Bright

BIOL 353 ECOLOGY II

VEGETATION DEVELOPMENT

- ✓ Diff group of plants evolved at diff eras and periods.
- ✓ First grp of plants evolved from the filamentous algae which are the mosses. ✓ Members of the bryophytes resemble those of chlorophyta
- ✓ Sphenophyta, Lycophyta and Pteridophyta were the first before seedless plants emerged.

ADAPTATIONS THAT ENABLED WATER PLANTS TO MOVE UNTO LAND

- ✓ Had to develop stronger stems and roots • To withstand strong forces
- ✓ Tough cell walls. • To prevent dessication
- ✓ Vascular system development • For transportation of food to other parts

FURTHER ADAPTATIONS OF THE GYMNOSPERMS [IN WHICH BRYOPHYTES DO NOT POSSES]

- ✓ Seeds with thick, resilient, outer coat or exposed • To withstand unfavourable environmental condition • Prevent damage • Prevent H2O loss • Prevent digestion in mammals.
- ✓ Evolution of pollen grain leading to a very high rate of reproductn. No water is needed as in the bryophytes.

FURTHER ADAPTATIONS OF THE ANGIOSPERMS.-

- ✓ Develop more efficient vascular tissues. ✓ for transportation purposes.
- ✓ Embryo protected by a seed coat
- ✓ Waxy cuticles of leaves to resist desiccation
- ✓ More efficient pollinatn due to possession of flowers [to attract insect pollinators to enhance pollinatn]
- ✓ Develops ovary (fruit) which houses/protects ovules (seed)
- ✓ Effective seed dispersal due to possession of fruits

BIOGEOGRAPHY

The study of the

- ✓ Distribution of organisms over time and space. [or spatial and temporal]
- ✓ Deals with where, at time and factors responsible for the distribution of organisms

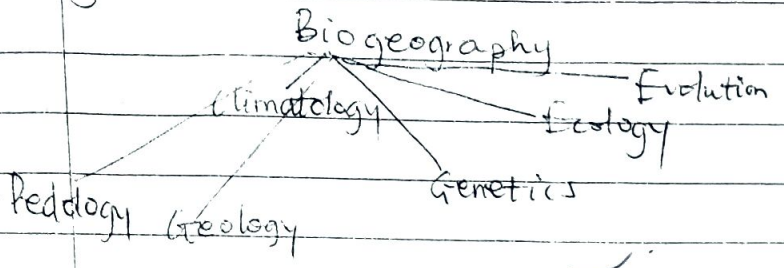
Q) Why is the lianas in Ghana diff from the lianas of Malaysia?

A) ✓ ✓ biodiversity in the tropics greater than that of the temperates? Diff in historical, edaphic, and evolutionary and climatic factors btn the 2 geological regions accounted for the difference in lianas.

historical — The current distribution of a species may be explained by the past distr. of sp
species or closely related species in the same region.
climatic and human disturbance causes extinction of species

Goals of Biodiversity

1. Account for the ~~distribution of~~ factors responsible for biotic distribution.
2. To obtain baseline information on the spacial and temporal distribution of organisms that can be used to manage and conserve Earth's biotic resources and heritage.



Types of biogeography

- Phytogeography — plants.
- Zoogeography — animals.
- Microgeography — microorganisms.

Types of Biogeography based on time:

- ~~Historical~~ Historical — Always relyon the distributn of previous present species and Paleogs ones and to be able to predict the future distrib depend on phylogenetics.
- Ecological: Study of the current species in relation to their environment.

Phylogenetics: The science of reconstructing the evolutionary relationships among organism.

In Biogeography (historical) you can be dealing with extinct and extant species. Phylogenetic trees and cladograms

Continental drift and historical biogeography

A phenomenon which believed the earth was once a full mass but later on had to drift so that there were diff. species found in each section

ECOLOGICAL BIOGEOGRAPHY

The study of current/present/modern species in relation to the environmental factors which influence their distribution.

ENVIRONMENTAL FACTORS: Climatic, edophic (soil), topography (altitude, slope angle, slope aspect)

Possible: Is it ever possible that you can also use the past/extinct organisms to relate to ecological biogeography.
You can rely on the past distribution without looking at the evolutionary trend

Based on biogeography

Areas with distint environ. factors and plant distribution are referred to as **biomes** eg. Trophical forest biome which is across all continents.

Processes of Biogeography

There are three processes that are fundamental to biogeography.

- ✓ Evolutionary change
- ✓ Extinction
- ✓ Dispersal

Evolution: the irreversible change occuring in the genetic construction of a population of an organism. It may or may not evolve new species. They will be called new species only if they cannot mate with their old/previous species.

Dispersal: The higher the ability of the organism from its place of birth to other areas; the greater the Biogeography [or distribution range]; the opposite is observed when the dispersal rate is low.

Extinction: When extinction occurs the distribution of organisms becomes reduced.

BARRIERS TO DISPERSAL

1. Physical barrier 2. Physiological 3. Ecological

- Physiological: When the environmental factors of the native organism are so diff. from the new environment of the dispersed organism; then it is termed physiological barriers. such that it's not able to survive.
- Ecological: When certain organisms existing in the new environment prevent the survival of the dispersed organism due to predation competition
- Physical: It is when any physical structure separating two areas such that activity prevents the dispersal of organisms eg. large distance, oceans, lakes, mountains

Extinction is the process where by organisms are wiped out from their geographical location (2 types) (i) local extinction - found in all parts but not a particular place; Physiological: difference in the environment condition between original and new environment the dispersing organism is unable to survive in the new environment. eg. dispersal of fish in different condition location where there is different salt conc.

(ii) Global extinction - found cannot be found at all places

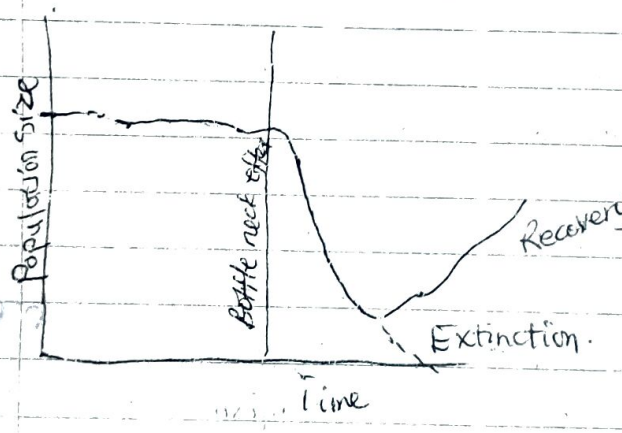
Factors that Influence Distribution of organisms in Islands

ISLAND BIOGEOGRAPHY

An island is any small area separated from the main land. Brings about species diversity. Because of the small nature of island species there are prone to extinction.

Definition: It is the study of the distributn and dynamics of species in island environment. Species on island can better undergo evolution that those on the main island → this could be if there is a difference in the genetic makeup and environmental changes on the island ~~such as~~ will bring about various adaptation leading to evolution.

- ✓ The small size makes them prone for extinction due to natural phenomenon such as fire, earthquake, disease, etc. and low dispersal.
- ✓ Island pop. therefore become vulnerable to population bottleneck effect, founder effect and genetic drift.



Bottleneck : When there is a sudden / drastic decrease in the pop of organisms. Species here could completely undergo extinction or recovery.

FOUNDER EFFECT: Occurs when a small group of organisms move to a new area to start a new population, because of their small number the allele frequency is smaller than the original population and any natural disaster could completely wipe away the whole pop.

In-breeding is a genetic factor that can lead to extinction.

Genetic drift.

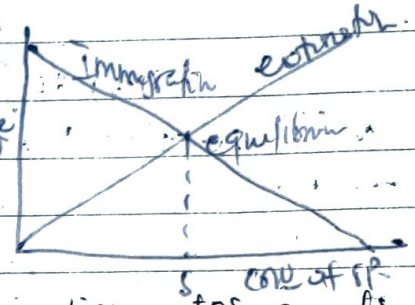
THE THEORY OF ISLAND BIOGEOGRAPHY

A. ~~smaller~~ larger island would have a ~~smaller~~ larger number of species than a smaller island.

FACTORS AFFECTING SPECIES DIVERSITY OF ISLANDS

1. Extinction
2. Immigration / colonisation
3. Emigration
4. Extend of isolation : the ~~extention~~ proximity of the land to other ecosystem / mainland
5. Human disturbance
6. Climate change
7. Natural disasters volcano, earthquake
8. Size of island

4 & 8 - are main factors that affects the diversity of island.



ISLAND EQUILIBRIUM

An island is said to be in equilibrium when immigration rates equals extinction rates. Species diversity is constant ; but species composition is not constant (diff kinds of species in the island).

IMPLICATIONS OR APPLICATIONS OF ISLAND BIOGEOGRAPHY

Assignment

② explain the effect of size & distance on sp richness of islands. why island than

APPROACHES TO THE STUDY OF SPECIES DISTRIBUTION

1. Autecology (species ecology) : The study of a single species or individual organism with its biotic and abiotic factors in its habitat. It is an experimental approach revealing the range of conditions (light, temp., soil nutrients) which a particular species can tolerate or which can support dispersal.

✓ The findings of autecology studies are used to interpret and/or predict patterns of distribution ~~of~~ or diversity.

✓ The result obtained may not be a true reflection/mimic of what really exists in nature. (disadvantages)

2. Fossil records : Used to explain the distribution patterns of some species. eg. fossil records of some land plants in rocks.

3. interactive effect of environmental factors in a natural habitats of the sp are not observed in a autecology

UNRELIABLE REASONS FOR THIS APPROACH

1. Fossils of certain organisms might be ~~damaged~~ carried long distances from their source
2. Many fossils have gaps making interpretations difficult and unreliable
3. Some parts of the fossil may be lost or not preserved, or misleading scientists in the reconstruction of flora of a place.

BIOMES.

Biomes are gross ecological communities located in areas that are widely spaced although, they are characterized by similar environmental factors (climatic factors and adaptic (soil) factors).

SEVERAL TYPES OF BIOMES

- ✓ Terrestial Biomes.
- Tropical moist forest
- Tropical seasonal forest / Moist semi Deciduous
- Coniferous forest (Taiga)
- Grasslands / Tropical Savannah
- Deserts.
- Tundra
- Temperature rainforests
- Temperature deciduous forest

Tropical rainforest is an example that falls under Tropical moist forest
has an annual rainfall above 200 cm.

TROPICAL MOIST FOREST (TMF).

They are forests that are characterised by uniform annual temperature and high amount of rainfall (> 2,000 mm or above 200 cm annually).
- There are several kinds of T.M.F. Eg. Cloud forest, tropical rainforest, wet evergreen forest, etc. Nevertheless they share a number of common attributes the trees do not shed their leaves and the trees are tall.

ENVIRONMENTAL FACTORS

- Tropical rainforest receive plenty rainfall throughout the year (>2 000 mm annually)
- They experience warm to hot temperature year round.
- The area has high humidity (77-88%)
- Cloud forests are usually located on mountainous areas where fog and mist make their vegetations wet all the year.
- The soil of TMF are usually old, acidic, thin and nutrient poor.

Acidic soil vrs. nutrients: The higher the acidic level/low pH the lower the availability of nutrients to be released in solution to plants for use.

This is because when H_2O reacts with CO_2 to form H_2CO_3.
($H_2O + CO_2 \rightarrow H_2CO_3$) -> This causes the high acidity of the soil.

Farming activities are very diff. compared to any other biome. ← Leaching, High acidic level leading to poor nutr
Weed control is very diff. because of high amount of rainfall. It is diff. because of high prevalence

VEGETATION

The tropical rainforests have diverse growth forms which include trees, shrubs, climbers, epiphytes, parasitic plants, hedges, etc. This diversity is lacked in the temperate zones. Trees are the dominant growth forms in the rainforest constituting 70%.

The trees in the TRF are usually tall with huge trunks (stems) with some growing beyond 30m. Most of the trees have smooth bark. If the bark is smooth, climbers are likely to fall and organic materials are deposited.

Trees in tropical rainforests are vertically stratified. Emergent layer that are made up of very tall trees usually are widely spaced and have minimum height of 30m canopy layer made up of trees whose crowns come together to form an umbrella-like structure known as canopy. NB Understorey layer refers to the region b/n the canopy layer and the floor.

Because the emergent project above all, they will suffer more sunlight. The main animals found at the emergent layer are birds and insects. In addition to insects, birds and mammals are found in the canopy layer.

- The understorey layer is made up of a dark cool environment. It means the plants should be able to tolerate shade. In other words, sun loving plants cannot survive in the understorey. Plants usually found in the understorey are herbs that tolerate shade; seedlings, samp saplings

Before the seelings and saplings can grow into trees, there should be gaps in the canopy so that sunlight can penetrate them to use.

The forest floor is often made up of dead organic matter and litter. Organisms are centipedes, milltepedes, earthworms and many insects.

FAUNA: All the animal component of a particular place at a

The fauna is diverse because plant diversity is high. The canopy of forests has been estimated to contain millions of insects species throughout the tropics

* The high diversity of insect many huge calls for a high cost of controlling since some of the insects are destructive
* Presence of tall trees causes for a very high initial clearing of land and is diff to
* Because of the high rainfall and humidity in the TMF, fungal disease is very high in incidence [resulting in lower yield as well as increased cost of production]

Because they don't shed their leaves most of the nutrients are stored in the leaves other living organisms

List all the barriers to agriculture in the TMF

Diff btn TMF and TSF

TMF	TSF
① Uniform annual high am	Rainfall is not uniform throughout the year (ranges from 250 mm to 2000 mm)
② Humidity is high (77-88%)	Low humidity
③ They do not shed their leaves	Most of the plants are deciduous thus shed their leaves just by drying
④ Trees have thin barks	Trees have thicker barks
⑤ Trees/plants are spatially close	Trees are not spatially close Relatively detached

Nutrient cycling in tropical rain forest.

90% of nutrients are found in organisms hence once they die, the add nutrient to the soil by the decomposers.

- Plant have an effective nutrient absorption because of the presence of mycorrhiza fungi

Plant adaptations: shallow roots

- Buttress root - no need for the root to go deep into the soil since nutrients are not
- Silt roots - Provide extra support for the plant
- Reed leaves - Protect the plant. Photosynthetic organs are not fully developed, later it develops and
- Lianas and epiphytes - use tree canopies to get sunlight, typically occur on branches in order to photosynthesize
- Leaf arrangement - developed so that upper leaf do not block lower leafs from sunlight
- Leaf drip tips - waxy surfaces and pointed tips, so when water falls, it quickly drips making it dry to prevent algae, fungi, infestation.

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- reptile not common because dry nature
- Insects, birds and mammals are common
- Because of the harsh environmental conditions, animal diversity is very low.
- Some animals undergo hibernation during winter whereas others migrate and others go under the earth until winter is over before coming out.
- Soil is poor in nutrient due to
1. the soil is moist making decomposition difficult
2. the acidic nature of the soil due to the nickle-like leaves of pines undergoing decomposition. [limiting availability of nutrients to plants].

Understorey - Mosses, ferns, grasses, upper storey - leaves of mainstorey | - shrubs

GRASSLANDS (TROPICAL SAVANNAS)

- Trees are very scarce and normally dominated by grasses with scattered shrubs.
- Temp. is very high or very high daily and season temperatures, than TSF.
- Inadequate rainfall, 500-1270 mm per year
- Frequent bush fires because of arid nature/conditions
- Compact soil

NB: Conditions are termed arid [dry] conditions even than TSF

- Have long dry seasons
- Associated with tall trees with thicker barks
- Plants have deeper root system than tsf and tmf; and tsf more than tmf.

FAUNA.

- Wild herbivores, most are ungulates eg. Lions, zebra, buffels, rhinoceros.
- Frogs, reptiles and insects are found there.

WEST AFRICA SAVANNA VEGETATION

Sahel, Sudan and Guinea - They are differentiated according to the amount of rainfall.

Guinea > Sudan > Sahel. based on rainfall and precipitation.

Another emerging type is the Derived Savanna (4th type)

✓ Transition zone is btn savanna and forest and has a mixture of savanna and forest vegetation. Human activities leads to the removal of the forest in the transition and hence it becomes derived savanna.

Q: Adaptation of plants and animal in the savanna

- have highly early seasonal temp
- frequent bush fire
- tall perennial grasses growing to a height of 10m or above
- drought tolerant and fire resistant
- form open canopies.

SAVANNA VEGETATION IN GHANA

There are only two types in Ghana the Guinea and Sudan Savanna. The Guinea is the largest (over 1.8 k^2m). The Guinea is found in the Northern middle area. Sudan is found around Navrongo, Bawku and Bolgatanga ~~areas~~ corridor.

Since Guinea and transition are close, also the forest is also close to the transition and hence Trees in the transition are similar to Guinea and forest. ✓Trees in Guinea have broad leaves and some can form canopies except that canopies formed are not continuous as in forest areas.

✓ In the Sudan Savanna, trees have small leaves. Also trees are shot and do not form canopies.

✓ Trees in the Sudan Savanna have thicker barks than those in Guinea Savanna. Sunlight intensity is higher in Sudan than Guinea so as to preserve water; i.e adaptation to water loss; also because Sudan ~~the~~ biome is dry than Guinea; they are more susceptible to fire and have adapted this feature to prevent fire outbreak.

- Grasses in the Guinea Savanna are very tall as compared to the grasses of Sudan Savanna.

DESERTS

It is any area where the rate of evapotranspiration exceeds/higher than rainfall.

✓ Rainfall pattern is highly unpredictable, ~~they~~ not frequent.

✓ Average temperature is about 30°C.

VEGETATION ADAPTATIONS

1. Xerophytes – Store and conserve water eg. Cactus
2. Phreatophytes Have very long roots that make contact with the water table so they can absorb water
3. Perennials – They remain dormant as seeds in the soil until water activates them
4. Annuals – The seeds of annuals germinate only after heavy rains and then complete their reproductive cycle b4 water runs out completely.

NB: Plants also adapt to predators; for this reason some produce spines, thorns to discourage animals from eating them.

S question: What are sedges ⇒ short grass like leaves that grow in marshy area which are forever

FAUNA & ADAPTATION

1. eg. Kangaroo rat – feeds on dry plants seeds and converts them to water internally. It does not pant or sweat so that it can conserve water. They also live in burrows which are more humid than outside.
2. Coyote: They are able to eat anything it comes across. Eg. they can eat deer, insects, fish, snakes, etc; plants
3. Scorpion: They have a very thick outer covering to reduce water loss.

⇒ Generally all mammals in the desert, concentrate urine to conserve water.

TUNDRA

It is the simplest / least of all biomes in terms of species composition and food chain.

- ✓ Little precipitation (150 – 300mm per year)
- ✓ It has the lowest temperature, and long cold, dark winters (−30°C) (−30°C)
- ✓ Strong, dry winds and snowfall
- It is the colder than the coniferous forest
- ✓ Soil is poor in nutrients
- ✓ There are short growing seasons (6 – 10 ~~weeks~~ ~~Months~~ weeks) ⇒ bcos rainfall is spread within 6 – 10 ~~months~~ weeks.
- ✓ Has a layer of permanently frozen subsoil called permafrost, consisting mostly of gravel and finer particle

long cold, dark winter 6 - 10 months around −30°C

• VEGETATION

Plant growth is limited by the presence of permafrost eg. trees do not develop deep roots because of permafrost

- ✓ Plant height is also affected by permafrost → Tallest trees is less than 1 metre.
- ✓ Plants usually grouped together to resist the cold temp.
- ✓ Veg. of tundra biome consist of short trees, low shrubs, sedges, reindeer mosses, lichens and grasses.

FAUNA

Morphological adaptations

a) They posses large compact bodies
b) Insulation from thick body fur / feathers eg. musk ox

Physiological Adaptation

-) Some animals are able to accumulate fat during short growing seasons. This

Community Ecology: branch of ecology looking at/delve how interaction within a community will shape or influence community organization.

Features characterizing community organization:

Insulates the body against heat loss. It also serves as energy store for them during winter when they are inactive.

2) Some animals loose appetite during winter so they can endure the harsh condition eg musk ox.

3) Some invertebrates become dormant during winter

Behavioural Adaptation.

Aquatic ground squirrels burrows in the soil under the earth and line themselves with insulators (eg. musk ox hair, leaves) to avoid heat loss/harsh condition.

PLANT COMMUNITY ORGANIZATION

Comm. organizatn is the structure of a community as well as the factors responsible for their structures.

Plant community properties can be classified into 2: qualitative and quantitative OR synthetic and analytical.

ANALYTICAL PROPERTIES
QUANTITATIVE

Quantitative means they are measurable. You can assign specific values to it

1) Species density: where the no of individuals within a defined area is determined. It measures the numerical strength of the individual in the area.

Species density = total no of indi. of a species / total area sampled.

Average species density: important because you may like to compare the numerical strength of a particular species among diff habitat/sites.

2. Comparison of a numerical strength in a control area with other treatment areas. => treatment [exposed to fire] and control [not exposed to fire]

Average species density: [density in plot 1] + [density in plot 2] + ... [density in plot x] / total no of plots.

Units can be in individual/plot or individual/plot

Abundance refers to counting the number of individuals without considering the area. It measures the numerical strenght of a species in a community

2) Species Freqyency

The occurence of a particular species within a particular area.

Species freqyency = No of plots within which a particular species occurs / Total no of plots sampled

Application

1. It is used to determine the distribution of species over time
2. ~~~ ~ ~ change in species composition.

3) Species cover

It is based on visual estimation. It is the % area occupied of an area covered by a particular species.

eg 2/3 X 100 = 66.66%

Disad - It is subjective and not quantitative

QUALITATIVE

1) Physiognomy: the general appearance of a vegetation as determined by the growth form of a dominant species.

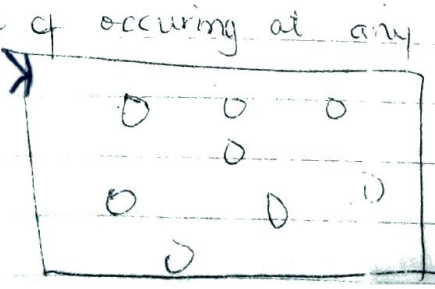
2) Phenology: the study of the periodic life events of organisms in relation to their climatic and habitat factors eg. diff. species have diff periods of seed germination, vegetative growth, flowering, fruiting, leaf fall, and fruit and seed dispersal.

3) Stratification: This is the arrangement of plants in vertical layers within forests.

4) Sociability (Gregariousness): This is spatial distribution of species within a community, and expresses the degree of association both species

there are three types of spatial distribution: Random regular/uniform and clump

- RANDOM: this is where each indiv. within a community has an equal chance of occuring at any place. the individuals are not distributed according to any pattern. this dist. occurs when organisms are not influenced by competition: In the absence of competition, species are likely to undergo random distribution.

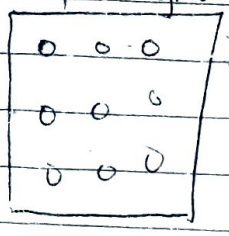


Occurs when resources are randomly distributed

/uniform

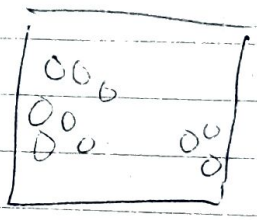
REGULAR DISTRIBUTION: This dist. occurs when the indi. within a comm. are regularly spaced. This type can occur when

1) The resources being dependend on are regularly distributed/uniformly
2) Parent plants produce toxins within the comm. driving away young ones or prevent young ones from growing near them or staying in the community.



3) CLUMPED DISTRIBUTION: This distribution occurs when individuals occur in high density patches which are separated by areas of few/no individuals. This dist. occurs when there is

1) Mutual attraction among individuals,
2) Attraction/movement of individuals to a common resource site.
3) Vegetative reproduction undergone by the species.



4) Modification of environment by a particular species making it favourable for other individuals converging at the spot/area. eg. Shade tolerant plants under trees.

DETERMINATION OF SPATIAL DISTRIBUTION PATTERNS

Demarcate a no of sampling units (plots) and enumerate indiv. of a particular species within each unit.

Calc mean (m) and variance (V) for the samples, and use it to det. ~~variance~~ variance/mean ratio (i.e V/m)

If V/m < 1, the dist. is uniform
If V/m = 1, ✓ random
If V/m > 1, ✓ clumped

$$\text{Variance} = \frac{\Sigma (x - \bar{x})^2}{n}$$ where $\bar{x}$ = mean and n = no of plots

$$\text{Mean} = \frac{\Sigma(n_1 + n_2 + \dots n_n)}{n}$$

SPECIES DIVERSITY DETERMINATION

For most of the diversity indices, they combine species richness and abundance
However, diff indices place diff emphasis on species richness and abundance
for this reason the type of diversity index used/employed would depend on the type of study and the objectives of the study. Two common types of indices

- SHANNON DIVERSITY INDEX

It is expressed by the following eqn

$$H' = -\sum (p_i \times \ln p_i)$$

species richness → no of species
higher species richness and evenness increase species diversity

p_i = proportion of the i^{th} species and
$\ln p_i$ = natural log of p_i

Species name	no	p_i	$\ln p_i$	$p_i \times \ln p_i$
Abaukamo	6	0.012	-4.42	-0.05307
Akataniwa	5	0.01	-4.61	-0.04605
Akolawere	1			
	2			
	9			
	4			
	1			

500 $\sum p_i^2$ $\sum(\ln p_i)$ $\sum(p_i \times \ln p_i)$

$N(N-1)$

- SIMPSON DIVERSITY INDEX

It is expressed as

$D = 1/\sum p_i^2$, $\delta = \frac{\sum n(n-1)}{N(N-1)}$ N = total no of individuals of all species

n = number of individual for each species

The Shannon ranges from 0 to any number.
✓ When there is a single species, the Shannon index is 0.
✓ The higher the Shannon diversity index value, the higher the diversity.

NB CI (confidence value) = 95%
SL (significant value) = 5%

Where perm val is > 0.05 then the diff is not significant and vice versa

Simpson index of diversity

$$SID = 1 - D$$

WORKED EXAMPLE

Determine and compare Shannon diversity index for the two forests bel

Species	Primary forest	pi	lnpi	pi x lnpi
A	8	0.015355	−4.17631	−0.06413
B	48	0.092131	−2.38455	−0.21969
C	62	0.119002	−2.12862	−0.25331
D	31	0.059501	−2.82176	−0.1679
E	23	0.044146	−3.12026	−0.13775
F	38	0.072937	−2.61816	−0.19096
G	41	0.078695	−2.54218	−0.20006
H	36	0.069098	−2.56687	−0.18465
I	40	0.076775	−2.51808	−0.19707
J	42	0.080614	−2.51808	−0.20299
K	28	0.053743	−2.92355	−0.15712
L	40	0.076775	−2.56687	−0.19707
M	36	0.069098	−2.67223	−0.18465
N	26	0.049904	−2.99765	−0.14959
O	22	0.042226	−3.16471	−0.13363
	Σ = 521	Σpi = 1	Σlnpi = −41.874	Σpi x lnpi = −2.64057

Primary forest

$H' = -1 \times -2.64$

$H' = 2.64$

Species	Secondary forest	pi	lnpi	pi x lnpi
A	374	0.222752	-1.5017	-0.33451
B	61	0.036331	-3.31508	-0.12044
C	69	0.041096	-3.19185	-0.13117
D	68	0.0405	-3.20645	-0.12986
E	52	0.030171	-3.47471	-0.10761
F	56	0.033353	-3.4006	-0.11342
G	67	0.039905	-3.22126	-0.12854
H	50	0.02978	-3.51393	-0.10464
I	71	0.042287	-3.16327	-0.13377
J	430	0.256105	-1.36217	-0.34886
K	67	0.039905	-3.22126	-0.12854
L	64	0.038118	-3.26707	-0.12453
M	59	0.03514	-3.34842	-0.11766
N	63	0.037522	-3.28282	-0.12318
O	128	0.076236	-2.57392	-0.19623
Σ = 1679		Σpi = 1	Σlnpi = -45.0445	Σ pi x lnpi = -2.34297

Secondary forest

$H' = -1 \times -2.34$

$H' = 2.34$

Comparing the two forests (i.e primary and secondary) it was observed that the primary forest had a higher Shannon diversity index than the secondary forest. This implies that the species abundance of the primary forest is more than the species abundance in the secondary forest. The

Species richness : the no of diff. species within an area

ECOLOGICAL SAMPLING TECHNIQUES

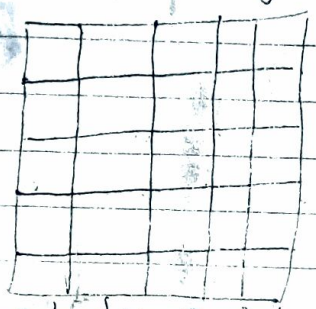
There are two basic types of sampling unit

1) Quadrat : It can either be square or rectangular in shape. It can be made of wood or made by putting stakes and joining them with ropes. Wooden quadrat is for sampling small plants and the rope for trees.

It captures as many organisms as possible

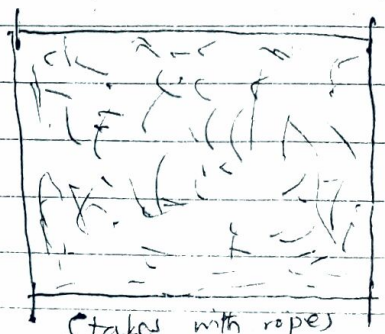
It permits the sampling of different microhabitats thereby permiting variation ~~of~~ in the samples

~~is~~ It is time consuming



Wooden Quadrat

for determining % of species cover. Subdivided square frame.

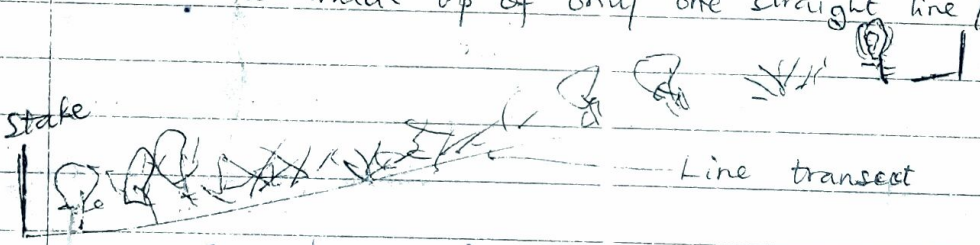


Stakes with ropes

for determining population density

2) Transect sampling : A transect is any straight path or line linking two diff. points. A transect is made up of one or two line parallel to each other

i. Line transect : Is made up of only one straight line/path



Line transect

transects are used when we want to determine a particular gradient or pattern along which communities change.

It only includes organisms which come into contact with the line; those outside are not enumerated. Mainly used on static animals and plants. It is most appropriate for small vegetation like herbs and shrubs.

Adv

It is very quick to sample

Disad

In areas where there are tall vegetation such as tree it is not possible to use this method.

The data gathered most often wouldn't make any statistical meaning (because many organisms will be left out, and data will be scanty).

2) Data collected may be affected by auto correlation (ie non-independence of samples). The samples are likely to be influenced by other samples because they may be close to each other and hence there isn't much variation. this means

Belt transect : Two parallel lines are demarcated by a particular margin and organisms within the margin are counted

Adv. Unlike the line transect, many organisms are sampled ; therefore data obtained is of much statistical relevance.

It can be used in areas of tall and sparse vegetation.

Disadvantage. This method also suffers from autocorrelation

It is much more diff. to use in areas with small plants that are intermingled.

* Another method is to combine both quadrat and transect line sampling in order to sample areas of tall trees. [Transect line is used and then quadrats are used to sample organisms on either side of the transect]

DISTURBANCE ECOLOGY

1. Could be both natural or artificial
2. Disturbance can be internal or external (endogenous, exogenous)
3. Can be biotic (insects, humans, diseases) or abiotic (wind, etc)

can be alternating manner

There are several agents of disturbance (Abiotic disturbance agents)

→ Drought : Drought can lead to drying up of water bodies and this causes death of aquatic organisms. It can also lead to fire outbreak. It also affects soil organisms because organic activities in the soil is reduced. Rate of decayed organic matter is reduced. It can cause desertification.

* Fire : It can cause organisms to die. It can also destroy soil organisms

Adv: It can create canopy openings within an area thereby causing the under storey species to receive enough sunlight for growth.

In ecosystems such as Savannah, fire is intentionally used to induce the growth of organisms. facilitate invasive alien species

* Wind : Like fire, wind can also cause tall trees to fall → giving space for sunlight for understorey species to grow and biodiversity loss. acts as agent

Positive effects of fire can be used to remove Invasive species. Also nutrient locked up in plants are returned to the soil to make it rich. to soil

(wind, flood, fire, volcano) - abiotic.

⇒ INSECTS AND DISEASES (Biotic)

Insects and their associated diseases causes plants to die leading to biodiversity loss. It also induces fire outbreak.

It could lead to the creation of canopy openings which is good for understorey species.

It helps create habitat for other organisms through decay process

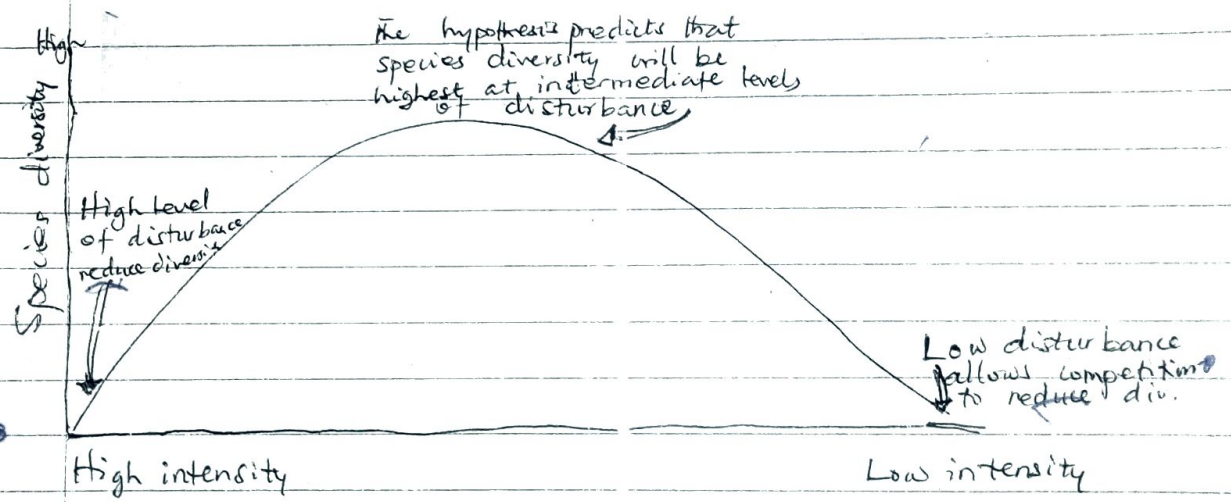
They also contribute to nutrient cycling

Plant growth reduction, tree volume loss, it can kill individual trees

⇒ Grazing (Reading).

⇒ Human impacts

THE INTERMEDIATE DISTURBANCE HYPOTHESIS



Diversity is highest at intermediate disturbance whereas at high or low level of disturbance diversity is at its lowest

	No of individuals		
Species	Forest 1	Forest 2	Pi
A	2	0	–
B	214	23	
C	12	32	
D	4	52	
E	7	32	
F	8	0	–
	247	139	

Species richness for forest 1 is 6 and forest 2 is 4

NB: The pi of 0 is – ie it is neglected

It is always better to use species diversity because it combines species richness and evenness

Evenness ~~is~~ the measures how equitably the no of individuals are distributed among the diff. species. The more equitably the no of individual are distributed within diff species, the higher the evenness and the higher the Shannon diversity.

If you use only species richness to characterise the diversity of an area, you will be wrong.