

## Community Ecology I

### Competition

- I. Intro to Community Ecology
  - A. What is a community?
  - B. Types of interactions
  - C. Regulation of population dynamics
- II. Competition
  - A. Terms and Concepts
  - B. Competitive exclusion principle
  - C. Factors that allow for coexistence
  - D. Predicting Outcomes of Comp.

Reading: Chap. 13

### I.A. What is a community?

Definition: Any assemblage of populations in an area or habitat, i.e., all the different species interacting in a given location

Encompasses many populations of different species.

### Questions

- How do biotic interactions affect the distribution of particular species?
- What biotic interactions structure communities?
- What factors cause changes in species richness across community types?

### B. Types of interactions

Neutral:	0	0
Mutualism:	+	+
Commensalism:	+	0
Predation:	+	-
Parasitism:	+	-
Competition:	-	-



### Understanding interactions helps restoration



### Understanding interactions

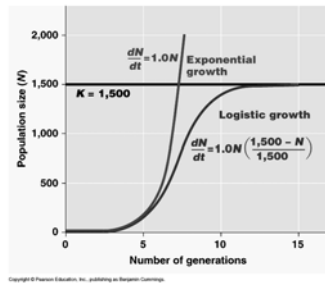


L. Gonzalez photos 2005

D. Hooper photos 2005

## C. Control of populations

Density independent vs.  
Density dependent



## II. Competition (-/-)

Multiple organisms or species trying to maximize their own use of a limited pool of resources.

## II. Competition

A. Terms  
Exploitative  
Interference

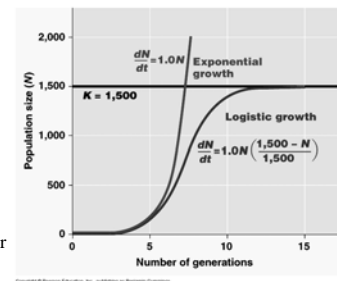
## A. Terms

### Intraspecific

- among individuals of one species
- implicit in the logistic population growth curve (density dependence)

### Interspecific

- among individuals of different species
- may restrict the range of one or the other species



N

## Intraspecific competition and niches

And NUH is the letter I use to spell Nutches  
Who live in small caves, known as Niches, for hutchies.  
These Nutches have troubles, the biggest of which is  
The fact that there are many more Nutches than Niches.  
Each Nutch in a Nich knows that some other Nutch  
Would like to move into his Nich very much.  
So each Nutch in a Nich has to watch that small Nich  
or Nutches who haven't got Niches will snitch.

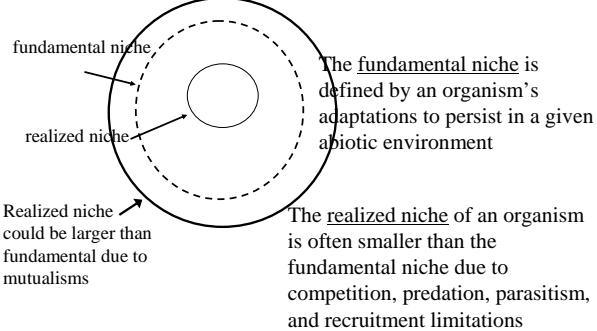
“On beyond zebra”, Dr. Suess (Geisel, 1955)



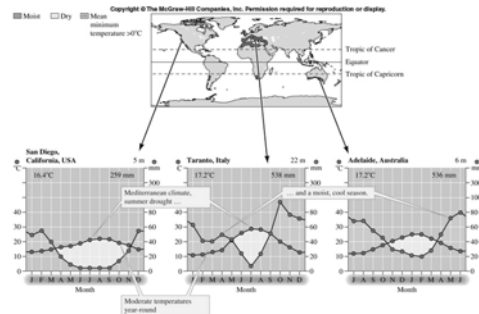
## A. Terms

Niche  
n-dimensional hypervolume  
Fundamental vs. Realized

## Niches: fundamental and realized



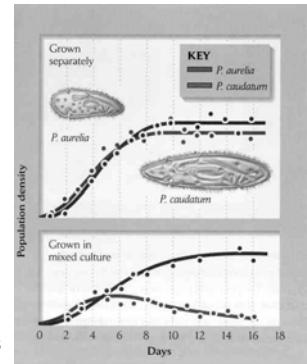
Many invasive species have similar fundamental niches to the areas they invade.



## B. Competitive exclusion principle

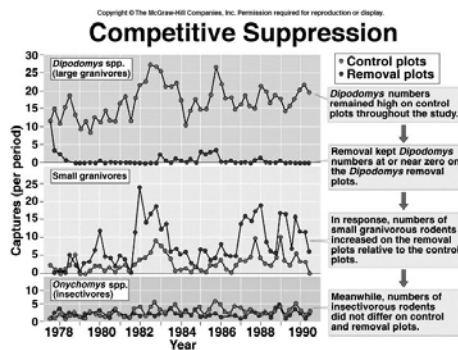
## Competitive exclusion and the niche

Gause: Competitive exclusion principle.



Ricklefs Fig. 19.6

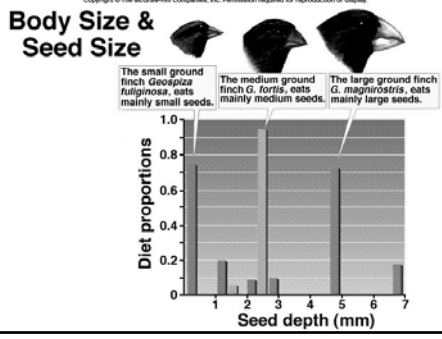
## Niche overlap – regulation of population size



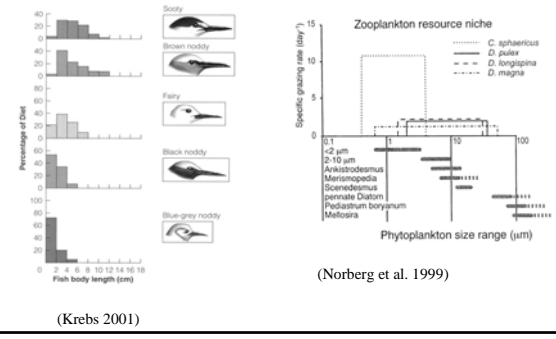
## C. What allows coexistence?

1. Non-overlapping niches
2. Variable environmental conditions
3. Other species interactions

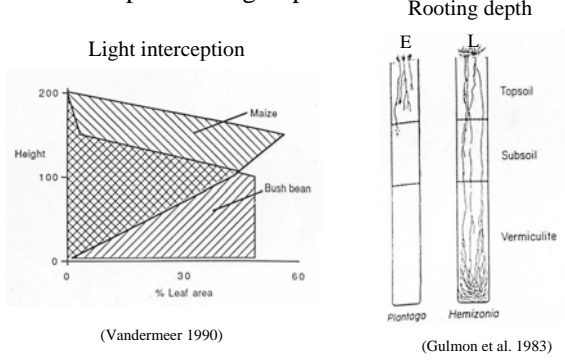
# 1. Non-overlapping niches = resource partitioning



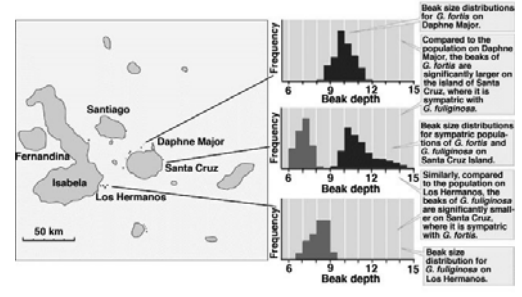
# Resource partitioning among animals



# Resource partitioning in plants

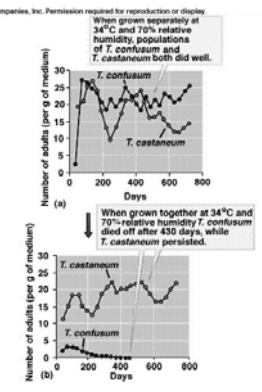


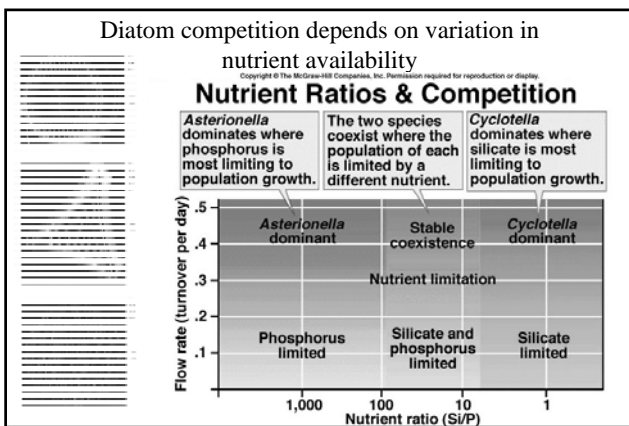
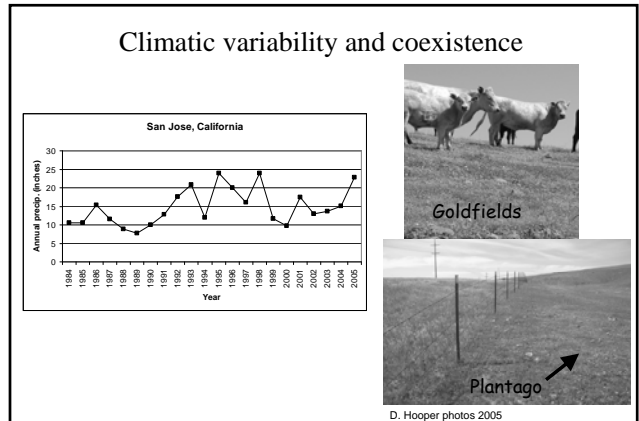
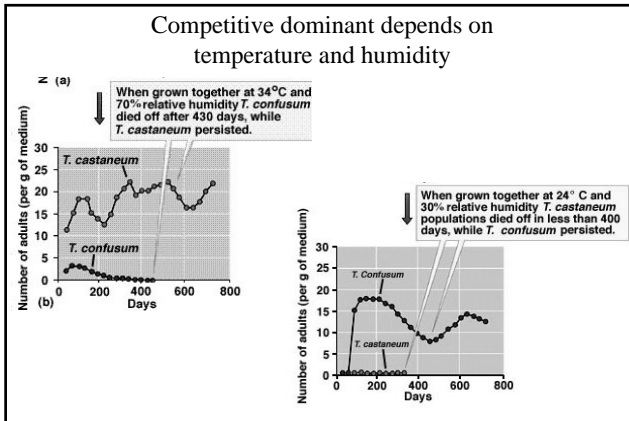
# Character Displacement



# 2. Variation in environmental conditions

# Species Competition





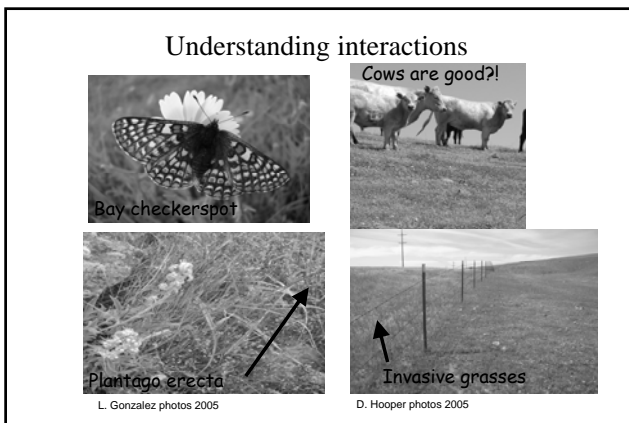
### 3. Effects of other species interactions

(see Ecobeaker barnacles)

Predation can lead to coexistence if...

- Selective predation

2. for the competitive dominant.



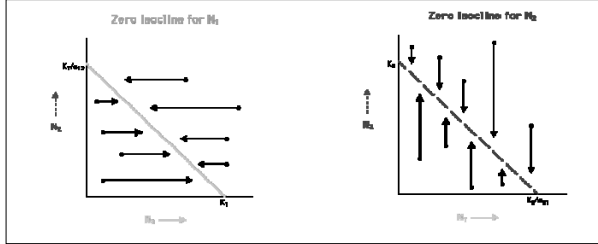
### D. Predicting Outcomes of Competition

Lotka-Volterra models

- Models
- Outcomes
- Assumptions

## Where will each population grow?

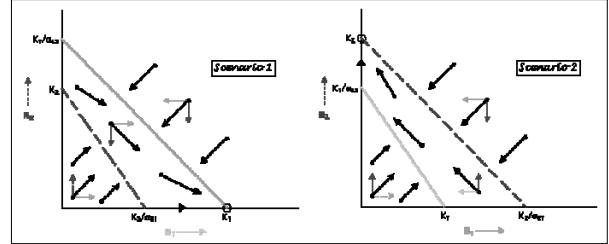
Zero growth isoclines: solve for  $dN/dt = 0$



<http://www.tiem.utk.edu/bioed/bealsmodules/competition.html>

## Where will each population grow in competition?

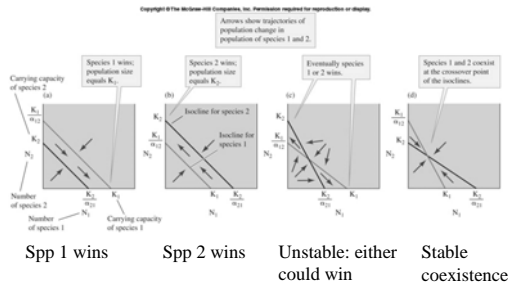
Put both species' isoclines together



<http://www.tiem.utk.edu/bioed/bealsmodules/competition.html>

## L-V Predictions

Competitive dominant depends on relative magnitudes of  $K$ 's and  $\alpha$ 's



## Assumptions of L-V models

1. Environment is homogenous and stable, without fluctuations ( $K$ 's and  $\alpha$ 's constant);
2. Coexistence requires a stable equilibrium point;
3. Migration is unimportant;
4. The effect of competition is instantaneous;
5. Competition is the only important biological interaction.

End

## Diatom Competition – multiple resources

