



Foraging Challenges






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Primary Compounds vary in different plant species and parts.

Energy, protein, minerals, and vitamins

Can herbivores detect primary compounds and if so by what mechanisms?



All plants contain secondary compounds

Secondary compounds originally were considered waste products metabolism.

ALKALOIDS: wiregrass, reed, oat, bamboo, brome grasses, Rhodes grass, orchard grass, fescue, barnyard grass, millet, barley, spear grass, ryegrass, rice, switch grass, bluegrass, sorghum grasses, corn.

CYANOGENIC GLYCOSIDES: wheat grasses, bentgrass, big bluestem, broomsedge, oat, bamboo, grama grass, fescue, manna grass, barley, ryegrass, rice, switchgrass, bluegrass, sugarcane, sorghum grasses, wheat, corn

PHENOLICS: nearly all grasses, including canarygrass, bromegrass, wildrye, sorghum, corn, oats, timothy

TERPENES: Monoterpenes - 4 genera, Sesquiterpenes - 2 genera, Triterpenes - 36 genera

SAPONINS: 25 genera and numerous species of grasses

SILICA: wide variety of grass and sedge species

NITRATES: oats, rye, wheat, corn, Sudan grass, Johnson grass, flax

CONDENSED TANNINS: switchgrass, wiregrass, big bluestem, broomsedge

PROTEINASE INHIBITORS: grama, barley, wheat, big bluestem, broomsedge







Primary Roles for Secondary Compounds in Plants


Sun Screen
Antioxidants
Adaptive Coloration
Attract Pollinators
Fruit Eaters

Allelopathy
Drought Resistance
Persistence

Recovery Injury
Regrowth Grazing
Defense Grazing

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Secondary Compounds vary in different plant species and plant parts.



Over 10,000 alkaloids, 25,000 terpenes, and 8,000 phenolics -- that chemists have identified to date.


Phenolics









Terpenoids



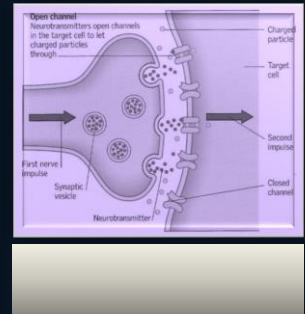
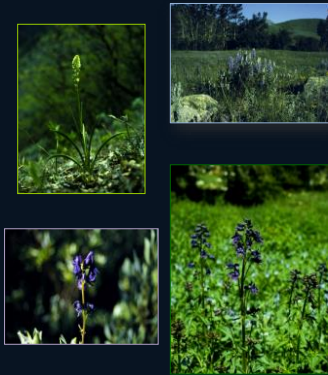




Alkaloids

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Structures of secondary compounds all differ for alkaloids, terpenes, and phenolics.



Can herbivores detect secondary compounds and if so by what mechanisms?

Primary and secondary compounds vary in both space and time.



Environments – moisture, nutrients, sunlight – affect kinds and concentrations of secondary compounds.



How well do herbivores track changes in primary and secondary compounds?

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Morphological defenses vary among different plant species and parts.



Intake = bite size x bite rate x grazing time



Pasture Design

Mixtures versus Patches

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Increases in Production on Grass-Clover Pastures

Sheep

Increase of 25% in intake (265 g/day)

Dairy Cattle

Increase of 11% in milk production (2.4 kg/cow/day)



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How well do herbivores
cope with morphological
defenses and what can we
do to help them?

Unfamiliar
environments
present unknown
risks and
opportunities.



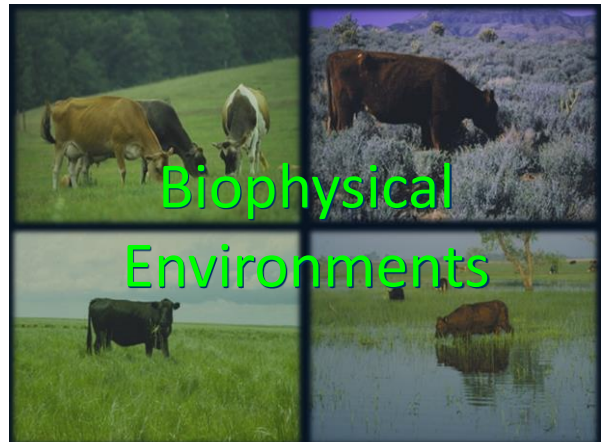
Acts of Nature
Fires, Floods, Volcanoes



Forced Emigration



Biophysical
Environments



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How well do herbivores
cope with unfamiliar
environments and what
can we do to help them?

