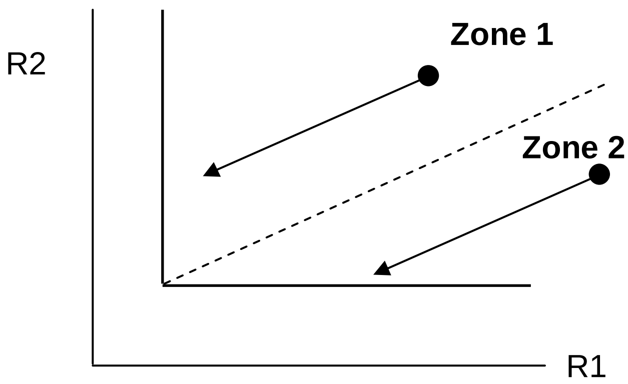
Supplement to class (11/6):

Clarifying Tilman's approach:

Consider the graph for one species, Species A:



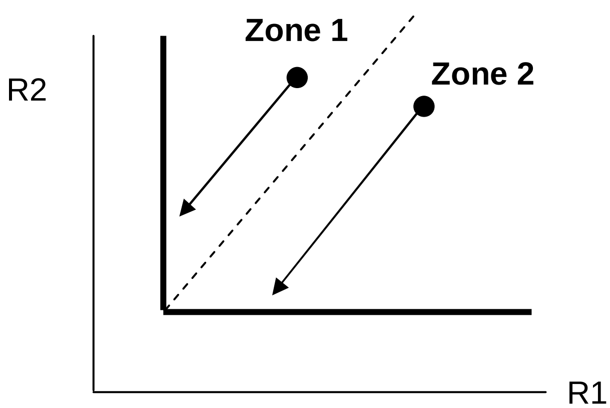
Suppose that Species A uses Resources 1 and 2 in the ratio of 2:1 (shown by the dotted line)

If the supply point falls in Zone 1 (above the line), then R1 will be limiting. In other words, if Species A uses up the resources at a constant 2:1 ratio, and the supply point ratio of R1:R2 is less than 2:1, then Species A will run out of R1 first.

Below the line, in Zone 2, R2 will be limiting.

For Species A, because the usage ratio of R1:R2 is greater than 1, Species A is more efficient at using R2, and it is generally considered to be limited by R1. Whether or not it will actually be limited by R1 depends on conditions in the environment (whether your starting point is in Zone 1 or 2).

Consider the graph for Species B:

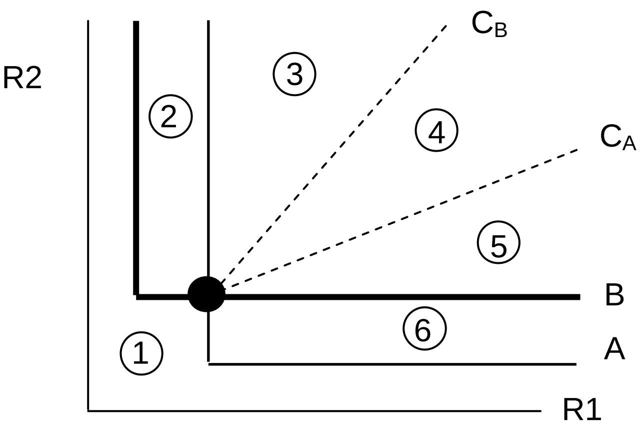


Now let's consider the case for Species B.

Again in Zone 1 (above the dotted line), Species B will be limited by R1, and below the line will be limited by R2.

Generally speaking, Species B will be more limited by R2, and is considered more efficient at using R1.

Species A and B together:



① Species A and B both lose

② Species B wins over Species A

③ Falls within Zone 1 for both Species A and B. Hence, R1 will be limiting for both. Since Species B is more efficient at using R1, it will predominate.

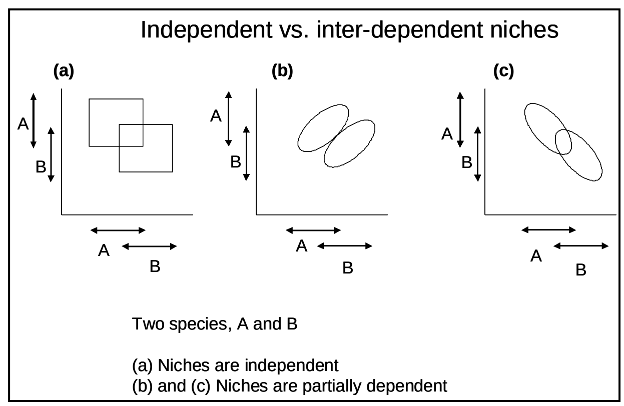
④ Here, A will be limited by R1 and B will be limited by R2. Since B is generally more limited by R2 and A is generally limited by R1, neither species will have a competitive advantage over the other and both will be limited. This is the zone of coexistence. The stable equilibrium point will occur at the intersection of the two lines (since dN/dt=0 for both species here).

⑤ Falls within Zone 2 for both Species, meaning that R2 will be limiting for both species. Since Species A is more efficient at using R2, Species A will be able to outcompete Species B in this region.

⑥ Species A wins over Species B

Independent vs. inter-dependent niches

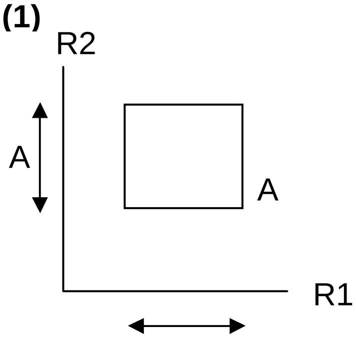
The axes in graphs on right represent availability of two resources. The arrows show the range of availabilities that will permit the growth of Species A and B.



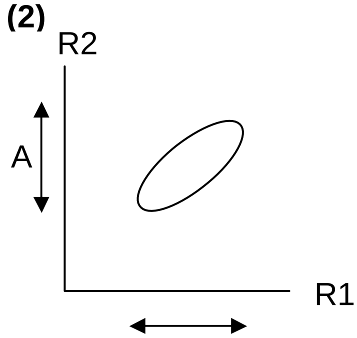
Let's consider the shape of the niche for just Species A, in two dimensions. There are three general shapes for the two-dimensional niche.

(1) No interdependence of niches. At high availability of R1, any level of R2 will permit growth.
(2) Interdependent niche. At high availability of R1 (e.g. bright sunlight for a plant), Species A requires high availability of R2 (e.g. high water availability) in order to grow.
(3) Interdependent niche. This time, high availability of R1 permits Species A to grow only if availability of R2 is low.

(1)



(2)



(3)