

## Terrestrial

### Weathering

What are igneous rocks and aluminosilicate minerals?

What is carbonation weathering and what other types of acids can weather rock?

Understand the basic reaction of carbonic acid on rock

Aluminosilicate mineral reacts with carbonic acid to form dissolved cations, bicarbonate, silica and a secondary mineral (which can be further weathered)

Contrast congruent from incongruent weathering

What types of materials would be left if full weathering occurs (aluminum or iron oxides or perhaps quartz)

### Cation exchange

What is it?

How is it affected by pH

What conditions are needed for anion exchange to occur instead?

### Major soil layers (know what O, A, B and C are)

Why do soils become thicker when one moves from the W to E in the US?

### Primary production

Plants attempt to equalize importance of major drivers of photosynthesis (water, light, nutrients, CO<sub>2</sub>)

NPP vs. GPP

NPP ends up in various locations within plant and in herbivores and emissions

Distribution depends on habitat and species, but is also controlled by water and nutrient availability (e.g., low nutrients leads to robust root growth and high root exudation)

Plants have ratios of C:N:P that affect nutrient use

e.g., if plant N:P ratio is higher than soil, then plant will be starved for N and will try to get more, perhaps by excreting organic C to stimulate N fixation.

Growing season greatly affects annual NPP in biomes, but on a daily basis during the growing season there is only about a 4-fold difference in NPP for all biomes including deserts and tundra vs. tropical rain forests.

Precipitation and temperature control biomes, but precipitation seems to be more important

What is water and nutrient use efficiency?

How can you use stable C isotopes to measure water use efficiency?

What is the difference between an open and closed system in terms of stable isotopes?

Where does N go in plants?

Much N is in rubisco, but as tree grows it needs more structural parts that are devoid of N, which dilutes N.

N acquired rapidly in young tree stands and slowly in old ones.

Where does fixed C go in a plant and how does this change as a plant ages?

What is role of fine roots and how does this change with tree age?

What is the connection between N availability and the activity and abundance of rhizosphere bacteria and fungi?

How does C:N:P ratio in fertilizer relate to the use of nutrients in soils and the availability of nutrients to plants?

Understand how reflectance can be used to measure primary net production remotely including connection to leaf area index (LAI).

Decomposition

Define mineralization

How does decomposition at the soil surface differ from tropics to higher latitudes?

What is the difference between humin, humic acid and fulvic acid?

## **Aquatic**

Wetlands

Where do most occur?

Minerotrophic vs. ombrotrophic

Succession of freshwater wetlands

*swamps to marshes to fens to bogs/*

*or reeds and grasses to sedges to mosses*

*How does hydraulic conductivity (permeability) change with succession and how does peat change?*

*How does pH and cations change*

## Lakes

How do lakes stratify, when does it occur, how does it affect nutrients and what conditions make it lead to lose of O<sub>2</sub> in bottom water?

How does primary production vary in large and small lakes (relative contribution of macrophytes vs. plankton)

Why are lakes P limited and not N limited?

## Rivers and Streams

What controls the infiltration of water into soils and streams?

How can chloride, bicarbonate and dissolved solids measurements be used to describe rivers?