Tropical rainforest inhabitants: a smattering

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4. Figs and bats and tent-making
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1. A few predictions of Bret's latitudinal diversity gradient theory
- In favorable conditions, tropical species should be more efficient at accumulating resources than similar temperate counterparts
- Climax temperate communities should be vulnerable to invasion by species from habitats with similar average but lower variance in abiotic conditions
- Climax tropical communities should prove almost impossible to invade because potential invaders will comprise small populations of competitors equal to those already in the community. Those populations are more likely to go extinct than they are likely to become large.
- Species in mature aseasonal environments should be range limited by small variations in conditions.

2. Tapirs and their palms

Tapirs are large (250 kg), tropical herbivores with home ranges of several thousand hectares. They ingest palm seeds intact, and defecate in specific latrine sites. Several species in neotropics, fewer in Asia. Related to horses and rhinos.

What do palms need to do to reproduce?

- Facilitate the meeting of gametes, and produce seeds.
- Ensure that those seeds go on to produce new plants. ***How?***

- Disperse seeds away from the parent. ***Why is this helpful?***

How does a Brazilian palm reproduce?
Attalea maripa grows in clusters, and produces lots of fruit. Small mammals that feed on the fruits leave the seeds. Bruchid beetles lay their eggs on the damaged fruits: their larvae consume the seeds. Seed survivorship close to the parent tree is less than 5%. But tapir fruit-eating behavior is different.

Hypothesis: with their large home ranges, tapirs transport the seeds that they eat farther, out of range of seed predators.
Experimental design?

Experimental results: Palm seed dispersal by tapirs

Seed survival significantly enhanced by distance from parent tree (because seed predators--bruchid beetles--are scarce far from the parent). Burying also enhanced seed survivorship, but not as significantly as did distance from parent tree.

This work illustrates the complexity of interactions between palm, tapir and beetle; and has a bearing on conservation. Restriction of tapir movement, by habitat fragmentation for example, could severely affect palm population dynamics. The patches of palm in the forest and sometimes also in the savanna, created at tapir latrines, constitute a mosaic of habitats in which biodiversity thrives.

3. *Cecropia* trees and *Azteca* ants

- *Cecropia* is a pioneer species common throughout the neotropics. It grows quickly, with stem elongation occurring in "internodes" which are initially filled with soft pith (and are surrounded by hard tissue), but become hollow as the tissue ages. Internodes produce petioles, which are the stems that support leaves.
- Furthermore, depending on the particular species of *Cecropia*, most petioles produce small beads of glycogen (form of stored carbohydrate) called muellerian bodies.
- *Azteca* ants engage in nuptial flights, during which females get fertilized by multiple males. The newly mated *Azteca* queens then search out *Cecropia* saplings in which to initiate colonies.
- They chew and burrow into an internode, and then seal the hole with scrapings from the interior wall. It heals itself with callous tissue, sealing the queen inside.
- *Cecropia* stems thus may act as apartment complexes, each holding independent nest sites. Ultimately, one or more queens expands into multiple internodes, forming a massive colony that inhabits an entire *Cecropia* tree. Early on, colonies often fail due to parasitism by other hymenopterans.
- Most ant inhabitants of *Cecropia* harvest muellerian bodies as their primary food source.
- In some cases, *Cecropia* trees that are inhabited by *Azteca* experience significantly lower rates of herbivory by both invertebrates and vertebrates. Other research has failed to find a benefit to *Cecropia*.

Is the *Cecropia-Azteca* association a mutualism? What parameters might affect the answer?

(For more information, see Jack Longino's site at :
http://www.evergreen.edu/ants/ANTPLANTS/CECROPIA/Cecropia.html)

4. Phyllostomid bats: a recent radiation
   - *New world leaf nosed bats*
   - 150+ species
   - Very recent (adaptive) radiation. The phyllostomoids are therefore still ecologically diverse, a point easily made by looking at their feeding ecology.

5. Phytotelmata: hidden forest resources
   - From the Greek, meaning "plant-pool" or "water-filled plant". Phytotelmata are almost entirely a tropical phenomenon.
   - Phytotelmata are found in bromeliads and other plants with axils (*Heliconia,* zingibers…), pitcher plants, internodes of bamboo, brazil nut capsules, cacao pods, buttresses, tree holes…They are discrete ecosystems of limited scope, into and out of which most inhabitants cannot themselves move, but many animals are deposited as larvae, and emerge as adults.

Characteristics of phytotelmata ("wells")

- Liquid is derived either from rain water, or from plant secretions (which also contain nutrients).
- Wells are often ephemeral, and subject to rapid change in water level, quality, and chemistry, which is strongly correlated with rainfall.
- Production and respiration in wells are largely dependent on placement of phytotelm relative to other plants, and type of phytotelm:
  - Wells in sun dominated by algae and other autotrophs, low in bacteria.
  - Wells in shade get some of their nutrients from leaf fall. Bacteria are numerous and diverse.
  - Wells in tree holes tend to be relatively low in nutrients. ***Why?***

Other biota in wells

- Usually contain insects (especially larvae). Common forms include mosquito larvae, midges, odonate larvae (e.g. dragon- and damselflies).
- Sometimes contain frogs (in some cases restricted to eggs/larvae, often all life stages use the phytotelm).
- Rarely contain other vertebrates: snakes and lizards hang out as sit-and-wait predators, or to take naps.

Phytotelmata make great experimental subjects: due to their quantum nature, phytotelmata can be used to test various aspects of theoretical ecology.
For instance:

- What modes of inter-specific competition rule in a restricted system?
- Do low, intermediate, or high levels of disturbance produce higher levels of diversity?
- Which proposed mechanism of succession is taking place—is "tolerance" the rule? (That is--does succession proceed in a deterministic fashion, producing exactly the same communities over time regardless of new inputs?)

6. Basilisks (aka jesus christ lizards can run for short bursts on the surface of the water. They live in lowland rainforests in the neotropics, near stream edges. What's the advantage?

7. Nest-building in frogs include a variety of forms, including:

- foam nests created by parents during amplexus (e.g. *Leptodactylus pentadactylus*)
- by folding leaves over the eggs during mating, and sealing them shut with oviducal secretions (several species of *Afrixalus*)
- by excavating soil (gladiator frogs)

Gladiator frogs

- Neotropical "treefrogs" (family: Hylidae) that have aquatic eggs and tadpoles. Egg are laid in protected areas (nests), so both parents can keep track of them.
- Males build nests to attract females, who will then lay their eggs
- in those nests. Other males try to steal the nests, so the males have to defend their territories, usually through fighting.
- The gladiator frogs (a species group including *Hyla rosenbergi* and *Hyla boans*, among others) are uniquely well-adapted to fight with each other…
- Any idea what they might have?