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# The Habitat Characteristics of the Chelonia mydas Nesting in Kaimana, West Papua

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**Abstract**

Venu Island Wildlife (VIW) is located in Kaimana, West Papua that established as conservation for Turtle Green (Chelonia mydas, Linn. 1758) which the local name is Jelepi. This study is aimed at identifying the characteristics of Green Turtle nesting habitat in the region of VIW, in Kaimana, West Papua.

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This study was conducted in April 2014 showed that the characteristics of the coastal in the VIW is sandy (≥99.82%). Based on step-wise analysis, with a nest of green turtles for 42 treatments and 60 sub-plots resulted determinant coefficient of 61.87%. This factors is affect green turtles nesting, i.e: the existence of nest, vegetation cover, and sandy texture at 10 cm depth.

Furthermore, the principal component analysis by eigen analysis cumulative of 95.9% was found that the air humidity at 23.00 to 01.00 range between 76.29%−86.38%, and sandy texture at 30 cm depth which have the range between 6.71% -23.04% and it strongly affect turtle nesting success. On the other hand in the Western Waranggera area that have no vegetation on 2th transect in the Southern Venuisl and that there is no vegetation on 2th, transect found green turtles nesting. This sub-plot may be considered as a protection zone for green turtles nesting. On the other hand, study station that is ideal for nesting green turtles are in the Southern and Eastern part of the Venu station.

***Keywords:*** Chelonia mydas; habitat characteristic; nesting site; Venu island wildlife.

## 1. Introduction

Venu Island Wildlife (VIW) is located in Kaimana District, West Papua Province [1] and the habitat existence and nesting site of Green turtle (Chelonia mydas) which have the local name in Koiway tribe is Jelepi; [2,3,4,5,6,7] . The VIW is not completely delineated for 62.256kmlengthwith the regulation of Forestry Minister number SK 783/Menhut-II/2014 of 22 September, 2014. VIW is located in the Southern Kaimana District, West PapuaProvince and it is also part of bird's head landscape of coral triangle (Coral Triangle Inisiative−CTI) in the world. Geographically, it is located between 133026'32 "BT─133034'19" BT and 4013'57 "LS─4022'51" LS.

The efforts of the turtle conservation is categorized as endangered and protected species (Appendix 1). According to [8,9]; and based on the Red Data Book of IUCN (International Union for Conservation of Nature), and CITES (Convention on International Trade in Endangered Species) stated that the green turtles including endangered species. According to [10], the combination of ecological factors which found green turtles nesting, i.e: the sand temperature, sand texture, moisture, salinity, lagoons existence, length and height of the coastal, wood, the tide, width and slope of the coastal, the types of coastal vegetation [11]. In addition to anthropogenic factors such as distance residential/building [12], and the management of mitigation strategies in the form of action to improve the habitat and adaptation strategies such as predicting the effects of climate change;[13,14]. The characteristics of habitat are one of the natural factors that influence the success of nesting turtles on nesting coastal. Thus study of the turtle nesting on habitat characteristics were tested for the purpose of turtle conservation management in a certain area and its integration with other area.

Based on the above phenomenon, it is necessary to identifyof the ideal of turtle nesting habitat in finding the location/coastalfor nesting. This study is aim at identifying the characteristics habitat of turtle nesting in the Venu Island Wildlife area, in Kaimana District, West Papua Province.

## 2. Methods

The study was conducted in the Venu islands coastal and Southern part of the Adijaya Island (Western Waranggera), in Kaimana District, West Papua Province, Indonesia (Figure 1). The observations were conducted on the 5 station (60 sub-plots), i.e.: the station of Western Waranggera($04^0$14,093'S; $133^0$27,102'E) along 1.114m (11 transects), station of Northern Venu($04^0$19,497'S; $133^0$30,390'E) along 347m (3 transects), station Eastern Venu($04^0$19,497'S; $133^0$30,390'E)along 745m (7transects), station Southern Venu($04^0$19,826'S; $133^0$30,228'E) along 320m (3 transects), and station Western Venu($04^0$19,574'LS; $133^0$30,233'BT) along 633m (6 transects). The each transect sized 100mx40m, consists of two sub-plots each (size 100mx20m) to distinguish both vegetated and not vegetated areas. While each sub-plots are carried 42 treatments, respectively.

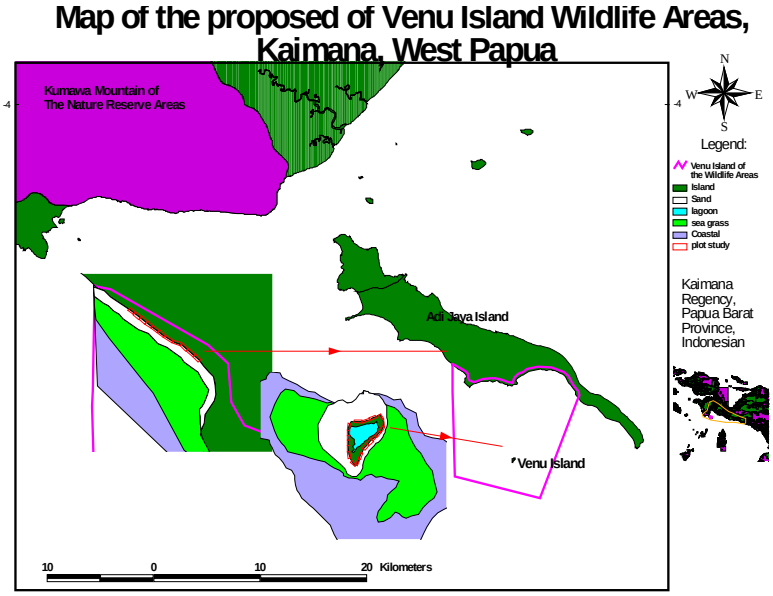


**Figure 1:** Map of The Region Designation Venu Island Wildlife, in Kaimana, West Papua.

The field observations was included the identification and recording of the type and the number of nesting turtles based on direct observation and tracks, length of sandy coastal, width of coastal (supratidal, splash and intertidal), slope of coastal, soil (sand) texture of nesting coastal and vegetation cover. In particular the measurement of temperature and humidity using hygrometers and temperature measurements at the depth ≤30cm of nesting sand using candy thermometers (30cm) which was conducted at 11.00−13.00, 19.00−21.00, 23.00−01.00, and 03.00−05.00. While the lighting measurements were using lux meters conducted at 11.00−13.00, and 23.00−01.00. Sediment analysis was done by the Center for Soil Laboratory in Bogor to determine the sediment texture [10]. Furthermore, the data processing used Microsoft Excel 2003, 2007 and Minitab 16.

According to [12], the measurements of width coastal boundary is based on coastal areas, supratidal, intertidal and splash. The splash boundary is a daily boundary (not fixed) between the front coastal (foreshore) with boundary line of permanent sea (coastline), or the area above the highest tide of the sea line that just got a spray of the sea water of waves ripples and waves. Usually the splash boundary is marked heap mosaic form shells or

fragments of dead coral reefs (marine animals) or collisions of dead algae-algae (kelp) and also small pieces of wood or trash the supratidal boundary is the boundary between high tide and the sea border. While the intertidal boundary is the boundary that affected both land and sea [15], which caused the highest tide to lowest tide [16]. Intertidal boundary are along the coastline, such as lagoons, estuarine, coastal and river branches [17], with the characteristics of sandy substrate, coral sandy to rocky [18]. Furthermore the boundary is a boundary coastal waters (marine and lake) between the lowest and the highest tide [15].

The slope of the coastal is measured using a meter roller 50m and clinometers (Figure 2). Furthermore, the equation for calculating the slope of the obtained results of each width of flat coastal (the coastal area, supratidal, splash and intertidal), presented in the (equation 1). Furthermore, the equation for calculating the height of coastal obtained results of the high of each coastal, presented in the (equation 2).

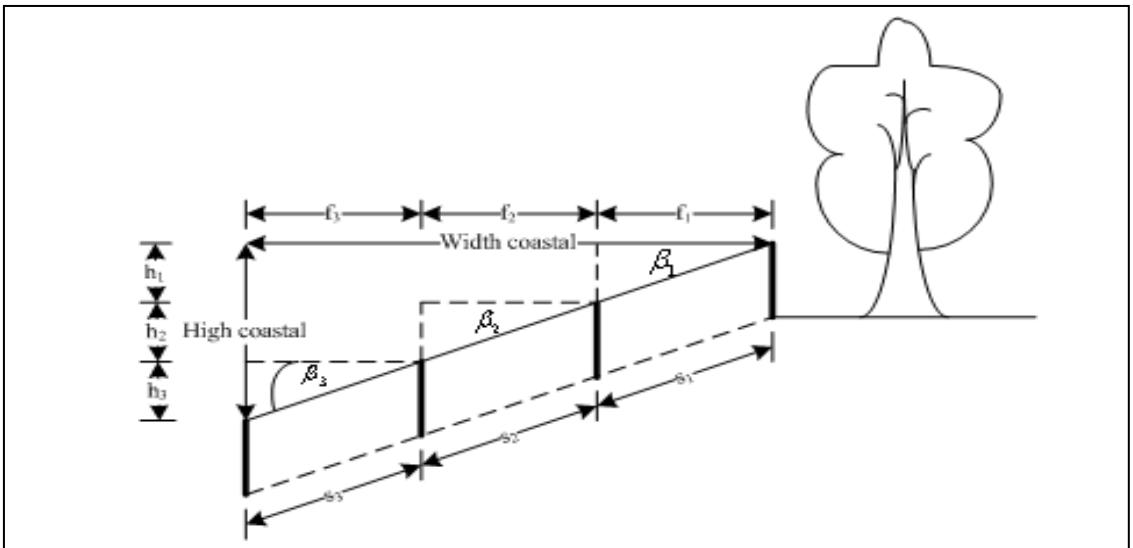


**Figure 2:** The measurement of high and flat width of the coastal

$W_{fi}=\text{Cos}(\text{RADIANS}(\beta_i))$ x $W_{si}$ …….. Equation (1)

$H_i=\text{Tan}(\text{RADIANS}(\beta_i))$ x $W_{fi}$ …….. Equation (2)

Keterangan:

$W_f$ = The width length flat of coastal

Ws = The width length slope of coastal

β = The slope angle of coastal

H = The high of coastal

i = $1^{th}$, $2^{th}$, … $n^{th}$

The sampling of sediment is conducted by using the "core / acrylic pipe" ± ø10cm at the point of nesting turtles that clustered/adjacent to each other. After extraction, the sediment sample is introduced into polyethylene that have been labeled.

Analysis of variance (ANOVA) in one direction is used to test for differences between independent variables with the dependent variable. The data requirements are chosen at random, normal distribution of data, and the data is homogeneous. Thus, the parameters used in this analysis is a characteristic factor of the habitats of coastal as the independent variable (X), and the presence of nesting Green Turtles as the dependent variable (Y).

Principal Component Analysis (PCA) is aimed at gettingthe description of the pattern of correlation between the presences of the coastal habitat characteristics of green turtle nesting. According to[12], PCA was to extract the most important information on a group of data, data reduction as other important information, and simplify the description of the data set that can be analyzed simultaneously in the graphic/image a two-dimensional structure based on the diversity of observations and variables [19];[20];[21], as well as calibration purposes [22].

**3. Results**

Based on observations monitoring by individual and collective which have conducted since 2009−2013 (Figure 3), the landing and nesting of green turtles in VIW area in general have increased. This is related to the result of the cooperation between the Center for Conservation of Natural Resources in Kaimana, West Papua; Local Government of Kaimana; Conservation International Indonesia−Kaimana Corridor; and traditional community of tribes Koiway (petuanan)since the beginning of 2011 that causedthe green turtle nesting is constantly increasing. While in 2009-2010, the green turtle nesting decreased due to natural factors (erosion and accretion coastal, large trees uprooted and the breakdown of the lagoon/atoll causing intrusion of seawater), and human factors/anthropogenic (theft of eggs and turtle parts, etc. ).

Furthermore, the study which was conducted in April 2014, showed that in the five observation stations found green turtles nesting (Figure 4). Thus, the activity of green turtle nesting in the region designation of Venu Island Wildlife, in Kaimana, West Papua.

Based on observations of splash boundary in April 2014 has not been found to influence on the existence of green turtle nesting. Although the green turtles nesting are also found in the splash area, where the nesting holes flooded as a result of the high tide that followed the surf and at full speed with the wind.

The coastal of the VIWarea inKaimana, West Papua is based on the results of the sediment analysis related to the soil characteristics of the sand-textured is ≥99,82%. Furthermore, the biggest sand texture was found on (0.50─0,25mm) is ≥40,60% (medium sandy texture).

Based on the analysis of step-wise with a green turtle nesting to 42 treatments at the 60th sub-plot generated from determinant coefficient (R-Sq (R2) (Adj)) of 61.87% was found that the vegetation cover ranged between 5:43%−86.07%, building area ranged between 0.00m2-14.51m2, at depth 10cm of the sand temperatures ranged between $27.83^0$-$29.01^0$ very influential (P-value = 0:01). On the other hand air humidity at 19:00 to 21:00

ranged between 7.68% -81.96%, air temperature at 03:00−05:00 ranged between $27.12^0$−$28.32^0$, and very fine sand is ranged between 0.00% -5.77% as well as a major factor affecting the existence of the turtle green nesting. Based on PCA with a confidence interval 95.9% (Figure 5), showed a variable of the habitat characteristics that influence the presence of green turtles in the region VIW, in Kaimana, West Papua, i.e.: the humidity at 23.00-01.00 (81.02%±11.32%( $\bar{X}$ ±Stdev)), and the texture of fine sand at depth of 30cm (14.04cm±8.23cm). On the other hand, width of intertidal coastal (9.22m±1.59m), the slope of the coastal ($18.41^0$±$2.68^0$), the height of the coastal (4.69m±0.69m), building areas ($2.56m^2$±$13.13m^2$), and the texture of fine sand on the depth 10cm (29.20cm±29.33cm),, as well as the main factors affecting the existence of green turtle nesting. Based on observation of both tracking and finding turtles to the success of landing and nesting green turtles in April 2014 showed as much (0.83±1.06nest). The average temperature of sand that is optimal for the green turtle nesting on the region of the coastal of VIW, the lowest temperature at a depth of 30cm from the surface of sand is $26.61^0$ and the highest temperature at a depth of 5cm from the surface of sand is $29.71^0$.

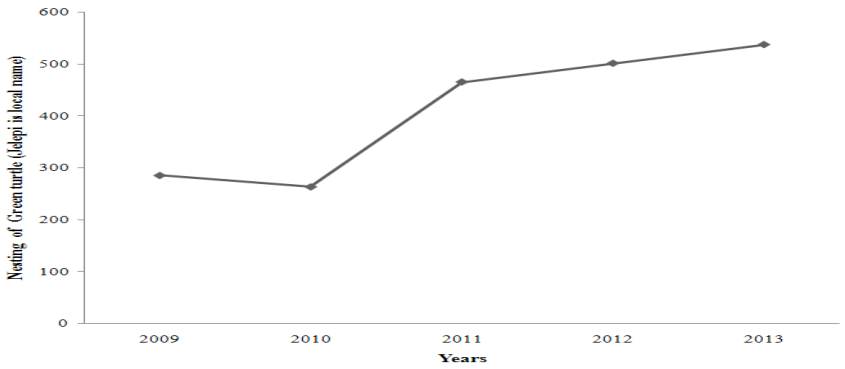


**Figure 3:** The numbers of the Green turtle nested at 5 station on Venu Island Wildlife Areas, Kaimana, West Papua (source: [23]; [24]; & primary data, 2014)

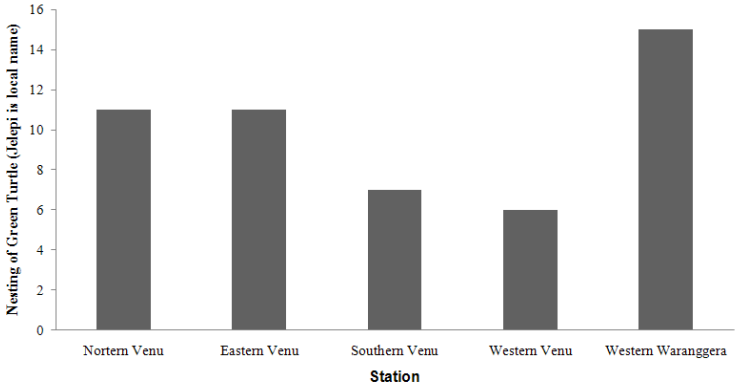


**Figure 4:** The numbers of the Green turtle nested at 5 station on Venu Island Wildlife Areas, Kaimana, West Papua (source: [23]; [24]; &primary data, 2014)

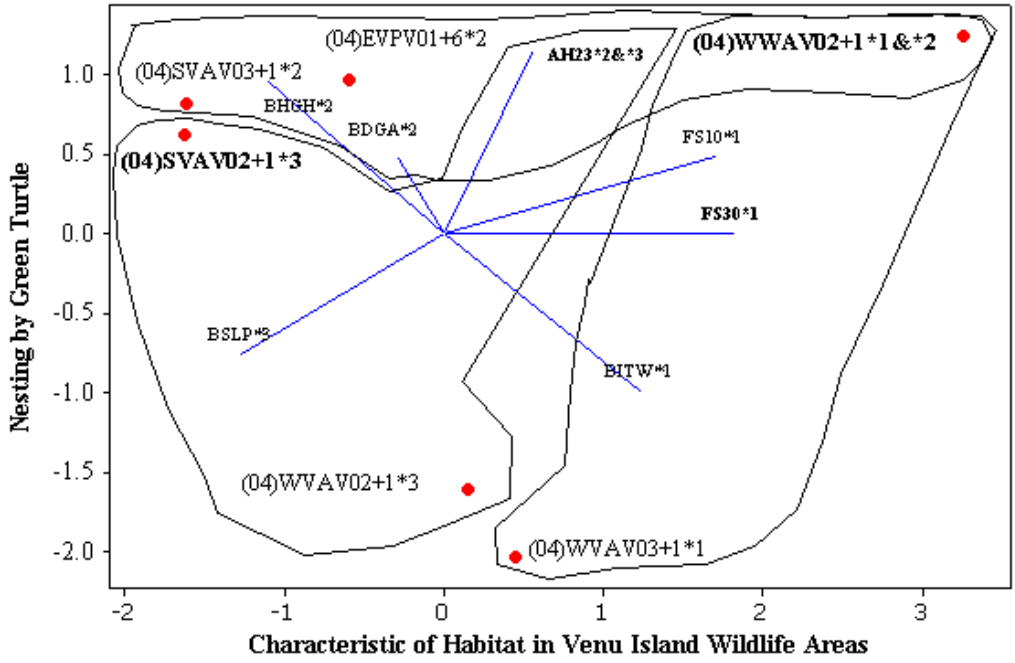


**Figure 5**: Principal Component Analysis used to test between turtles nested with Characteristics of Habitat. (BHGH= Coastal of the High; BDGA=Building areas; AH23=Air huminity at 23.00-01.00; FS10= The grain of the fine sand at the depth 10cm; FS30= The grain of the fine sand at the depth 30cm; BSLP=Slope of the coastal; BITW= the Width of the coastal intertidal; EV=Eastern Venu; SV=Southern Venu; WV=Westhern Venu; WW=Western Waranggera; AV=Non Vegetation; PV=Vegetation; +01, +02 &+03=nested Hole; (04)=bulan April 2014, and *1,*2 &*3=category/ group

Green turtles lay of the their eggs found under the vegetation as many as 50% of the boundary of vegetation as far as the average (3,48m±3,48m), supratidal areas including splash boundary as many as 35% of the highest tidal boundary as far as the average (3,31m±1,73m), and the intertidal area 15% of the highest tidal boundary as far as the average (0,82m±0,40m).The splash area of highest tide boundary as far as the average (1,68m±1,04m). So the average green turtles lay their eggs on vegetation areas of vegetation boundary the extent to 6.96m, supratidal areas of highest tide boundary the extent to 5.04m, intertidal areas of highest tide boundary as far as 1.22m, and splash areas of highest tide boundary as far as 2.72m.

Along the coastal in the VIW found the plant casuarina (Casuarina equisetifolia) at the level of the tree and papaceda (Scaveolafrutences) at the level of the shrubs, katang-Katangan (Ippomeacrassipes) at the level of the floor of coastal on the surface of sand, and also the lagoon/atoll brackish water on the island of Venu. However on the region Western Waranggera (Adi Jaya island) not found the laguna, and close to one of the river small.

## 4. Discussion

The Turtle Development and Habitat Characteristics

Based on the results of joint monitoring conducted since 2011, in terms of monitoring and the success of hatching turtles (hatchlings) related to the turtle eggs being transported to a place deemed safe. The treatment

for relocating of the eggs are done when the green turtle after turtle nesting no more than 1 hour, then the egg is moved to a place that is certainly not flooded by sea water (the area in-situ), and without changing the position of the egg.

According to [25], that the texture of the sand ≥85% viable for successful of turtle nesting. Based on the analysis of the sediment resulted ≥99,82%, the coastal VIW area in Kaimana, West Papua is worthty as a management area for conservation of turtle. It still needs the support of Habitat Suitability Index (HSI), in the utilization of space in the distribution of zoning and quota arrangements for the carrying capacity of the habitat for the presence of turtles and the carrying capacity of the tourists for nature tourism. VIW has a medium texture sand which has a texture of macro pores reduced. Thus, it is able to improve the ability to retain water, thereby increasing the water content at field capacity [26].

Related to the water content in the capacity of the texture of the sand is one of the factors that can affect the speed of change in the temperature of the sand nest. The sand temperature of nest has an important role to hatchling fitness, with good speed of hatching eggs and ability face a predator (based on morphology and swimming speed) at the optimum temperature of $26^0$−$30^0$C. In addition, the temperature of the sand of nest of ≤$26^0$C showed all male hatchlings, and ≥$30^0$C show all female hatchlings [27]. Thus, the resulting hatchlings on the region VIW, in Kaimana, West Papua is thought to have a 50% chance of male and female. Furthermore, according to [28], limited the temperature range of the sand of nest suspected of males and females are $29,0^0$−$29,5^0$C. One stability of the sand temperature from nest, allegedly influenced rooting pine [29,26] and the shadow of the vegetation. Furthermore, the temperature of the sand at each depth is influenced by the propagation of sunlight, type of soil texture, wind and rain, biological activity in the nests and changes in the surrounding environment. The laying eggs for turtle predicted associated with the influence of East season so that more is placed on vegetated areas. While supratidal area associated with both shadow and rooting vegetation plant floor and plant coastal of the tree level. In addition intertidal areas related to the former big trees were uprooted both buried and new fallen in restraining the movement speed of the water, while the wave's splash or flooded tide. Associated with the development of green turtles in facing the challenges of the future, it is necessary to consider the factors of global climate change/increase in extreme temperatures and other climatic variables [30,31].

Green turtles usually lay their eggs on the coastal at night, but there are some individuals who are stuck laying on the time of daylight. This is due to extreme weather conditions (high rainfall and cloudy), and the effect of high tides with the hardness of the wind speed. In addition, the light of the sun during the day under the sea pine trees and shrubs papaceda that similar a state of the environment at night alleged as choice of the green turtle nesting. Therefore, it is affected light shadow falls reduce of the heat temperature in sandy coastal of the non-vegetated and sandy coastal of the vegetation.

Buildings that do not pay attention to the ecological to green turtle would hinder the success of green turtle for nesting. Therefore, anthropogenic factors is influenced by the distance of the settlements. Furthermore, the combination of ecological factors which lets found green turtles nesting, among other things: the temperature of the sand, the particle size and texture of the sand, moisture, salinity, the presence of lagoons, length and height

of the coast, wood, [10], pairs Tide, width and slope of the coastal, coastal vegetation types [32,33,11].

On the other hand where potential nesting , i.e.: Southern part of Venu Island without vegetation on 3th transect and Western part of Waranggera in Adi Jaya Island without vegetation on $1^{th}$ and $2^{th}$ transect, while turtle nesting others that need attention are Eastern Venu contained vegetation on $6^{th}$transect and the Eastern Venu that without vegetation on $2^{th}$ transect. On the other hand, the study station that is ideal for green turtles nesting are the station of Southern part of Venu Island as many as 1.63 ≈2nests per sub plot and the station of Eastern Venu as many as 2.97 ≈ 3 nests per sub plot. So the study station of the Eastern Venu and the Southern Venu can be pursued as a protection zone, while the other part of the zone needs further study to be limited tourist zone and setting the time to visit. In addition, the green turtle nesting in the region VIW found approaching 1.89≈2nests per sub plot. Further results of this study can be used for other areas, but require consideration for the traditional wisdom of a community either from one or several communities that traditional prople can live together with management of turtle conservation.

The Implications of Turtle Conservation

Successful management of turtle conservation in an effort of biodiversity resilience is not only based on the characteristics of habitat. It requires a strategy of mitigation and adaptation strategies [13]. In addition, during this time the turtle conservation management pays little attention to human welfare through anthropological approach to human and natural surroundings. So it needs a systems approach to adaptive management, in which human beings and the natural surroundings affect each other in a living system. Thus the use of turtle conservation related to the density and size of the population need to consider the population of the species. As for the population of the turtle species are large, healthy, and stable requires knowledge and study on genetic diversity, populations of species that have the ability to recover is high, and the geographical distribution of community.

## 5. Conclussion

Venu Island Wildlife area in Kaimana District, West Papua Province is worthy established as one of the spawning grounds for Green Turtle (Chelonia mydas) or Jelepi. This study was conducted to identify the habitat characteristics of Green Turtle nesting in the region Venu Island Wildlife, in Kaimana, West Papua. Based on the analysis of step-wise with determinant coefficient ≥50% found the factors that influence the green turtle nesting, i.e: how extensive buildings, vegetation cover, and the texture of very fine sand at a depth of 10 cm. Furthermore, principal component analysis conducted by Eigen analysis cumulative of 95.9% was found that the air humidity at 23:−01:00 ranged between 76.29% -86.38%, and the texture of the fine sand at a depth of 30cm ranged between 6.71%−23.04% strongly affect success of the turtle nesting. On the other hand, in the Western part of Waranggera in Adi Jaya Island that there is no vegetation on $2^{th}$ transect and the Southern part of Venu Island, there is no vegetation on $2^{th}$ transect found green turtles nesting. Thus both sub plots can be considered at any time as a protection zone for the existence of green turtles.

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