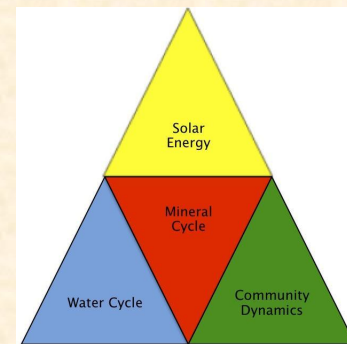


FOUR ECOSYSTEM PROCESSES

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“The nation that destroys its soil, destroys itself.”

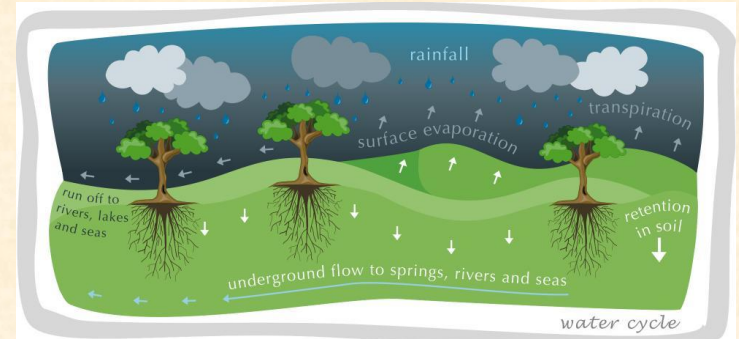
- **Four basic processes at work in all ecosystems** allow us to quickly gauge the health of the land:
- Only when these four processes are functioning in a farm are we getting real milk, real grains, real vegetables , fruits and real water .



4 ecosystem processes

- Water cycle:
- Mineral cycle:
- Energy flow:
- Community dynamics (also called **succession**):

Water cycle



Water Cycle

- Does rain feed plants and recharge groundwater,
- or does it run off the land, causing erosion?
- Do springs and streams flow seasonally or year-round?

Bare soil Vs Covered soil



Effective rainfall

- It is the rain that falls on the surface of the soil, soaks in and then leaves the soil only by two ways
 - By flowing through the soil to perennial flows, underground water reservoirs
 - By transpiration through green growing plants

With Non effective water cycles

- Droughts occur more frequently and are more severe
- Good plant growth takes place only in short bursts for a few days after the rain
- Plants do not start growing until later in the growing season
- Plants stop growing earlier at the end of the growing season.
- Floods are more severe when a high portion of the ground is bare

Muddy water

If rain water runs off it carries organic matter and soil with it



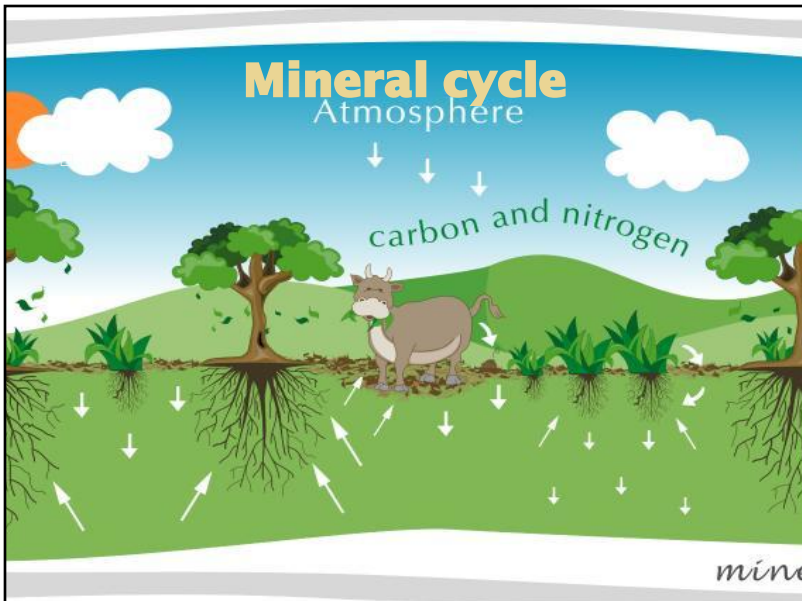
Surface ponding



Consequences of a Non effective water cycle

- Increased runoff
- Decreased water penetration and increased losses through evaporation
- Less production in all years
- Falling ground water tables, drying up springs and wells
- Unstable rivers prone to flash flooding and intermittent flow
- Silted dams and eroding catchments
- Detrimental effects on the other ecosystem processes

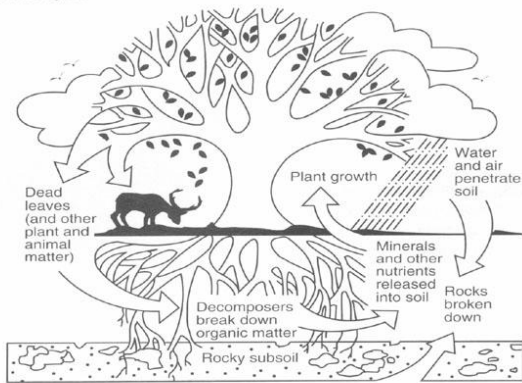
Capped soil



Trees shed leaves to bring minerals on top



Nutrient cycle.



Mineral depletion in vegetables 1940 - 1991

- Copper reduced by 76%
 - Calcium reduced by 46%
 - Iron reduced by 27%
 - Magnesium reduced by 24%
 - Potassium reduced by 16%
- Source: UK Ministry of Agriculture

Signs of effective and non effective mineral cycle

- | | |
|--|---|
| □ Ample litter on surface of soil | □ Little to no litter on soil surface |
| □ Many surface insects are visible | □ Few to no insects observed |
| □ Litter and animal manure decompose quickly | □ Litter and animal manure decompose slowly |
| □ Soil surface is porous and soil is crumbly | □ Soil surface is crusted, sealed and not crumbly |

Signs of effective and non effective mineral cycle

- | | |
|--|--|
| □ Diversity of plants and root structure | □ Lack of plant diversity and root structure |
| □ Plants healthy and no signs of nutrient stress | □ Plants diseased with signs of nutritional deficiency |
| □ Earthy smell for soil | □ No characteristic smell |

Energy flow

- The basis of all life depends on the plants ability through photosynthesis to convert sunlight energy to edible form so does every economy, every country and civilization.

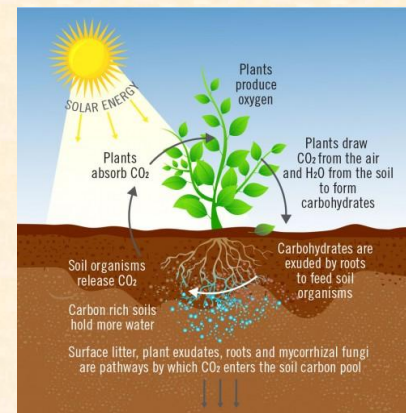
Flow of fuel that animates life

- The basis of all life depends on the plants ability through photosynthesis to convert sunlight energy to edible form so does every economy, every country and civilization.

Bare soil does not harvest sunlight



Energy cycle and carbon cycle



Signs of effective and non effective energy flow

- Close plant spacing, high plant density
- Rapid plant growth
- Plants growing over a long growing period
- A long food chain, including grazing animals, predators and decomposing organisms
- Bare soil visible between plants
- Slow plant growth
- Short spell of productive growth
- A short food chain with fewer grazing animals and low biological activity of decomposing organisms

Community dynamics

- Biodiversity
- Community Dynamics is the process of change and development in communities of all living organisms – including plants, microorganisms, and small and large creatures of every sort.
- A species will move into an environment when the conditions are suitable for its establishment, and will move out of that environment when the conditions become unsuitable for its reproduction

Biodiverse vs mono cropping



Ecological succession

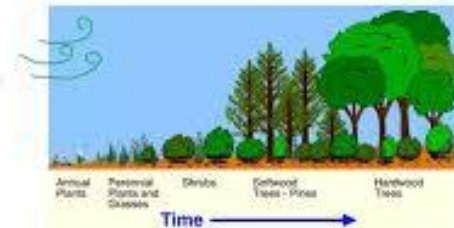
What is ecological succession?

Key Concepts:

- Ecological succession is the sequential process of rebuilding an ecosystem when a disaster destroys it.
- There is primary and secondary ecological succession

Key Terms:

• climax community



Signs of good and poor community dynamics

- Many different plant species
- Mainly perinneal plant species
- Decreasing amount of bare soil visible
- Rapid manure decomposition
- Monoculture
- Increasing no of annual plant species
- Increasing amount of bare soil visible
- Slow manure decomposition

- An advance in Community Dynamics, an increase in Energy Flow, or an improvement in the Water Cycle or Mineral Cycle, is a replenishment of capital.

Biodiversity-Life on earth our capital

- When there is abundance of birds, bees, insects, plants, animals and microorganisms there would be biodiversity
- Meaning biological wealth
- Financial prosperity
- Biodiversity happens only when the four ecosystem processes are highly effective

Nature works as a whole

- In order to have an effective water or mineral cycle, or adequate energy flow, an ecosystem must have communities of living organisms. For living things to thrive, they need effective energy flow to feed them, a water cycle that supplies adequate moisture, and a mineral cycle that supplies vital nutrients. **All four processes work together to create a healthy or unhealthy ecosystem.**

Organic material put as mulch



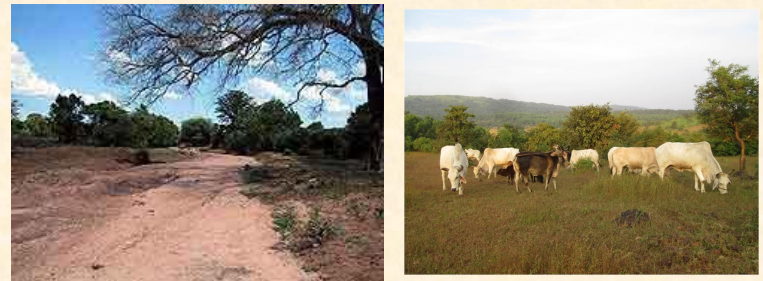
Eaten up by soil micro and macro organisms



Turned to black gold



Bare soil- Enemy No 1



To forget how to dig the earth and to tend the soil is to forget ourselves.

Water cycle-Circulation of life blood

- Water constantly cycles around between bodies of water, the sky, and the earth. The cycle is powered by the sun. **The most important factor in the way the water cycle works is the soil, particularly the soil surface -- where the earth meets the air.**

Water cycle

- **Soil cover, root mass, organic matter, and aeration -- these are synonyms for an effective water cycle**, where water is absorbed and retained as much as possible in the ground, and the surplus goes through plants (transpiration) and down into the water table.

- Are nutrients available to living things? Or are they locked in standing dead growth, or sunk below the root zone? Do they escape when plants burn or soil washes away?

Mineral depletion in fruit and vegetables 1948 1991 Reduction

- Potatoes Calcium 27 mg to 3 mg 89%
- Broccoli Magnesium 160 mg to 29 mg 82%
- Carrots Vit. A 25,000 IU to 91 IU 99.6%
- Apples Vit. C 25 mg to 5 mg 80%

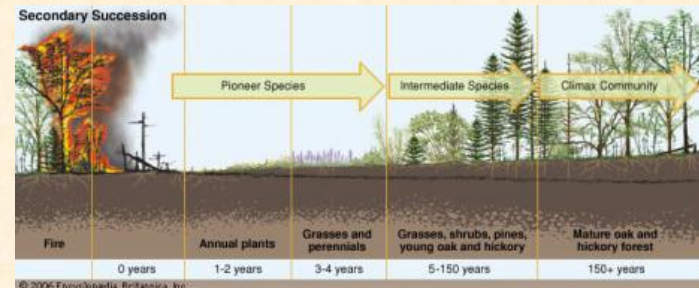
- It is possible to buy an orange today that contains ZERO vitamin C.

Australian Dept. of Agriculture and a A Canadian study showed this

Bare soil Vs Covered soil



Ecological succession



The very changing pattern in the development of living community

- The process of never ending developing process
 - it is system of cooperation for survival rather than competitor as such of monocrops.
 - Collaboration is more apparent then competition for survival.
- e.g. varieties of grass in sq ft plot. Bio-diversity is the rule of nature, which is constantly changing.

A Canadian study showed this decline in vitamins in potatoes over a 50 year period

- 100% of Vitamin A
- 57% of Vitamin C and Iron
- 28% of Calcium
- 50% of Riboflavin
- 18% of Thiamine

- Do not fall into the trap of seeking a Monoculture when you are trying to increase or decrease a species.
- By nature, succession moves toward greater stability and complexity

Caution

- **Modifying any one of these processes automatically changes all of them** because in reality, **they are only different aspects of the same thing.** Think of them as four different windows through which you can observe the same room

- “Soil erosion is as old as agriculture. It began when the first heavy rain struck the first furrow turned by a crude implement of irresponsible tillage in the hands of man. It has been going on ever since, wherever man’s culture of the earth has bared the soil to rain and wind.” - *Hugh H. Bennett and W.C. Lowdermilk, circa 1930’s*