17BTU613B ENVIRONMENT MANAGEMENT PRACTICAL 4H - 2C

Total hours/week: L:0 T:0 P:4 Marks: Internal: 40 External: 60 Total: 100

Practical

1. Study of all the biotic and abiotic components of any simple ecosystem- natural pond or terrestrial ecosystem or human modified ecosystem.
2. Determination of population density in a terrestrial community or hypothetical community by quad rate method and calculation of the Simpson's and Shannon-Weiner diversity index for the same community.
3. Principle of GPS (Global Positioning System).
4. Study of the life table and fecundity table, plotting of the three types of survivorship curves from the hypothetical data.
5. Study of the types of soil, their texture by sieve method and rapid tests for –pH, chlorides, nitrates, carbonates and organic carbon
6. Study any five endangered/ threatened species- one from each class.

References

1. Divan Rosencraz. (2002). *Environmental laws and policies in India*. Oxford Publication.
2. Ghosh, S.K., & Singh, R. (2003). *Social forestry and forest management.* Global Vision Publishing House
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7. Rana, S.V.S., (2013). *Environmental pollution – health and toxicology* (2nd ed.). Narosa Publication.
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ENVIRTONMENTAL MANAGEMENT PRACTICAL

(Course code: 17BTU613B)

Practical Manual

EXP No. 1 STUDY OF ALL THE BIOTIC AND ABIOTIC COMPONENTS OF ANY SIMPLE ECOSYSTEM- NATURAL POND OR TERRESTRIAL ECOSYSTEM OR HUMAN MODIFIED ECOSYSTEM.

AIM:

Conduct a quantitative study of all the biotic and abiotic components of any simple ecosystem- natural pond or terrestrial ecosystem or human modified ecosystem.

Materials/Equipment Required:

Hand lens
Forceps
Ruler
Suitable container(s)
Identification keys
Frame quadrat

Procedure

1. Familiarize yourself with all procedures before starting.
2. Select the sample area in the ecosystem and mark it off.
3. Decide on and record the organisms to be studied.
4. Throw a small object over your shoulder to select a random sample point. Place the quadrat at therandom sample point.
5. Record the presence or absence of the named organisms within the quadrat, on the chart on thenext page
6. Repeat for a number of throws.
7. Use the formula below to calculate frequency.
8. Transfer results to graph or bar chart.

Frequency Table

Organism	**Quadrat Throw**					**Total**	**Frequency**	**%Frequency**
	1	**2**	**3**	**4**	**5**			

$$Frequency = \frac{No.of quadrats containing organism}{No.of\ quadrats\ thrown}$$

Ifpercentagefrequencyisrequireduseformula:

%Frequency=Frequency x 100

EXP No. 2 DETERMINATION OF POPULATION DENSITY IN A TERRESTRIAL COMMUNITY OR HYPOTHETICAL COMMUNITY BY QUAD RATE METHOD AND CALCULATION OF THE SIMPSON'S AND SHANNON- WEINER DIVERSITY INDEX FOR THE SAME COMMUNITY

Aim:

To study communities by quadrate method and to determine % Frequency, Density and Abundance.

Requirements:

Meter scale, string, four nails or quadrate, notebook.

(i) Frequency:

Frequency is the number of sampling units or quadrats in which a given species occurs.

Percentage frequency (%F) can be estimated by the following formula:

$$\%\ \text{frequency (F)} = \frac{\text{Number of quadrats in which the species occurred}}{\text{Total number of quadrats studied}} \times 100$$

(ii) Density:

Density is the number of individuals per unit area and can be calculated by the following formula:

$$\text{Density (D)} = \frac{\text{Total number of individuals}}{\text{Total number of quadrats studied}}$$

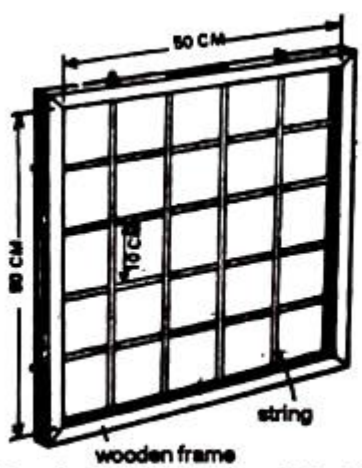


Fig. 68. A wooden quadrat of 50 x 50 cm.

(iii) Abundance:

Abundance is described as the number of individuals per quadrat of occurrence.

Abundance for each species can be calculated by the following formula:

$$\text{Abundance (A)} = \frac{\text{Total number of individuals}}{\text{Number of quadrats of occurrence}}$$

Method:

Lay a quadrat (Fig. 68) in the field or specific area to be studied. Note carefully the plants occurring there. Write the names and number of individuals of plant species in the note-book, which are present in the limits of your quadrat. Lay at random at least 10 quadrats (Fig. 69) in the same way and record your data in the form of Table 4.1.

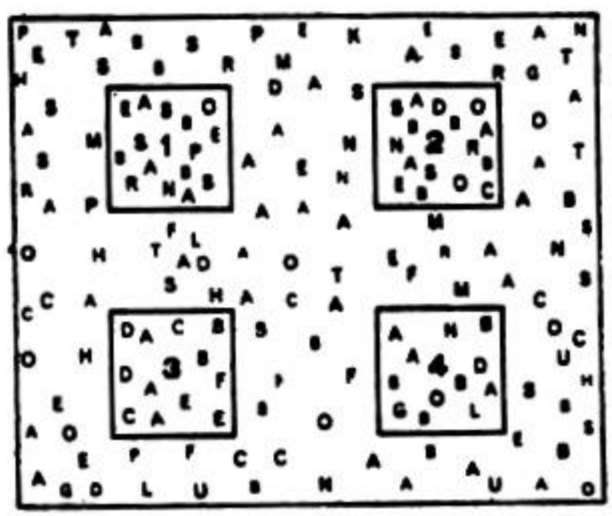


Fig. 69. Sketch of an artificial field showing four quadrats (1–4).

In Table 4.1, % frequency, density and abundance of Cyperus have been determined. Readings of the other six plants, occurred in the quadrats studied, are also filled in the table. Calculate the frequency, density and abundance of these six plants for practice. (For the practical class take your own readings. The readings in Table 4.1 are only to give an explanation of the matter).

Observations:

See Table 4.1.

Results:

Calculate the frequency, density and abundance of all the plant species with the help of the formulae given earlier and note the following results:

(i) In terms of % Frequency (F), the field is being dominated by…

(ii) In terms of Density (D), the field is being dominated by…

(iii) In terms of Abundance (A), the field is being dominated by…

Observations:

Table 4.1: Size of quadrate: 50cm × 50cm = 2500 cm^2

S. No.	Name of plant species	Number of individuals in quadrat number										Total number of quadrats of occurrence	Total number of quadrats studied	Total number of individuals	% Frequency (F)	Density (D)	Abundance (A)
		1	2	3	4	5	6	7	8	9	10						
1.	*Cyperus*	10	9	7	0	0	3	8	15	0	7	7	10	60	70%	6	8.57
2.	*Cassia*	0	0	2	0	3	0	5	0	6	10						
3.	*Cynodon*	50	0	7	41	6	0	0	8	0	5						
4.	*Eclipta*	0	0	4	0	3	0	0	1	0	2						
5.	A	0	0	0	0	2	0	0	1	3	0						
6.	B	5	10	1	0	0	0	3	1	0	2						
7.	C	3	5	0	0	2	1	8	0	2	0						

EXP No. 3 PRINCIPLES OF GPS (GLOBAL POSITIONING SYSTEM).

Introduction

The Global Positioning Satellite (GPS) system was established by the United States Department of Defense (DoD) to provide a real-time navigation system for the Similary. Since its inception it has grown to provide not only world-wide, all-weather navigation, put precise position determination capabilities to all manner of users. The resulting precision available exceeds any previously attainable without large expenditures of time and resources. This introduction will provide a brief description of how the system works and how it may be used.

The operation of the GPS system is divided into several topics. An attempt has been made to cover each topic in such a way that a new user will have sufficient information to understand the critical elements of the system, and so that an engineer will have an introduction to the major topics sufficient to suggest where additional study may be required.

Section I, The Elements of the GPS System, describes the logical breakdown of the system.

Section II, Principles of Operation, gives an overview of the general theory of the system's operation.

Section III, The GPS Signal, and

Section IV, The Navigation Message, give greater details to the implementation of elements described in Section II.

Section V, GPS Errors, describes the types and sources of errors that affect the operation of a GPS system, and explains terms commonly found in GPS literature.

Section VI, Differential GPS, and Section VII, Applications of GPS, explain some of the ways GPS can be used.

EXP No. 4

STUDY OF THE LIFE TABLE AND FECUNDITY TABLE, PLOTTING OF THE THREE TYPES OF SURVIVORSHIP CURVES FROM THE HYPOTHETICAL DATA

OBJECTIVES

- To construct a life table for several human populations
- To generate survivorship curves and mortality curves using these data
- To develop and test hypotheses about these populations based on the life table and survivorship and mortality curves

INTRODUCTION

"Population, when unchecked, increases in a geometrical ratio. Subsistence increases only in an arithmeticalratio."–Thomas Malthus, An EssayonthePrincipleofPopulation1798 Population size is determined by a number of factors, with a maximum population size determined by the **carrying capacity** of the environment. This does not prevent organisms from "over - reproducing" but a balance between birth rates and death rates controls population growth. Therefore, the control of population growth must necessarily be related to death rates in most natural populations. The study of **mortality**, how organisms die and when they die, is an important aspect of the study of life, and is of considerable interest to population biologists. Of course, this is not easy in natural populations, primarily because dead or dying organisms are not often found and if they are, S their age at death and there as on they died are not easily determined. These difficulties can be addressed by long-term monitoring and censusing of populations. Several populations have been tracked. In this manner and have provide useful data to understand the control of population growth by death.

The objective of the collection of mortality data may be to construct a **lifetable** or to plot **survivorship curves**, both of which may give us a clue as to how population numbers are controlled. Life tables may be of two types: a **horizontal lifetable**, where a cohort of individuals (all born at a particular time and place) is followed through time with deaths recorded as they occur in each age class, or a **vertical lifetable**, where all the age classes present at a particular time are followed. Vertical tables calculate age-specific death rates for an entire population on the assumption that there is no change in the environment from year to year (and hence age-specific death rates remain constant) and that no immigration or emigration occurs. The horizontal type is by far the more accurate but has the drawback of being very time consuming when long-lived organisms are being studied. n this exercise, we will demonstrate the construction of a vertical life table in humans.

Purpose

Using data from gravestones in a local cemetery,we will generate lifetables and create survivorship and mortality curves for several populations. These life tables and survivorship/mortality curves will enable us to analyze historical factors affecting survivorship of the human population in and around Lewis burg and how these factors change through time. We will attempt to make connections between life table data and historical events/patterns and to look for differences in survivorship between males and females from several time periods.

METHODS

For the two combined lab sections for each afternoon we will collect the following data:

1. Age at death and sex of atleast 400 individualsbornin1840orbefore
2. Age at death and sex of atleast 1000 individualsbornbetween1860and1890inclusive

Work in pairs to collect data. Divide a piece of paper into two columns on each side. One side is for pre-1840data and the other is for 1860-1890 data. The columns are for males and females. Select an area of the cemetery that is not likely to be used by an other pair, and note the birth and death dates and sex for 60-70 individuals who we reborn in the periods of interest.

Donot record data from stones for which you are not sure of the individual's sex or age at death. Note that some stones have only age and date of death–you will have to calculate dates of birth forthese. Record stones systematically to avoid bias; do not jump around from place to place. In particular, do not over look small stones, as these are often from young children and their omission would bias the sample.

Upon returning to the lab, you need to determine the number of individuals dying in each age class(age classes are 5-year intervals: 0-5, 6-10, 11-15, …)for each of the human populations. Calculate these for your own data set and enter these value into the Google Spreadsheetlinked

From the course website. Your data will be combined with those of your classmates (oneachlab day) to provide a complete dataset for each population.These data will be entered into an Excel spreadsheet and made available on the course website (under“Labs”)foryoutoaccess.

<u>DataAnalysis</u>

LifeTables:

Prepare lifetables separately for males1860-1890 and females1860-1890 containing the following columns (you donot need to prepare complete lifetables for the pre-1840 populations or the post-1890 populations):

1.Age interval (x) (5year periods:0-5,6-10,11-15,...)

2. Number alive at beginning of age interval (n_x)

NOTE:n_{0-5}isthetotal#ofindividualsinthedataset(foreachpopulation)

3. Number dying during the age interval(d_x)–

NOTE:$d_x$foreachpopulationisprovidedinthespreadsheetoriginalExcel

4. Proportion of original population surviving to the beginning of the age interval (l_x)

5. Proportion of individuals entering an age interval to die during that age interval(q_x)

6. Number of individuals alive at them id point of each age interval(L_x)

7. Total number of person-years still to belived by population of agex (T_x)

8. Life expectancy of individuals entering each age interval(e_x)

Survivorship and Mortality Curves:

You will be developing your own hypotheses regarding how these populations may differ. You will test your hypotheses using the class data.Your test should include survivorship and/or mortality curves. To plot survivorship and mortality curves, use Microsoft Excel or another acceptable graphing software. To do this, you will need to calculate x and q_x for all populations (you already have them from the1860-1890 lifetables).Age class should be on the x-axis with survivorship (l_x) or mortality(q_x) on they-axis, and you should plot all elevant populations ON THE SAMEGRAPH.

LABWRITE-UP

Your report must include:

A. (30points)2 lifetables(malesborn1860-1890,femalesborn1860-1890)with descriptive heading(abovetable)foreach.

B. (30points)Hypothesis testing

1. (5 points) Develop a hypothesis and predictions based on your observations comparing some of these populations. For example, ask which populations might be expected to live longer?Have higher infant mortality?Have any historical events produced a notice able change in these data?

2. (20points) Test your hypothesis by plotting the appropriate data insurvival and/or mortality curves.

3. (5points)Was your hypothesis supported? Explain your results.

C. (20points)Plot the survivorship and mortality curves for males and females from the pre- 1840 and1860-1890 populations. Plot the four survivorship curves together on the same graph and the four mortality curves together on a different graph.

D. (20points)Answers to the following questions using the analyses above(single-spaced,typed):

1. (5points)How have survivorship and mortality changed between the two time periods inpart C? Describe the patterns for each timeperiod and note any differences.

2. (5points)Do the survivorship or mortality curves from part C show any irregularities that might be related to historical factors? Which historical fact or might have caused the patterns in l_x and q_x in your data? You might need to look closely to see patterns, particularly in middle age classes of mortality curves(hint).

3. (5points)Do your survivorship curves be around the established fact that women tend to livelonger than men?At what age do women seem to have greatest survival advantage?

4. (5points)What are possible sources of error in our data, and how would these affect our results

Microsoft Excel Instructions

1. Enter data(example from previous year's lab)and add up all individuals in each population.

A B C

Age Class	Pre-1840 Female	Pre-1840 Male
0-5	0	1
6-10	0	0
11-15	3	1
16-20	1	1
21-25	4	1
26-30	2	3
31-35	1	5
36-40	8	5
41-45	3	8
46-50	6	5
51-55	8	11
56-60	13	12
61-65	18	14
66-70	15	29
71-75	34	36
76-80	25	26
81-85	31	22
86-90	14	8
91-95	5	5
96+	1	0

A B C

Age Class	Pre-1840 Female	Pre-1840 Male
0-5	0	1
6-10	0	0
11-15	3	1
16-20	1	1
21-25	4	1
26-30	2	3
31-35	1	5
36-40	8	5
41-45	3	8
46-50	6	5
51-55	8	11
56-60	13	12
61-65	18	14
66-70	15	29
71-75	34	36
76-80	25	26
81-85	31	22
86-90	14	8
91-95	5	5
96+	1	0
[illegible]	[illegible]	[illegible]

2. Setuplifetable.

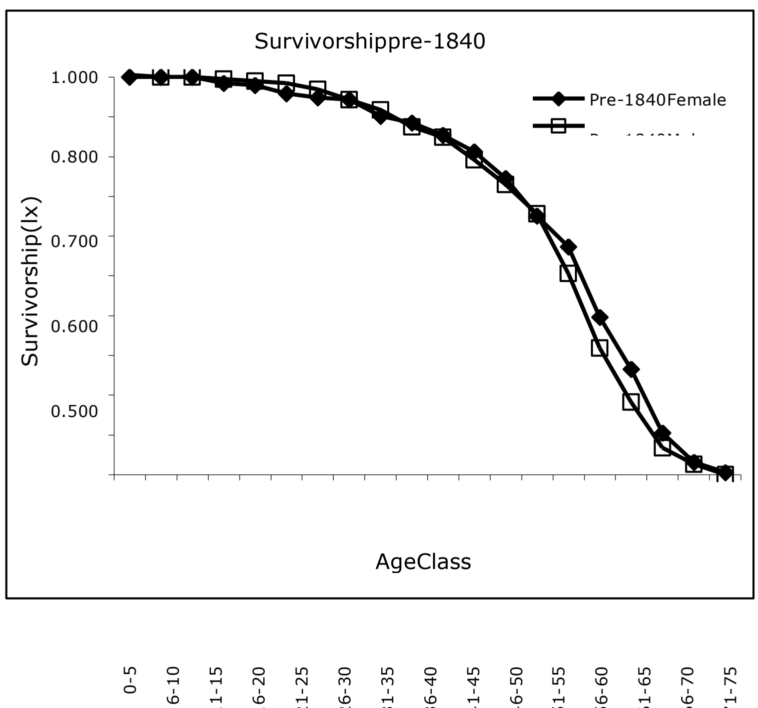
A	B	C	D	E	F	G	H
AgeClass	dx	nx	lx	qx	Lx	Tx	ex
0-5	0						
6-10	0						
11-15	3						
16-20	1						
21-25	4						
26-30	2						
31-35	1						
36-40	8						
41-45	3						
46-50	6						
51-55	8						
56-60	13						
61-65	18						
66-70	15						
71-75	34						
76-80	25						
81-85	31						
86-90	14						
91-95	5						
96+	1						

3. Fill in equations.

	A	B	C	D	E	F	G	H
1	Agec lass	dx	nx	lx	qx	Lx	Tx	ex
2	0-5	0	=sum(B2:B21)	=C2/$C$2	=B2/C2	=(C2+C3)/2	=sum(F2:F21)*5	=G2/F2
3	6-10	0	=C2-B2	=C3/$C$2	=B3/C3	=(C3+C4)/2	=sum(F3:F21)*5	=G3/F3
...			...					
21	96+	1	=C20-B20	=C21/$C$2	=B21/C21	=(C21+C22)/2	=sum(F21:F21)*5	=G21/F21

4. Making graphs using Excel
Ex.Survivorship curves:Chart
Wizard: Line graph
Data:it's easier to setthe data upaway from the lifetable as follows:

AgeClas	Pre-1840 Female	Pre-1840 Male
0-5	1.000	1.000
6-10	1.000	1.000
11-15	1.000	1.000
16-20	0.984	0.995
21-25	0.979	0.990
26-30	0.958	0.984
31-35	0.948	0.969
36-40	0.943	0.943
41-45	0.901	0.917
46-50	0.885	0.875
51-55	0.854	0.849
56-60	0.813	0.792
61-65	0.745	0.729
66-70	0.651	0.656
71-75	0.573	0.505
76-80	0.396	0.318
81-85	0.266	0.182
86-90	0.104	0.068
91-95	0.031	0.026
96+	0.005	0.000



NOTE:EXCEL DEFAULTS LOOK BAD–CHANGE SETTINGS FOR YOUR GRAPHS

EXP No. 5
STUDY OF THE TYPES OF SOIL, THEIR TEXTURE BY SIEVE METHOD AND RAPID TESTS FOR –PH, CHLORIDES, NITRATES, CARBONATES AND ORGANIC CARBON

Scope:

To determine the pH in water and wastewater by using electrometric method (pH meter).

Principle:

The pH value is determined by measurement of the electromotive force of a cell consist of an indicator electrode (as electrode responsive to hydrogen ions such as a glass electrode) immersed in the test solution and a reference electrode (usually mercury / calomel electrode). Contact between the test solution and the reference electrode is usually achieved by means of a liquid junction, which forms part of the reference electrode. The electromotive force is measured with a pH meter. The glass electrode system is based on the fact that a change of 1 pH unit produces an electrical change of 59.1 mV at 25° C.

ELECTROMETRIC METHOD:

Apparatus: pH meter,

Thermometer.

Magnetic stirrer

Chemicals: pH Buffer solution 4.0, 7.0 and 10.0

Procedure:

1. Switch ON the power of the instrument.
2. Calibrate the pH meter with a known buffer solutions as per calibrating procedure.
3. Rinse the probe with distilled water.
4. Wipe the probe with Tissue paper
5. Place the sample and immerse the probe
6. Change the knob to pH mode and measured the pH.
7. Note the pH value & record

Calculation: Report pH to the nearest 0.01 units.

Indian standard Method of sampling and test (Physical & chemical) for water and waste water IS 3025 (part : 11)

Scope:

To determine the Chloride in water by Argent metric method.

Principle:

In a neutral or slightly alkaline solution, potassium chromate can indicate the end point of the silver nitrate titration of chloride. Silver chloride is precipitated before red silver chromate is formed.

Interferences:

Bromide, Iodide, cyanide, Sulphite, Thio, and sulphide ions interfere but can be removed by treatment with hydrogen peroxide.

Apparatus:

Burette – 50 ml

Erlenmeyer flask – 250ml capacity

Magnetic stirrer.

Chemicals:

Potassium chromate,

Silver nitrate AR grade,

Sodium chloride,

Reagents:

Standard sodium chloride 0.0141N :

- Dissolve 0.824g of NaCl in distilled water. and make up to 1000ml
  (1ml = 0.5mg of chloride)

Potassium chromate indicator:

- Dissolve 50g of potassium chromate in 1000ml-distilled water. Add silver nitrate solution in drops to produce a slight red precipitate and filler.

Standard silver nitrate solution 0.0141N:

- Dissolve 2.395g of silver nitrate in distilled water and make up to 1000ml.Standardize with a standard sodium chloride solution. The solution shall be kept in the dark. (1ml = 0.5mg of chloride)

Aluminium hydroxide suspension:

- Dissolve 1.25g Aluminium potassium sulphate or Aluminium ammonium sulphate in 1litre of distilled water. Warm to 60°C and add 55ml of con NH_4Cl slowly with stirring. Let it stand for 1 hr. transfer to a large bottle and wash ppt by successive addition, with thorough mixing and decanting with distilled water until free from chloride. When freshly prepared the suspension occupies s volume of about 1 litre.

Procedure:

Use 100 ml sample or suitable portion diluted to 100ml.If the sample is highly colored add 3ml of Aluminium hydroxide suspension, mix, let settle and filter.

If other interference is present, add 1ml of H_2O_2 and stir for 1minute. Directly titrated the sample in the range of pH to 7.0 to 10.0. Adjust sample pH to 7-10 with H_2So_4 or NaOH if it is not in the range.

Add 1ml of potassium chromate indicator and titrated against standard silver nitrate solution to a pinkish yellow end point & Run a blank.

Calculation:

$$\text{Chlorides (as Cl) mg/l} = \frac{(V1-V2) \times N \times 35450}{V3} =$$

V1 = Volume in ml of silver nitrate used by the sample

V2 = Volume in ml of silver nitrate used by the blank

V2 = Volume in ml by the sample taken

N = Normality of silver nitrate

EXP No. 6

STUDY ANY FIVE ENDANGERED/ THREATENED SPECIES- ONE FROM EACH CLASS.

- 1. Amur Leopard

Since 1996, the amur leopard has been classified by the IUCN as Critically Endangered with less than 70 individuals thought to exist today. It is hunted and killed for its beautiful fur, its habitat is being destroyed for human settlement and agricultural practices.

- 2. Gorillas

Cross River Gorillas and Mountain Gorillas are both classified as Critically Endangered and Endangered by the IUCN since 1996 – that is two out of five gorilla subspecies. There are currently only **200-300** Cross River Gorillas left in the wild, and **900** Mountain Gorillas.

- 3. Sea turtles

Two types of sea turtles are amongst the most endangered species in the world: the Hawksbill Turtle and the Leatherback Turtle

In the past 100 years, the Hawksbill Turtle has lost 90 percent of its population, 80 percent of which has been lost in the past 10 years. As of 1996, the IUCN classified it as a critically endangered species. The Leatherback turtle is listed by the IUCN as Vulnerable, yet many subpopulations are facing extinction.

- 4. Orangutan

Since the millennium, the Sumatran Orangutan has been classified by the IUCN as **Critically Endangered** with approximately 80% of the population lost in the past 75 years mainly as a result of mass deforestation. This awful trend continues to put pressure on the remaining population of 6,600 Sumatran Orangutans that are estimated to remain on this earth.

- <u>5. Sumatran Elephant</u>

In the past 25 years, the Sumatran Elephant has lost an astounding 70% of its habitat to deforestation for palm oil plantations, agriculture and human settlements. Less than 2000 are estimated to exist and in 2011, the Sumatran Elephant was classified by the IUCN as **<u>Critically Endangered</u>**.

- <u>6. Saola</u>

In 1992, the discovery of this mystical creature, sometimes referred to as the Asian Unicorn, in Vietnam was hailed one of the most spectacular zoological discoveries of the 20th century. Yet already, this elusive and beautiful animal been deemed by the IUCN to be Critically Endangered and is one of the rarest large mammals to exist on Planet Earth.

- <u>7. Vaquita</u>

With less than 100 thought to exist, the Vaquita is the rarest marine mammal in the world. Time is running out for these elusive little sea porpoises, with **<u>extinction predicted as soon as 2018</u>**.

- 8. Tiger

The tiger has long been hunted for its distinctive patterned fur. Of the nine tiger subspecies, three are already extinct, many are endangered but it is the South China Tiger and the Sumatran Tiger that currently face the biggest threat to their survival.

Tragically, the **South China Tiger** is thought to be extinct in the wild as it hasn't been spotted since the 1970s. The Sumatran Tiger is the only surviving tiger subspecies indigenous to Indonesia and as of 2008 it has been classified by the IUCN as **Critically Endangered**. Less than 500 of these tigers exist today in comparison with a population estimation of up to 1,000 in 1978.

- 9. Rhinos

Three of the five species in the family of Rhinocerotidae, are among the most endangered species in the world: the Black Rhino, the Javan Rhino and the Sumatran Rhino. The **Javan Rhino** is the most threatened with extinction with the total population of only 60 surviving in one National Park in Java, Indonesia. The **Sumatran Rhino** is Critically Endangered. It has been estimated that less than 100 exist today in the wild. The **Black Rhino**is classified by the IUCN as Critically Endangered with three subspecies declared extinct in 2011.

- 10. Pangolin

Despite their tough appearance, these small, warrior built mammals are losing the battle against poachers and habitat loss. All eight species of pangolin are under threat, ranging from **Vulnerable to Critically Endangered**. They are the most trafficked animal in the world, hunted for their scales which can be sold on the black market for up to $3,000/kg.