Mar 5  Herbivore abundance and richness

Key Concepts

• The ability of large herbivores to persist changes across gradients of plant (i.e. forage) abundance and quality.
  • How much food -- quantity
  • How nutritious -- quality

• The importance of quantity versus quality varies by species, body size and life-history (e.g. digestion) strategy

• Plant productivity and quality are influenced by the availability of two principal plant resources, water and nutrients.

• Previous results have shown that plant abundance increases linearly with rainfall - a crude measure of plant-available moisture.
  • This increase is stronger at higher nutrient availability.

• However, leaf tissue nitrogen content, an index of plant quality to herbivores, decreases with plant available moisture in both nutrient-poor and -rich soils.
Key Concepts

- Plant abundance is lowest at either low moisture or low nutrient availability, and highest when both are high.

- Plant nutrient content is lowest at combinations of high plant-available moisture and low nutrients, and highest at combinations of low plant-available moisture and high nutrients.
Key Concepts

• The plant abundance threshold of a herbivore species is the minimum plant-available moisture, for a given nutrient availability, above which plant productivity will be sufficiently high to support a population of that herbivore species.

• Likewise, the plant quality threshold of a herbivore species is the maximum plant-available moisture, for a given nutrient availability, below which plant tissue is sufficiently nutrient-rich for that herbivore species to persist.

• Together, the quality and abundance thresholds define a ‘wedge’ of combinations of moisture and nutrients at which a herbivore species can persist.
Key Concepts

• Larger herbivores require more abundant plants but can tolerate lower plant quality than smaller herbivores.

• Smaller herbivores can persist on less-abundant plants but only if the plants are of higher quality.

Hypothesis 1:
• The occurrence of larger herbivores is expected to increase with greater moisture, but to be relatively independent of plant available nutrients.

Hypothesis 2:
• Smaller herbivores should decrease in occurrence with greater moisture and increase with greater nutrient availability.
Evidence from the Real World
Predicted large herbivore biodiversity (% of continental species pool)