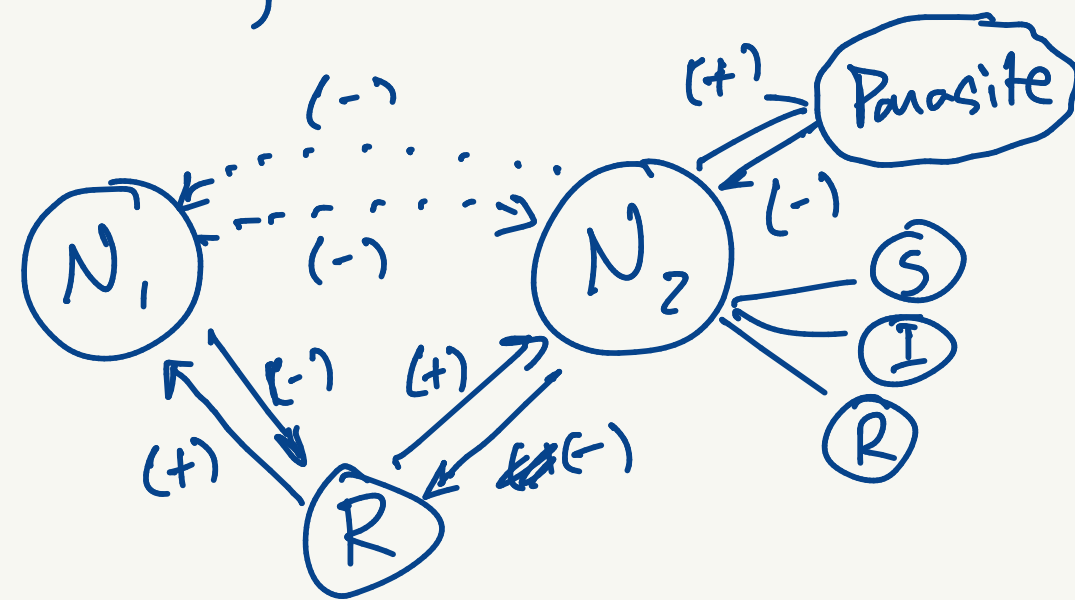


Chapter 15, 16



Mutualism (+, +)

Commensalism (+, \emptyset)

Motif ~ network of interactions among a few species embedded within a larger community

Mutualistic Interactions

Symbiotic

ex) pea aphids \rightleftharpoons bacterial symbionts

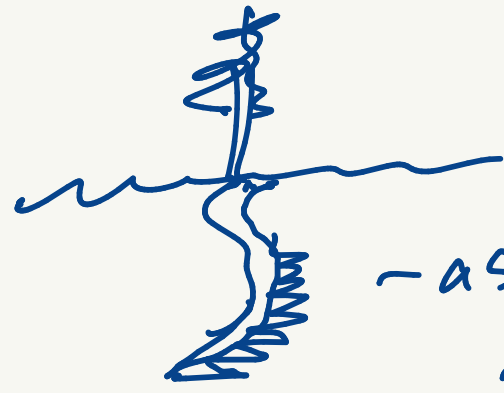
humans \rightleftharpoons gut biota

Eukaryotes \rightleftharpoons mitochondria ~ originally prokaryotic cells that parasitized early eukaryotic cells

Mutualistic interactions facilitate the persistence of each species

The world runs on mutualistic relationships

- Mycorrhizal fungi



- association btw plant root and fungi \uparrow the SA/Vol. ratio, which allows efficient uptake of water/nutrients

- Nitrogen-fixing

- Coral + Algae

Coral provides a home for algae

Algae provides carbohydrates via photosynthesis

- Wood-eating termites and gut protists that allow them to digest wood

- Herbivores and fruit as seed dispersers

Avocado

{
- Gomphotheres
- Giant ground sloths

- Flowering plants (Angiosperms) and birds/insect pollinators

- Indirect mutualistic interaction

Elephants and gazelles

↓

clear the landscape of trees

enable the ~~sp~~ formation
of grasslands

→ benefit from the establishment
and maintenance of grasslands

- Acacia trees
provide food/
habitat

↔ Ants
defend the Acacias
from herbivory

How do they evolve? Typically from +/- interactions

Rod-shaped bacterium ^{infecting} → Amoeba

1) initial negative effect (↑ mortality of ~~the~~ Amoeba)

2) Coevolution: selection for Amoeba w/ greater tolerance for R.S.B.
AND selection for R.S.B. w/ less negative effects on

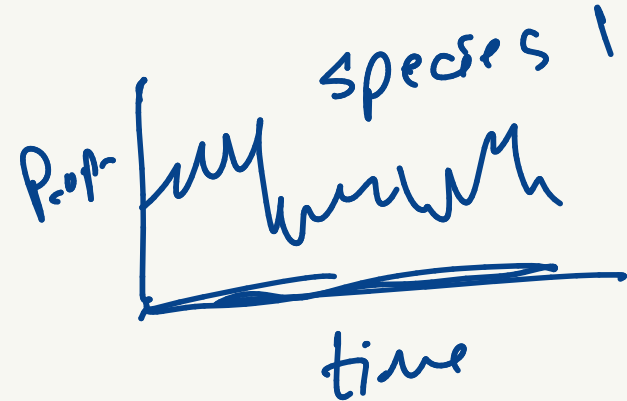
3) Within 5 yrs, neither ^{amoeba} species could survive w/o the other

This is not charity

- selection and adaptation are inherently selfish

↳ mutualisms only remain if there is a net positive

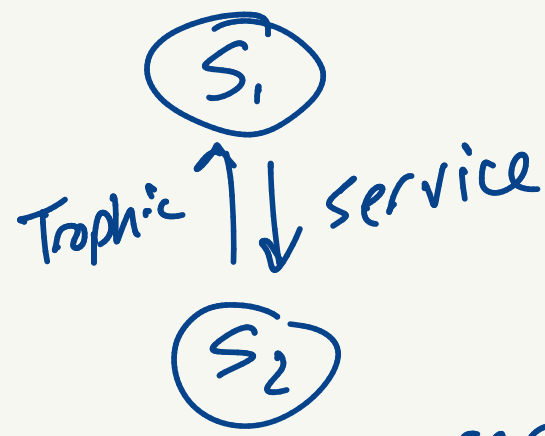
both species experience a fitness gain



} engaging in mutualistic partnership ↑ extinction risk

Types of mutualisms

1) Trophic mutualisms



- one spp. receives energy resource, the other a service
- service might be reproductive (plant/pollinator interactions)
seed dispersed/seed plants

- service may of a different type that increases fitness

Ant/Acacia

Ants receive < habitat nutrients

Acacia receives reduced herbivory due to defense by ants

2) Habitat mutualism

- one partner receives shelter/favorable habitat, in return for a service
- more likely to occur in environments that are not food limited

Pistol shrimp / Gobi fish

↳ use the
gobis to warn
of approaching danger

↳ receives habitat dug by pistol shrimp

ironwood

3) Obligate mutualisms

- required for species to exist

e.g. leafcutter ants - fungus mutualism

e.g. fig/wasp mutualisms

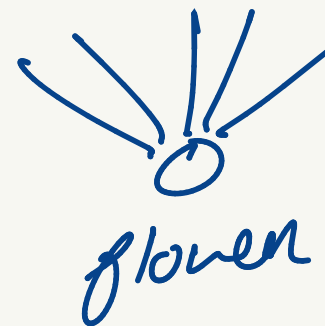
4) Facultative mutualisms

- Flexible needs fulfilled by multiple species

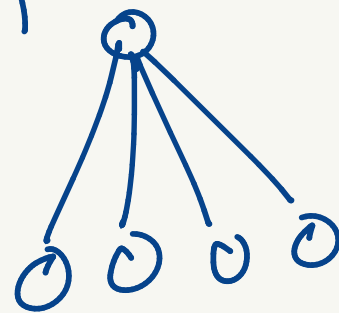
Nurse plants in deserts provide shade
for other plants to germinate and
grow

↳ Desert Ironwood can nurse up to 165 spp.

~~At~~ pollinator
species



pollinator



flower
species