

# GLOBAL CLIMATE, PRODUCTIVITY & SOILS

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1

With this class we leave historical aspects of explanation of patterns  
we have earlier seen (richness) that climate has a profound effect on biota

here we begin to describe patterns in *global climate*

we will find that these patterns drive many aspects of biotic patterns

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2

climate is driven by solar energy and its (indirect) impacts on earth's atmosphere  
(atmosphere is +/- transparent to sunlight)

climate is patterned in space & time

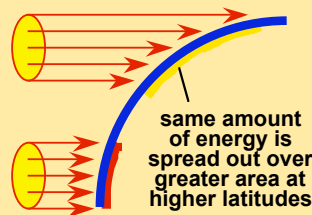
time dimension = seasons →

spatial dimension = latitude ↓

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earth's spherical shape means solar energy impinges on earth's surface differently according to **latitude**.....



also, energy passes through deeper atmosphere and more gets reflected away

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4

but solar energy heats up earth's surface  
energy re-radiates in **infra-red**  
warms up atmosphere **near the surface**

this now less-dense atmosphere rises  
**CONVECTION CELL**

this draws in surface air from neighbouring regions

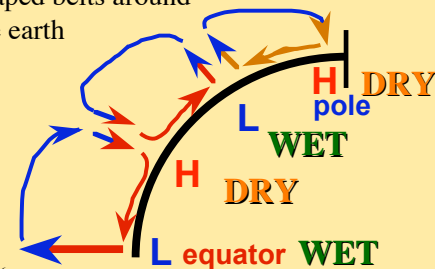
strongest effects are over low latitudes

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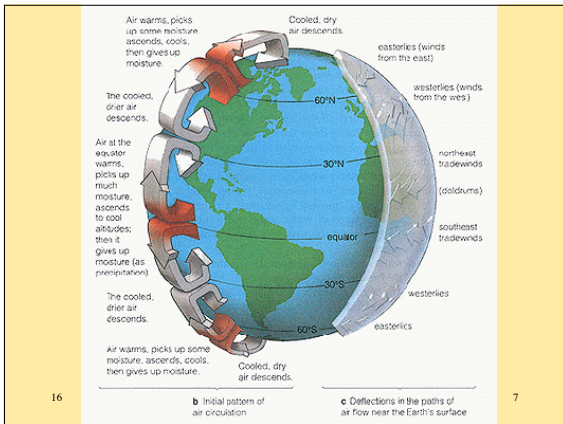
**This sets up a series of rolling cells**

which form doughnut-shaped belts around the earth



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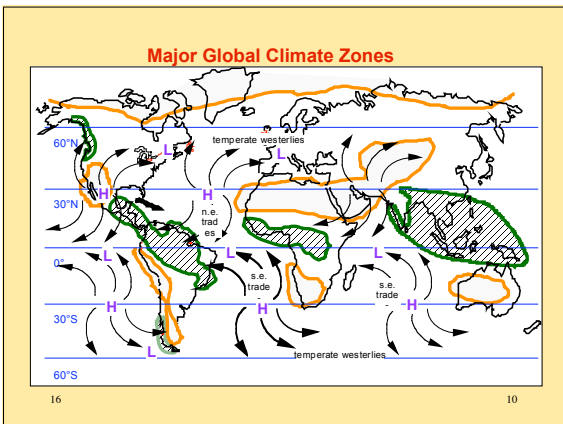
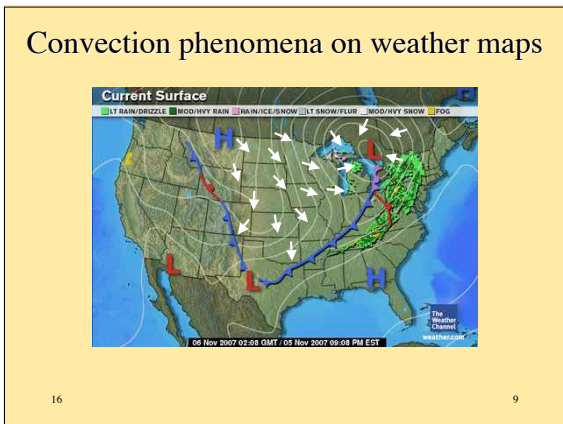
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air moves from **HIGH** to **LOW** pressure generating **SURFACE WINDS**

the **major winds** run from the **20-30° zone** both towards the equator (Trade Winds) and towards temperate latitudes (Westerlies)

but they don't run straight N or S because of **CORIOLIS FORCE** from earth's rotation



so, on global scale, there are **4 main climate belts:**

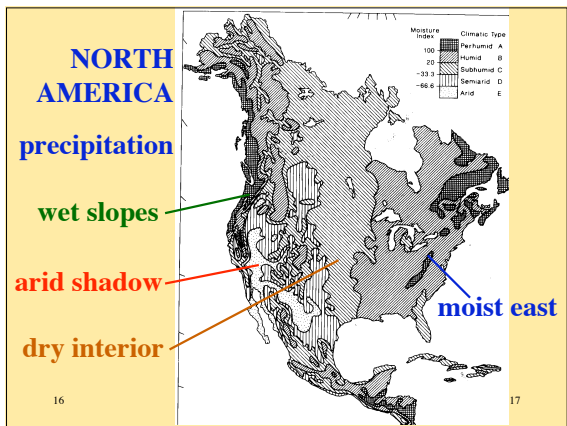
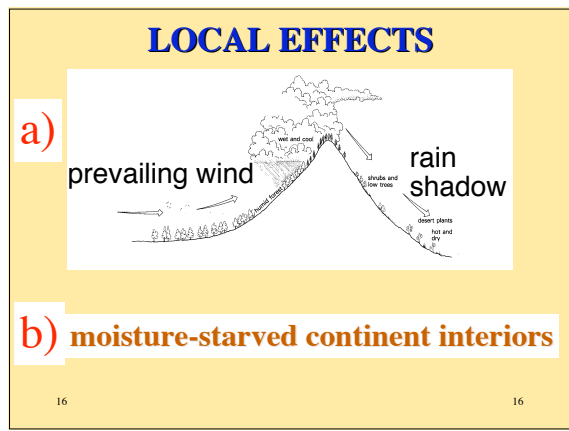
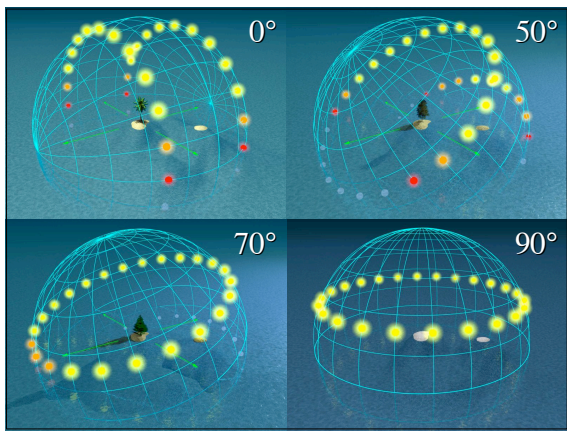
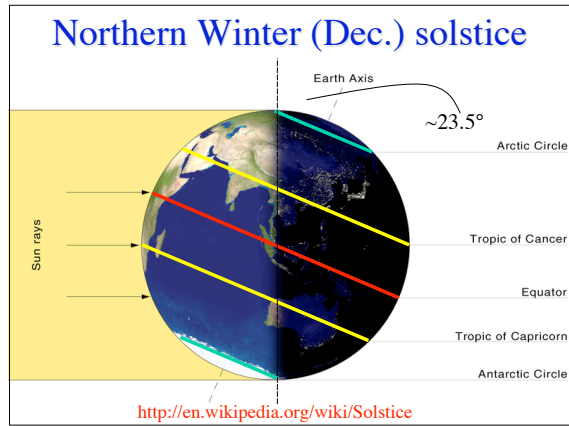
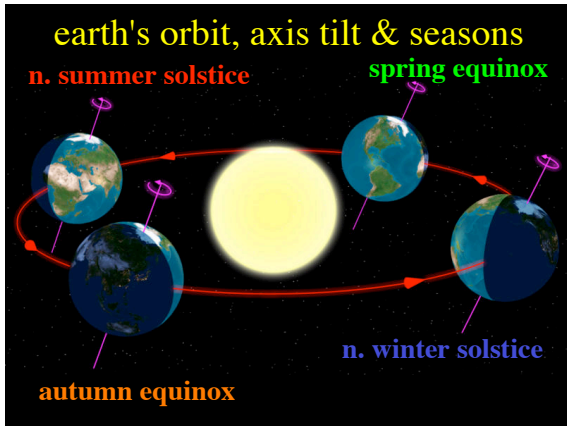
<b>TROPICS</b>	hot, moist
<b>SUBTROPICS</b>	hot, dry
<b>TEMPERATE</b>	cool, moist
<b>POLAR</b>	cold, dry

now we can understand why the climate is different at different latitudes

**why are there seasons?**

seasons result from the fact that the earth's equator is **NOT** in the plane of the earth's orbit around the sun

therefore "effective latitude" changes throughout the year



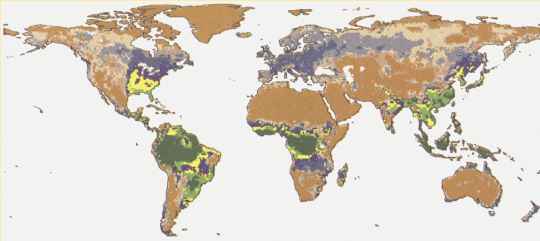
in terrestrial systems,  
**temperature** and **precipitation** directly  
 determine **PRIMARY PRODUCTIVITY**

-the rate at which CO<sub>2</sub> is fixed  
 from the atmosphere

therefore we see latitudinal belts of  
 Primary Productivity closely similar  
 to those shown by climate

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**an index of global Primary productivity**



polar/deserts : 0-2.5 tons/Ha/yr

tropical forests : >30 tons/Ha/yr

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the picture is very different in **Marine Systems** because

**O<sub>2</sub> is not uniformly available**

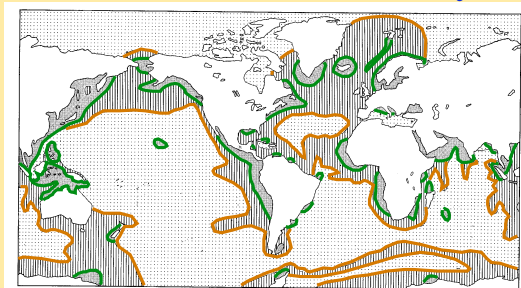
also turbulence & turbidity and availability of nutrients

in Marine systems, Productivity is mainly associated with **shallow shelf seas** and **upwellings of cold, rich waters**

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**Global Marine Productivity**

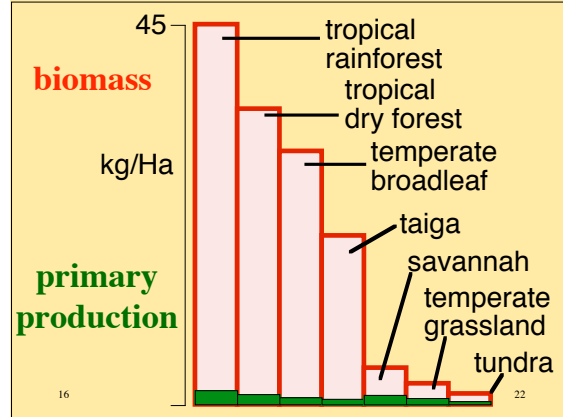


<2.2 metric tons/ha    2.2 - 5.5 tons/ha    >5.5 tons/ha

most oceans =/ < land deserts

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climate affects the biota, while both affect the physical environment  
**this interaction is readily seen in SOILS**

soils are not a given; they evolve from parent rock, climate + biota

key factors in interaction:  
**rate of decay - temperature**

**O<sub>2</sub> availability - waterlogging**

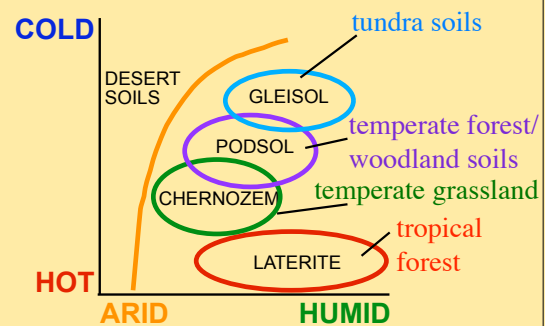
**rain vs. evaporation**

**- leach or evaporite; minerals**

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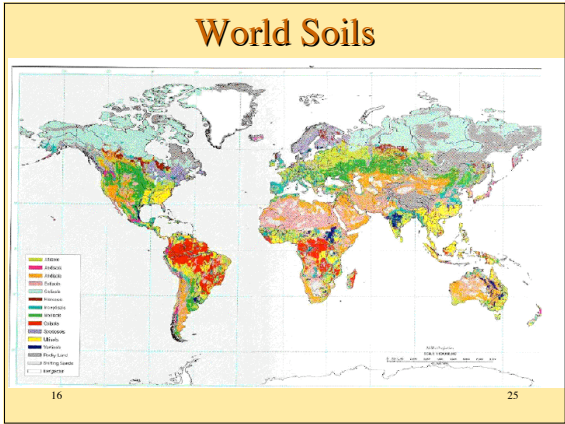
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**Soil-types by Climate-types**



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## NEXT CLASS

### THE BIOTA'S RESPONSE TO CLIMATE

- why there are BIOMES

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