

# L2 Roadmap

## What is Ecology?

### 1) Ecology's Roots

- *Kingsland: Defining ecology as a science*

### 2) Major Areas of Inquiry

### 3) *Friday*: Ecological Approaches and Tools

# Community Ecology

**Community:** a group of species that occur together in space and time (Begon et al. 2006)

Community Ecology: focuses on understanding Earth's biodiversity, including the generation, maintenance, and distribution of the diversity of life in space and time

*“Species interact with their environment and with one another... these interactions underlie the processes that determine biodiversity. Yet, unlike interacting particles studied by physicists, species also change through time – they evolve. This continual change makes the study of interacting species perhaps even more challenging than the study of interacting particles”*  
-Mittelbach 2012, Community Ecology

*“The community is... the hierarchical level where the basic characteristics of life – its diversity, complexity and historical nature – are perhaps most daunting and challenging.”*

– Michel Loreau 2010



# Sharon Kingsland

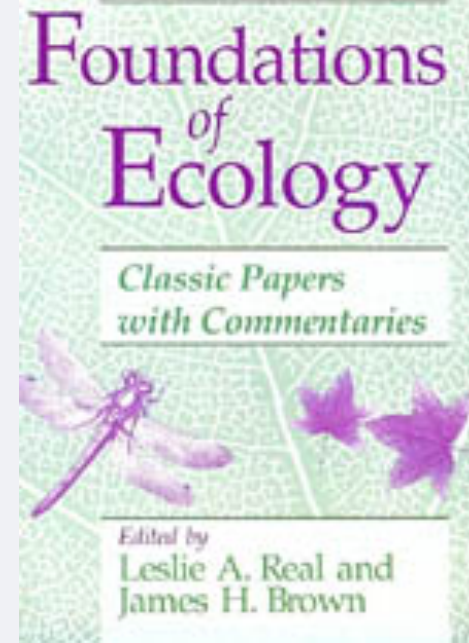
Johns Hopkins, Dept. of History of Science and Technology

*Defining ecology as a science.*

*Reading Questions:*

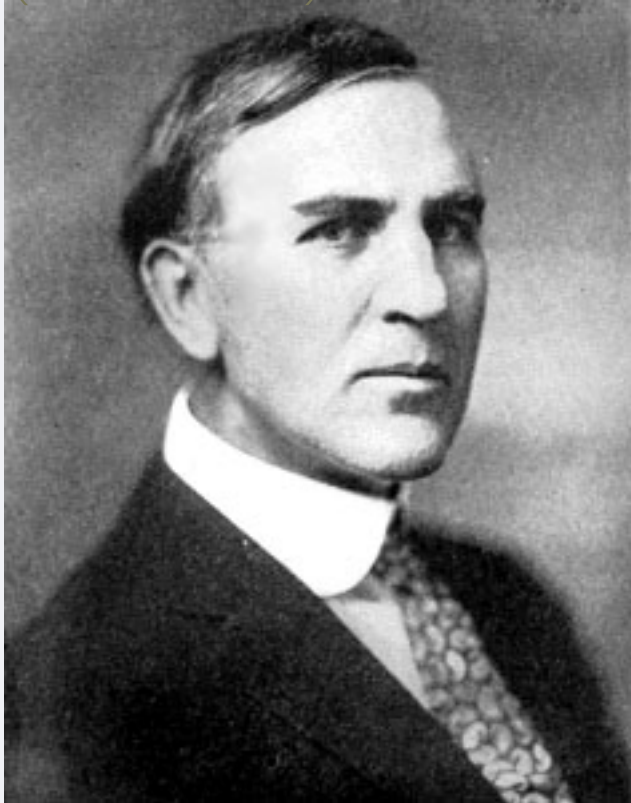
- 1) How did the field of ecology develop?
- 2) What are some of the major areas of enquiry?
- 3) How is ecological knowledge acquired?

class on Monday



# Ecology's Roots

Frederic Clements  
(1874-1945)



Community as 'superorganism'

'Balance of nature'

Stephen Forbes  
(1844-1930)



<http://people.wku.edu/charles.smith/chronob/CLEM1874.htm>

# Ecology's Roots

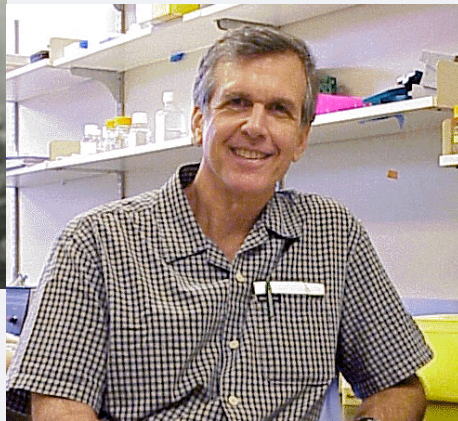
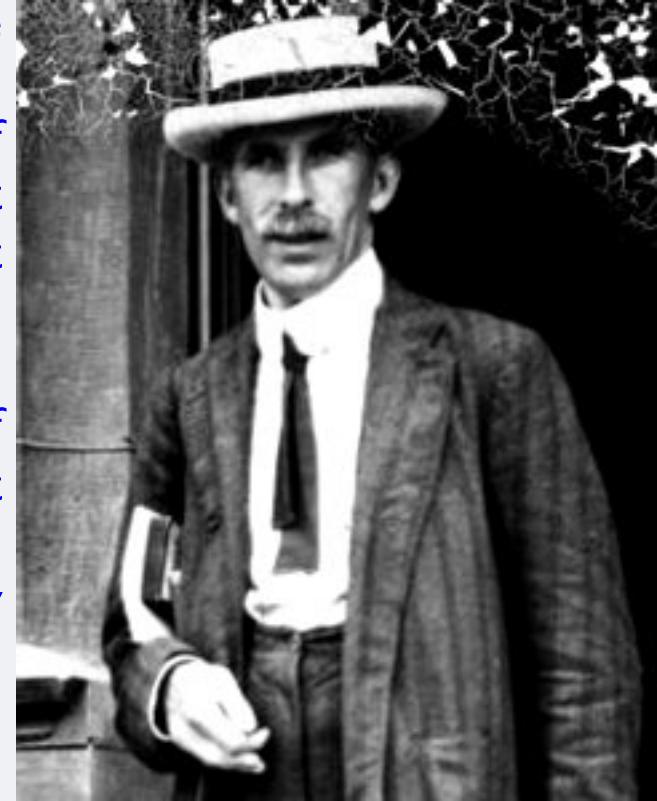
Henry Gleason  
(1882-1975)



“Every genuine worker in science is an explorer, who is continually meeting fresh things and fresh situations, to which he has to adapt his material and mental equipment. This is conspicuously true of our subject, and is one of the greatest attractions of ecology to the student who is at once eager, imaginative, and determined. To the lover of prescribed routine methods with the certainty of “safe” results, the study of ecology is not to be recommended”  
-Arthur G. Tansley

Arthur G. Tansley  
(1871-1955)

<http://people.wku.edu/charles.smith/chronob/TANS1871.htm>

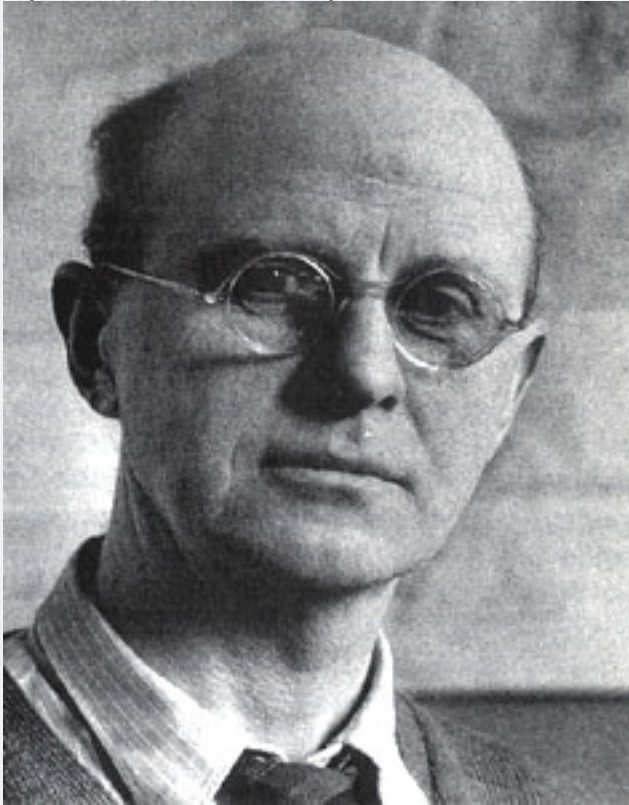


Rob Ricklefs:  
“ecologists should abandon... concepts of local communities. Except in cases of highly discrete resources or environments with sharp ecological boundaries, local communities do not exist.”  
LOCAL or REGIONAL PROCESSES?

[http://sciweb.nybg.org/science2/libr/finding\\_guide/gleapap.asp.html](http://sciweb.nybg.org/science2/libr/finding_guide/gleapap.asp.html)

# Ecology's Roots

Charles Elton  
(1900-1991)



<http://people.wku.edu/charles.smith/chronob/ELTO1900.htm>

*Animal Ecology* (1927):

-discussed food webs, community diversity, community, invasibility, and the niche;

*The Ecology of Animals* (1950):

-proposed that communities had limited membership:  
“only a fraction of the forms that could theoretically do so actually form a community at any one time.”

Alfred J. Lotka  
(1880-1949)



# Ecology's Roots

Georgyi Gause  
(1910-1986)



*Coupled differential equations to describe species interactions*  
*-showed that two species competing for a single resource cannot exist*

*Gause: experimentally tested this theory*  
*-> Competitive Exclusion Principle: 'two species cannot coexist on one limiting resource'*

*\*Provided a way of relating community structure and the process of succession directly to the ongoing competitive interactions between the populations within a community*

Vito Volterra  
(1860-1940)



<http://www.ggause.com/gausbio.htm>

# Ecology's Roots

*Do density dependent or density-independent factors regulate populations?*



Alexander J. Nicholson  
(1895-1965)



*Hutchinson (1957) 'Concluding Remarks: formalized the concept of the niche*



# Ecology's Roots

Raymond Lindeman  
(1915-1942)



<http://www.minnesotaalumni.org/s/1118/content.aspx?sid=1118&gid=1&pgid=1177>

*Tropho-Dynamic Aspect of Ecology (1942):  
'path-breaking in its general analysis of ecological  
succession in terms of energy flow through ecosystem'*

*-focused on the trophic relationships within the lake*

*-influenced by Elton and by Hutchinson, whom he  
worked with at Yale*

*-revived term 'Ecosystem'*

*-initially rejected from the journal Ecology*

# Sharon Kingsland

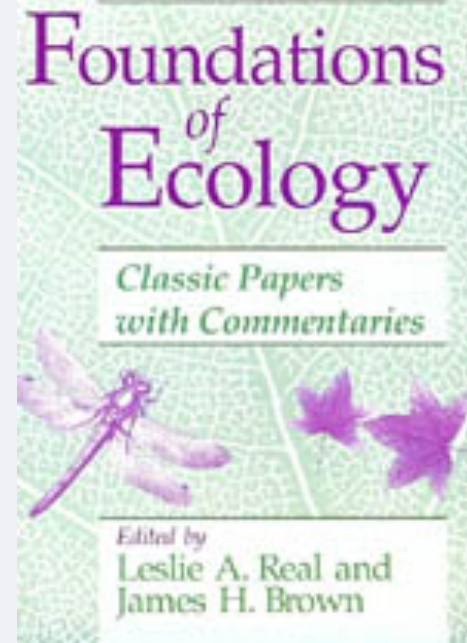
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# 2) Major Areas of Ecological Inquiry

## 'Six General Problems' from 1950s onwards:

- 1) The number and relative abundance of species in a community
- 2) Niche theory
- 3) Demography and population dynamics of single species
- 4) Multispecies interactions
- 5) Movement and scale i.e. Population structure, including the effect of spatial structure in populations along with the problem of scale in ecological processes
- 6) (Implications of individual behavior on population phenomena)

-Real, L.A. and S.A. Levin 1991. Theoretical Advances: The Role of Theory in the Rise of Modern Ecology, *In: Foundations of Ecology*

## 2) Major Areas of Ecological Inquiry

- 1970s: Idea that **interspecific competition** is the only – or even primary – factor structuring communities challenged...
- New Directions
- Rise of a more ‘pluralistic’ approach to ecology: recognizing that multiple factors may interact to determine the distribution and abundance of species
- “The difficulty with plurality is that it can quickly lead us into a morass”

-Gary Mittelbach, Community Ecology 2012