自然的經濟

Robert E.Ricklefs 2001 The Economy of Nature 5 th ed
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簡要大綱

歡迎到 E-study center 自然的經濟，5 th / ed 本網路為設計來促進豐富本教科書-生態觀念了解，你將發現學習的幫助，網路活動、生活照片和增加的內容。資源內容亦以各章節方式展示，為獲得此資源，請選擇以下目錄，本網路為你而設，你若有任何建議或意見，請與我們聯絡，讓我們曉得。

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刊頭語 Preface
感謝詞 Acknowledgments

Chapter1.前言

（1） 生態學可以小致有機個體大致整個生物圈 Ecological systems can be as small as individual organisms or as large as the entire biosphere
（2） 生態學家由許多不同觀點研究自然 Ecologists study nature from several different roles in ecological systems
（3） 在生態系裡植物動物和多數生物皆扮演不同角色 Plants、animals、and microorganisms play different roles in ecological systems
（4） 生育地(habitat)：有機體在自然的位置 The habitat defines an organism’s place in nature
區位（niche)：有機體在自然的功能角色 the niche defines its functional role
（5） 生態學與過程在時間空間上有其特定的尺度 All ecological systems and processes have characteristic scales in time and space

（6） 生態系由一般物理與生物原則所主宰 Ecological systems are governed by general physical and biological principles

（7） 生態系係由觀察與實驗來研究世界 Ecologists study the natural world by a combination of observation and experimentation

（8） 人類為生物圖（biosphere）特殊的部分 Human are a part of the biosphere

（9） 人類的衝擊在自然世界有增加的超現慢慢成為生態學術研究的重點 Human impacts on the natural world have increasingly become a focus of ecology

田野的生態學家對一假設（hypothesis）的實驗測驗執行的生態學家誰如何和為什麼

ECOLOGISTS IN THE FLELD

An experimental test of a hypothesis

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Who、How、and Why

PART Ⅰ Life and the physical Environment

CHAPTER 2 The Physical Environment

1 Water has many properties favorable for the maintenance of life
2 All natural waters contain dissolved substances
3. The concentration of hydrogen ions profoundly affects ecological systems
4. Carbon and oxygen are intimately involved in biological energy transformations
5. The availability of inorganic nutrients influences the abundance of life
6. Light is the primary source of energy for the biosphere
7. The thermal environment provides several avenues of heat gain and loss
8. Organisms must cope with temperature extremes
9. Organisms use many physical stimuli to sense the environment

ECOLOGISTS IN THE FLELD

Keeping cool on tropical islands

PRACTICING ECOLOGY

The Future Physical Environment

Chapter 3Adaptation to Aquatic and Terrestrial Environments

1. Availability of water depends on the physical structure of soil
2. Plants obtain water from the soil by the osmotic potential of their root cells
3. Forces generated by transpiration help to move water from roots to leaves
4. Adaptations to arid environments control loss of water from leaves
5. Plants obtain mineral nutrients from soil water
6. Photosynthesis varies with levels of light
7. Plants modify photosynthesis in environment with high water stress
8. Salt balance and water balance go hand in hand
9. Animals excrete excess nitrogen in the form of small organic molecules
10. Water conservation mechanisms are important in hot environments

11. Organisms maintain a constant internal environment
12. Large animals deliver oxygen to their tissues through circulatory systems
13. Countercurrent circulation increases transfer of heat and substances between fluids
14. Each organism functions best under a restricted range of conditions

ECOLOGISTS IN THE FLELD

Effects of patchy soil nutrients on plant growth

PRACTICING ECOLOGY

Adaptations and Conservation

Chapter 4 Variations in the Physical environment

1. Global patterns in temperature and precipitation are established by the energy of solar radiation
2. Ocean currents redistribute heat and moisture
3. Seasonal variation in climate is caused by the movement of the sun's zenith
4. Temperature and winds drive seasonal cycles in temperate lakes
5. Climate sustains irregular fluctuations
6. Topographic and geologic features cause local variation in climate
7. Climate and the underlying bedrock determine the diversification of soils

ECOLOGISTS IN THE FLELD

A half-million-year climate record

Which came first，the soil or the forest

PRACTICING ECOLOGY

Variation over Space and Time

Chapter 5 Biological communities the biome Concept

1. Climate is the major determinant of plant distribution
2. Variations in topography and soils influence local distributions of plants
3. Form and function are adapted to match the environment
4. Climate defines the boundaries of terrestrial biomes
5. Walter climate diagrams distinguish the major terrestrial biomes
6. Temperate climate zones have average temperatures between 5℃and20℃
7. Boreal and polar climate zones have average temperatures below 5℃
8. Equatorial and tropical climate zones have average temperatures exceeding 20℃
9. The biome concept must be modified for aquatic systems

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Shifting Biome Boundaries

MORE ON THE WEB

Edaphic specialization

Living together on different resources

Biomes and animal forms

Characterizing climate

PART Ⅱ Ecosystems

Chapter 6 Energy in the Ecosystem

1. Alfred J.Lotka developed the first thermodynamic concept of the ecosystem
2. Primary production is the assimilation of energy and production of organic matter by photosynthesis
3. Only 5% to 20% of energy passes between trophic levels
4. Energy moves through ecosystems at different rates
5. Ecosystem energetic summarizes the movement of energy through the ecosystem

ECOLOGISTS IN THE FLELD

Primary production can be measured by gas exchange or the growth of plants

PRACTICING ECOLOGY

How Long Are Food Chains ?

Chapter 7 Pathways of Elements in the ecosystem

1. Energy transformation and element cycling are intimately linked
2. Ecosystems may be modeled conveniently as a series of link ed compartments
3. Water provides a physical model of element cycling in the ecosystem
4. The carbon cycle is closely tied to the flux of energy through the biosphere
5. Nitrogen assumes many oxidation states in its cycling through ecosystems
6. The phosphorus cycle is uncomplicated chemically
7. Sulfur exists in many oxidized and reduced forms
8. Microorganisms assume diverse roles in element cycles

ECOLOGISTS IN THE FLELD

What caused the precipitate decline in atmospheric carbon dioxide during the Devonian?

PRACTICING ECOLOGY

Methanogenesis

CAPTER8 Nutrient Regeneration Terrestrial and Aquatic Ecosystems

1. Nutrient regeneration in terrestrial ecosystems occurs primarily in the soil
2. The quality of plant detritus influences the rate of nutrient regeneration
3. Mycorrhizae are mutualistic associations of fungi and plant roots
4. Climate affects rates of nutrient regeneration
5. In aquatic ecosystems, nutrients are regenerated slowly in deep layers of water and sediments
6. Thermal stratification binders vertical mixing in aquatic ecosystems
7. Nutrients frequently limit production in the oceans
8. Oxygen depletion facilitates regeneration of some nutrients in deep waters
9. Phosphorus concentration controls the trophic status of lakes
10. High external and internal nutrient input makes estuaries and marshes highly

productive

ECOLOGISTS IN THE FIELD

Will global warming speed decomposition of organic matter m boreal forest soils?

Can iron limit marine productivity?

PRACTICING ECOLOGY

Nutrients and Productivity near Deep

Sea Vents

CHAPTER 9 Adaptation to Life in Varying Environments

1. Adaptation results from natural selection on traits that affect evolutionary fitness
2. The phenotype is the expression of the genotype in the form and function of the individual organism has an activity space defined by conditions of the environment
3. Organisms can select microhabitats
4. Acclimation is a reversible change in structure in response to environmental change
5. Developmental responses are irreversible changes in response to persistent variation in the environment Migration, storage, and dormancy enable organisms to survive extreme conditions
6. Animals forage in a manner that maximizes their reproductive success

ECOLOGISTS IN THE FIELD

Temperature and microhabitat selection by the cactus wren

Optimal foraging by starlings

Experiments with risk-sensitive foraging

PRACTICING ECOLOGY

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Variable food supplies and risk-sensitive foraging

Optimal prey choice in the great tit

Chapter 10 Life Histories and Environment Fitness

1. Trade－offs in the allocation of resources provide a basis for understanding life histories
2. Phenotypic plasticity allows an individual to adapt to environmental change
3. Life histories vary along a slow-fast continuum
4. A life history represents the best resolution of conflicting demands on the organism Life histories balance trade-offs between current reproduction and future reproduction
5. Semelparous organisms are those that breed once and then die Senescence is a decline in physiological function with increasing age

ECOLOGISTS IN THE FIELD

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3. Populations exist in heterogeneous landscapes
4. Population size may be estimated by several techniques
5. Movement of individuals maintains the spatial coherence of populations

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2. How fast a population grows depends on its age structure
3. A life table summarizes age-specific schedules of survival and fecundity
4. The intrinsic rate of increase can be estimated from the life table
5. Population size is regulated by density-dependent factors

ECOLOGISTS IN THE FIELD
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3. Population cycles result from time delays in the response of populations to their own densities
4. Metapopulations are discrete populations linked by movements of individuals
5. Chance events may cause small populations to go extinct

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3. The Hardy-Weinberg law governs the frequencies of alleles and genotypes in large populations at equilibrium
4. Most natural populations deviate from
5. Hardy-Weinberg equilibrium
6. Natural selection may be stabilizing, directional, or disruptive
7. Evolutionary changes in allele frequencies have been documented in natural populations
8. Ecologists can draw useful conclusions from population genetics studies

ECOLOGISTS IN THE FIELD

Inbreeding depression and selective abortion in plants

Selection and change in the frequency of' melanistic moths

PRACTICING ECOLOGY

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Evolution of body size in Galapagos marine iguanas

Modeling selection against a deleterious recessive gene

Rates of evolution in populations

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Predators have adaptations for exploiting their prey

1. Prey have adaptations for escaping their predators
2. Parasites have adaptations to ensure their dispersal between hosts
3. Parasite-host systems feature adaptations for virulence and resistance
4. Plants have structural and chemical adaptations for defense against herbivores
5. Herbivores effectively control some plant populations

ECOLOGISTS IN THE FIEED

The relative sizes of mammalian predators and their prey

Predator avoidance and growth performance in frog larvae

PRACTICING ECOLOGY

The Cost of Defense

CHAPTER 18 Dynamics of Predation

1. Consumers can limit resource populations
2. Predator and prey populations often increase and decrease in regular cycles
3. Predator-prey interactions can be modeled by simple equations that exhibit cyclic dynamics
4. Modifications of the Lotka-Volterra model incorporate more complex relationships of predators and prey
6. Several factors tend to reduce oscillations in predator-prey models

7. Predator-prey systems can have more than one stable state

ECOLOGISTS IN THE FIELD

Huffaker's experiments on mite populations

Testing a prediction of the Lotka-Volterra model

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CHAPTER 19 Competition

1. Consumers compete for resources
2. Failure of species to coexist in laboratory cultures led to the competitive exclusion principle
3. The theory of competition and coexistence is an extension of logistic growth models
4. Field studies demonstrate the pervasiveness of competition in nature
5. Plant competition differs between nutrient- rich and nutrient-poor habitats
6. Competition may occur through exploitation of shared resources or direct interference
7. The outcome of competition can be influenced by predators

ECOLOGISTS IN THE FIELD

An experimental study of competition in a forest herb

Competition for space among barnacles

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Asymmetry in competition

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Living Graph: Competition and Coexistence

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3. Consumers and resources can achieve an evolutionary equilibrium
4. Competitive ability exhibits genetic variation and responds to selection
5. Traits of competing populations may diverge through character displacement

6. Mutualists have complementary functions
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2. Ecologists use several measures of community structure
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5. Feeding relationships organize communities in food webs
6. Trophic levels are influenced from above by predation and from below by production
7. Species in biological communities vary in relative abundance
8. Number of species increases with area sampled
9. Diversity indices weight species richness by relative abundance

ECOLOGISTS IN THE FIELD

How are species distributed along an ecological gradient?

Food web complexity in the rocky intertidal zone

How does nutrient addition affect trophic levels in an aquatic system?

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Plants upon Plants

The lognormal distribution

CHAPTER 22 Community Development

1. The concept of the sere includes all the stages of successional change
2. Succession results in part from changes in the environment caused by colonists
3. Early and late successional species have different adaptations
4. Some climax communities are maintained by extreme environmental conditions
5. Transient and cyclic climaxes result from variable environments and unstable successional sequences

ECOLOGISTS IM THE FIELD

How does gap size influence succession on marine hard substrates?

Old-field succession on the Piedmont of North Carolina

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Putting Succession to Work

CHAPTER 23 Biodiversity

1. Large-scale patterns of diversity reflect latitude, habitat heterogeneity, and productivity
2. Diversity has both regional and local components
3. Local communities contain a subset of the regional species pool
4. Ecological release provides evidence for local interactions
5. Diversity can be understood in terms of niche relationships
6. Equilibrium theories of diversity balance factors that add and remove species
7. Explanations for high tree species diversity in the Tropics focus on forest dynamics

ECOLOGISTS IN THE FIELD

Species sorting in wetland plant communities

Experimental manipulation of' island faunas

PRACTICING ECOLOGY

Soil Pathogen Effects on Seedling Mortality

CHAPTER 24 History and Biogeography

1. The history of life can be gauged by the geologic time scale
2. Continental drift has changed the positions of landmasses
3. Biogeographic regions reflect the long- term evolutionary isolation of large areas
4. Changes in climate have shifted the distributions of plants and animals
5. Catastrophes have caused major changes in the direction of evolution
6. Organisms in similar environments converge in form and function
7. Communities in similar environments often include different numbers of species
8. Processes on many scales regulate biodiversity

ECOLOGISTS IM THE FIELD

Species diversity in temperate deciduous forests

PRACTICING ECOLOGY

History of Diversity of North American

Herbivorous Mammals

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CHAPTER 25 Extinction and Conservation

1. Biological diversity is incompletely described and catalogued
2. The value of biodiversity arises from social, economic, and ecological considerations
3. Extinction is natural but its present rate is not

4. Humans have caused extinction by several mechanisms
5. Conservation plans for individual species must include adequate habitat for a self-sustaining population
6. Some critically endangered species have been rescued from the brink of extinction

ECOLOGISTS IN THE FIELD

Identifying critical areas for biodiversity

PRACTICING ECOLOGY

A Road Runs Throught It

CHAPTER 26 Economic Development and Global Ecology

1. Ecological processes hold the key to environmental policy
2. Human activities threaten local ecological processes
3. Toxins have accumulated in the environment
4. Atmospheric pollution threatens the environment on a global scale
5. Human ecology is the ultimate challenge

ECOLOGISTS IN THE FIELD

Assessing the earth's carrying capacity for humankind

PRACTICING ECOLOGY

Impacts of Decreasing Ozone

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