A SURVEY ON THE POPULATIONAND PHYSICO-CHEMICAL PROPERTIES OF MANGROVES IN BARANGAY CULAJAO, ROXAS CITY, PHILIPPINES

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by

Kevin O. Ip

Fourth Year – Graviton

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APPROVAL SHEET

This research paper herein entitled:

A SURVEY ON POPULATION AND PHYSICO-CHEMICAL PROPERTIES OF MANGROVES IN BARANGAY CULAJAO, ROXAS CITY, CAPIZ, PHILIPPINES

Prepared and submitted by Kevin O. Ip in partial fulfillment of the requirements in Science Research 2, has been examined and recommended for acceptance and approval.

EDWARD C. ALBARACIN
Science Research 2 Adviser

Approved by the members of the Science Research Committee on March 2011.

HAROLD P. MEDIODIA

FLORDELIZA T. REMONDE

ARIS C. LARRODER

MIALO C. LACADEN

ERIKA EUNICE P. SALVADOR

Accepted in partial fulfillment of the requirement in Science Research 2.

JOSETTE T. BIYO, Ph. D.
Director III - PSHSWVC

Survey on the Population and The physic-chemical Properties of Mangroves in Barangay Culajao, Roxas City

Ip, Kevin O.

Philippine Science High School - Western Visayas Campus, Bito-on, Jaro, Iloilo City
kvn_ip@yahoo.com

ABSTRACT

Mangrove forests serve as natural habitat for many birds and sea creatures. They thrive in brackish water, which is part sea water and part fresh water. Mangroves that have been planted on coastlines have been proven to minimize the occurrence of calamities. Mangrove forests are among the most threatened habitats, mostly because of modern development. In Roxas City, a law has been implemented on the conservation of mangrove forests and an eco-park was formed for the further protection of the mangrove species and wildlife. The study described the population of the mangroves in Barangay Culajao, Roxas City. Tree diameter, soil pH and salinity were also determined. Population density was measured on three sites using ladder transect. A tape measure was used for measuring tree diameter. A pH probe was used to measure the soil pH and a salinity refractometer for the soil salinity. There were 600±87 trees per hectare and 3700±2406 seedlings per hectare. The mean tree diameter was 5.32±2.56 inches, soil pH was 8.10 and salinity was 19.33 parts per thousand. There is a low population of trees in the forests. Soil pH was high and salinity was inside the normal brackish water range.

Keywords: brackish water, population, diameter breast height, pH, salinity

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CHAPTER 1

INTRODUCTION

A. Background of the Study

Mangrove forests serve as natural habitats for birds and sea creatures. They are also great sources of wood and medicine. Surrounding these mangroves is brackish water which is partly salty and partly fresh water. Mangroves grow best in saline water equal to half the salinity of seawater (Chiu C.Y. and others. 1995). Mangrove ecosystems planted on coastlines have been proven to minimize calamities such as cyclones, storm surges and erosions (www.mangroveindia.org).

Naturally resilient, mangrove forests have withstood severe storms and changing tides for many millennia, but they are now being impacted by modern encroachments. Mangrove forests are currently among the most threatened habitats in the world and are disappearing at an accelerated rate. Only few species of higher plants have over the course of geologic time, become adapted to demanding conditions such as ample fluctuations of water and soil temperature and salinity, of air humidity and temperature; thus, because it is the forest that creates the mangrove ecosystem and the forest is constituted by only a few species at any site, the system as a whole is marginal and fragile, vulnerable to sudden or drastic changes. (http://www.unesco.org/csi/intro/mangrove.htm).

Destruction of mangrove forests is taking place in most parts of the planet. Approximately 35% of mangrove area was lost during the last several decades of the twentieth century (Millennium Ecosystem Assessment (2005) *Ecosystems and Human Well-being: Synthesis* (p.2) Island Press, Washington, DC. World Resources Institute).

In Roxas City, mangroves were not rare in the old times. Now, they are decreasing at a quick rate due to the progression of conversions to subdivision and ponds. In Barangay Culajao, an Eco-park has been formedfor the further protection of the mangrove species and as well as wildlife. Information about the mangrove areas there are still at a minimal and more information is still needed by local government units in implementing laws of conservation and protection.

B. Statement of the Problem

This study aimed to describe the population of the mangrove area in Barangay Culajao, Roxas City.

C. Objectives

- To determine the mean population density (in individuals/hectare) of the mangrove area in Barangay Culajao, Roxas City
- To determine the mean diameter of the mangrove trees at breast height (DBH in inches).
- To determine the soil pH of the mangrove area in BaranagyCulajao, Roxas City
- To determine the soil salinity (in ppt) of the mangrove area in Barangay Culajao, Roxas City

D. Significance of the Study

It is important for the local government to know the status of mangrove areas affected by human destruction in different places. Reforestation projects are handled by the local government and various organizations and are showing improvement. Through the data that will be collected, reforestation projects can be monitored. By rebuilding these forests, greenhouse gases can be reduced and more fresh air can be produced. Through this study, local government units will be guided on implementing laws on mangrove conservation and protection.

E. Scope and Delimitation

This study will determine the population density, tree diameter,soil pH,and soil salinity, of the mangrove area in Barangay Culajao, Roxas City.

The parameters temperature, dissolved oxygen, soil redox will not be included in the study.

F. Definition of Terms

DBH – is the diameter of the tree taken from a spot 140 cm. above the ground.
http://forestry.about.com/cs/glossary/g/dbh.htm
In this study, DBH refers to the diameter of the mangrove tree at 140 cm above the ground.

Mangroves – Any certain shrub or tree growing along tidal estuaries or salt marshes.

Mangrove Area – In this study, mangrove area refers to the area where mangroves thrive, in water or on soil.

pH (potential Hydrogen) - A numerical measure of the acidity or alkalinity of a solution, usually measured on a scale of 0 to 14. Neutral solutions (such as pure water) have a pH of 7, acidic solutions have a pH lower than 7, and alkaline solutions have a pH higher than 7.
http://www.thefreedictionary.com/Ph
In this study, pH refers to the acidity of the soil inside the quadrat.

Population density – Population density refers to the number of individuals per given unit of land area (usually square kilometers or square miles). It is a common biological measurement and is more often used by conservationists as a measure than population size.
http://www.answers.com/topic/population-density
In this study, population density refers to the number of mangrove plants inside a quadrat over the area of the quadrat ($100m^2$)

Salinity - Measure of the total quantity of dissolved solids in sea water in parts per thousand by weight when all the carbonate has been converted to oxide, the bromide and iodide to chloride, and all the organic matter is completely oxidized.
http://www.encyclopedia.com/doc/1O13-salinity.html
In this study, salinity refers to amount of salt present in the soil inside the quadrat.

CHAPTER 2

REVIEW OF RELATED LITERATURE

A. Mangroves

Mangroves are called facultative halophytes because they do not strictly require salt to thrive. However, the best growth occurs when the plants live in sea water diluted with about 50 percent fresh water (Horst W. 1998).

Mangroves characteristically have prop roots and in most species, the roots project above the mud for respiration.

Mangroves are found in different places in the world. They are found in coastal areas, forests, and places water is brackish. Thirty-five percent of the total 18 million ha of mangrove forests are found in the Southeast Asian countries of Brunei Darussalam, Cambodia, Indonesia, Malaysia, Myanmar, the Philippines, Thailand and Vietnam. (http://mangroveweb.seafdec.org.ph/html/fmangrov.htm).

There are four kinds of mangroves according to their root type – stilt roots, pneumatophore, root knees, and plank roots. Stilt rooted mangroves (Rhizopora, Bruguiera, and Ceriops) form branched aerial roots from the lower branches of the tree. They grow harder, and become shallow stands to support the tree. Pneumatophore mangroves (Avicennia and Sonneratia) have buried root system growing outward from the center. Mangroves with root knees (Bruguiera and Ceriops) have roots that loop upward before continuing their horizontal form. Plank rooted mangroves (Xylocarpus) have outward horizontal growing roots from the cambium activity.

B. Parameters

1. Population Density

Population density refers to the number of individuals per given unit of land area. It is a common biological measurement and is more often used by conservationists as a measure than population size. To measure population density, use: population divided by the area (http://www.answers.com/topic/population-density).

Factors affecting the decrease in population of mangrove forests are human pressures, mining, harvest for woodchips, overharvesting of the forests, and conversion to aquaculture ponds. Natural calamities also affect the population of mangroves: typhoon, tsunami, volcanic activity.

2. Diameter at Breast Height

Traditionally has been the spot where most measurements like growth, volume, yield, and forest potential. (http://forestry.about.com/cs/glossary/g/dbh.htm)

3. Soil pH

The letters *pH* stand for *potential of hydrogen,* since pH is effectively a measure of the concentration of hydrogen ions (that is, protons) in a substance. The pH of a substance is the acid/base activity in a solution. Lower values in pH are indicative of high acidity, which can be caused by the deposition of acid forming substances in precipitation. A high organic content will tend to decrease the pH because of the carbonate chemistry. The pH of the soil solution is very important because soil solution carries in it nutrients such as Nitrogen, Potassium, and Phosphorus that plants need in specific amounts to grow, thrive, and fight off diseases.If the soil solution is too acidic plants cannot utilize N, P, K and other nutrients they need. In acidic soils, plants are more likely to take up toxic metals and some plants eventually die of toxicity. The pH level of the soil directly affects soil life and the availability of essential soil nutrients for plant growth. (http://soil.gsfc.nasa.gov/soil_pH/plant_pH.htm)

4. Soil Salinity

Salinity refers to the dissolved salt content of a substance like soil or water. It may be measured in a number of ways; parts per thousand and parts per million are the two most common measurements, and salinity is sometimes expressed as a percentage as well. In soils,

salinity can prevent crops from growing, a major concern in several countries where soil salinity is on the rise. Soil salinity is generally increased through poor land management, such as over farming and excessive use of chemical fertilizers, compounded with extremely dry conditions. If the rise in salinity is not checked, the land can become useless for farming, and it may take decades to recover.The occurrence of salinity depends on several factors, the most important of which are climate, soil type,water use, and irrigation routines.Man-made saline soils are often the result of improper irrigation and drainage practices in (semi)arid regions (http://waterwiki.net/index.php/Soil_salinity).

C. Related Literature

In a study by Mendoza A. B. and Alura D. P., they used tree density, canopy height, basal area, and density of seedlings and saplings as their parameters. They determined the relationship of the parameters to soil conservation. They used 10 x 10 meter plots laid in 100 meter intervals from the shoreline and 5 x 5 meter subplots for saplings and seedlings. The results of the study showed the different densities, canopy height, basal area, and number of saplings and seedlings from different parts of site and will be used to guide the local government units in implementing laws for protection.

In a study by Thorne B., he compared the different parameters from different study sites. The parameters were water content, temperature, ph, salinity, conductivity, and dissolved oxygen. The results of the study showed that a large proportion of the fringing mangroves have dead roots, compared to the number that are still living.

In an article by Kathiresan K., the methods on how to measure different parameters in a mangrove area. Measurement of pH, salinity, density and sampling methods were discussed in this article.

CHAPTER 3

METHODOLOGY

A. Description of Study Site

The study was conducted in Culajao Mangrove Eco-Park in Barangay Culajao, Roxas City, Capiz. It has a total area of 4.69 hectares which covers 19 species of mangroves that serve as habitat for a vast variety of fishes, crustaceans, mollusks, and shells. The park was a project of the city government of Roxas in partnership with the KatunggansaCulajaoSalbaron Association (KACUSA), Inc. And PEW Fellows Program in Marine Conservation.

B. Materials and Equipment

These materials were used to construct the transect line and quadrat in determining population density: rope, wooden stakes.

The materials that was used in determining tree diameter: diameter tape.

The material that was used to collect soil samples: plastic trowel.

These materials were used in determining soil pH: distilled water, glass/plastic jar, portable pH meter.

These materials were used in determining soil salinity: filter paper, salinity refractometer, syringe.

C. Sampling

a. Laying of Transects and Quadrats

Three sites were chosen, each having three transect lines and three quadrats per transect. Each transect line was made up of 6 wooden stakes and a rope measuring 60 meters long. Each quadrat measured 10 meters by 10 meters. The quadrats were then placed on alternate sides 10 meters apart from each other. The quadrats were constructed from wooden stakes and ropes. If

too many seedlings were to be found inside the main plot, 3 random subplots measuring 1 meter by 1 meter was laid inside the main plot. Collection of data was done during low tide.

b. Determination of Population Density

Inside the quadrats, the number of individuals was counted manually. The total number of individuals inside the quadrat was divided by the total area of the quadrat; $100m^2$. If subplots were created, the number of individuals inside the subplot will be counted and estimation of individuals will be done.

c. Determination of tree diameter

A diameter tape was used to measure the tree diameter. The circumference of the tree trunk was measured at about 140 cm. above the ground using the diameter tape. Every tree inside the quadrat was measured for DBH.

d. Determination of soil pH

Loose soil was collected in a glass/plastic jar. Stones and any other contaminants were removed to prevent damage to the glass electrodes of the portable pH meter.Soil sample was mixed with distilled water (1:1 ratio) in a clean jar to form an emulsion. The jar was shaked vigorously and was allowed to settle for 5 to 10 minutes. The electrode of the instrument was submerged fully. Soil pH was measured once in each quadrat.

e. Determination of soil salinity

Soil sample taken for samplingwas strained in a 20 mL syringe loaded with two layers of filter paper. The plunger was pushed until the end. One or two drops of the extracted soil water were dropped on the salinity refractometer. Soil salinity was measured once for each quadrat.

D. Data Analysis

The collected data was compared to the normal mangrove soil pH and soil salinity. Normal pH of soil ranges from 6 to 7. Brackish water ranges from 0.5 to 33 ppt.

Chapter 4

Results and Discussions

This study determined the population of the mangrove area in Culajao, Roxas City, and its physico-chemical properties.

Trees and seedlings were counted by hand per quadrat. Tree diameter was measured with a tape measure measured at 140 cm above ground. Soil pH was measured by using a pH probe from a solution of balanced volume of soil mixed with the same volume of distilled water. Salinity was measured by placing drops of water from the extracted soil to the refractometer.

Parameters were measured from a 10 m by 10 m quadrat; on a 50 m transect line. Data was collected from 3 quadrats from 3 transect lines.

A. Results

The mean population density of the mangrove forest was 600±87 trees per hectare and 3700±2406 seedlings per hectare.

Trees in this mangrove area have a mean tree diameter of 5.32±2.56 inches. The mean soil pH of the area was 8.10. Mean soil salinity was 19.33 ppt.

B. Discussions

There were 600±87 trees per hectare and 3700±2406 seedlings per hectare, which is relatively a very low number compared to forests in Samar or Cebu. In the study conducted by Mendoza A. B. and Alura D. P., some mangrove areas on Samar can reach densities of 3000±656 trees per hectare. The densities of both mangrove areas has a huge difference mainly because the mangrove forest in Barangay Culajao was a newly rehabilitated forest while that of Samar was natural and was minimally threatened.

The mean tree diameter was 5.32±2.56 inches. Diameter of trees are measured species wise, different species have different tree diameter. In this study, the species was not noted.

According to a study by Raga M. N., trees in Barakau Village, have trees with diameters that rarely exceeds 30 cm (11.81 inches). Young Rhizophora trees has diameters ranging from 10 to 20 cm (3.93 to 7.87 inches) while mature Rhizophora has diameters ranging from 40 to 50 cm (15.75 to 19.69 inches). Avicenniawas seen to have very variable tree diameter.

The pH of the soil was close to that of ocean water. Ocean water has a pH value that ranges from 7.8 to 8.3. Normal mangrove soil ranges from 6 to 7. The high pH value of the soil may have been caused the mangrove area's location and by the time interval between when the sample was gathered and tested. According to the study of Joshi H. and Ghose M., soil on the Sundurban was slightly alkaline with pH ranging fronm 7.05 to 7.89, similar results were reported by Sah et al. and Pal et al. Soil pH had no uniform rise or fall with increasing distance from the tidal coast.

The salinity of the soil was inside the normal range for brackish water. Brackish water ranges from 0.5 to 33 ppt. depending on the input of fresh water to the system and the mixing of sea water due to tidal influence. In the study by Joshi H. and Ghose M., soil salinity in the Sundurbans ranges from 13.01 ppt to 31.25 ppt. Soil salinity decreased with the increasing distance from the tidal coast.Naidoo&Raimanreported soil salinity to be relatedwith extent of tidal inundation and seepage in themangrove soils.

Chapter 5

Summary of Findings, Conclusion, and Recommendations

This study described the population and the physico-chemical properties of the mangrove forest in Barangay Culajao, Roxas City.

This study specifically aimed to:

1. To determine the population density
2. To determine the diameter of the tree at breast height
3. To determine the soil pH
4. To determine the soil salinity

A. Summary of Findings

1. The population density of the mangrove area was 600±87 trees per hectare and 3700±2406 seedlings per hectare.
2. Average tree diameter in the mangrove area was 5.32±2.56 inches.
3. Average soil pH of the area was 8.10.
4. Average soil salinity of the entire area was 19.33 ppt.

B. Conclusions

There is a low population of trees in the mangrove area in Barangay Culajao. Soil pH is high and soil salinity is in the normal range.

C. Recommendations

It is recommended that the testing of samples should be done immediately after gathering.

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Appendix A

Raw Data

SITE 1			
	Q1	Q2	Q3
Population	9 trees, 0 seedlings	2 trees, 0 seedlings	5 trees, 0 seedlings
Salinity	20 ppt	18 ppt	19 ppt
pH	7.49	7.69	7.67
Mean D.B.H.	5.34 in.	13.06 in.	6.05 in.

SITE 2			
	Q1	Q2	Q3
Population	9 trees, 27 seedlings	5 trees, 3 seedlings (3 subplots)	8 trees, 80 seedlings
Salinity	20 ppt	15 ppt	19 ppt
pH	7.19	6.91	6.66
Mean D.B.H.	3.79 in.	1.59 in.	4.10 in.

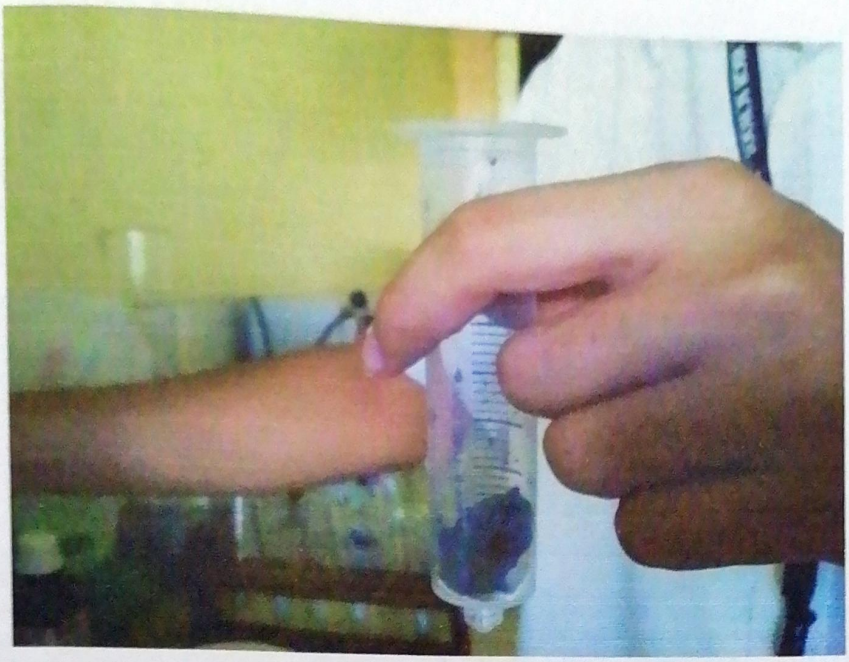
SITE 3			
	Q1	Q2	Q3
Population	6 trees, 42 seedlings	9 trees, 82 seedlings	2 trees, 12 seedlings
Salinity	25 ppt	18 ppt	20 ppt
pH	9.52	9.51	10.30
Mean D.B.H.	2.39 in.	3.29 in.	8.28 in.

Appendix B

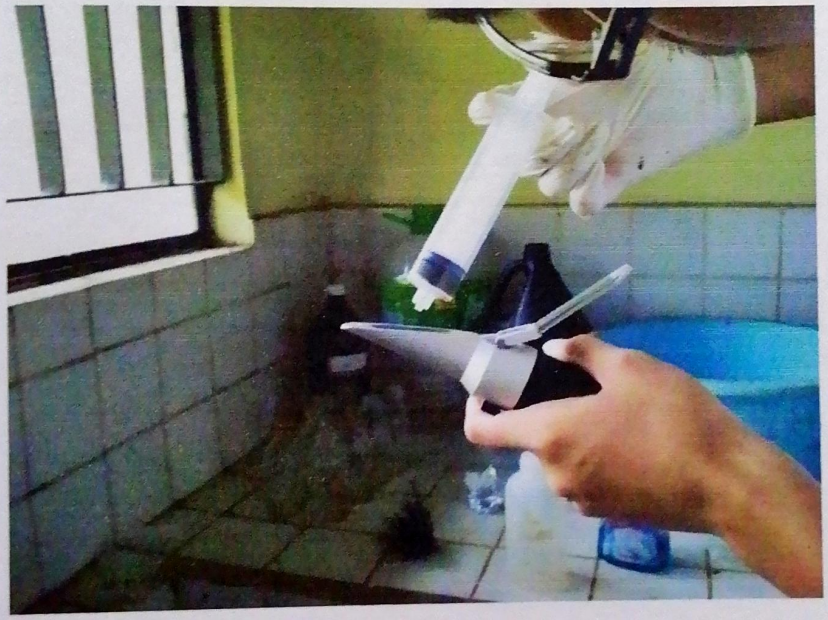
Photos

The Study Site

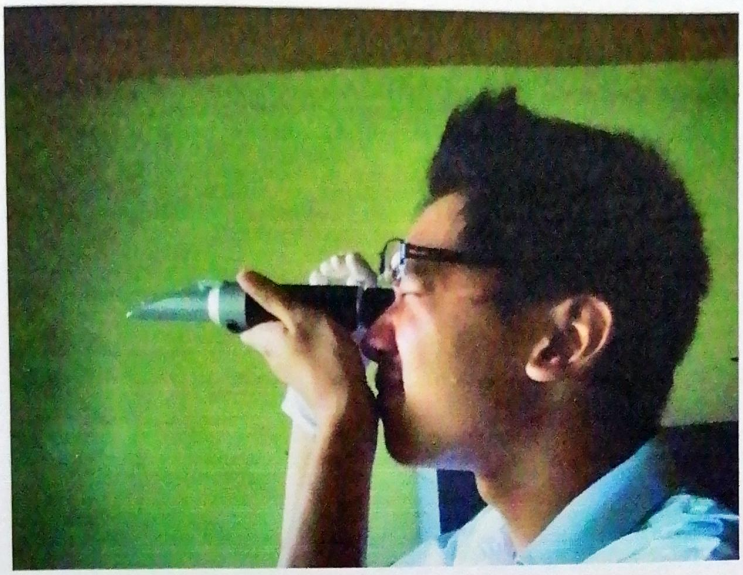
Diluting of Soil Samples



Water to be squeezed out from the soil in a syringe



Drops of water placed on a refractometer



Testing of salinity