

NICHE CONCEPTS

Enrique Martínez Meyer
Instituto de Biología, UNAM

What is “niche”?

1. A recess in a wall, as for holding a statue or urn

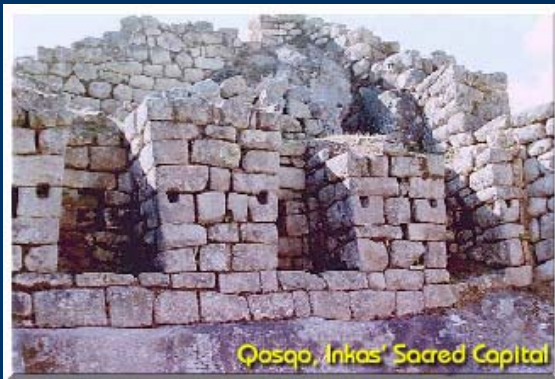


Photo by Warren Apel, Copyright (c) 2005 The Shanti Shop <http://www.shantishop.com>

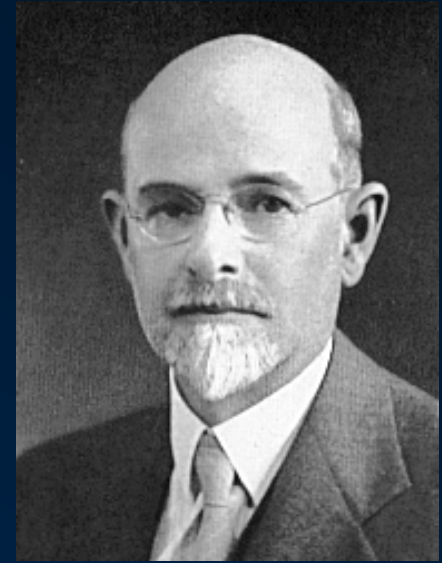
The American Heritage® Dictionary of the English Language, Fourth Edition 2000

In Ecology...

1. The particular area within a habitat occupied by an organism
2. The function or position of an organism or population within an ecological community

Joseph Grinnell (1916-28)

“...the ultimate distributional unit, within which each species is held by its structural and instinctive limitations” (1924).



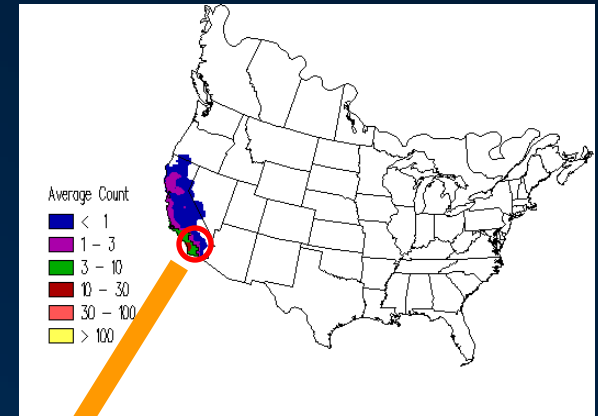
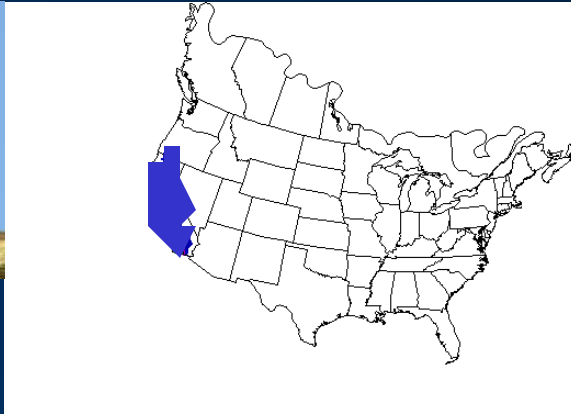
Every species has its own physiological, morphological, and behavioral profile, which makes it suitable to occupy particular spaces offered by nature.

Joseph Grinnell (1916-28)

A hierarchical classification of the environment could be recognized as a measure of distributional control



California Thrasher
(*Toxostoma redivivum*)



Ecologic or
Environmental
Niche

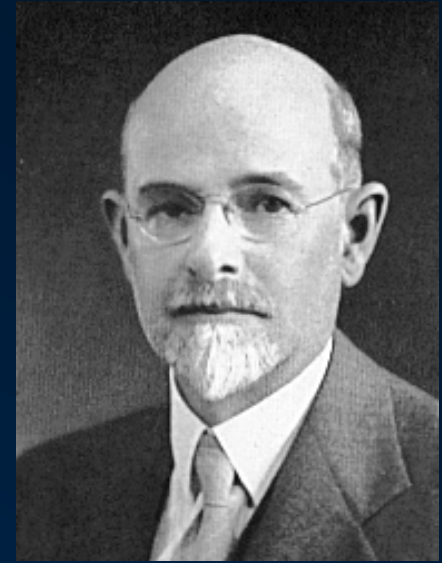
Food

Breeding sites

Refuges from predators



Joseph Grinnell (1916-28)



Other aspects of his niche concept

1. The niche is a property of the environment (not of its occupant):

“...the ecologic or environmental niche... is occupied by just one species...if a new ecologic niche arises, or if a niche is vacated, nature hastens to supply an occupant...” (1924).

2. Acknowledges the central role of interactions (Competitive Exclusion Principle):

“No two species in the same general territory can occupy for long identically the same ecologic niche. If by chance the vagaries of distributional movement result in introducing into a new territory the ecologic homologue of a species already endemic in that territory, competitive displacement of one of the species by the other is bound to take place. Perfect balance is inconceivable” (1928).

Charles Elton (1927)



“...[‘Niche’ describes] the status of an animal in its community, to indicate what is *doing* and not merely what it looks like...”

“...the ‘niche’ of an animal means its place in the biotic environment, *its relation to food and enemies.*”

The focus is on the functional role of species within the food web. Abiotic conditions are not taken into account.

Charles Elton (1927)

Mammal community of Africa

Top predators



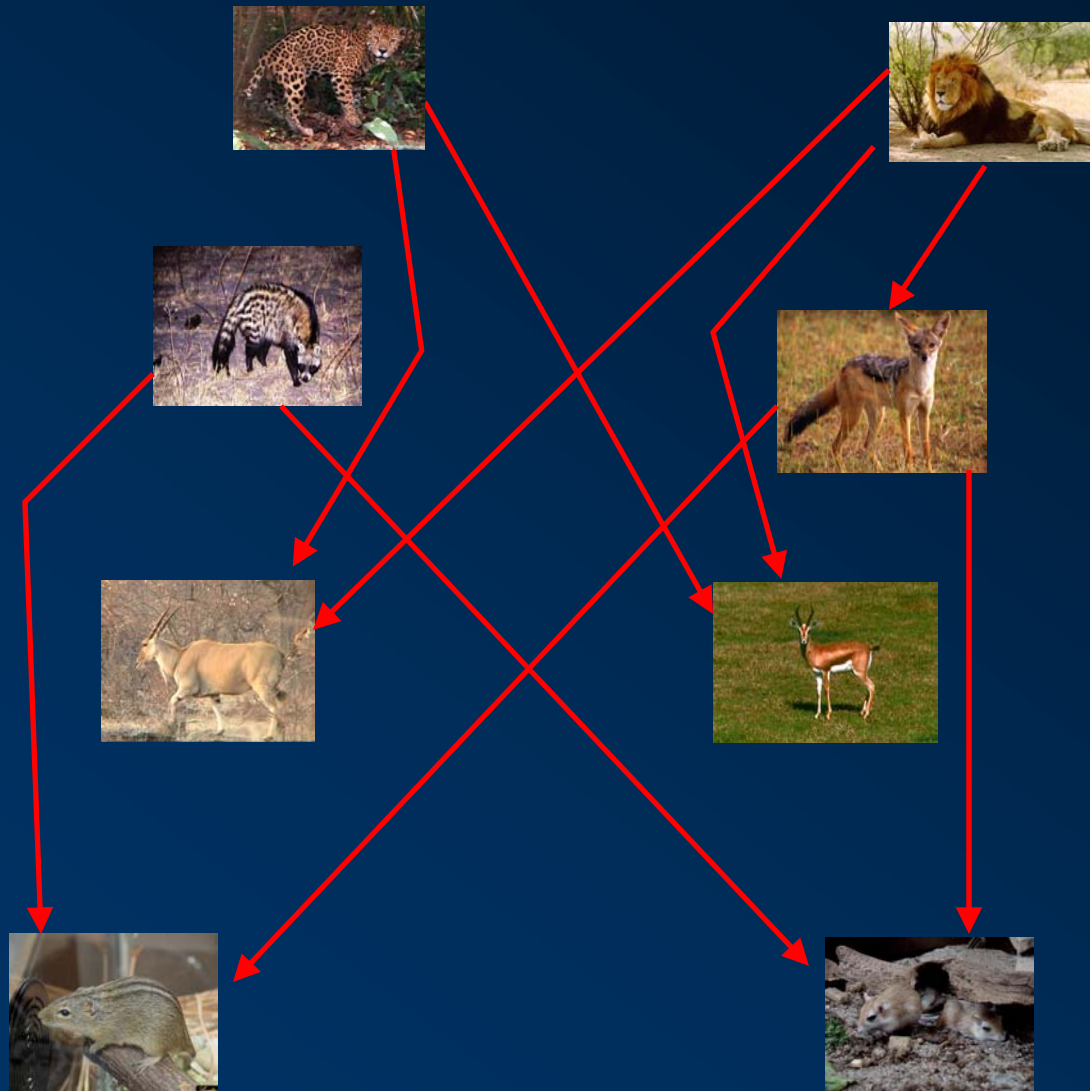
Meso-carnivores



Large herbivores



Small herbivores



Charles Elton (1927)

Mammal community of Tropical America

Top predators



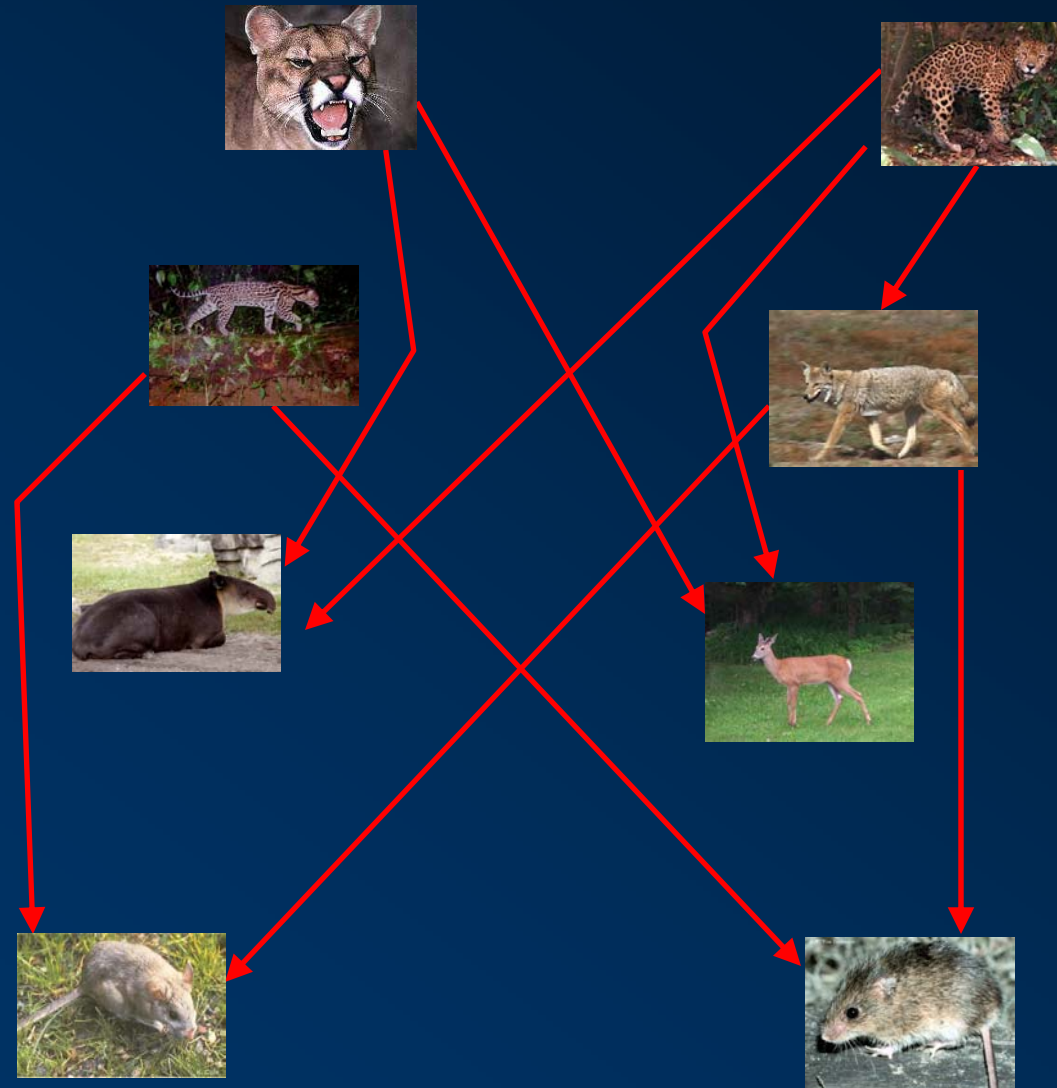
Meso-carnivores



Large herbivores



Small herbivores



Charles Elton (1927)

Other aspects of his niche concept

The niche is a property of the biotic community (not of its occupant)

The niche is not restricted to a single species:

“...we might take *as a niche* all the carnivores which prey upon small mammals, and distinguish them from those who prey upon insects...”

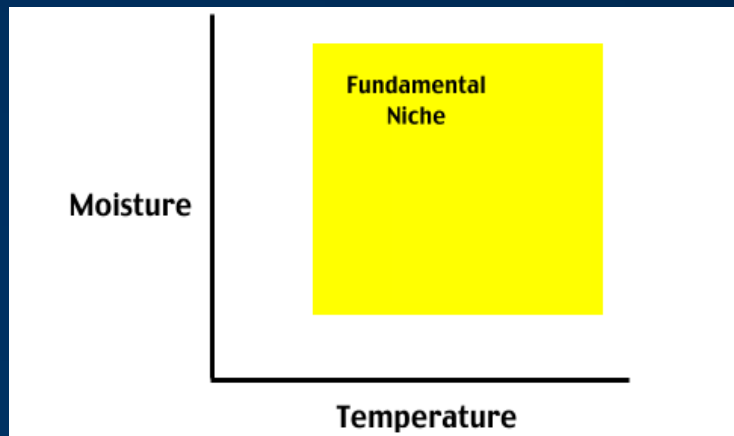
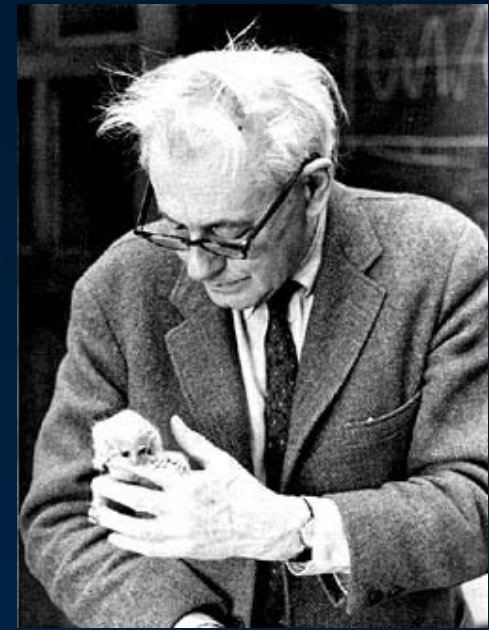
Ecological equivalents are an indication of similar niches:

“There is often an extraordinarily parallel between niches in widely separated communities.”



G. Evelyn Hutchinson (1944-58)

“The term niche... is here defined as the sum of all the environmental factors acting on the organism; the niche thus defined is a region of an n -dimensional hyper-space...” (1944).



Ecological space

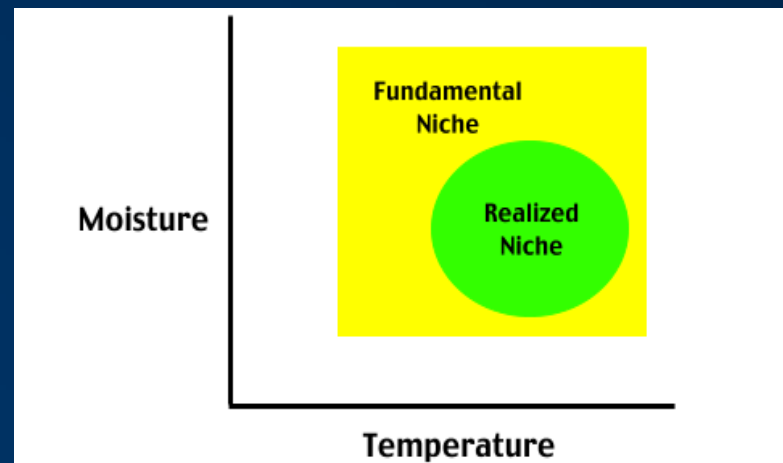
“...if this procedure could be carried out [with] all X_n variables, both physical and biological, the fundamental niche of species will completely define its ecological properties. The fundamental niche defined in this way is merely an abstract formalization of what is usually meant by an ecological niche” (1957).

G. Evelyn Hutchinson (1944-58)

Conditions in which species could feasibly live are often greater than those where the organism actually lives, and this is typically caused by biotic interactions.

Fundamental niche: all aspects of the n -dimensional hypervolume in the absence of other species.

Realized niche: the part of the fundamental niche to which the species was restricted due to interspecific interactions.



G. Evelyn Hutchinson (1944-58)

Other aspects of his niche concept

The niche is a property of the occupant (not of the environment)

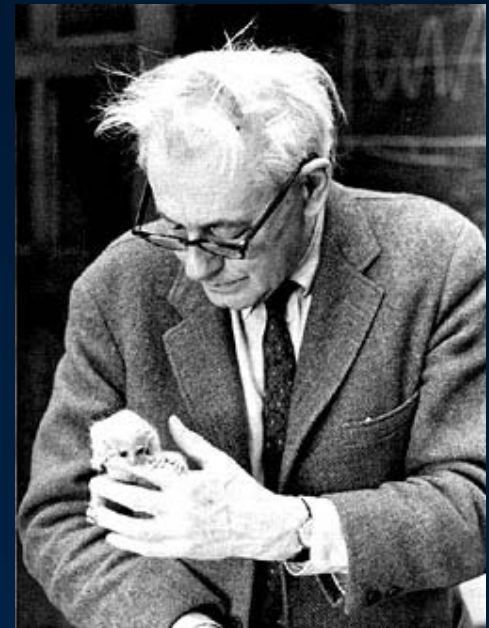
Niches have a temporal dimension.

Competitive exclusion is part of the formalization:

“...realised niches do not intersect” (1957).

Niches became quantifiable because the structure of the niche is determined by the species' performance (measured in terms of population fitness)

Niches are mutable (*i.e.*, evolve).



ENM and the Niche Concept(s)

Important take-home messages:

1. In ENM, there are two domains in which we analyze species' distributions: ecological (numbers/classes), and geographical (localities), and both have a temporal component that affects them.
2. Distributional controls of species in those domains are scale-dependent.

In ENM, what are we modeling, fundamental or realized niches?

