Ecology

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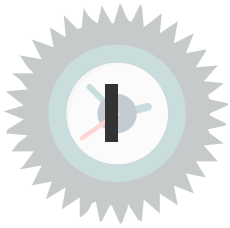
Objectives

- To gain an understanding of the broad biological significance of ecological theory.
- To gain an understanding of the questions that ecologists study, the methods they use, and the questions that remain unanswered.
- To develop your ability to apply quantitative skills to analyze and interpret ecological data.

DS 02: Ecological Factors



Introduction

The term `eco' refers to a part of the world and `system' refers to the co-ordinating units. The living organisms of a habitat and their surrounding environment function together as a single unit. This ecological unit is called as an `ecosystem'. An Ecosystem is a naturally occurring assemblage of life and the environment. Life refers to the biotic community including plants, animals, and other living organisms. This is denoted as biocoenosis, The environment is the biotope encompassing the physical region of life. The term ecosystem first appeared in a publication by the British ecologist Arthur Tansley, in 1935. An ecosystem may be of very different size. It may be a whole forest, as well as a small pond. Different ecosystems are often separated by geographical barriers, like deserts, mountains, or oceans, or are isolated otherwise, like lakes or rivers. As these borders are never rigid, ecosystems tend to blend into each other. As a result, the whole earth can be seen as a single ecosystem, or a lake can be divided into several ecosystems, depending on the scale. The ecosystem is an open system. It receives energy from an outside source (the sun), as input, fixes and utilities the energy, and ultimately dissipates the heat into space as output. An ecosystem has a physical environment, or factors, biological components, and interactions between them. Any ecosystem is characterized by a set of abiotic and biotic factors, and functions.

1. Climatic factors

Literary information on the ecological-physiological characteristics of the leading northern climatic factors has been analyzed. The combination of fluctuations of temperature and atmospheric pressure, high relative and low absolute humidity, strict wind regime, significant changes of solar activity, diversity of magnetic field behavior, sharp photoperiodicity, and pronounced UV deficit cause a special structure of the northern regions' climate. Per the totality of climatic characteristics and taking into account the general biological effect of these factors, their combinations, and the degree of manifestation, the territories of the North as a whole can be referred to the zone of uncomfortable natural-climatic living conditions with the elements of manifested extremeness of several parameters placing exclusive demands to human body functional systems.

1.1. Exercise 01:

Ombrothermal diagram

Climate diagrams are diagrams that summarize trends in temperature and precipitation for at least 30 years. They allow to establish the relationship between temperature and precipitation and to determine the length of dry, wet, and extremely wet periods.

Ombrothermic diagram also called as Walter Lieth diagram is one such climatic diagram used to compare the average wetness and dryness for an area of interest. The data must be average for nearly thirty years.

• On graph paper, draw the x-axis marking each of the months starting with the coldest month. Remember to start in January if you are plotting data collected in the northern hemisphere or in July if the data is from the southern hemisphere.

• Label the months on the x-axis.

• Draw two y axes one for temperature in degree Celsius and another for rainfall in mm.

• The scale must be chosen in such a way that line marking 10°C should be equal to 20 mm of rainfall in the other axis. Rainfall scale should be twice the value of temperature scale selected.

• Draw a graph with red colour corresponding to the temperature data.

• Draw a graph with blue colour corresponding to the rainfall data.

• When the temperature line runs above the precipitation line there is a **dry season** and the area between the lines should be illustrated by **filling itwith dots**

• When the temperature line runs below the precipitation line there is a **wet season** and the area between the lines should be illustrated by **filling it with vertical lines**

• There is a practice of colouring the portions which exceed 100 mm, precipitation as a period with excess water with black colour**.**

• The station name and its elevation should be mentioned in the top left, average temperature and average rainfall in the top right, extremes of temperature in the second line should be shown.

	Jan	Feb	Mar	Apr	Mai	Jun	Jul	Aug	Sep	Oct	Nov	Dec
T(C°)	6.8	7.4	9.7	12.3	16.1	20	23.4	24.6	12.1	16.7	12.1	8.3
P(mm)	242.8	190.3	170.3	139.7	68.8	26.1	7.4	17	64.8	152	175.8	235.9

- The ombrothermal diagram by Bagnouls and Gaussen (1953)

  These authors determine the dry season through a graphical representation where the months of the year are plotted on the x-axis, precipitation (P) of the month in millimeters on the left y-axis, and temperatures (T°) of the month in degrees Celsius on the right y-axis. They adopt the scale P=2T and consider a month to be dry when P<2T.

  Analysis of the diagram allows visualizing a rainy period that generally extends from late September to early May and a dry season lasting 4 months, coinciding with the summer period, thus confirming the classification of our study area in the Mediterranean climate as defined by Emberger (1943).

1. Determine the unfavorable (dry) season.
2. Determine the climate type of each station according to Gaussen's classification.
3. Determine the seasonal regime of precipitation.

1.2. Exercise 02:

The climagram (*Emberger* 1933)

Emberger (1933) focuses on thermal extremes M and m between which the vegetative period takes place, and which can constitute ecological thresholds for different plant species. If M is the average of the maximum temperatures of the warmest month of the year, m is the average of the minimum temperatures of the coldest month (expressed in degrees K°) *BONOBOS WORLD*[BONOBOS WORLD], and if P represents the annual precipitation measured in mm, the Emberger pluviothermal quotient is expressed as:

$$Q = \frac{2000P}{M^2 - m^2}$$

	Jan	Feb	Mar	Apr	Mai	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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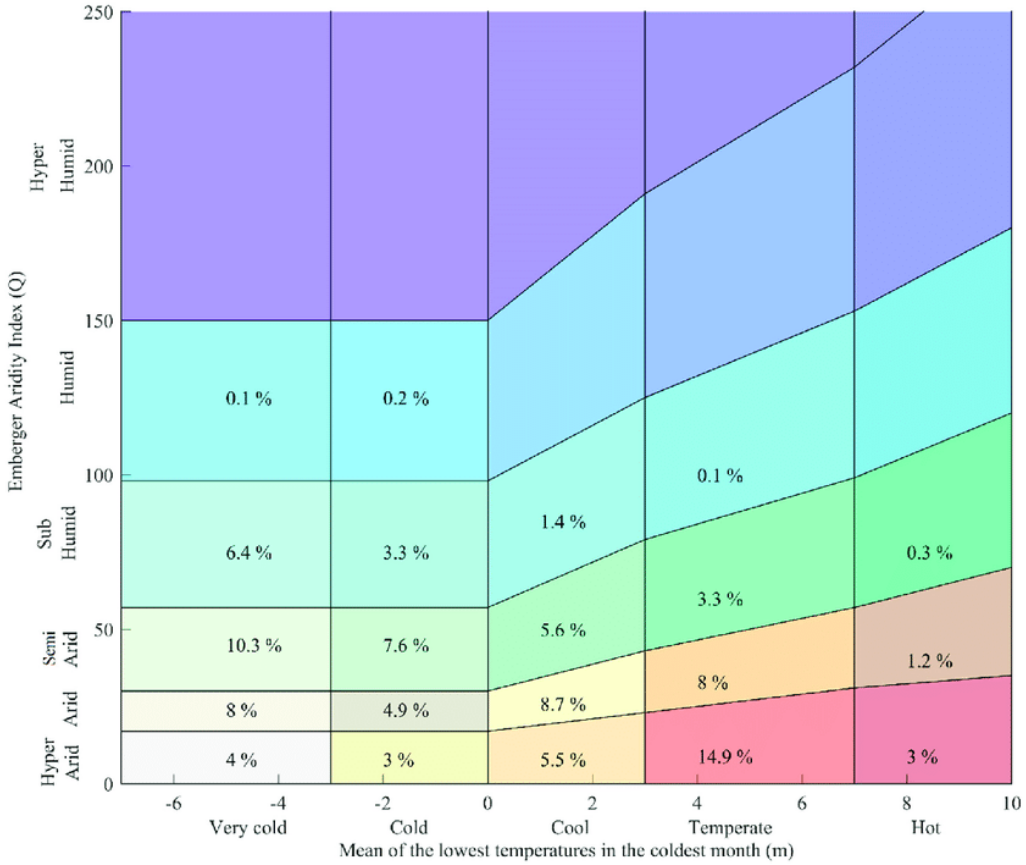
P(mm)	242.8	190.3	170.3	139.7	68.8	26.1	7.4	17	64.8	152	175.8	235.9

Based on the given data, determine the climate of the region.


Emberger Aridity Index (Q)
250
200
150
100
50
0
Hyper Humid
Humid
Sub Humid
Semi Arid
Arid
Hyper Arid
0.1 %
0.2 %
6.4 %
3.3 %
1.4 %
0.1 %
10.3 %
7.6 %
5.6 %
3.3 %
0.3 %
8 %
4.9 %
8.7 %
8 %
1.2 %
4 %
3 %
5.5 %
14.9 %
3 %
-6
-4
-2
0
2
4
6
8
10
Very cold
Cold
Cool
Temperate
Hot
Mean of the lowest temperatures in the coldest month (m)