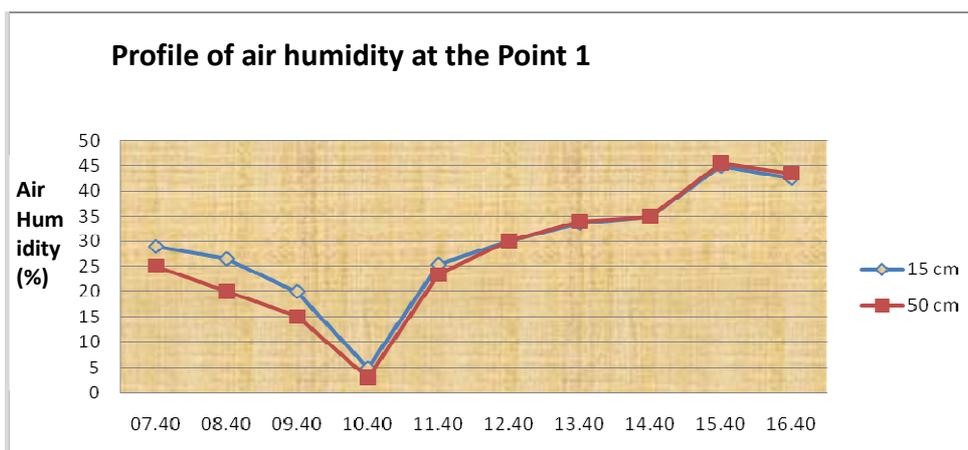


Figure 1b. Air humidity above sea level

Figure1b shows diurnal fluctuation of air humidity at above sea level. The lowest humidity of air (3%) occurs at 10.00 a.m., and the highest humidity of air (45%) occurs at 13.00 p.m. The diurnal fluctuation of air humidity under mangrove forest canopy are observed in the edge areas of mangrove forest (transect 1 and transect2).

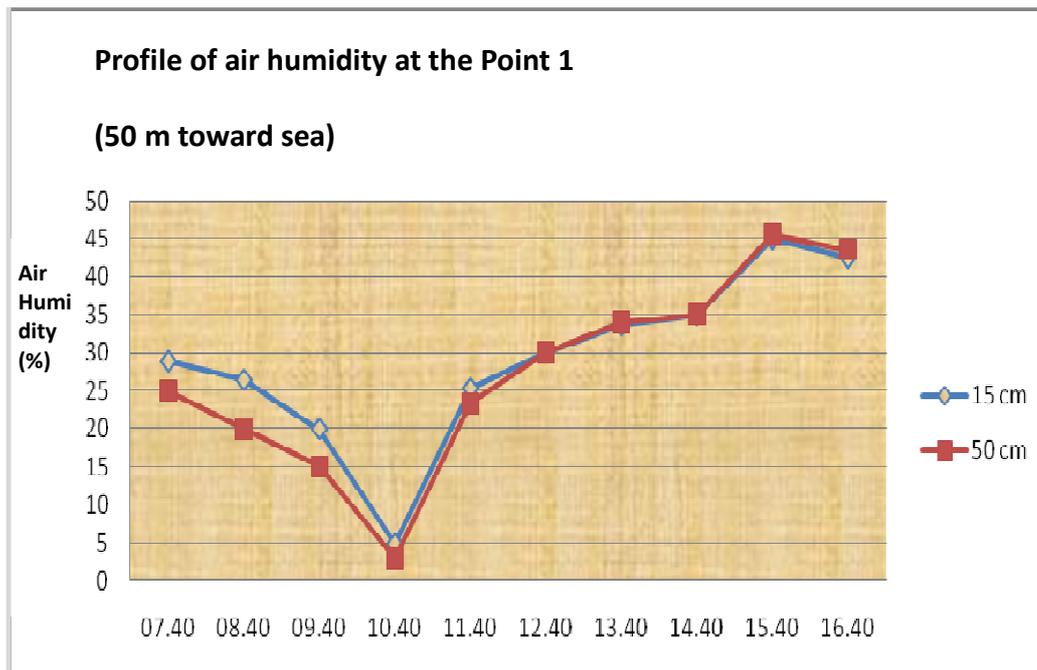


Figure 1c. Humidity above the vegetated land

Figure 1c shows the diurnal fluctuation of air humidity at above the vegetated land. Pattern of air humidity fluctuation above the vegetated lands are same as air humidity fluctuation in the mangrove forest. During the daytime, air humidity in the mangrove forest are higher than air humidity above the vegetated land.

### 3.2 Fluctuation of air humidity at the edge areas of mangrove forest toward the sea

Figure 2a, 2b, and 2c show the air humidity fluctuation in the edge areas of mangrove forest toward the sea at 07.00 a.m., 13.00 p.m, and 16.00 p.m.

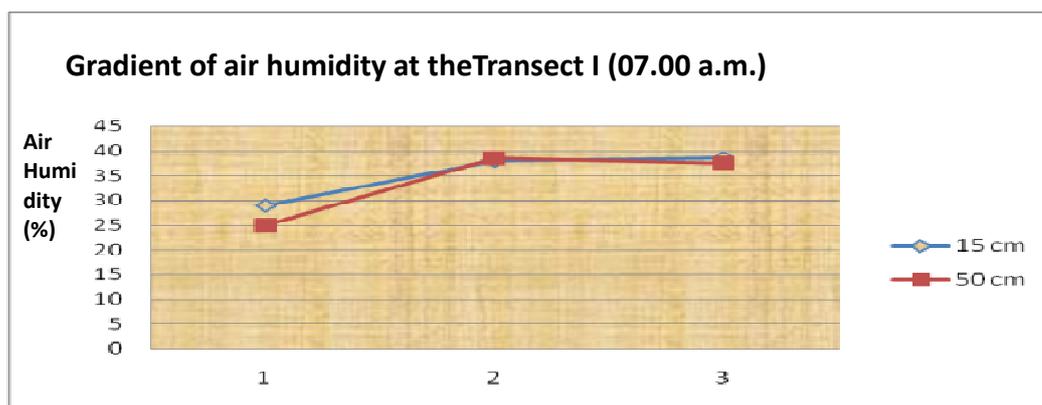


Figure 2a. Gradient of air humidity in the border of mangrove forest and sea at 07.00 a.m

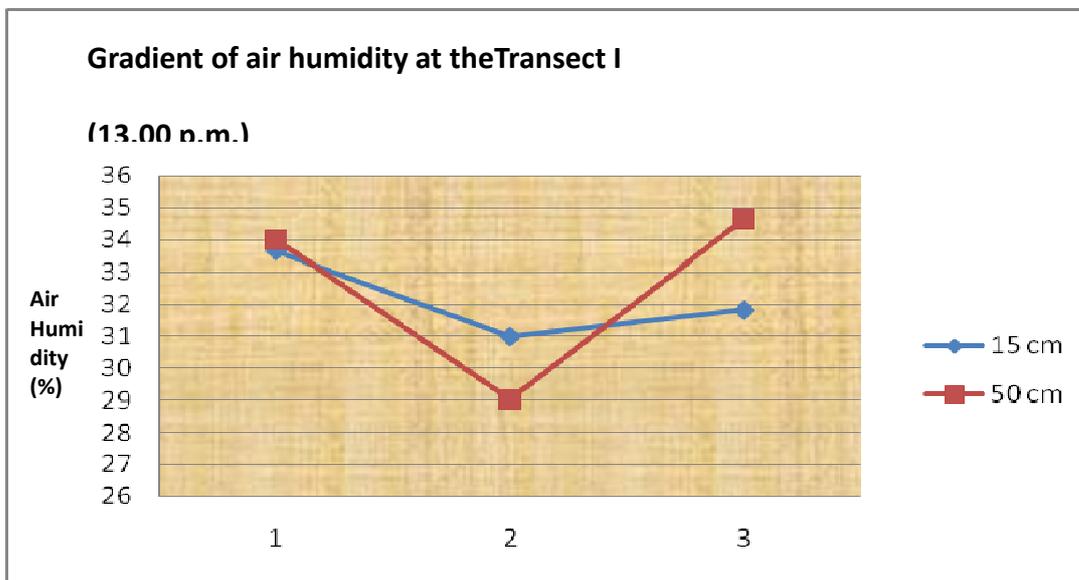


Figure 2b. Gradient of air humidity in the border of forest and sea at 13.00 p.m

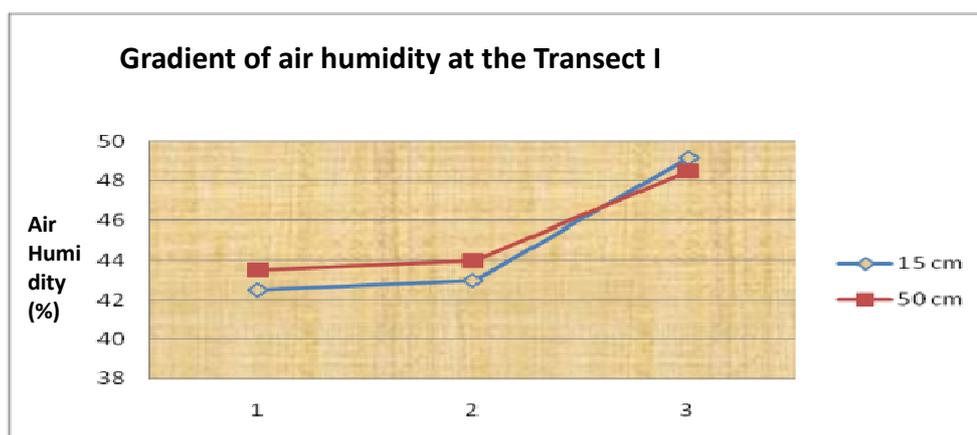


Figure 2c. Gradient of air humidity in the border of forest and sea at 16.00 p.m

Figure 2a and 2c show that in the morning and evening, air humidity in the mangrove forests (Point 3) are higher than the air humidity at sea surface (Point 1) and in the mangroves forest edge toward the sea (Point 2). Figure 2b shows that at 13.00 p.m., air humidity in the mangrove forests at a height of 15 cm above the water surface is slightly lower than the air humidity at the sea surface (at a height of 15 cm above water surface). For measurements at position of 50 cm above sea surface, the air humidity in the mangrove forests are higher than the air humidity on the open sea surface.

### 3.3 Fluctuation of Air Humidity at the forest edge toward the terrestrial land (vegetated land)

Figures 3a, 3b and 3c show the fluctuations of air humidity in the forest edge toward the land at 07.00a.m, 13.00p.m, and 16.00 p.m.

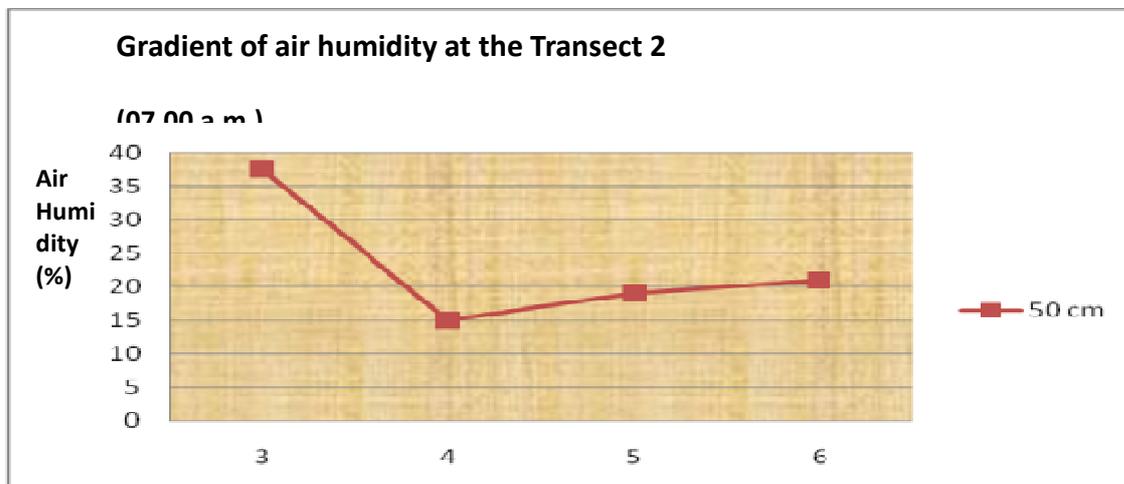


Figure 3a. Fluctuation of air humidity in the mangrove forest edge toward the land at 07.00 a.m

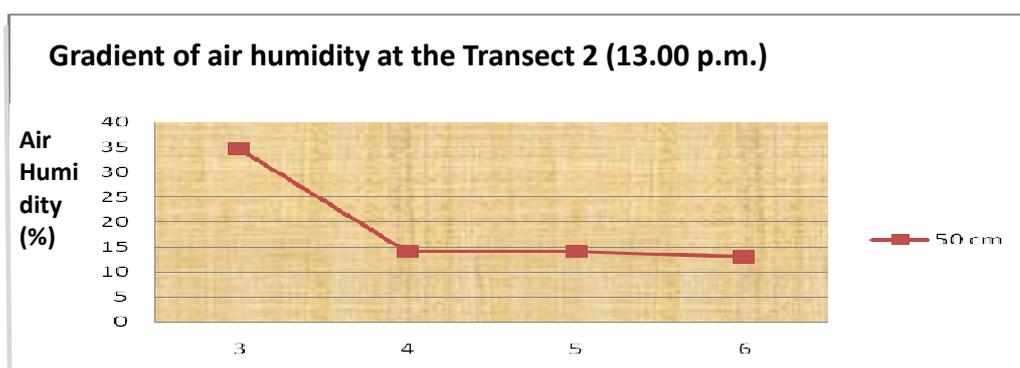


Figure 3b. Fluctuation of air humidity in the mangrove forest edge toward the land at 13.00 p.m

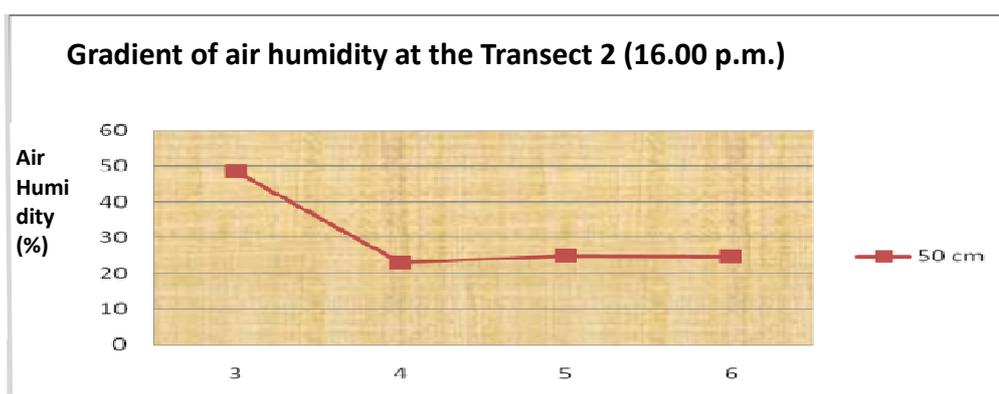


Figure 3c. Gradient of air humidity in the mangrove forest edge toward the land at 16.00 p.m

Figures 3a, 3b, and 3c show that during the daytime, air humidity in the mangrove forests are higher than the air humidity at the surface of vegetated land. Fluctuations in air humidity above the surface of the vegetated lands are stable enough, such as air humidity fluctuations in the mangrove forests.

## 5. Conclusion

Results of this research show the pattern of air humidity fluctuation in the forest edge are same with the fluctuation in the open lands, as measured by Chen *et al.* (1999). This pattern of air humidity gradient is same with the research results of Davies-Colley *et al.* (2008).

The mangrove forest is functioning effectively reduces effects of humidity fluctuations at the sea level , so as to ensure the stability of air humidity in the mangrove forests in the suitable range for mangrove organisms. Capacity of mangrove forests in controlling air humidity depends on the width of mangrove forests and their canopy density.

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