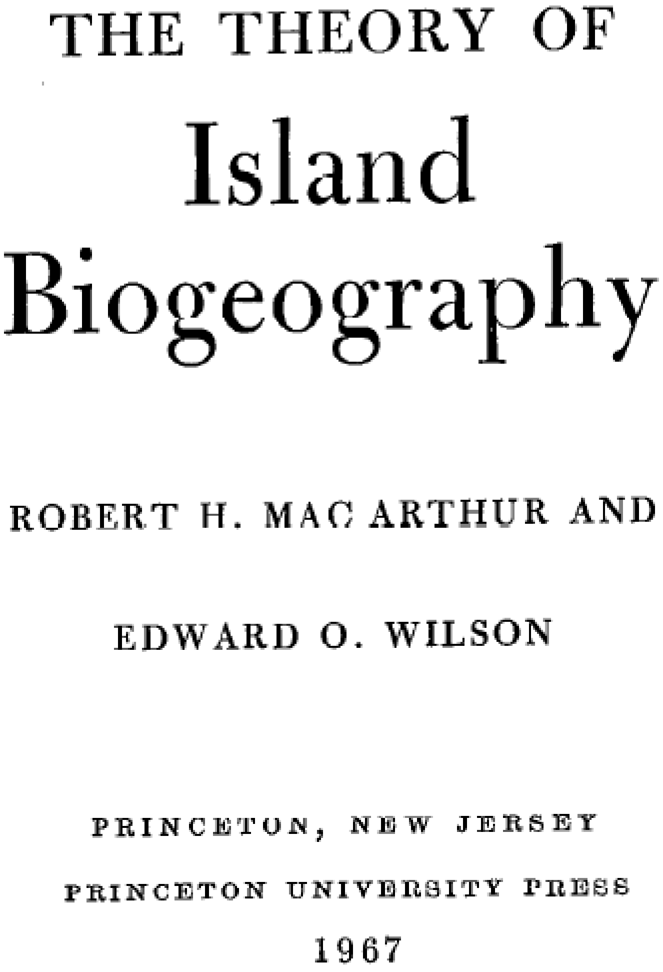
Biogeografia
(de ilhas ou não)
X
Ecologia

Uma homenagem a Robert MacArthur

What the crop is this?



THE THEORY OF

Island

Biogeography

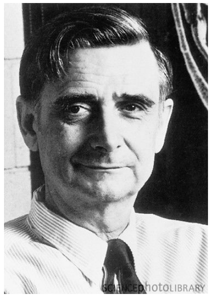
ROBERT H. MAC ARTHUR AND

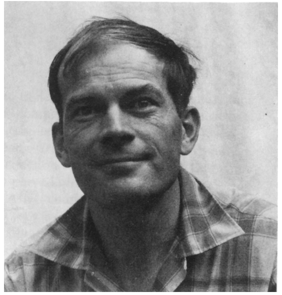
EDWARD O. WILSON

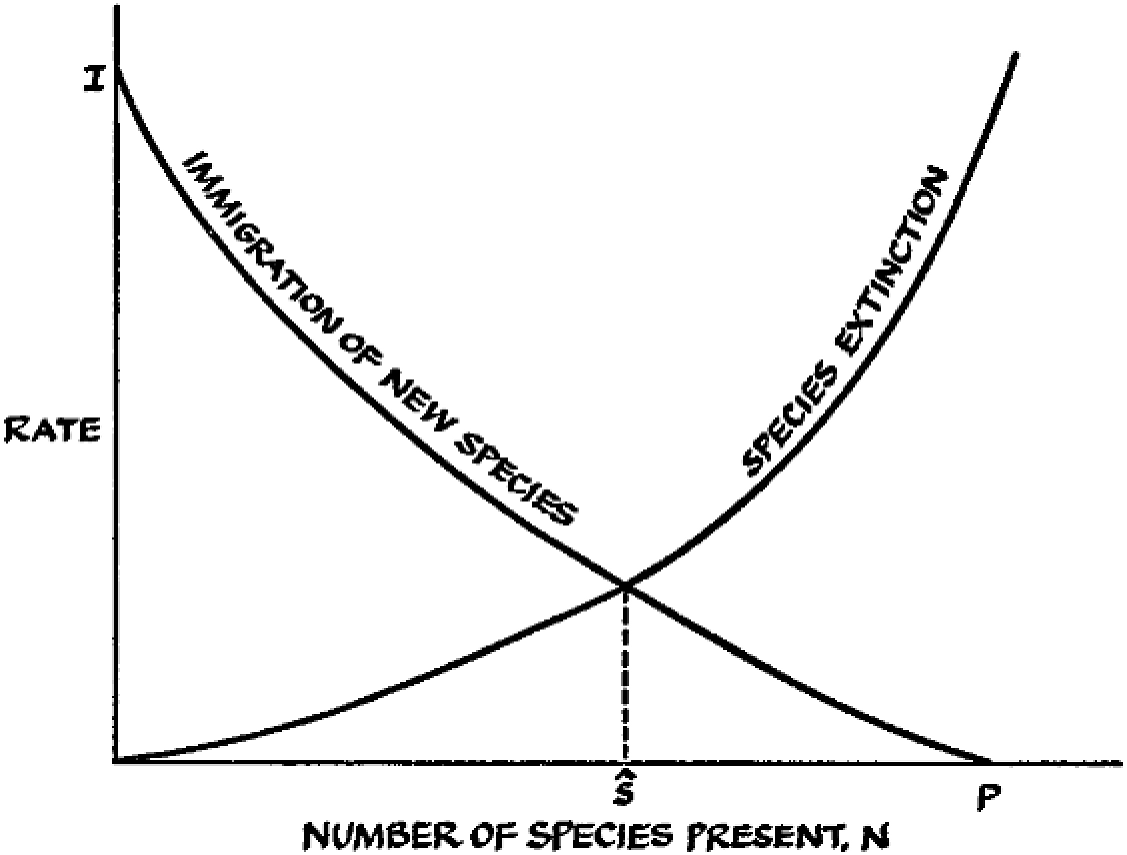
PRINCETON, NEW JERSEY

PRINCETON UNIVERSITY PRESS

1967





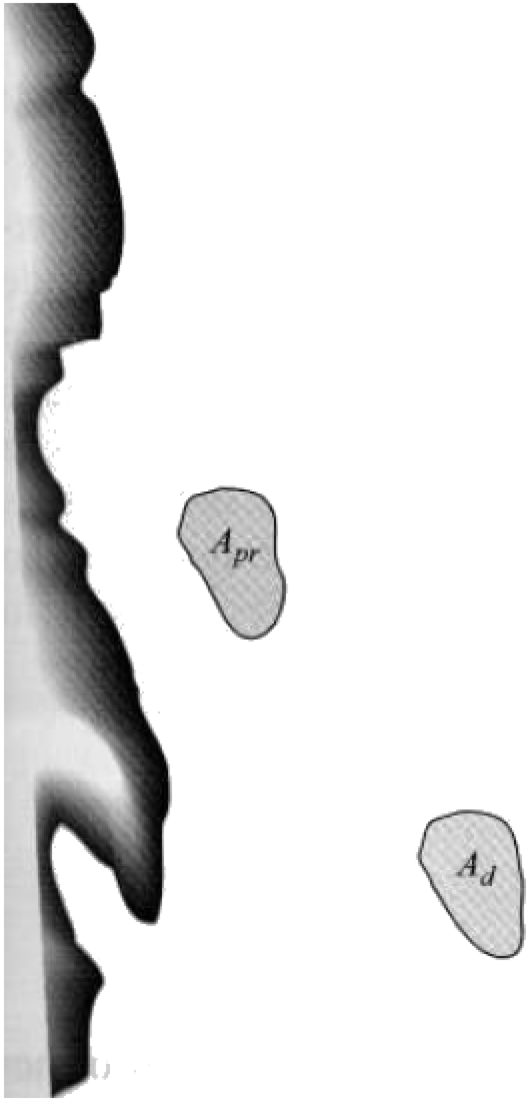

I
RATE
IMMIGRATION OF NEW SPECIES
SPECIES EXTINCTION
$\hat{S}$
P
NUMBER OF SPECIES PRESENT, N

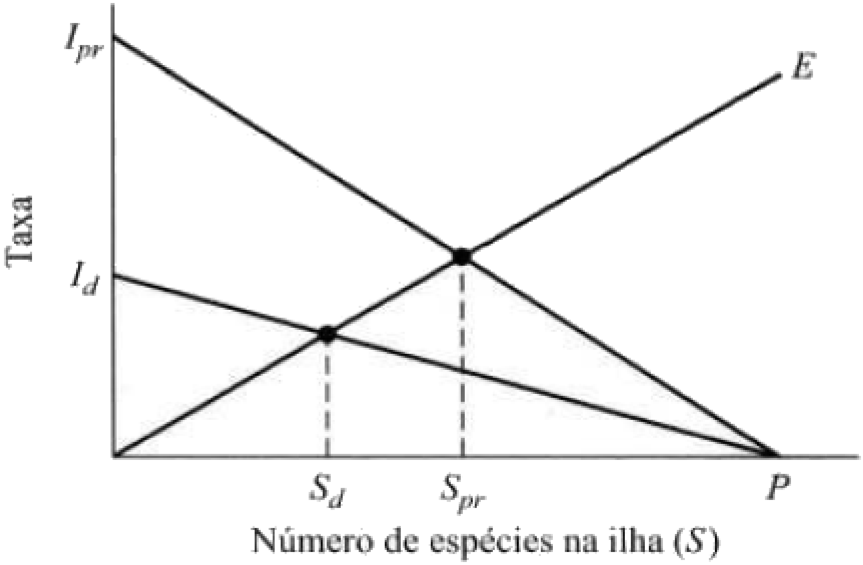
SE

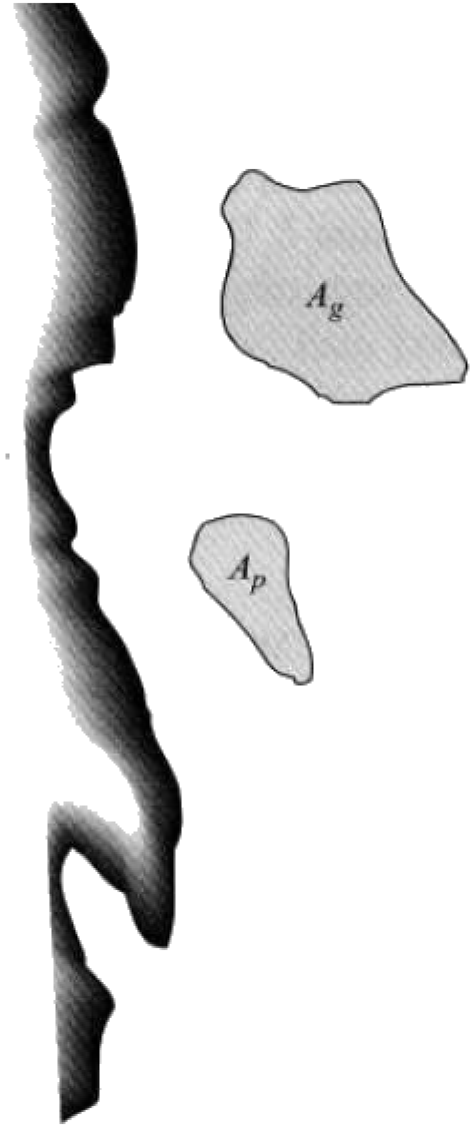
- ✓ taxas de colonização e extinção iguais para todas as espécies
- ✓ taxa colonização cai em função da riqueza na ilha
- ✓ taxa de extinção sobe em função da riqueza na ilha

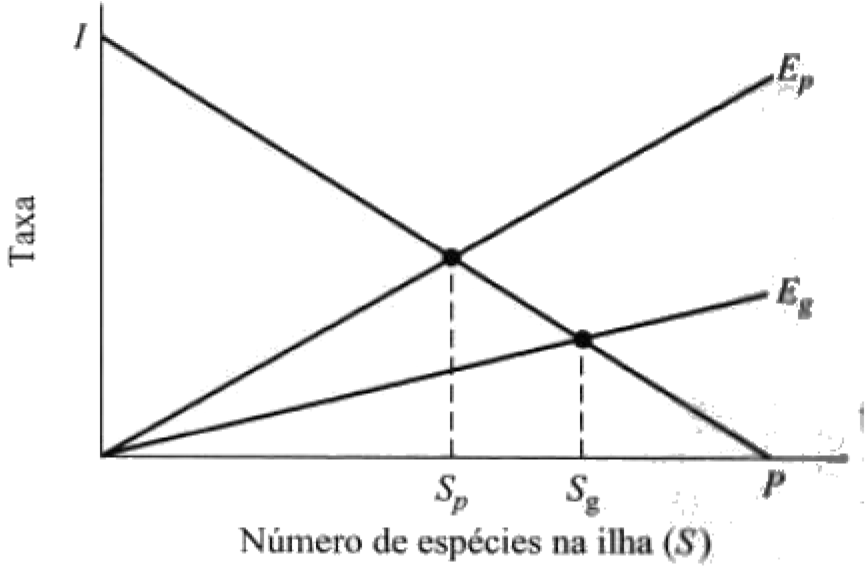
LOGO

- ✓ riqueza decorre do equilíbrio entre colonização e extinção


A_{pr}
A_d


Taxa
I_{pr}
I_d
E
S_d
S_{pr}
P
Número de espécies na ilha (S)

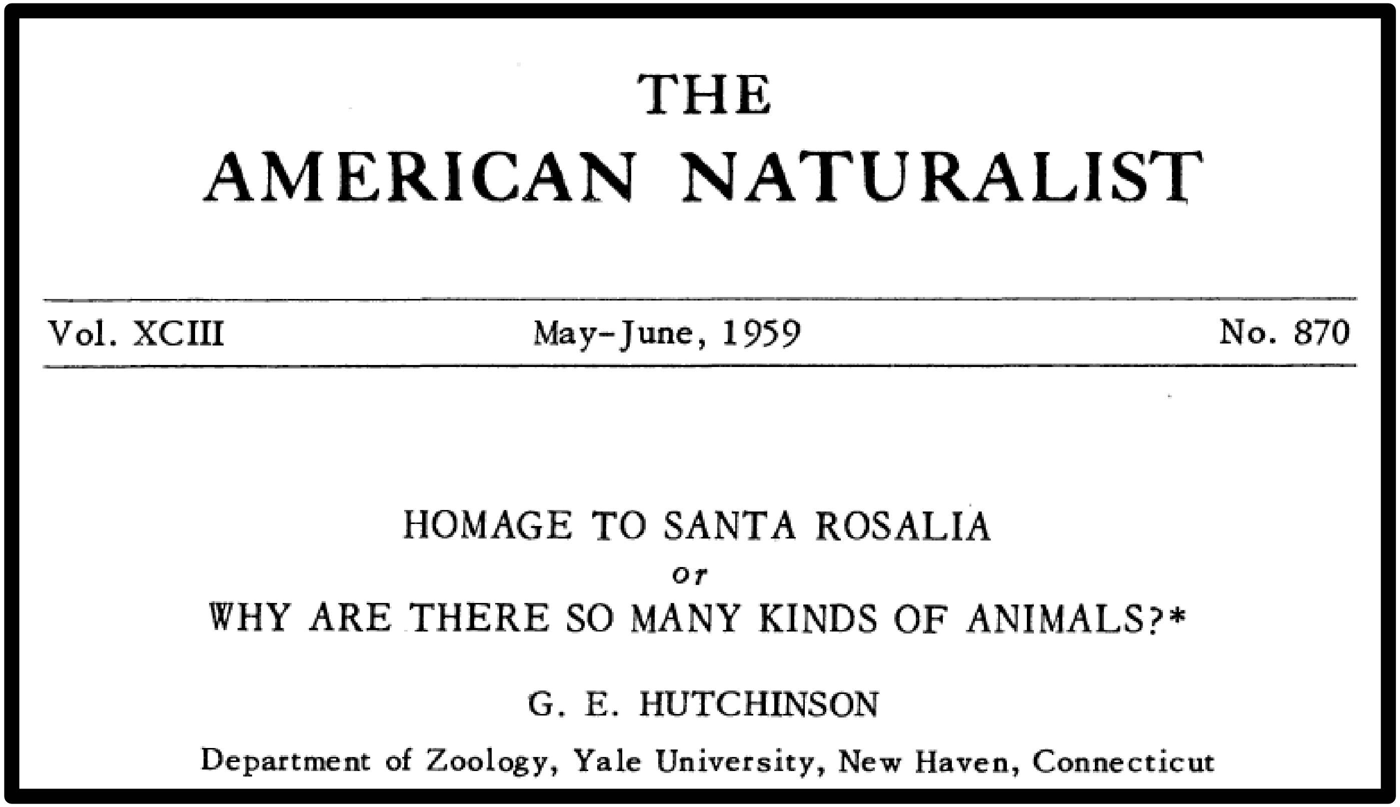

A_g
A_p


Taxa
I
E_p
E_g
S_p
S_g
P
Número de espécies na ilha (S)

Corolários da TBI

- ✓ Dinâmicas populacionais nas ilhas são irrelevantes
- ✓ Neutralidade (todas spp iguais)
- ✓ Comunidades são sistemas abertos
- ✓ Comunidades não estão saturadas de espécies

O paradigma vigente em 1967



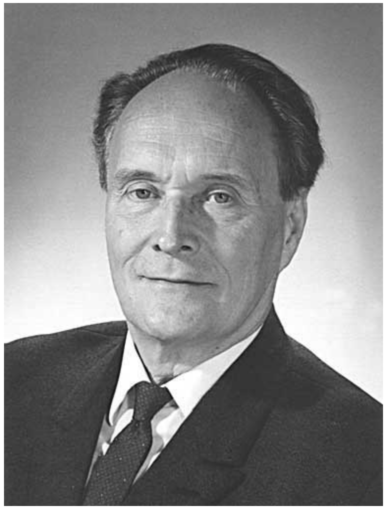
THE
AMERICAN NATURALIST

Vol. XCIII May–June, 1959 No. 870

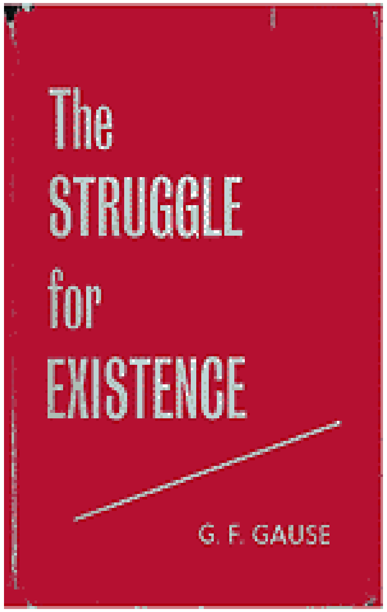
HOMAGE TO SANTA ROSALIA
or
WHY ARE THERE SO MANY KINDS OF ANIMALS?*

G. E. HUTCHINSON
Department of Zoology, Yale University, New Haven, Connecticut

George E. Hutchinson
1903-1991

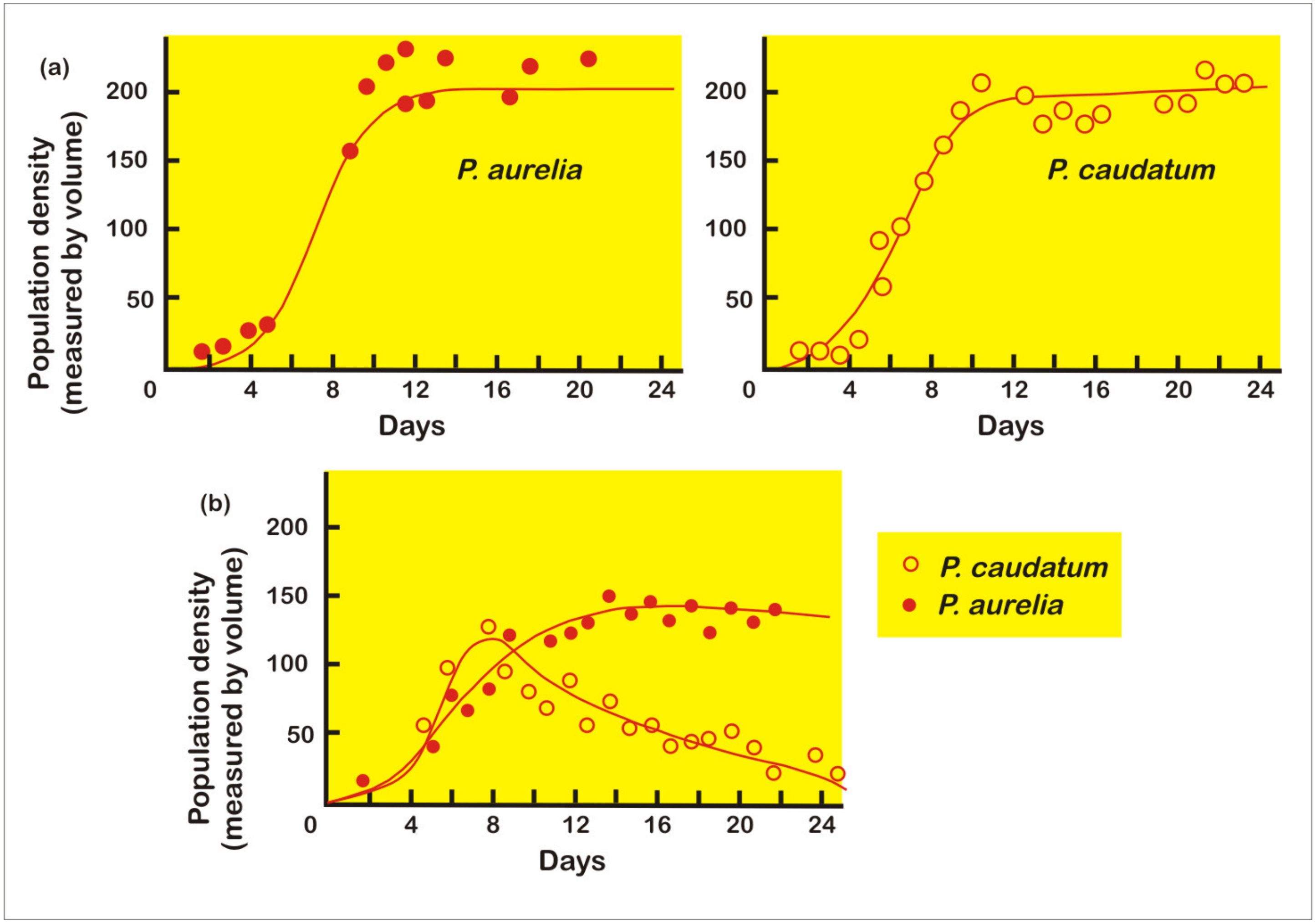


Georgyi Frantsevitch Gause (1910 - 1986)



The STRUGGLE for EXISTENCE

G. F. GAUSE



EDOs ou ODEs

$$\frac{dN_1}{dt} = r N_1 \frac{K_1 - N_1 - \alpha N_2}{K_1}$$

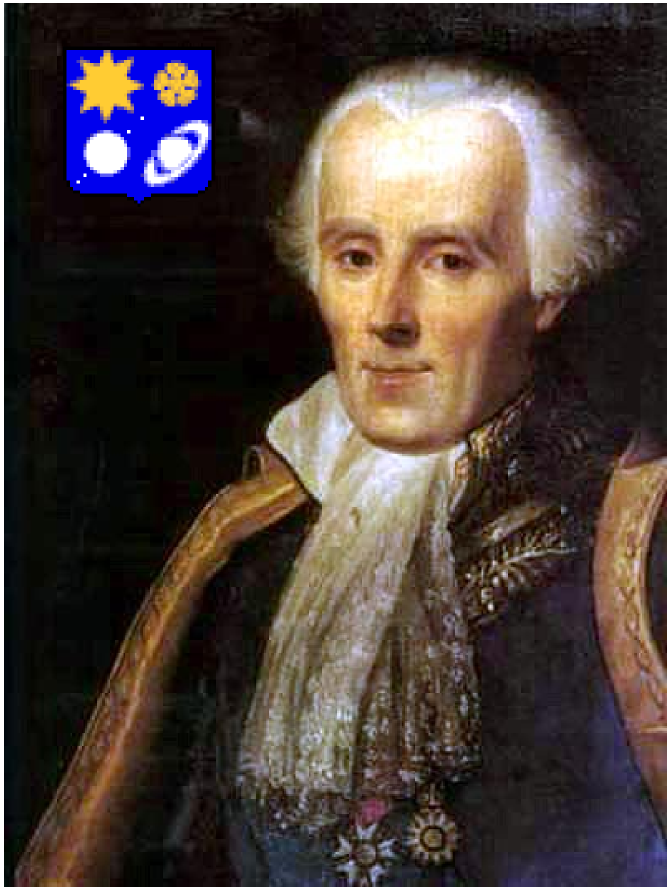
Velocidade

Lotka-Volterra generalizada

$$\frac{dN_1}{dt} = rN_1 \frac{K_1 - N_1 - \alpha_{12} N_2 - \alpha_{13} N_3 - \ldots}{K_1}$$

$$\boxed{\frac{dN_i}{dt} = rN_i \left(1 - \sum \alpha_{ij} N_j\right)}$$

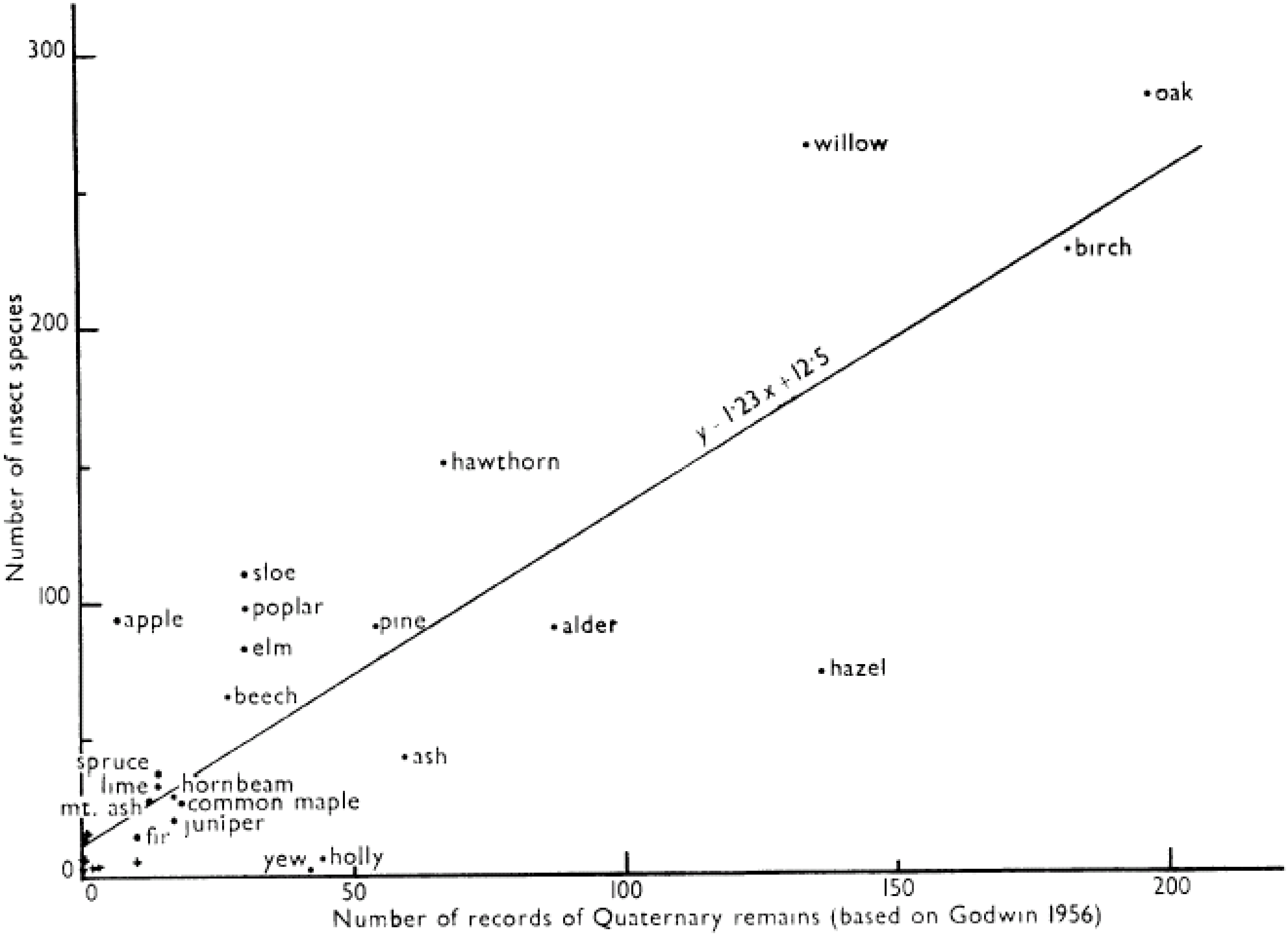
O demônio de Laplace

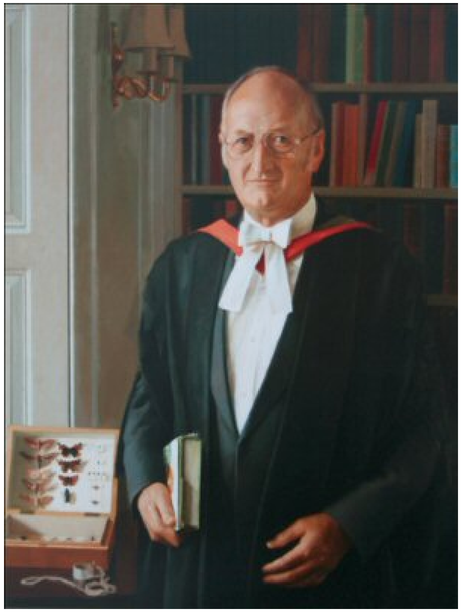


Marquês Pierre-Simon Laplace
(1749-1827)

*"Se houvesse um intelecto que num dado momento conhecesse todas as forças que colocam a natureza em movimento, e todas as posições de seus elementos, e que também fosse vasto o suficiente para submeter essses dados à análise, **ele poderia abranger numa única fórmula** os movimentos dos maiores corpos celestes e do mais ínfimo átomo, e para ele nada seria incerto, e passado e futuro seriam o mesmo que o presente a seus olhos."*

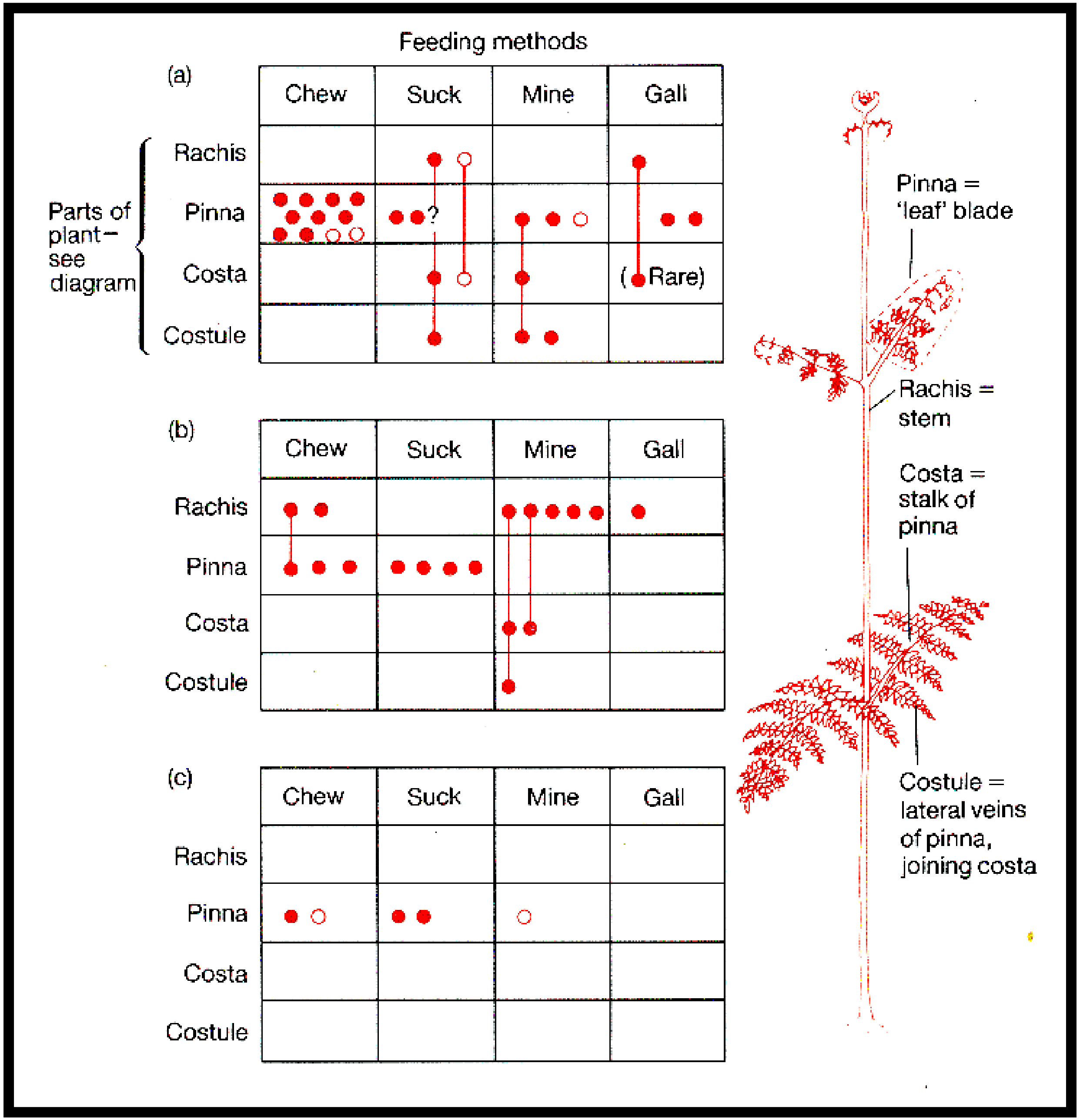
Saturação questionada

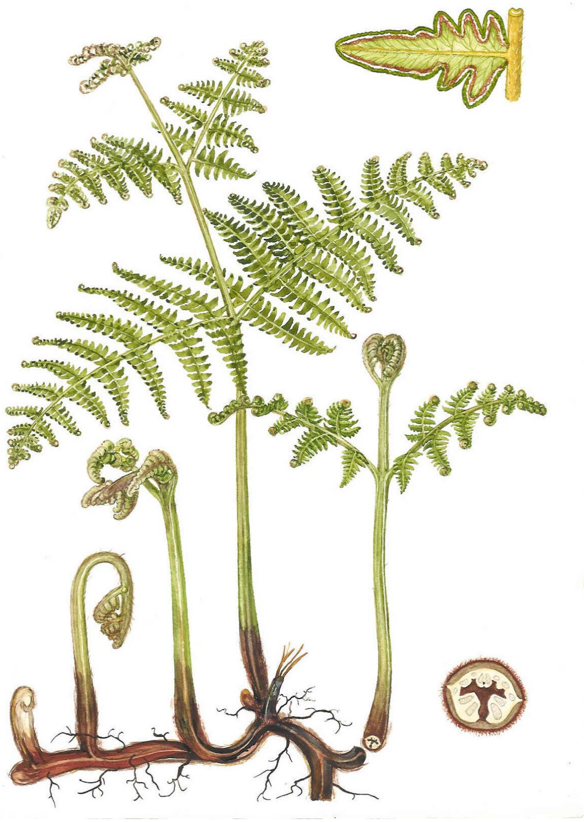




Sir T. R.Southwood, FRS
1931-2005

N de espécies de insetos herbívoros em árvores nas Ilhas Britânicas em função da frequência das espécies de árvores no registro fóssil quaternário. (Southwood 1960 J. Anim. Ecol.)

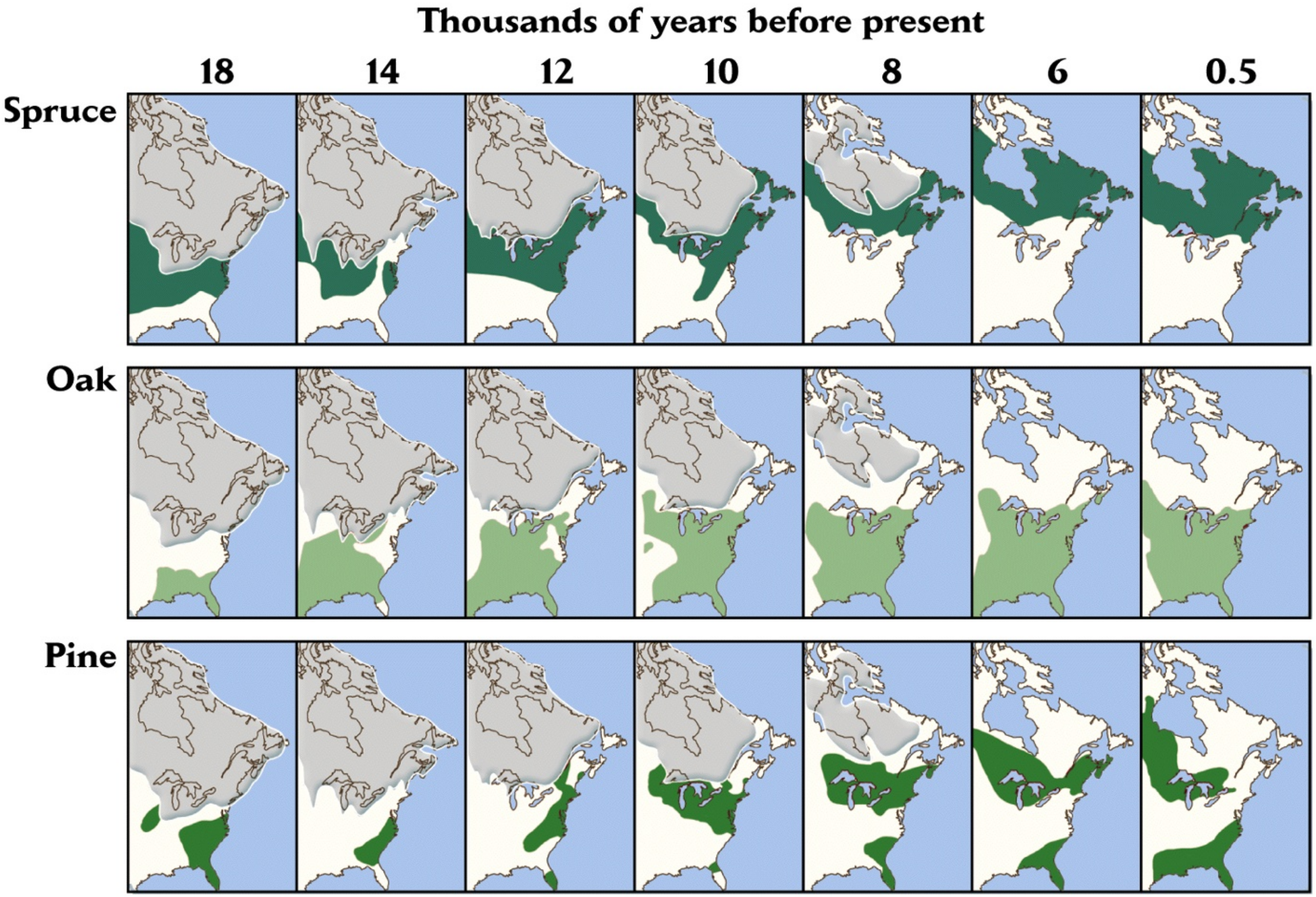

Feeding methods
(a)
Chew
Suck
Mine
Gall
Parts of plant – see diagram
Rachis
Pinna
Costa
Costule
?
(Rare)
(b)
Chew
Suck
Mine
Gall
Rachis
Pinna
Costa
Costule
(c)
Chew
Suck
Mine
Gall
Rachis
Pinna
Costa
Costule
Pinna = 'leaf' blade
Rachis = stem
Costa = stalk of pinna
Costule = lateral veins of pinna, joining costa



Pteridium anqulinum L..
Scandinavian Ferns .
Øllgaard & Tind, Rhodos, 1993

Lawton 1984 J. Anim. Ecol.

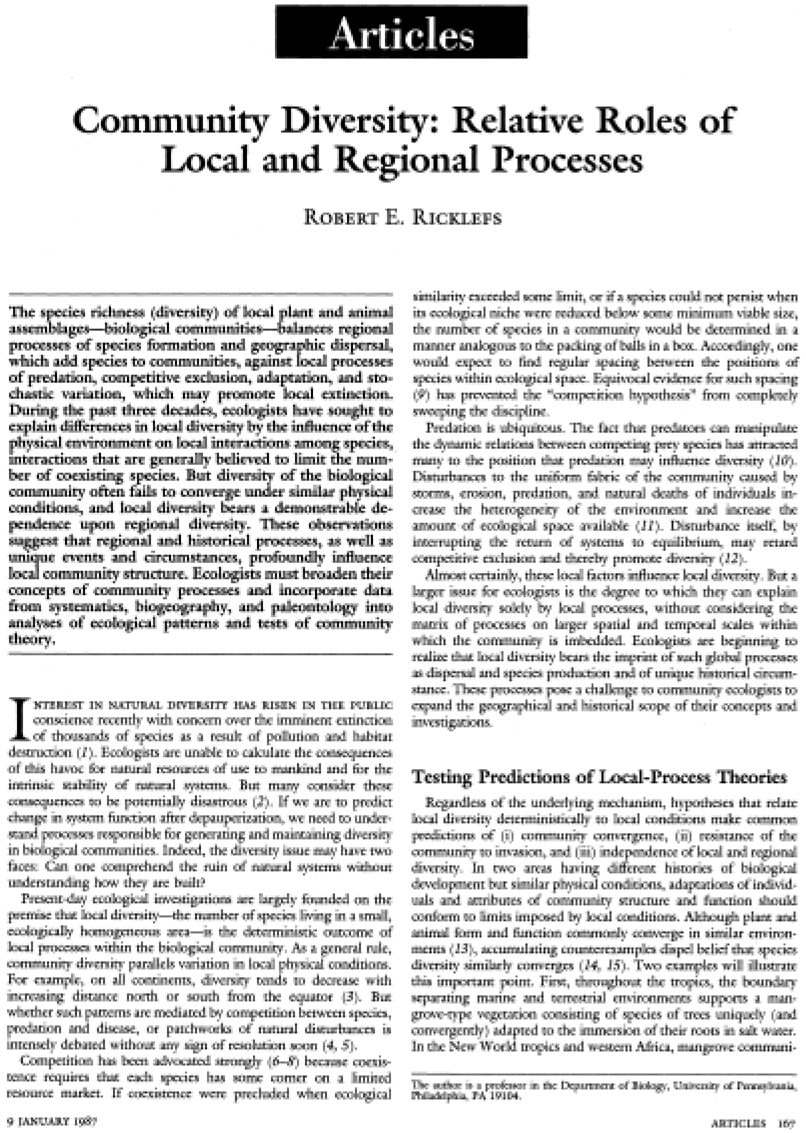
A marca da biogeografia


Thousands of years before present
18
14
12
10
8
6
0.5
Spruce
Oak
Pine

Distribuição geográfica de três espécies de árvores na costa leste da América do Norte, nos últimos
18 mil anos.

Jacobson et al. 1987, apud Ricklefs 2003.

O eclipse da história*



Articles

Community Diversity: Relative Roles of Local and Regional Processes

Robert E. Ricklefs

The species richness (diversity) of local plant and animal assemblages—biological communities—balances regional processes of species formation and geographic dispersal, which add species to communities, against local processes of predation, competitive exclusion, adaptation, and stochastic variation, which may promote local extinction. During the past three decades, ecologists have sought to explain differences in local diversity by the influence of the physical environment on local interactions among species, interactions that are generally believed to limit the number of coexisting species. But diversity of the biological community often fails to converge under similar physical conditions, and local diversity bears a demonstrable dependence upon regional diversity. These observations suggest that regional and historical processes, as well as unique events and circumstances, profoundly influence local community structure. Ecologists must broaden their concepts of community processes and incorporate data from systematics, biogeography, and paleontology into analyses of ecological patterns and tests of community theory.

INTEREST IN NATURAL DIVERSITY HAS RISEN IN THE PUBLIC conscience recently with concern over the imminent extinction of thousands of species as a result of pollution and habitat destruction (*1*). Ecologists are unable to calculate the consequences of this havoc for natural resources of use to mankind and for the intrinsic stability of natural systems. But many consider these consequences to be potentially disastrous (*2*). If we are to predict change in system function after depauperization, we need to understand processes responsible for generating and maintaining diversity in biological communities. Indeed, the diversity issue may have two faces: Can one comprehend the ruin of natural systems without understanding how they are built?

Present-day ecological investigations are largely founded on the premise that local diversity—the number of species living in a small, ecologically homogeneous area—is the deterministic outcome of local processes within the biological community. As a general rule, community diversity parallels variation in local physical conditions. For example, on all continents, diversity tends to decrease with increasing distance north or south from the equator (*3*). But whether such patterns are mediated by competition between species, predation and disease, or patchworks of natural disturbances is intensely debated without any sign of resolution soon (*4*, *5*).

Competition has been advocated strongly (*6*–*8*) because coexistence requires that each species has some corner on a limited resource market. If coexistence were precluded when ecological similarity exceeded some limit, or if a species could not persist when its ecological niche were reduced below some minimum viable size, the number of species in a community would be determined in a manner analogous to the packing of balls in a box. Accordingly, one would expect to find regular spacing between the positions of species within ecological space. Equivocal evidence for such spacing (*9*) has prevented the "competition hypothesis" from completely sweeping the discipline.

Predation is ubiquitous. The fact that predators can manipulate the dynamic relations between competing prey species has attracted many to the position that predation may influence diversity (*10*). Disturbances to the uniform fabric of the community caused by storms, erosion, predation, and natural deaths of individuals increase the heterogeneity of the environment and increase the amount of ecological space available (*11*). Disturbance itself, by interrupting the return of systems to equilibrium, may retard competitive exclusion and thereby promote diversity (*12*).

Almost certainly, these local factors influence local diversity. But a larger issue for ecologists is the degree to which they can explain local diversity solely by local processes, without considering the matrix of processes on larger spatial and temporal scales within which the community is imbedded. Ecologists are beginning to realize that local diversity bears the imprint of such global processes as dispersal and species production and of unique historical circumstance. These processes pose a challenge to community ecologists to expand the geographical and historical scope of their concepts and investigations.

Testing Predictions of Local-Process Theories

Regardless of the underlying mechanism, hypotheses that relate local diversity deterministically to local conditions make common predictions of (i) community convergence, (ii) resistance of the community to invasion, and (iii) independence of local and regional diversity. In two areas having different histories of biological development but similar physical conditions, adaptations of individuals and attributes of community structure and function should conform to limits imposed by local conditions. Although plant and animal form and function commonly converge in similar environments (*13*), accumulating counterexamples dispel belief that species diversity similarly converges (*14*, *15*). Two examples will illustrate this important point. First, throughout the tropics, the boundary separating marine and terrestrial environments supports a mangrove-type vegetation consisting of species of trees uniquely (and convergently) adapted to the immersion of their roots in salt water. In the New World tropics and western Africa, mangrove communi-

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The author is a professor in the Department of Biology, University of Pennsylvania, Philadelphia, PA 19104.

9 JANUARY 1987

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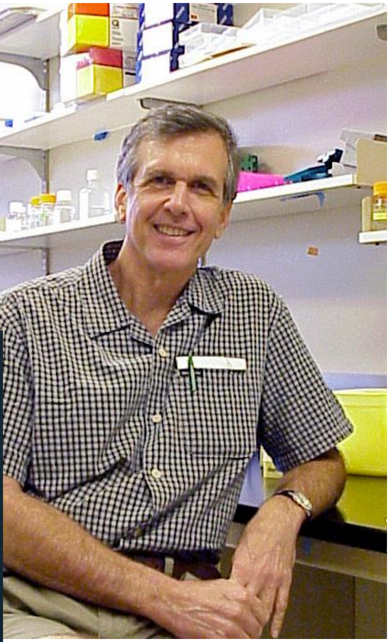
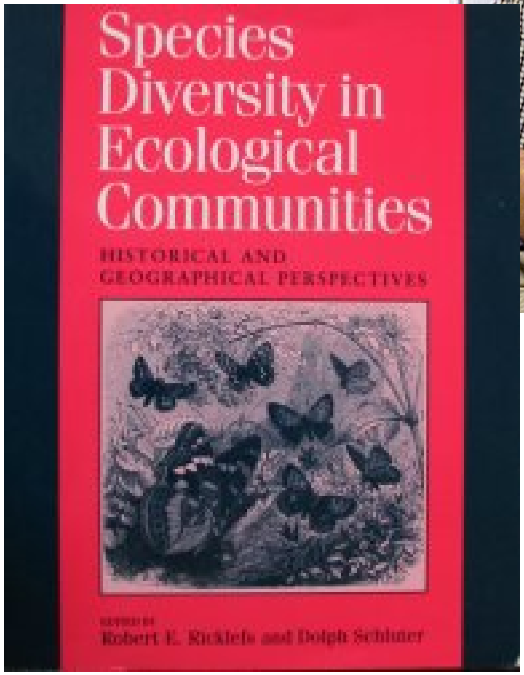
Science, 1987

Robert Ricklefs

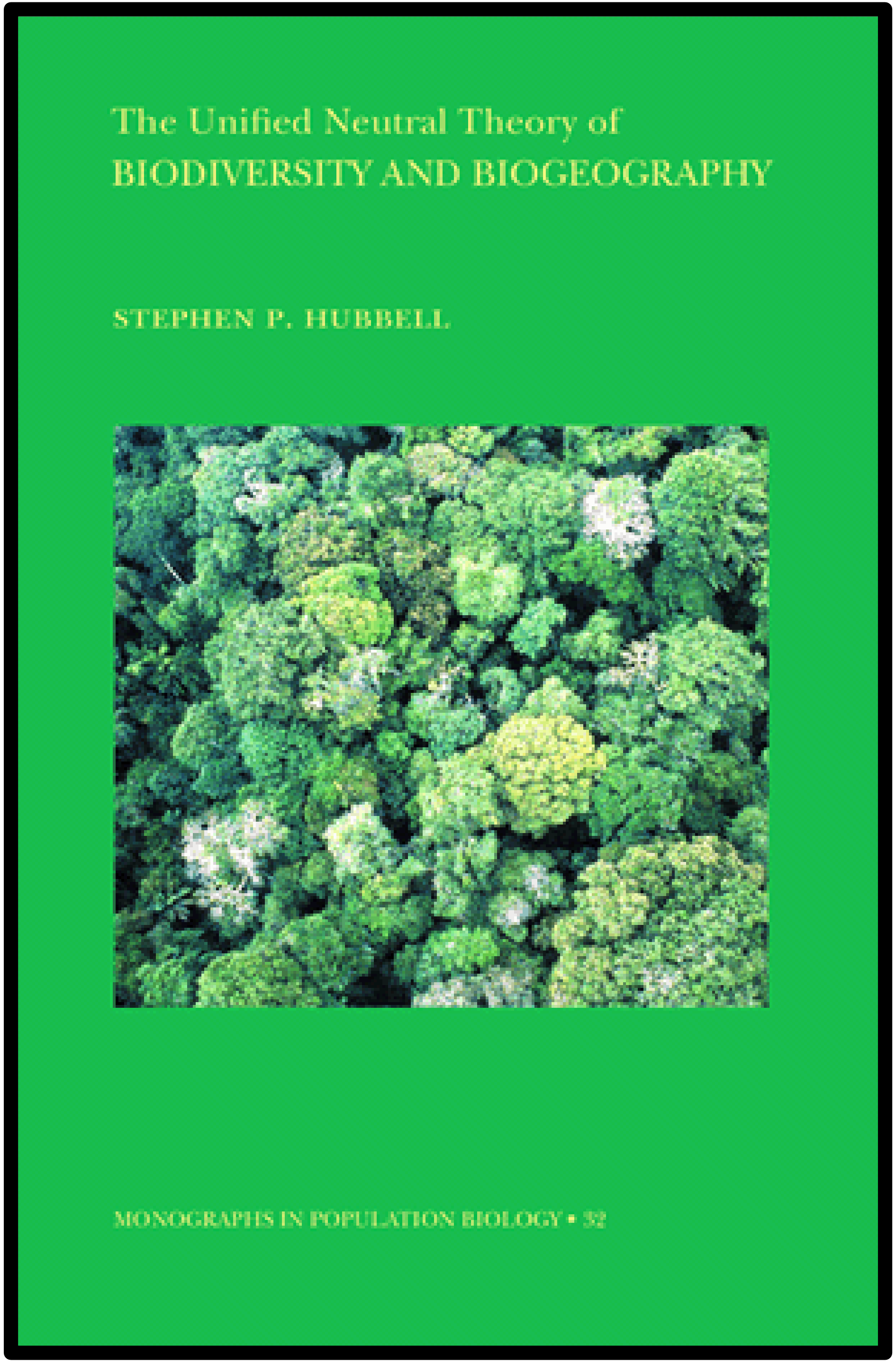



Species Diversity in Ecological Communities
HISTORICAL AND GEOGRAPHICAL PERSPECTIVES
EDITED BY
Robert E. Ricklefs and Dolph Schluter

1993

* Expressão de Kingsland, 1986

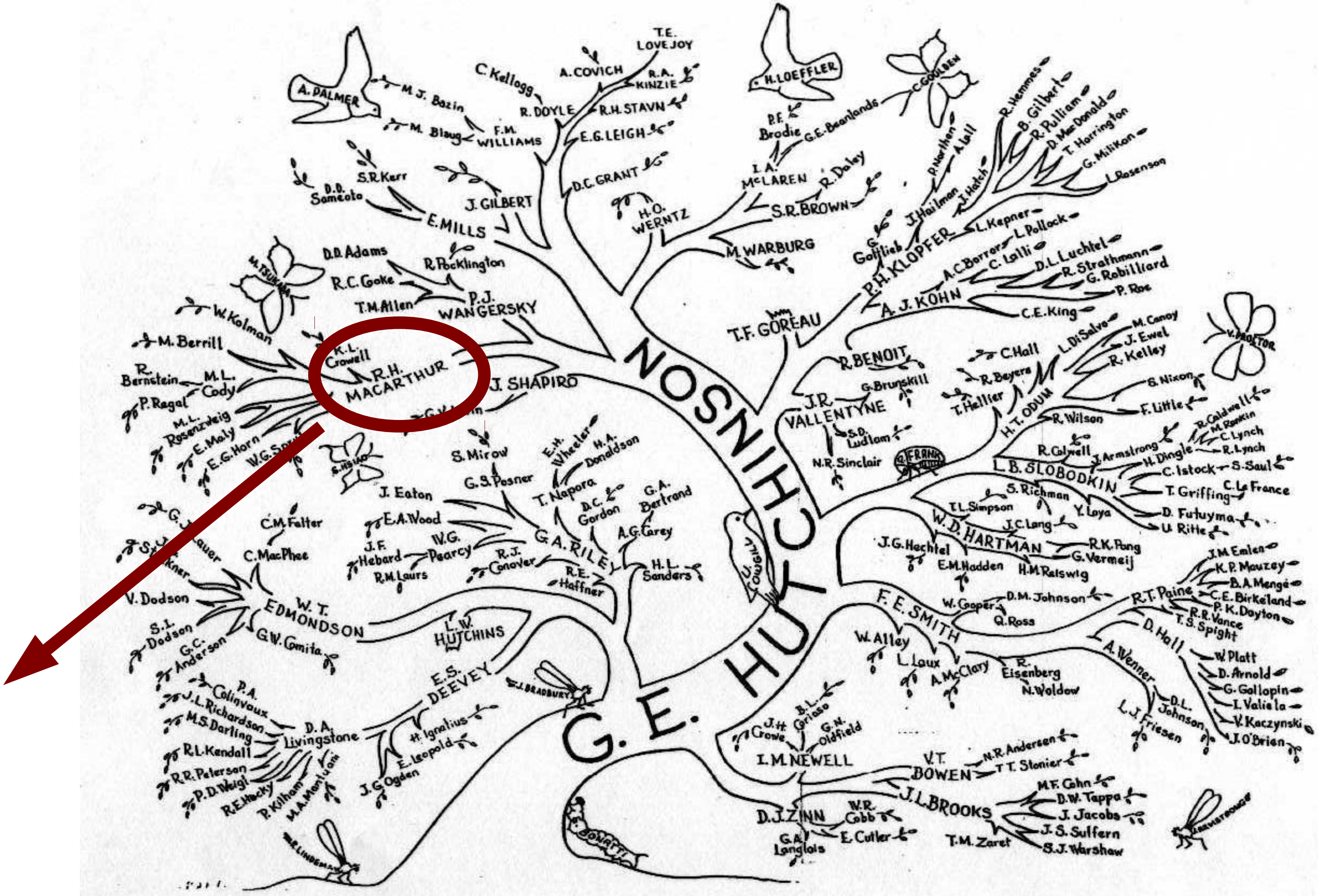
Teoria Neutra



The Unified Neutral Theory of
BIODIVERSITY AND BIOGEOGRAPHY

STEPHEN P. HUBBELL

MONOGRAPHS IN POPULATION BIOLOGY • 32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C. Lynch
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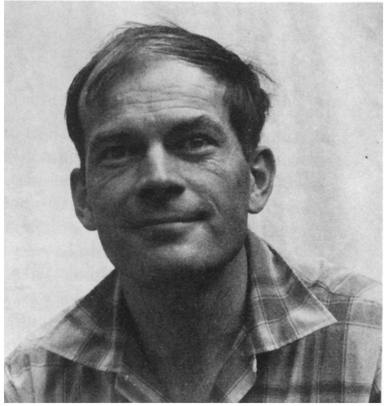
C. Istock
S. Saul
S. Richman
T.L. Simpson
J.C. Lang
Y. Loya
T. Griffing
C. LeFrance
D. Futuyma
U. Ritte
D.M. Johnson
W. Cooper
Q. Ross
C.J. Cowgill

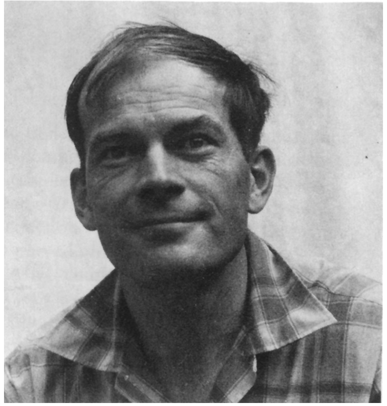
FIG. 9. Phylogenetic tree of intellectual descendants of G. E. Hutchinson, restricted to those possessing doctoral degrees. Main branches and capitalized names represent Hutchinson's own doctoral students. Secondary branches and twigs with lower-case names indicate second- and third-generation students. Terminal leaves indicate completed degrees, their absence means Ph.D. expected in 1971.

The attendant fauna represent people who have done postdoctoral work with Hutchinson; their particular character and disposition were dictated by aesthetic considerations alone.



Robert MacArthur
1930-1972

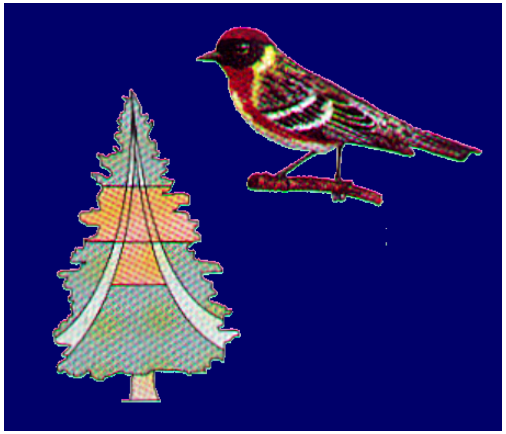
Kohn 1971. Limnology and Oceanography, Vol. 16

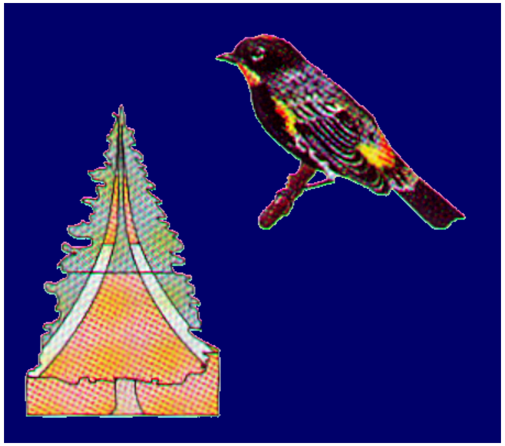


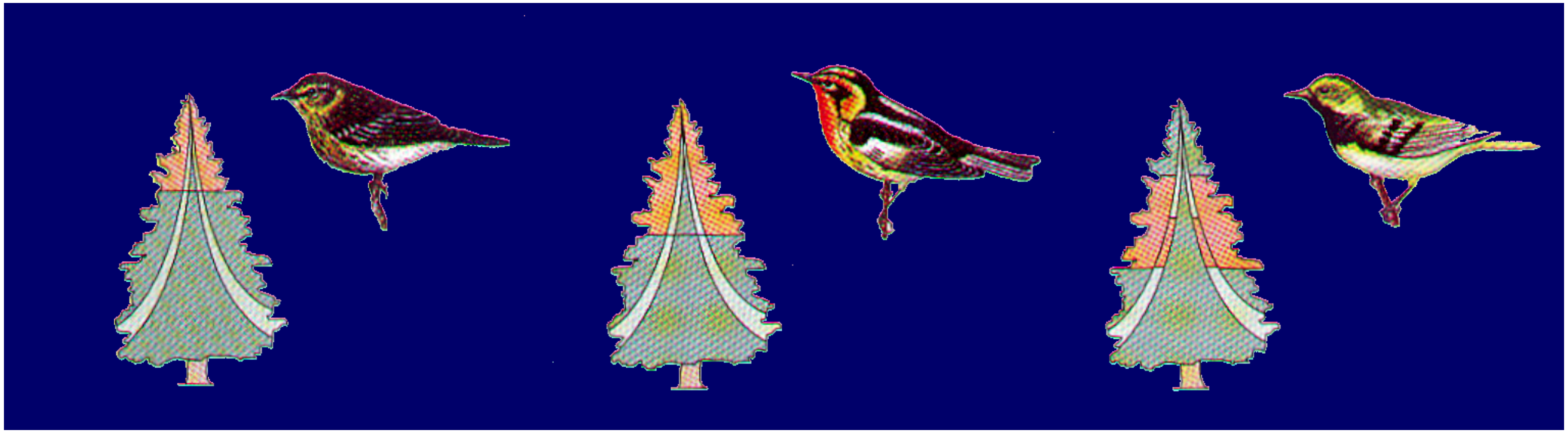
Robert MacArthur

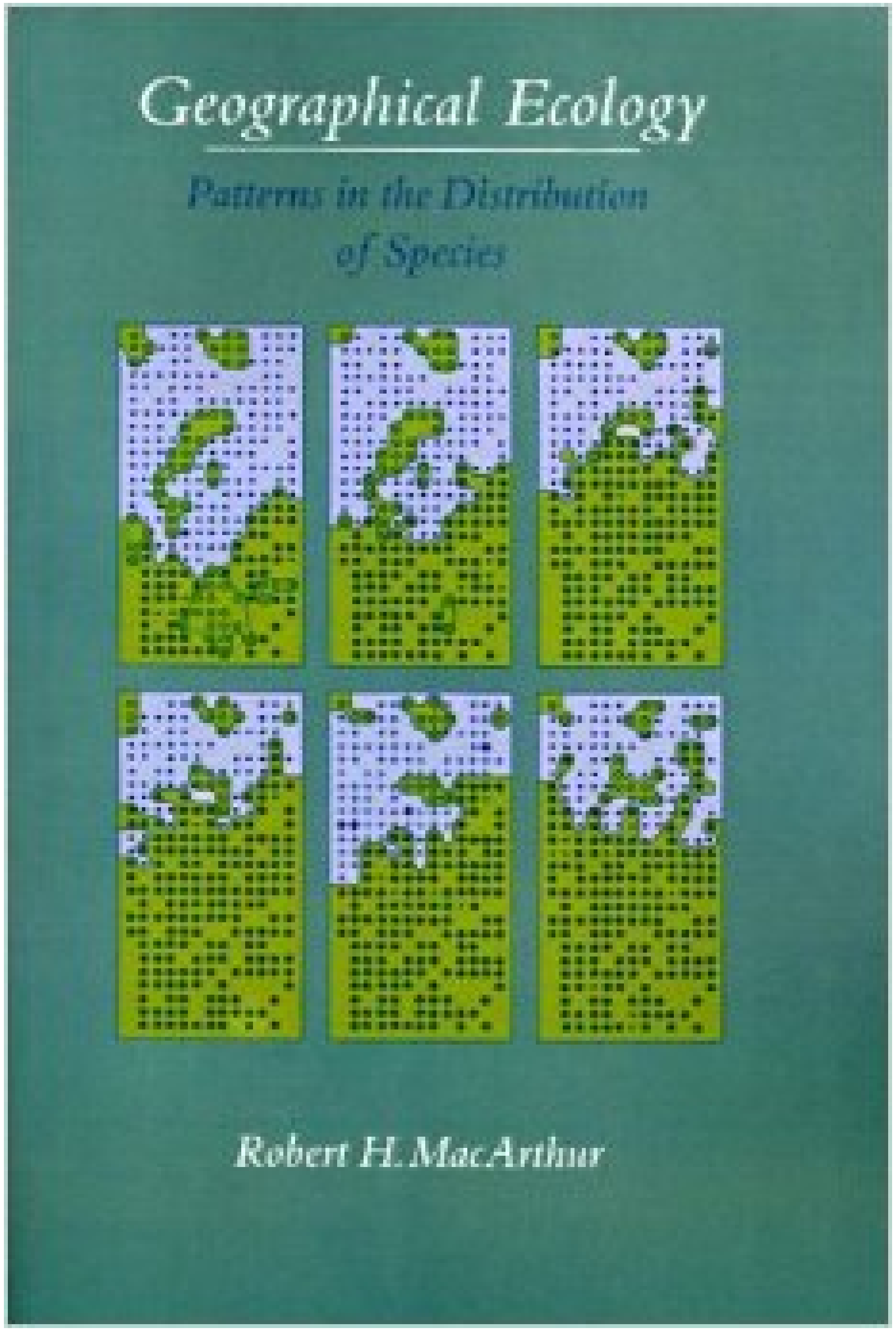
(1930 - 1972)

Robert MacArthur
1930-1972







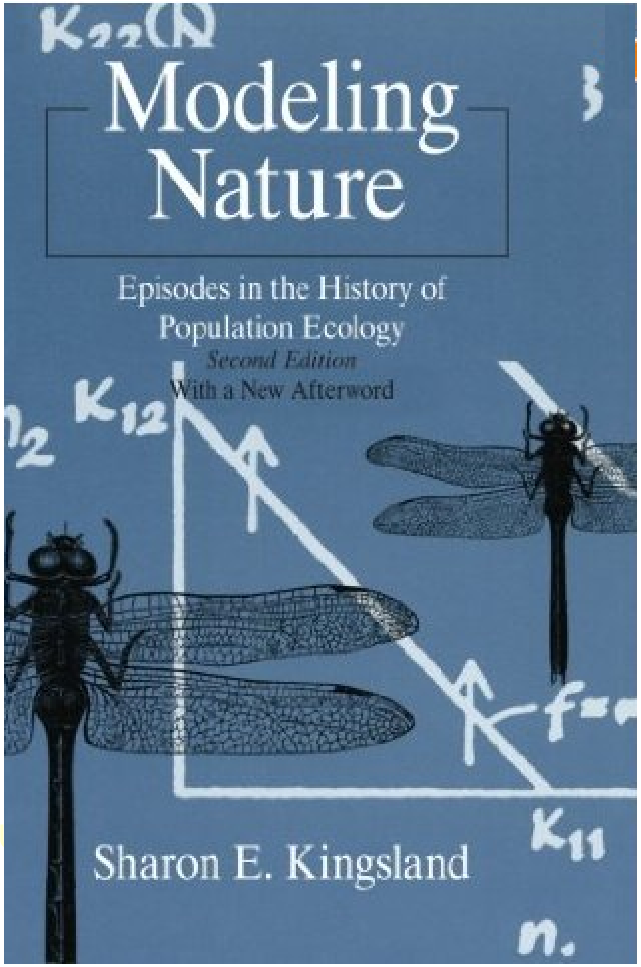

Geographical Ecology
Patterns in the Distribution of Species
Robert H. MacArthur

"As time passed MacArthur spoke of himself increasingly as a biogeographer and made the subject the focus of his teaching at Princeton. In 1971, when he learned he had only a year or two left to live, he quickly brought the many threads of his work together in the single book, Geographical Ecology: Patterns in the Distribution of Species. "

Obituário, por E.O. Wilson & G.E. Hutchinson

Chigago

1



Modeling Nature

Episodes in the History of Population Ecology

Second Edition

With a New Afterword

Sharon E. Kingsland