

# Trees & Forest Systems

Start with Martin Luther Quote:

*"Wenn ich wusste, dass die Welt morgen untergeht, würde ich dennoch heute einen Apfelbaum pflanzen"*

(Translation: "Even if I should learn that the world would end tomorrow, I would still plant this apple tree today.")

-- Martin Luther

## Trees:

Amazingly important to the ecosystems of the planet

Second only to shallow lakes/ponds or marsh/swamp in soil production

- shallow lakes, ponds, marsh and swamp
- forests
- prairies
- no till agriculture

Trees create food & habitat for an huge # of species

They also play a huge role in the earth's water cycle

When trees are cut and forests are logged

- droughts
- floods
- water retention ability of the soil literally evaporates
  - Soils dry and crack
  - Rivers and streams dry up
  - Ground water levels drop
  - Even the air dries out
- nutrients also quickly leach away and top soils erode
  - with it, the forest's ability to regenerate
- habitat is damaged and lost and whole ecosystems disrupted and destabilized
  - The effects are very far reaching!
- over time, soils become salinated (salty) which makes forest regeneration, even with human intervention, even more difficult.
- deforestation has impoverished entire nations
  - Haiti
  - Ethiopia and much of Africa
  - deforestation has even had adverse effects here in Thailand!
    - 70% of the country side was forest only 50 years ago - that reduced to only 20% by 2000

(segway) - all the more reason for Martin Luther to plant that apple tree, eh?

So what is in a Tree?

- Very interconnected!
- It's often very hard to tell where the tree ends and other life begins

- Waru is an aboriginal word for a shrub, the fire that germinates the seed of that shrub and a wallaby that feeds on the shrub - many parts of the same system

[ Draw a Tree ]

Tree Bio-mass zones:

Stem & Crown - What types of bio-mass might you see here?

Detritus & Humus - “ “ “ “

Root & Root associations - “ “ “ “

Trees literally grow out of a layer of their own fallen wastes (Detritus, fallen trees, etc... that fungi and bacteria decompose)

- Trees shed their own weight in leaf litter many times over the course of their life
  - Bacteria, fungi, and other types of organisms help to decompose this material and make it available again to the trees, other plants, animals and other organisms
  - This builds soil, sequesters carbon on the forest floor and helps to support the ecosystem of the forest. (forests are making their own compost right there where it's needed!)
- Roots and woody material also die back underground which leaves pathways for water and soil microbes that help to build humus under the surface.
  - BUILDING SOIL FROM ABOVE AND BELOW!

(Segway) So, as you can see, trees are a huge part of the forest eco-system... but trees do so much more!

Trees are **the ultimate translators and moderators** of incoming energy.

- sun, rain, wind, temperature
  - Trees modify these energies to improve conditions for increased health and life
  - not just the life of the trees themselves but other life as well.
- like the word Waru suggests, a forest is more than the sum of it's parts, it's a living body, a whole system.

What are some of the ways trees moderate these different energies?

## Rainfall

Six effects of forests on precipitation

- 1) Compression -[draw on white board]
  - Ocean evaporation -> Clouds -> Precipitation (generally 20x the height of the trees on the mountain)
- 2) Transpiration -
  - 50% of water in clouds comes from the trees transpiring
  - can increase to as much as 100% as you move inland especially if you cross more mountain ranges!
- 3) Condensation -

- accounts for a huge amount of water falling
- can outweigh precipitation in some areas (rainforest in central america)
- 4) Insulate -**
  - Snow and meltwater are stored and dispersed over a longer time period because of trees.
  - Trees also reduce evaporation in the same ways
- 5) Provision of Nuclei -**
  - bacteria living in forests help to seed the clouds
  - living on the leaves -> transpired into atmosphere -> water molecules condense around them until they are too heavy to stay in atmosphere -> rain falls -> bacteria end back up on the leaves where the process can begin again.
- 6) Slows water flows and sinks water into soils**
  - humus acts like a sponge and holds water from evaporation and leaching
  - shade also reduces evaporation
  - this creates a slow release system that supports and sustains life throughout the forest ecosystem

- In addition, water that does flow through these forest systems is about 50%

### **Temperature**

Ever walk into a forest and notice a significant temperature shift?

Transpiration - cooling

Condensation - heat moderation (cools on hot days and heats on cold days -- the transfer of heat)

- An average elm tree will evapotranspire up to 15,000 lbs of water on a clear hot day.  
8000 liters in one day!  
this creates a very cooling effect
- Condensation off the leaves at night warms cold surrounding air.  
condensation needs surface area to condense on and the surface area of a tree is immense
- Thermal Mass  
Leaves are 86% water  
water stores a lot of heat and radiates it slowly  
this effect further regulates the temperature of and keeps it cooler by day and warmer by night
- Humidification/Dehumidification by taking up moisture or producing moisture

all these things help to change and modulate temperatures

### **Wind**

Trees clearly break up wind patterns

In response to increasing winds, branches and leaves deform to reduce exposure.

(many trees and plants will do the same in hot intense sun (sometimes referred to as “solar saturation”))

By observing trees we can learn about wind patterns on our site.