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Lecture I
History of Ecology

Department of General Hygiene and Ecology

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Ecology is the study of the interrelationships between the earth's biological systems. Ecology is a relatively recent study and a significant field of biological research, having just gained prominence in the second half of the twentieth century.

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What is Ecology?

- Ecology can be defined as the scientific study of living organisms and their interactions with one another and with their surroundings.'
- Ernst Haeckel, a German biologist, initially invented the term ecology in 1869.
- It is made up of two Greek words: 'Oikos,' which means home or estate, and 'logos,' which means study.
- The focus is on the interactions between organisms and environmental components, both abiotic (non-living) and biotic (living).
- It is concerned with how organisms are shaped by their surroundings, as well as how they utilize environmental resources such as energy flow and mineral cycling.

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Significance of Ecology

- Ecology enables us to comprehend the impact of our actions on the ecosystem.
- It demonstrates to individuals the degree of environmental devastation we inflict.
- The destruction of land and the environment has resulted from a lack of understanding of ecology.
- Certain species have also become extinct or endangered as a result of it.

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Significance of Ecology

- As a result, studying the environment and creatures aids us in protecting them from harm and danger.
- Ecological knowledge allows us to determine which resources are required for the survival of various organisms.
- For their growth and development, all creatures require energy.
- Due to a lack of ecological awareness, energy resources such as light, nourishment, and radiation are over-exploited, resulting in their depletion.

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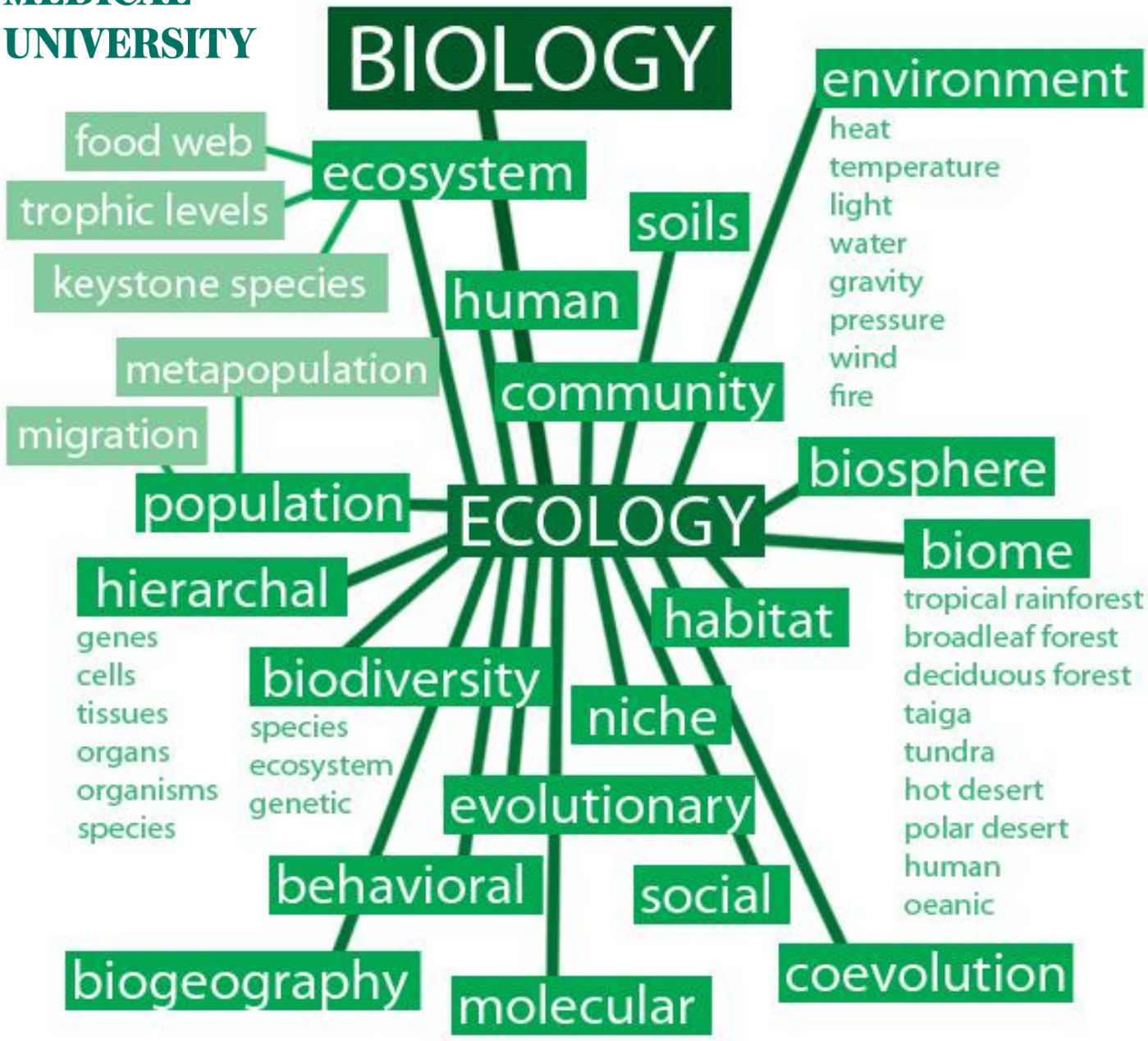
Relationship Of Ecology With Other Disciplines



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Content

Subject

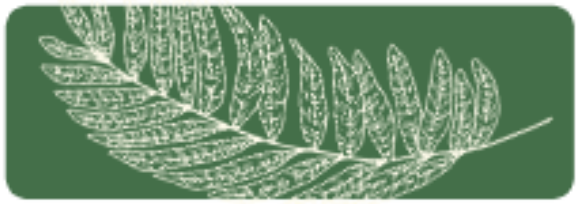
Tasks

Content

The study of the relationship of organisms with each other and with the environment at the population-biocenotic level and the study of the life of biological macrosystems of a higher rank: biogeocenoses (ecosystems), the biosphere, their productivity and energy

Subject

Biological macrosystems (population, biocenoses) and their dynamics in time and space



Tasks

Discovering the laws of ecological processes and learning how to manage them in the face of the inevitable industrialization and urbanization of our planet

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STUDY METHODS

Scientific Method:

- Observation
- Question
- Hypothesis
- Experiment
- Analysis
- Conclusion

OBJECT OF STUDY

- Life processes that explain the adaptations.
- Distribution and abundance of organisms.
- The movement of materials and energy through living communities.
- How ecosystems develop
- How and to what extent biodiversity is distributed.

DIVISIONS

- Autoecology (Ecophysiology and ethology).
- Ecology of the population (Demography).
- community ecology or synecology.
- Systems ecology.

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History

- At the first stage, knowledge was accumulated (lasts from the 4th century BC to 1866).
- The second stage is characterized by the formation of ecology as a science (1866-1936).
- The third is considered the stage of the formation of science (1936-present).

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History

The "zero" stage of the formation of ecology as a science (primitive stage)

Formation of certain knowledge about the environment or about the forces of nature, plants and animals for the organization of everyday life and human survival

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The first stage

Accumulation of factual material and the first experience of its systematization

Heraclitus (530–470 B.C.),
Hippocrates(460–370 B.C.),
Aristotle (384–322 rr. B.C.),
Theophrastus of Erez I (372–287 B.C.),
Pliny the Elder (23–79 A.D.)

Babylonia. Clay tablets

Chinese Papyrus

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The first stage

Middle Ages

- interest in the study of nature is waning
- individual works contain facts of scientific significance
- the applied nature of research (Razes, 850– 923; Avicenna, 980-1037, Marco Polo, XIII century., Afanasy Nikitin, XV century)

The period of the Late Middle Ages

The beginning of new trends in science

- Albert the Great's works on plants (examines the causes of "winter sleep" in plants, pays great importance to "solar heat", puts the reproduction and growth of organisms in inseparable connection with their nutrition)
- "The Mirror of Nature" by Vincent de Beauvais (XIII century),
- "The Teachings of Vladimir Monomakh" (XI century), which were on the lists in Russia,
- "On the teachings and similarities of things" by the Dominican monk John of Siena (beginning of the XIV century)

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The first stage

Renaissance Era

Accumulation and description of factual material (systematization): On the diversity of living organisms; On the spread of living organisms; Identification of structural features of plants and animals. The first taxonomists – A. Caesalpin (1519-1603), D. Ray (1623-1705), J. Tournefort (1656-1708) The first ecological experiment was carried out by the English chemist R. Boyle : he studied the effect of low atmospheric pressure on various animals

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The first stage

XVII–XVIII вв.

- XVII–XVIII centuries F. Redi experimentally proved the impossibility of self-generation of any complex animals
- the works of A. Reaumur on the life of insects (1734),
- L. Tremblay on hydra and mosses (1744),
- Antoine van Leeuwenhoek is a pioneer in the study of food chains and regulation of the number of organisms,
- S. P. Krasheninnikov, I. I. Lepekhin, P. S. Pallas, etc. about the interrelated changes in climate, flora and fauna in various parts of the vast country,
- M. V. Lomonosov, A. G. Bolotov studied the influence of the environment on the body,
- J.-L. L.Buffon studied the problem of external living conditions,
- J.-B. Lamarck evolutionary teachings

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The second stage

Large-scale botanical and geographical studies of the natural environment

The founder of plant ecology **A. Humboldt** showed the importance of climatic conditions, especially the temperature factor, for the distribution of plants

- K. Gloger (1833) teachings on changes in birds under the influence of climateT. Faber (1826) teachings on the peculiarities of northern birds
- K. Bergman (1848) on geographical patterns in changing the size of warm-blooded animals
- O. Dekandol justified the need to allocate a special scientific discipline "epirreology«
- E. A. Eversman considered organisms in close unity with the environment
- K. F. Roulier (1814-1858) ecological direction in zoology
- N. A. Severtsov (1827-1885) for the first time in Russia outlined deep ecological studies of the animal world of a particular region

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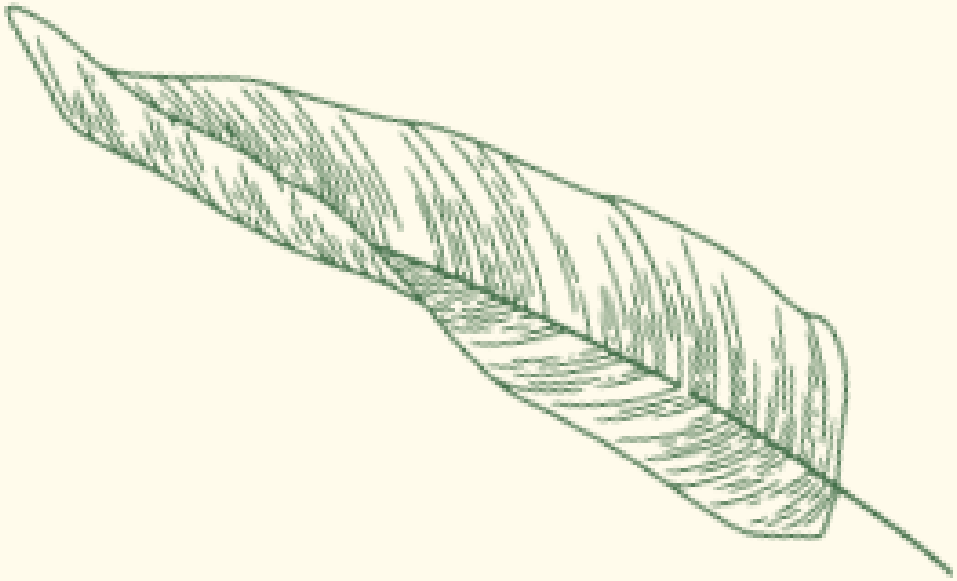
Breaking moment

The development of the science of ecology took place on the basis of the evolutionary doctrine of Ch . Darwin (1809-1882)
"The Origin of Species" (1859)

The "struggle for existence" is the driving factor of evolution



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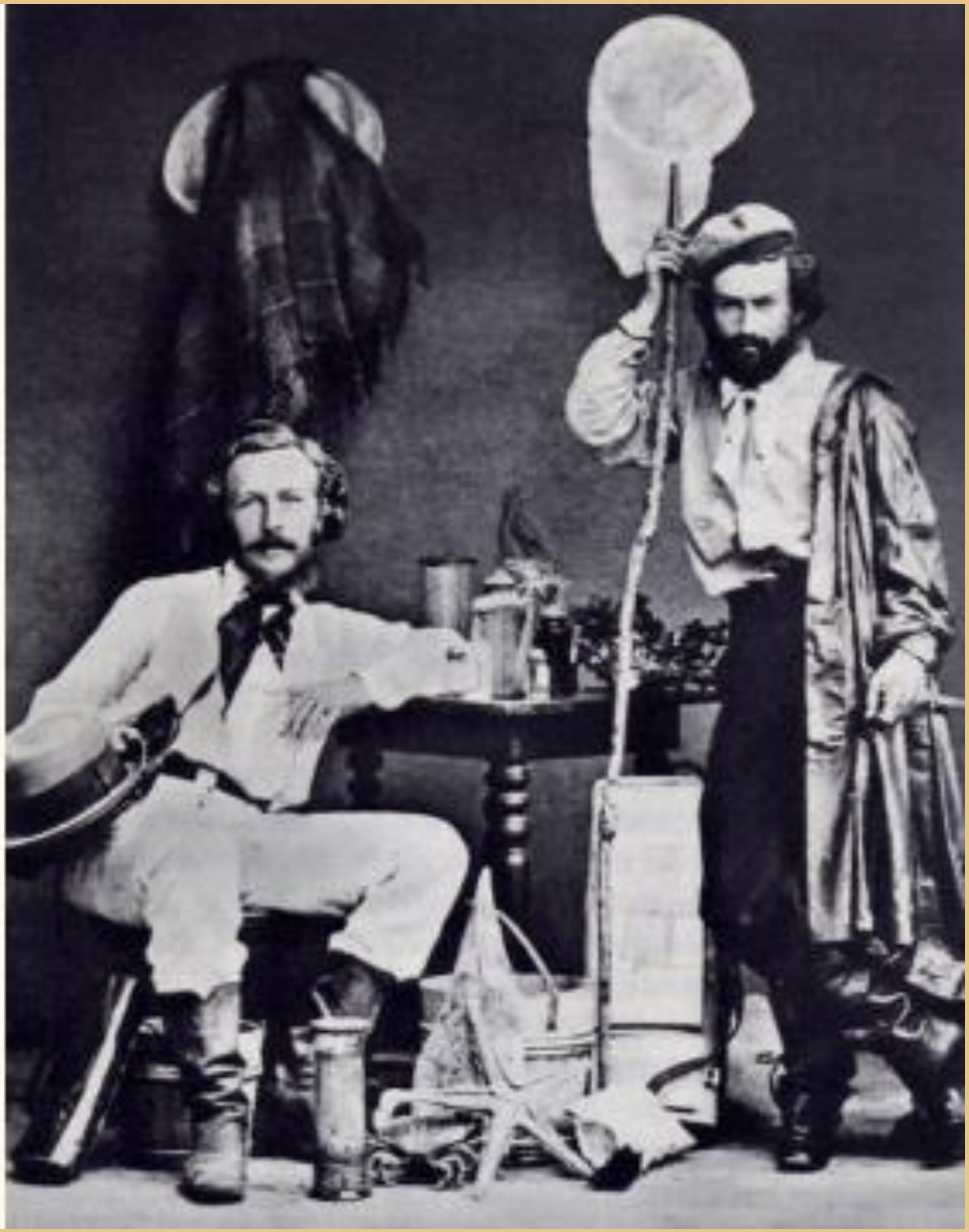
The third stage

Ernst Haeckel (1834-1919) with assistant – N.N.Miklukho-Maklay (1846-1888) Canary Islands, 1866

This photo was taken in the year of the release of "Universal Morphology", where **the term "ecology"** was introduced



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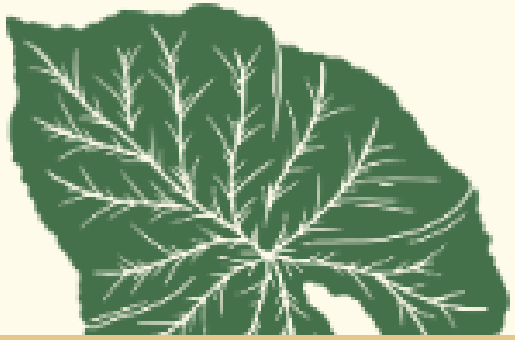
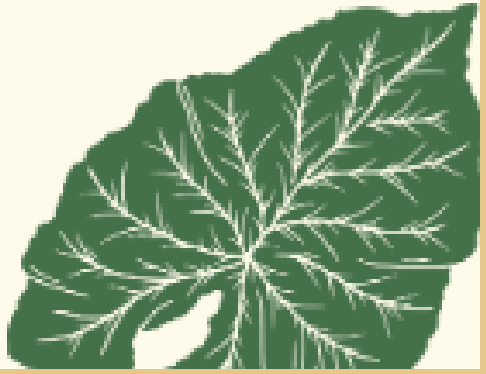
The third stage

E. Warming in the book "Oikological geography of plants" (1895) outlines the basics of plant ecology

A.N. Beketov in his scientific work "Geography of Plants" (1896) for the first time formulated the concept of a biological complex as a sum of external conditions, established the connection of the features of the anatomical and morphological structure of plants with their geographical distribution

D. Allen (1877) identified general patterns in changing the proportions of the body and its protruding parts, in the coloration of North American mammals and birds due to geographical climate changes





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The third stage

In the 70s XIX century a new direction in the study of biocenoses is being formed

In 1877, the hydrobiologist K. Mobius substantiated the idea of biocenosis as a deeply natural combination of organisms in certain environmental conditions in the work "Oysters and oyster farming"

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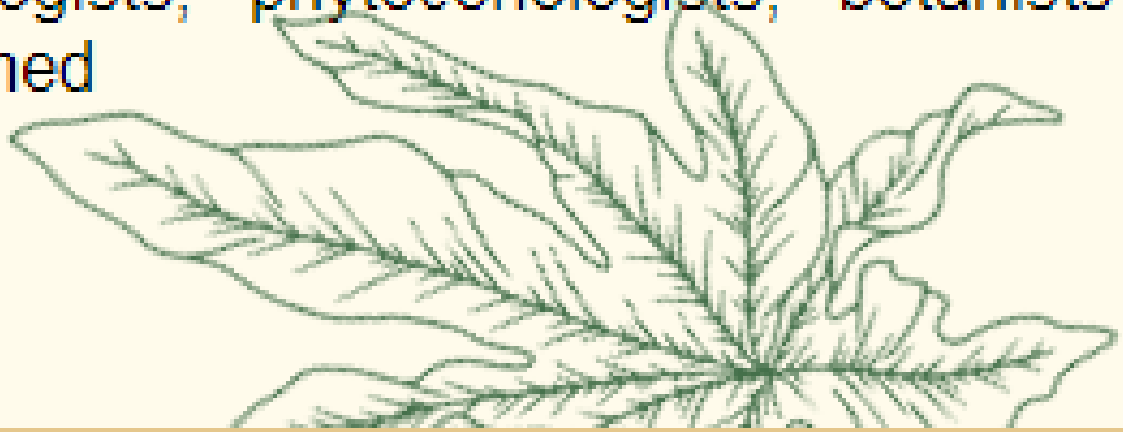
The third stage

The doctrine of plant communities (botanical ecology)

S.I. Korzhinsky and I. K. Pachosky "phyto-sociology" → "phytocenology" → geobotany

V. V. Dokuchaev (1846-1903) "The doctrine of the zones of nature"

At the beginning of the XX century, ecological schools of hydrobiologists, phytocenologists, botanists and zoologists were formed



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The third stage

Shelford Victor Ernest (1877-1968) American zoologist. He introduced a landscape-bionomic interpretation of the concept of "biome" into biogeography. The first described the nature of North America from an ecological point of view.

In 1910, at the III Botanical Congress in Brussels, at the suggestion of the Swiss botanist K. Schroeter, the ecology of individuals was called autecology (from the Greek autos – itself and "ecology"), and the ecology of communities – synecology (from the Greek prefix syn-, meaning "together")

There appeareds

- a guide to the study of animal ecology Ch .Adams (1913),
- V. Shelford's book on Terrestrial Animal Communities (1913),
- S. A. Zernov's book on hydrobiology (1913) and others.

In 1913-1920, ecology began to be taught at universities.

I.P. Borodin passionately urged his colleagues to protect nature and thereby fulfill "our moral duty "

G.A. Kozhevnikov (1917) formulated three stages of the formation of man's attitude to nature. He advocated the rationalization and modernization of the economy and its social structure

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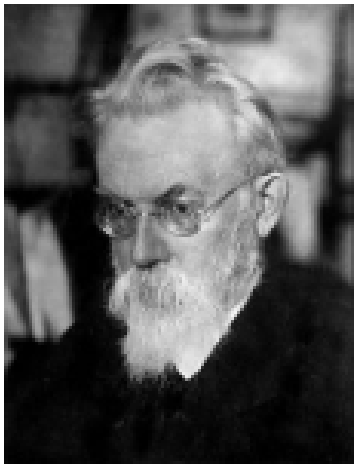
The third stage



V.I. Vernadsky

I.G. Serebryakov

The problem of interaction of living organisms with inanimate nature was developed in detail by V.I. Vernadsky in 1926

Phytocenological studies have been carried out
In Russia: V. N. Sukachev, B. N. Keller, V. V. Alekhine, A. G. Ramensky, A. P. Shennikov.
In other countries: F. Clements USA, K. Raunkier Denmark, G. Du Rieu Sweden, I. Brown-Blank Switzerland.

Theoretical problems of general ecology were studied by K. Friederiks (1930), F. Bodenheimer (1935) and others.
In the development of general ecology, a significant contribution was made by D.N.Kashkarov , C. Elton in the book "Ecology of Animals" (1927) switches attention from an individual organism to a population as a unit.
The development of population ecology: A. Severtsov, E. N. Sinskaya, I.G.Serebryakov, M. S. Gilyarov, N. P. Naumov, G. A. Viktorova, T. A. Rabotnova, A. A. Uranova, S. S. Schwartz, etc.

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The third stage

In the early 40s of the XX century, a new approach to the study of natural ecosystems appeared in ecology

G. Gause (1934) pointed out the importance of trophic connections as the main path for energy flows through natural communities

A. Tensley in 1935 in his work "Correct and incorrect use of concepts and terms in plant ecology" introduced the term **"ecological system"** into ecology In 1942

V.N.Sukachev (1880-1967) substantiated the idea of biogeocenosis

In 1942, the American scientist R. Lindeman outlined the main methods for calculating the energy balance of ecological systems

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The third stage

In the 50-90 years of the XX century, the works of prominent domestic and foreign researchers were devoted to environmental issues:
R. Dazho (Fundamentals of Ecology, 1975),
R. Riklefs (Fundamentals of General Ecology, 1979),
Y. Odum (Fundamentals of Ecology, 1975; Ecology, 1986),
M. I. Budyko (Global Ecology, 1977),
G. A. Novikov (Fundamentals of General Ecology and Nature Conservation, 1979),
F. Ramad (Fundamentals applied Ecology, 1981),
V. Tishler (Agricultural ecology, 1971),
S. G. Spurr, B. V. Barnes (Forest ecology, 1984),
V. A. Radkevich (Ecology, 1983,1997),
Yu. A. Israel (Ecology and control of the natural environment, 1984),
V. A. Kovda (Biogeochemistry of soil cover, 1985),
J. M. Anderson (Ecology and Environmental Sciences: Biosphere, Ecosystems, Man, 1985),
G. V. Stadnitsky, A. I. Rodionov (Ecology, 1988.1996),
N. F. Reimers (Nature Management, 1990; Ecology, 1994),
G. L. Tyshkevich (Ecology and Agronomy, 1991), etc .

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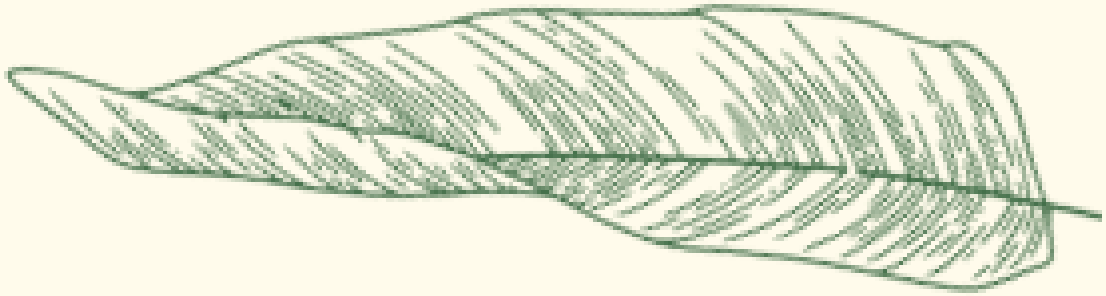

The development of ecology has been delayed for at least 50 years compared to disciplines such as embryology and genetics.

Reasons:
Underestimating the need to discover laws applicable to all living things
The degree of development and isolation of scientific knowledge
The need for broad coverage of various disciplines
Lack of real prospects for development up to the 30s of the XX century.

At the end of the XX century, the "ecologization" of science takes place

Human activity often not only harms the environment, but also affects it negatively, changing the living conditions of people, threatens the very existence of humanity.

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Ecological timeline

Aristotle

- Born in 384 and died in 372.
- He was a greek philosopher, botanist, astronomist, etc. And his most important contribution were his studies on plants: "Theory of plants" and "Treatise of the general principle of the movement in animals".

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Ecological timeline

Francis Bacon

- He was born in 1561, and died in 1626.
- Bacon was a British politician, lawyer, philosopher and writer.
- His most important contribution was the empiricism; he based knowledge through experience of the senses.

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Ecological timeline

Descartes

He was born in 1596, and died in 1650.

Descartes was a french philosopher and mathematic.

His most important contribution was the development of the scientific method.

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Ecological timeline

Carl Linnaeus

Born in 1707 and died 1778.

Was a Sweden physician , known as the father of modern taxonomy.

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Ecological timeline

Jean- Baptiste Lamarck

He was born in 1744 and died in 1829.

Was a French that studied medicine, botany and paleontology.

Was the first one to separate the classification of insects.

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Ecological timeline

Charles Darwin

Born in 1809 died in 1882.

Was an English biologist.

He proved Lamarck´s theory.

Published his book The Origin of Species.

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Ecological timeline

Ernst Haeckl

1834-1919
Nationality: German
Theory of Evolutionism
Was the first one to use the term Ecology to define relationships.

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Ecological timeline

Henry Ch. Cowles

Was born on 1869 and died on 1939.

He was an american botanist

He did research about the ecological sucession
Introduces the concept of ecological community in time and space.

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Ecological timeline

John Murray

1841-1914
Nationality: Scottish

He was an oceanographer who did "the depths of the ocean", expedition made by the british Admiralty through the Challenger, first treaties of Ecology.

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Ecological timeline

Arthur George Tansley

1871-1955

Introduces new concepts such as ecosystem

Brings plants from UK to USA and it didn't work because abiotic factors are different in every ecosystem.

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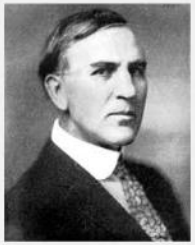
Ecological timeline

Frederic E. Clements

1874-1945



Nationality: American

"Plant sucession" is an analysis of development of vegetation; introduces the concept of community (born, reproduce and die as a whole.

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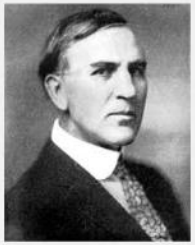
Ecological timeline

Frederic E. Clements

1874-1945



Nationality: American

"Plant sucession" is an analysis of development of vegetation; introduces the concept of community (born, reproduce and die as a whole.

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Ecological timeline

E. Birge

The term synecology.

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Ecological timeline

Raymond Lindemam

(1915-1942)

From his studies at Cedar Creek Bog in Minnesota, Lindeman designed a theoretical model of nutrient cycling expressed explicitly in terms of energy flows symbolized by mathematical equations.

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Ecological timeline

Rachel Carson

1907-1964

She wrote Silent Spring, raise awareness about the indiscriminate use of pesticides.

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Ecological timeline

Julia Carabias

1954

She is a mexican biologist born in 1954. She fight for the environmental protection and the fight against poverty.

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Ecological timeline

Eugene P. Odum

(1913-2002)

American biologist who discovered the homeostatic mechanisms of ecosystems. It is referred to as "the father of ecological ecosystem."

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Ecological timeline

Jorge Soberón Mainero

1954

Mexican biologist who promotes international cooperation programs in the areas of climate change, ozone depletion, loss of biodiversity and degradation of international waters

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