Lecture 7
Agricultural Potential of the Humid Tropics

Although the tropical forest is lush, net productivity is low.

This is one factor that accounts for lack of sedentary agriculture in the *Af* tropics.

Only 2.5% of *Af* lands are under sedentary cultivation compared to 10% in the habitable part of the world.

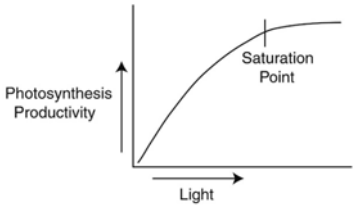
Jen-Hu Chang (1968) has developed *the theory of potential photosynthesis* to account for this.

Chang, Jen-Hu. 1968. Agricultural potential of the humid tropics. Geographical Review 58:333–361

Photosynthesis depends on the availability of water, air, temperature, and solar radiation to plants.

Without limiting factors, photosynthesis increases with sunlight up to the saturation light intensity which varies somewhat from plant to plant.

However, increased light increases photosynthesis because of the effect of shading.



Therefore long days, bright sunlight can be expected to increase the rate of photosynthesis.

However the rate of biomass production (carbohydrate production) or yield is based on net photosynthesis which is gross photosynthesis less respiration losses.

Net photosynthesis =
Gross photosynthesis – Respiration loss

However, the rate of respiration is directly related proportionally to temperature between 40° and 95°F.

Thus, the ideal climate would be bright sunny, long days and cool days and especially cool nights.

This does not describe *Af* climates.

Remember equatorial areas have zones of relatively low insolation due to cloud cover and short days.

At higher latitudes, greater insolation in the summer combined with lower night temperatures increase net photosynthesis.

Net Photosynthesis as a Percent of *Af* Climate

Time	*Af*	*Aw*	*Cs* (Medit)	*Ca* (Mild temperate)	*D* (Severe winter)
Entire Year	100	105	117	91	68
8 months (March to Oct)	100	106	127	123	101
4 months (May to Aug)	100	109	136	133	152

Light Energy and Temperature in *D* and *Af* Climates during June (Northern Hemisphere):

Climate	Light energy	Avg. temp. (°C)
D	510 langleys	17
Af	357 langleys	26

Actual Yields under Optimum Conditions
International Rice Research Institute (IRRI)

	Yields (tonnes/ha)	
Country	Best conditions	Average conditions
Japan, Australia	14.3	8.9
Phillipines, Malaysia	12.3	5.0

These differences are in accord with calculated discrepancy of net photosynthesis.

However differences are greater under "average" conditions.

Thus poor management carries a greater penalty in the tropics!

Within *A* climates, *Af* poorer than drier tropical climates such as *Aw* or *As* (dry season in summer).

This is true for sugar yields in Hawaii

Af **8.92 tons/acre**

As **12.52 tons/acre**

Note: *As* climate is very rare and is due to cyclonic factors; found in Ceylon, S. India, Hawaii.

Loading sugarcane, Maui, Hawaii