

Previous Lecture

Population Dynamics
D. Intraspecific Competition
Chapter 11

Lecture 7 1

Lecture 7

- Population Dynamics
- Interspecific competition - Chapter 13

Lecture 7 2

		Effect on Species 1		
		-	0	+
Effect on Species 2	-	Competition	Amensalism	Predation Parasitism
	0		Neutral	Commensalism
	+			Mutualism

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Another View


Competition	Species 1 $\xleftrightarrow{-}$ Species 2
Amensalism	Species 1 $\xleftrightarrow[0]{-}$ Species 2
Predation/Parasitism	Species 1 $\xleftrightarrow[+]{-}$ Species 2
Neutralism?	Species 1 $\xleftrightarrow[0]{0}$ Species 2
Commensalism	Species 1 $\xleftrightarrow[+]{0}$ Species 2
Mutualism	Species 1 $\xleftrightarrow[+]{+}$ Species 2

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Interspecific Competition: Exploitation

Exploitation competition -

→ **plants** - *Deschampsia antarctica* and *Colobanthus quitensis* (and moss!) using water or nutrients from the same soil patch, and shading each other.



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Exploitation Competition

→ **animals** - goldfinches and house finches both eating thistle seeds in the same field.




L. Elliot/CLO JR. Woodward/CLO

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Interspecific Competition

→ Interference competition -

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Lotka-Volterra Model

→ Premise: Adding individuals of another species is the same kind of density-dependent effect as adding individuals of the same species.



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Competition Coefficient (a_{12})

- If $\alpha = 1$, then species 2 = species 1
- If $\alpha < 1$, sp. 2 has a smaller effect than sp. 1
- If $\alpha > 1$, sp. 2 has a greater effect on 1 than 1
- Note: if $\alpha = 0$, then sp. 2 has no effect on sp. 1.
- Note: in sample exams, you will see: $\alpha = a_{12}$ and $\beta = a_{21}$

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Review: Lotka-Volterra Competition

For two species, L-V is two equations:

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Outcomes of Competition

- Exclusion of species 1 (regardless of initial N)
- Exclusion of species 2 (regardless of initial N)
- Coexistence
- Either species 1 or 2 wins, depending on initial conditions

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How to Determine the Outcome of Competition

“Zero-growth isolines” determined for each species

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Outcome of Competition

- Species 1 WINS!!! (where $K_1 > K_2/\beta$ AND $K_1/\alpha > K_2$)
- Endpoint: $N_1 = K_1, N_2 = 0$
- Endpoint is the same regardless of starting N's.

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Why are we doing this?

- New parameters important: K, α
- Defines:
 - conditions for coexistence,
 - the limiting similarity
- Predicts character displacement in zones of sympatry for competing species

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Graphical analysis - Case 1

Species 1 Wins

Conditions:

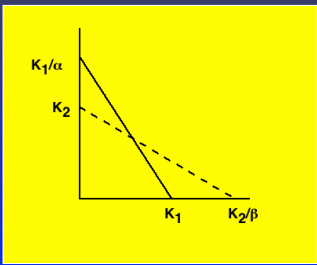
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Case 2
Species 2 wins



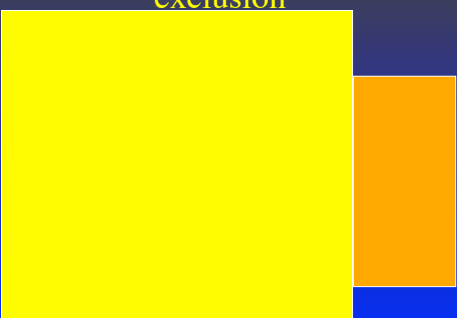
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Case 3 - Try One Yourself!




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Case 4 - Conditional competitive exclusion




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Graphical analysis - conclusions

- There are four possible outcomes of competition
- Qualitative outcome $=f(K, \alpha)$
- r does not influence the outcome (exc. Case 4)
- Initial N does not influence the outcome (exc. Case 4)
- We can define the boundary conditions of stable coexistence - VERY IMPORTANT!

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Summary

- Competition theory emphasizes the importance of competitive ability and carrying capacity in determining the outcome of competition
- Next time: The theory predicts the conditions required for coexistence, defines the limiting similarity, and predicts character displacement in zones of sympatry for competing species

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