Ecology I.

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- Krebs, C. J. (2014) Ecology, The experimental Analysis of Distribution and Abundance.Harper Int. Ed.

https://archive.org/details/KrebsCharlesJ.EcologyTheExperimentalAnalysisOfDistributionAndAbundance201440mb/mode/2up

- M. Begon, J.L. Harper & C.R. Townsend (2021) Ecology, Individuals, Population and Communities. Blackwell Sci. Publ.

Topics

1. Introduction to the Science of Ecology

2. Distribution of living organisms, Factors that limit distributions

3. Populations, Population parameters, Demographic Techniques

4. Population growth

5. Evolution and Ecology

6. Species interactions: Competition, Niche

7. Species interactions: Predation, Herbivory, Mutualism, Parasitism

8. Nature of the Community: structure and change

9. Flux of Energy and Matter trough Ecological systems

10. Natural and artificial ecological systems. Biological diversity

11. Climate change and its ecological consequences

1. Introduction to the Science of Ecology

History of Ecology

Primitive tribes, for example—who depended on hunting, fishing, and food gathering—needed detailed knowledge of where and when their quarry might be found.

Ancient Greeks

Aristotle (IV. B.C): high reproductive rate of field mice could produce more mice than natural predators can reduce. Reduce of mouse plagues can be by heavy rain.

Herodotus and Plato: nature is designed to benefit and preserve each species, number of every species essentially constant, outbreak of some population might occur (punishment of evil-doers). Each species had a special place in nature, and extinction did not occur because it would disrupt this balance and harmony of nature

History of Ecology

- Graunt (1662) Father of demography. Importance of measuring in a quantitative way the birth rate, death rate, sex ratio and age structure of human populations. Concluded, that even without immigration, London could double its population in 64 years.

- Leeuwenhoek (1687) studied the reproductive rate of grain beetles, carrion flies and human lice. One pair of carrion flies could produce 746 496 flies in three months. First attempts to calculate theoretical rates of increase for an animal species

History of Ecology

Buffon (1756) Population of man and other living organism subjected to the same processes.

Great fertility of every species was counterbalanced by innumerable agents of destruction.

Plague populations of field mice checked partly by diseases and scarcity of food (biological factors) – not only the heavy rains

He dealt among the first with population regulation.

- Malthus (1798) „The numbers of organisms can increase geometrically, but their food supply may never increase faster than arithmetically.”

Reproduction is checked by food production.

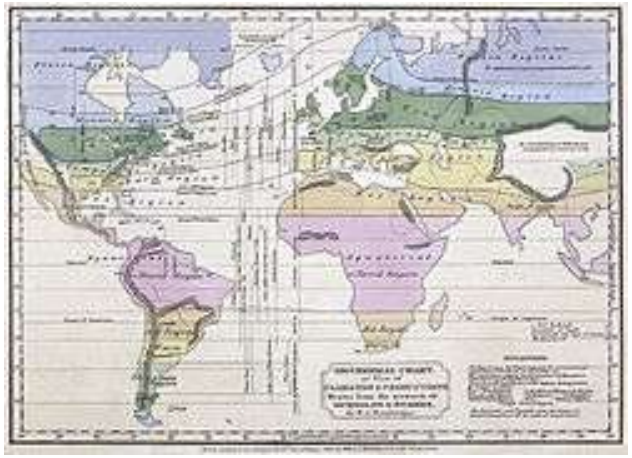
Interest in mathematical aspects of demography increased after Malthus

History of Ecology

- Möbius (1877) Biocoenosis

- Cowles (1899) Plant succession

- Humboldt (XIX century) Relation between climate and vegetation



History of Ecology

- Darwin (1859) Natural selection

Ecology, definition

The roost of ecology lie in natural history.

A word used first by Henry Thoreau (1858) without definition

Haeckel (1869) defined first: as the total relations of the animals to both its organic and inorganic environment -> Too wide definition **!**

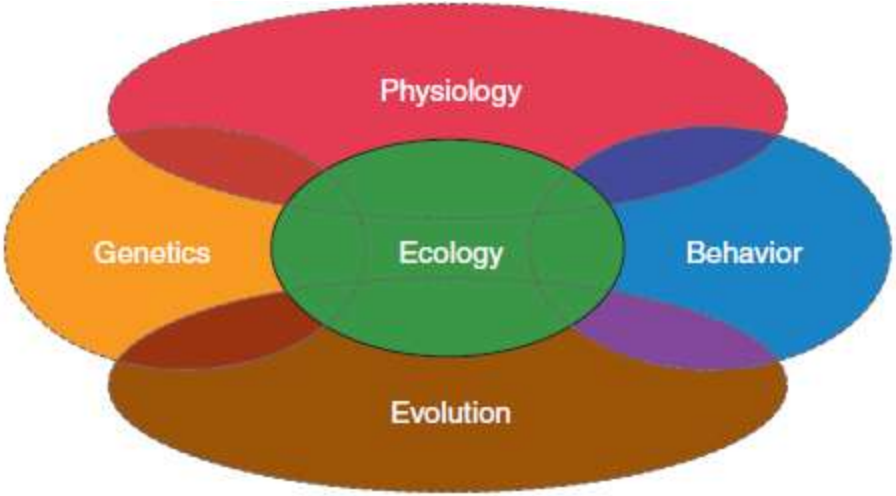
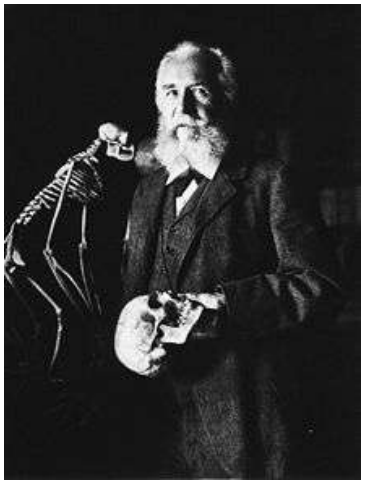


Figure 1 The four biological disciplines closely related to ecology.



Ecology - definition

Elton (1927): Scientific natural history

Odum (1963): Study of the structure and function of nature

Andrewartha (1961): Ecology is the scientific study of the distribution and abundance of organism – problem: this definition is static and leaves out the importance of relationships

Krebs (1985): Ecology is the scientific study of the interactions that determine the distribution and abundance of organism. Where organisms are found, how many occur there, and why

Hungarian approach
Juhász-Nagy Pál (1970):

Ecology:

- focusing on supraindividual levels of biological organisation
- Population is the basic unit of it

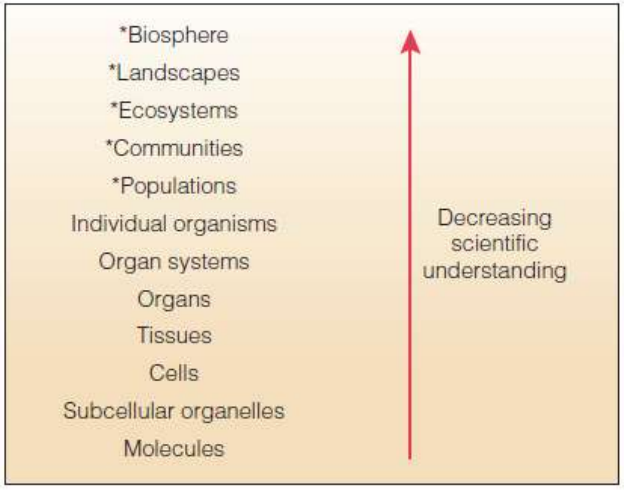
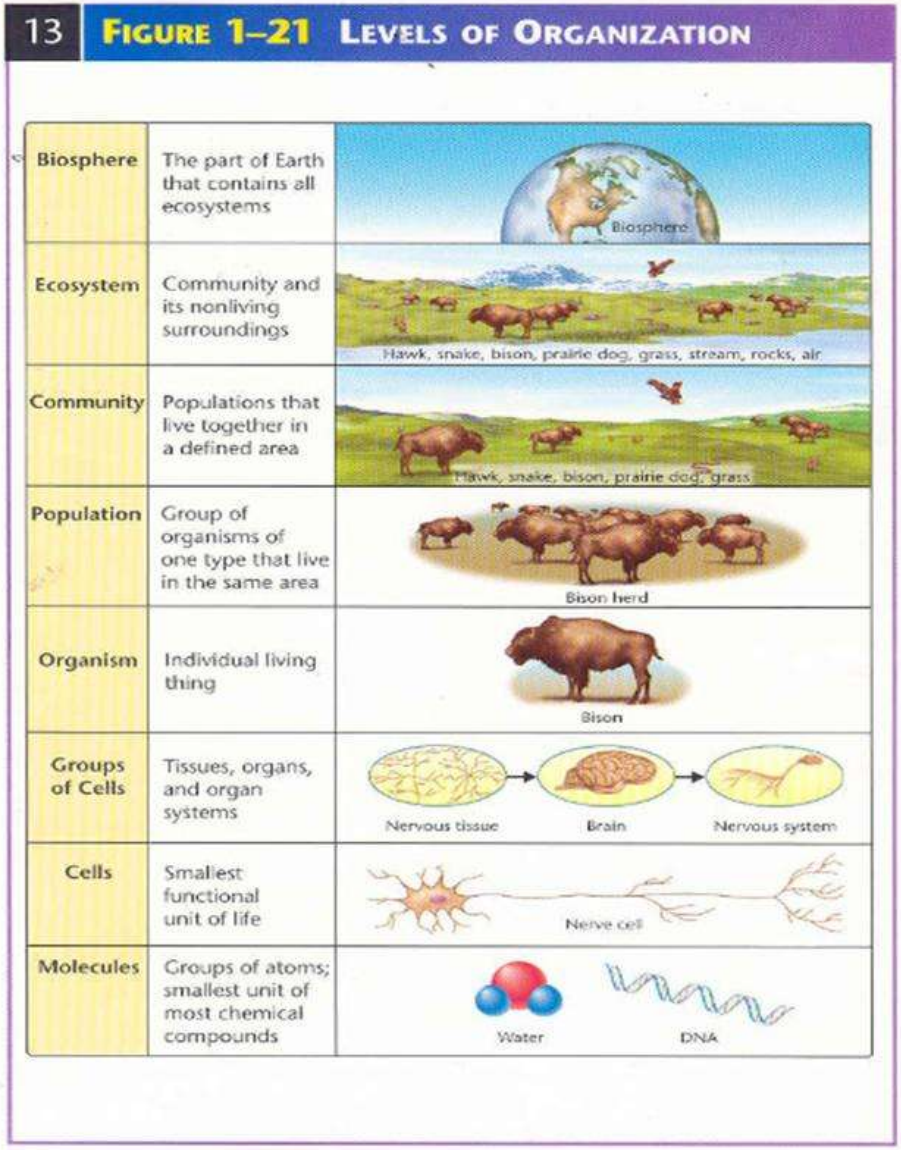


Figure 7 Levels of integration studied in biology.



Hungarian approach

Juhász-Nagy Pál (1970):

Ecology:

- focusing on supraindividual levels of

biological organisation

- Population is the basic unit of it

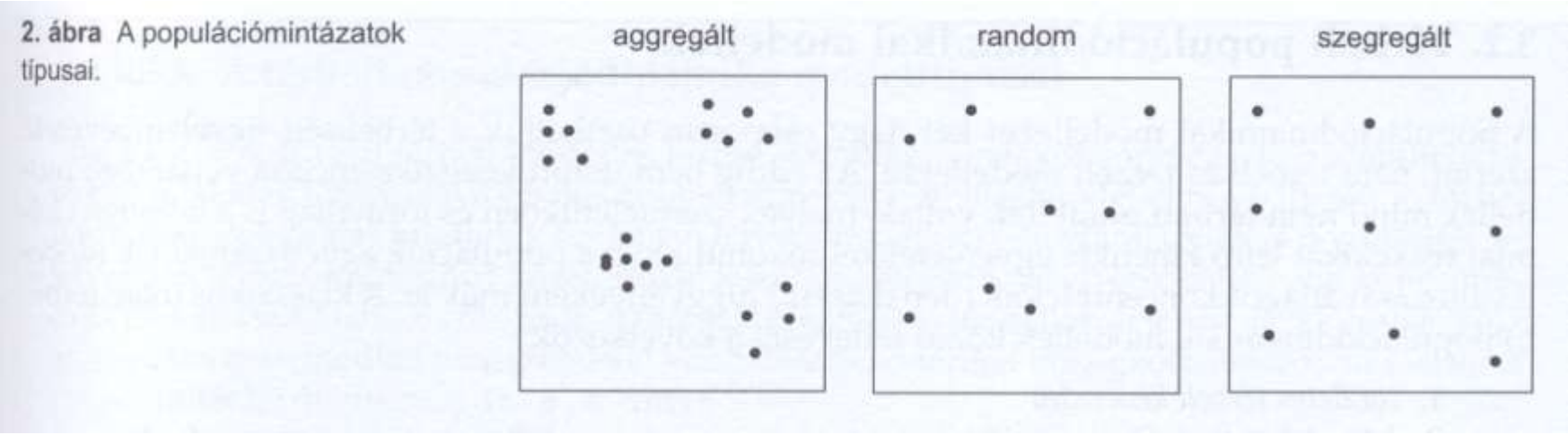
- Central (null) hypothesis (CH): Any population could find any where, any time, any quantity in the nature – occurrence in space, time and abundance is random

- Central fact: CH could be faulty
- Central problem: How the CH is faulty and Why?

Example: spatial distribution

Three basic distributions:

aggregated random segregated



In the case of non random distribution there is an chance to find factors responsible for the found pattern.

Ecological principles - Opportunities to explain difference from the random distribution

1. Indication principle

-indicators (living organisms)

-indicandum, environmental factor which ones the indicator indicates

2. Complementation principle

- Relation of exterior and interior environments – acting factors and perceptive abilities
- exterior-interior complexes, neighbourhood – living organism

-Exterior complexes, all potentially acting factors in the neighbourhood

- Miliö spectrum, potentially acting factors in the neighbourhood on the base of existing experience
- Miliő, effectively acting factors in the neighbourhood responsible for the found distribution – environment

-Interior complexes, all potentially perceptive abilities

- Tolerance spectrum, potentially perceptive abilities on the base of existing experience
- Tolerance, effectively perceptive abilities responsible for the found distribution

Ecological environment: all factors in the neighbourhood which directly and effectively act on the biological object

Neighbourhood –> topological environment

Habitat (biotope): area where the supraindividual biological object occur

3. Multiplural environmental principle

There are several ecological environments in the given topological environment in the given time

4. Limitation principle

- Environmental factors acts together, synergy, any of it which reach range of the tolerance became limiter. Liebig limitation.

  „The strength of the chain depend on the weakest chain link”

Type of ecological studies

- Descriptive

Natural history, describing populations, communities and their relationships

- Functional

Investigations of how the ecological system working. Discovering proximal processes.

- Evolutionary

Explanation of how evolution by natural selection has molded the ecological patterns we observe today. Discovering ultimal processes.

Type of ecological studies

Plant and animal ecology

Hydro and terrestrial ecology

Population and Community Ecology

Behavioural ecology

Study methods
- Field observation
- Experiment
- Modeling

Synecology – study of group of organisms

Autecology –> individuals organism –> environmental physiology

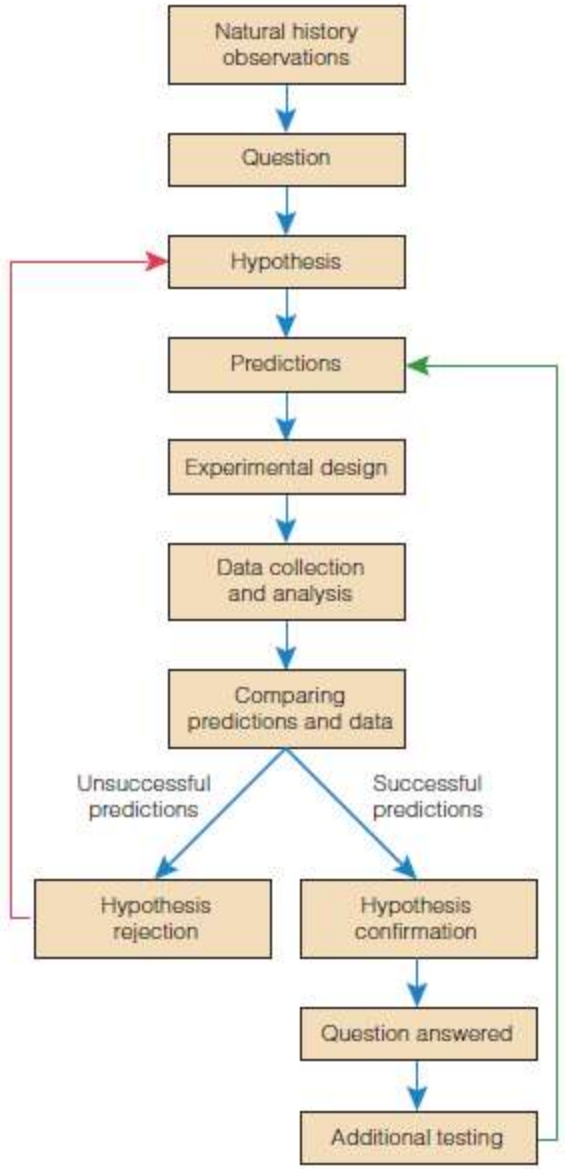


Figure 8 Schematic illustration of the scientific method as applied to ecological questions.