TOPIC #17

THE IPCC FINDINGS

Part 2:
The IPCC: More Impacts
Biodiversity & Forest Issues

pp 93-94 in Class Notes

Biodiversity (def)

- The variety of life forms found in the natural world.
  - usually refers to different species, also includes ecosystems and genetic diversity within a given species.

- The greater the biodiversity within an ecosystem, the more stable and resilient it is, and the more productive it will be.

Biodiversity in Terrestrial Environments:

greatest in forest biomes, esp. tropical forests

FORESTS are involved in the following global change issues we've already discussed:

- Carbon & GHGs
- Radiation Balance
- Feedbacks

Review

DEFORESTATION & BIODIVERSITY

Deforestation (def) =

Deforestation is the clearing of trees off an area of land. It includes any forestry practice that results in a long-term land use change.

Types of change:

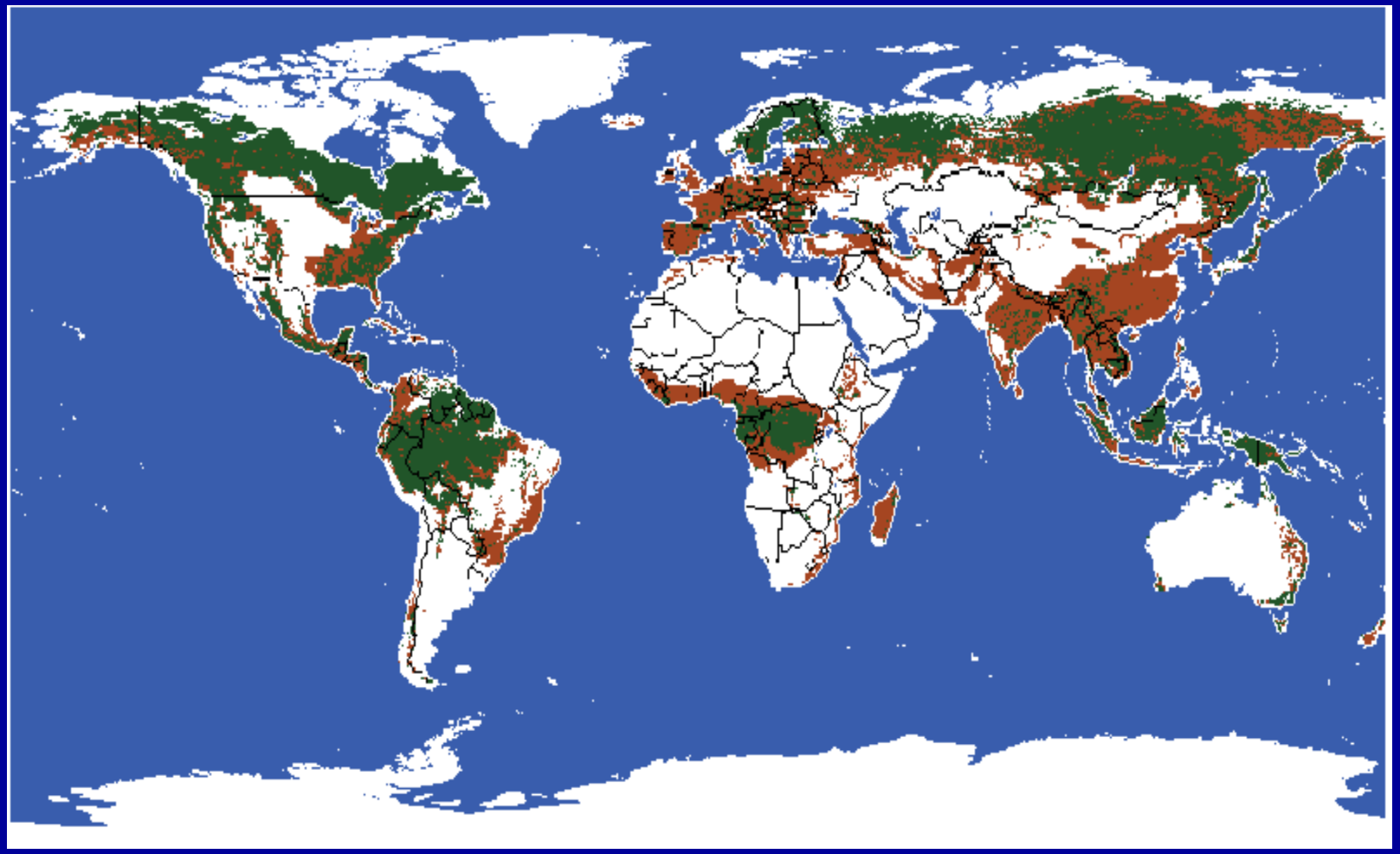
- Forest → agriculture
- Forest → human settlements
- Forest → non-forest uses e.g., urban, industrial, livestock, etc.

…all can affect plant and animal **BIODIVERSITY**

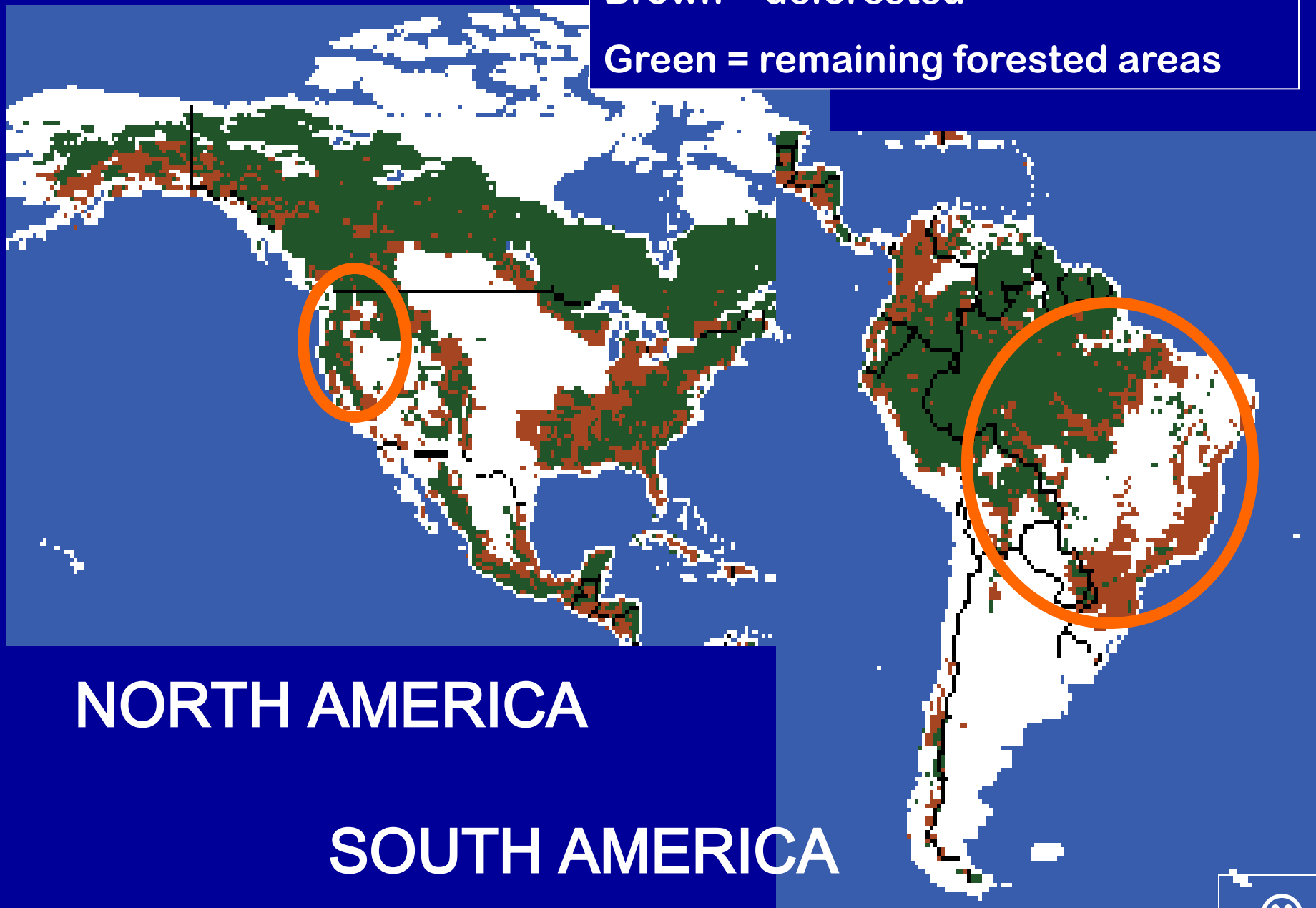
Why does it happen?

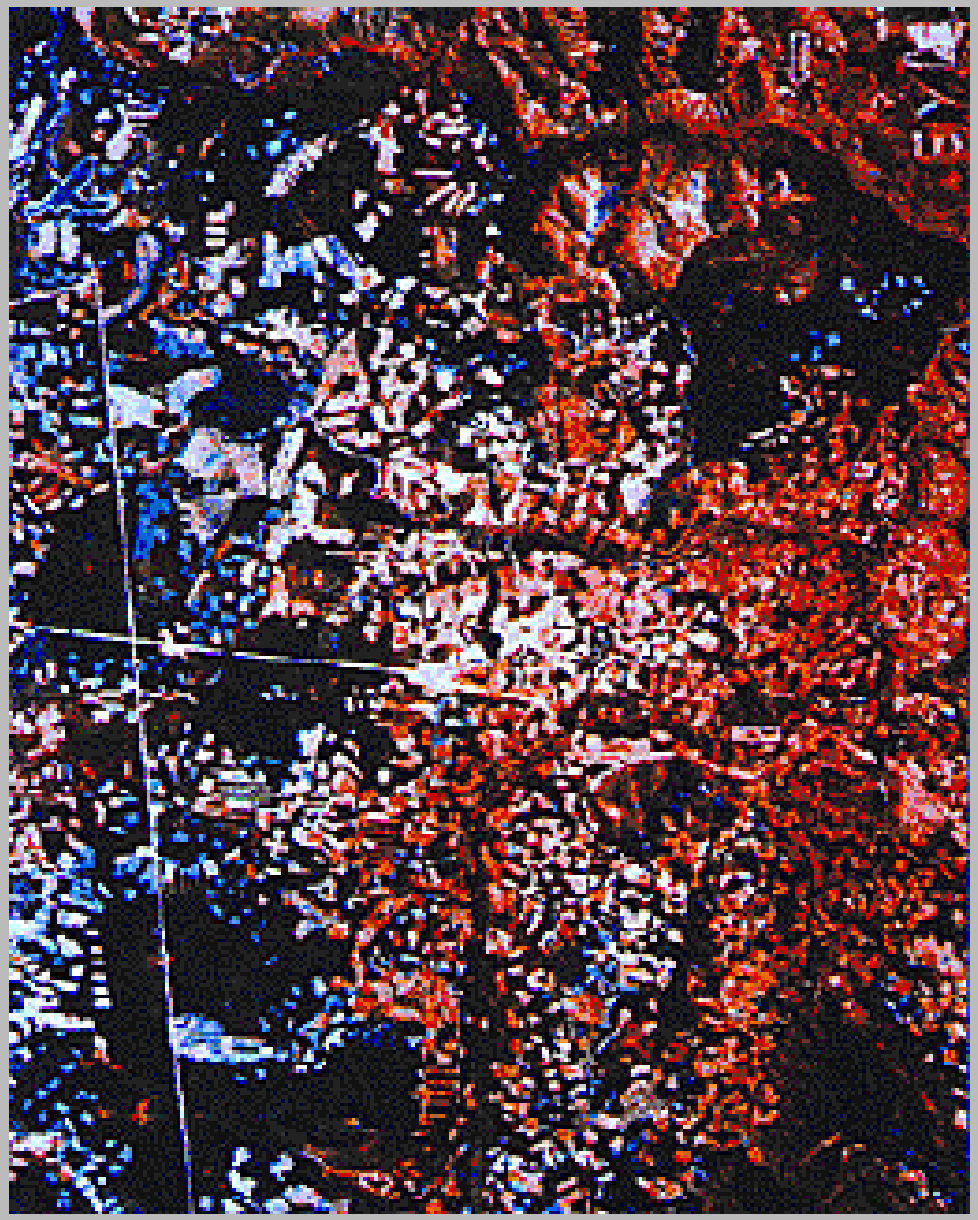
MULTIPLE CAUSES OF DEFORESTATION:

- Population pressure & resettlement
- Agricultural expansion
- Harvesting of fuel-wood for domestic energy purposes
- Conversion to farms and ranches
- Logging and timber industry



Estimated DEFORESTED areas (brown) vs.
Remaining Forested areas (green)
over last 8,000 Years.


Brown = deforested
Green = remaining forested areas
NORTH AMERICA
SOUTH AMERICA



Mt. Hood National Forest, Oregon

Vanishing Old Growth Forest in the Pacific Northwest

-- leads to high degree of habitat fragmentation

-- truncation of tree-ring record!

KEY TO SATELLITE IMAGE:

Dark Red = old growth

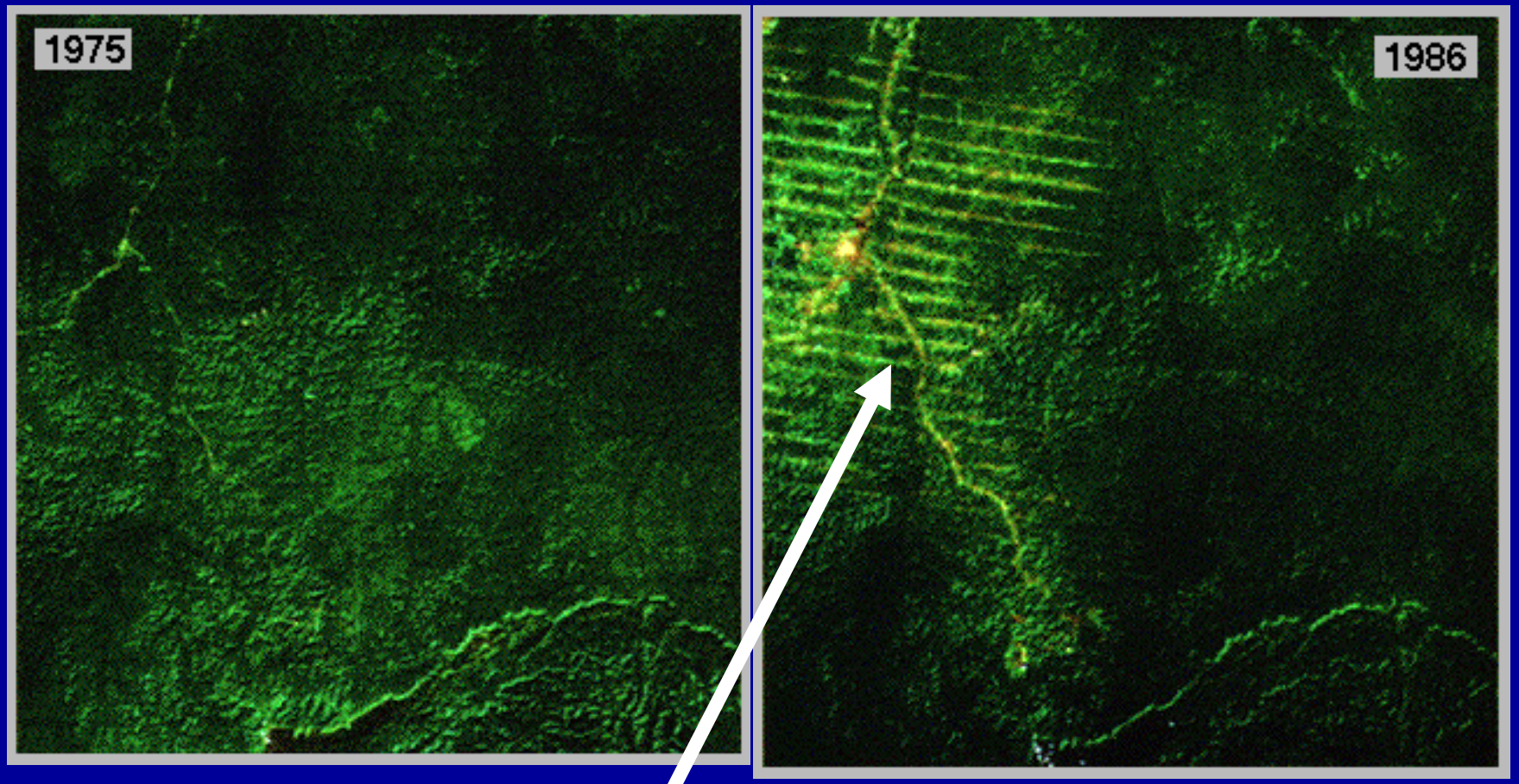
Light Red = regrowth

Pink = young saplings

Blue = totally logged

TROPICAL DEFORESTATION

(satellite imagery)



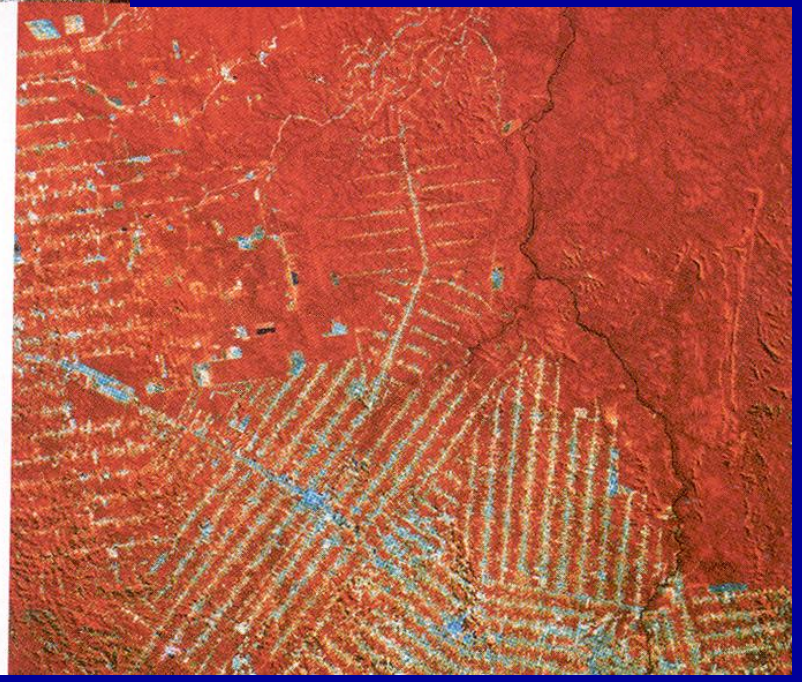
"striped" pattern of deforestation due to construction of logging and access roads

AMAZONIA
in 1972

Forest loss rate ~ 1.8% per year

Estimated that by 2025, almost half of the remaining rainforests will be lost along with 5 – 10% of all the species on Earth

AMAZONIA
in 1992



Color version of Fig 1-7 in SGC Chapt 1

Tropical Deforestation

- Tropics contain:
  - 3/4 of all the living things on Earth,
  - 2/3 of all plant and animal species

  But they cover only 6% of the land surface
  - Therefore they play a major role in shaping ecosystems on earth.

- With such diversity, deforestation of the tropics could lead to 27,000 species lost every year

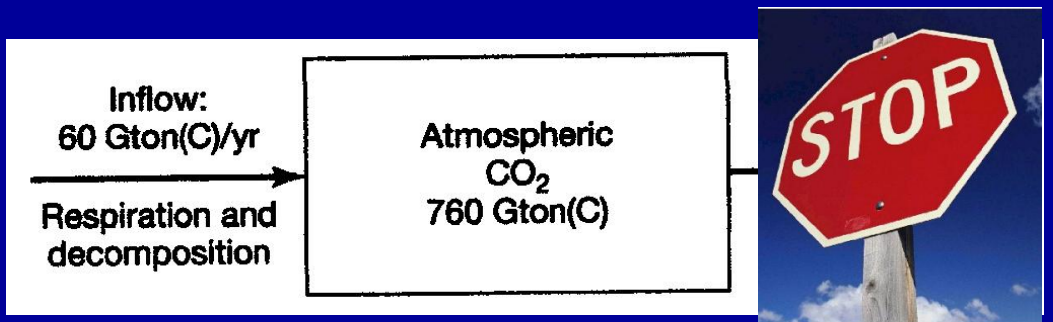
➔ **KEY CONCEPT #1 = LOSS OF BIODIVERSITY**

More consequences of deforestation:

- Forests are a major SINK for atmospheric CO2

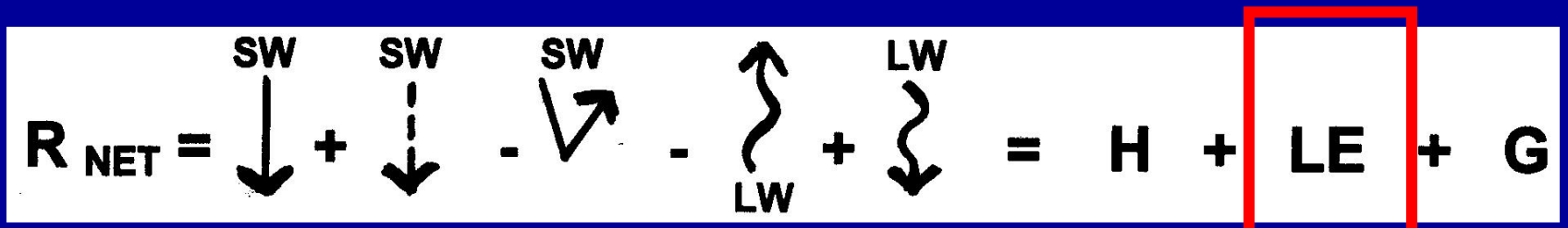
➔ KEY CONCEPT #2 = LOSS OF LARGE PORTIONS OF NATURAL CARBON SINK

Deforestation ➔ an increase of CO2 in the atmosphere ➔ warming



Other consequences of Tropical deforestation:

KEY CONCEPT #3 = Change in Local Hydrology & Energy Balance



Affects RIGHT side of ENERGY BALANCE EQUATION through LE (evapotranspiration)

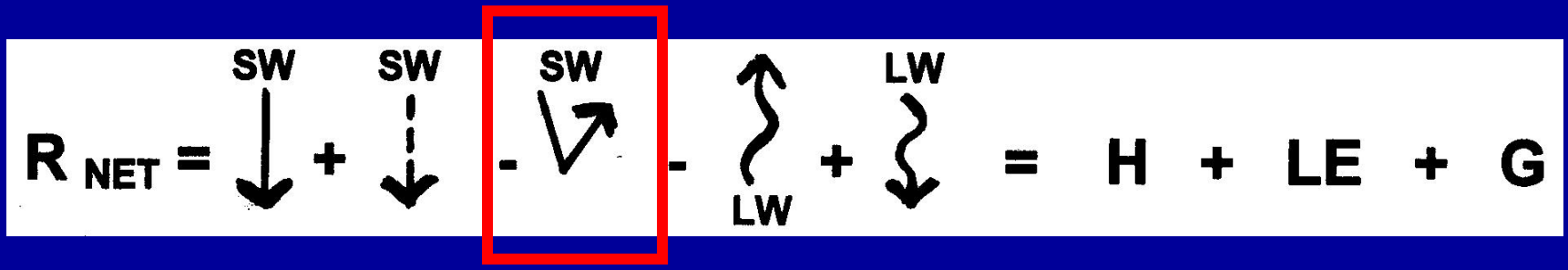
Less energy in LE ➔ more in H ➔ WARMING

p 94 (top)

Another consequence of Tropical deforestation:

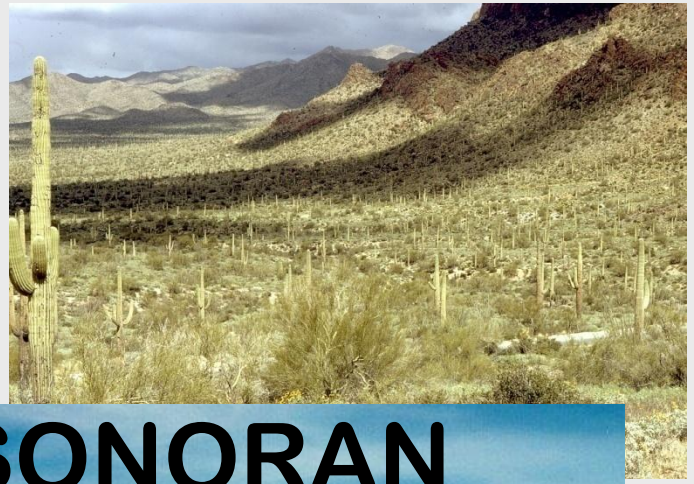
KEY CONCEPT # 4 = Change in the ALBEDO
(of the Earth's Surface)

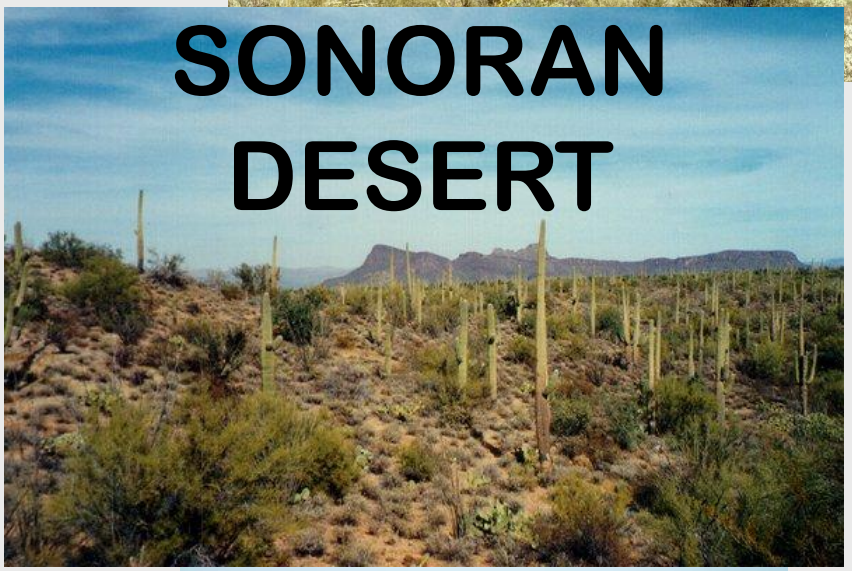
➔ affects Energy Balance (left side)

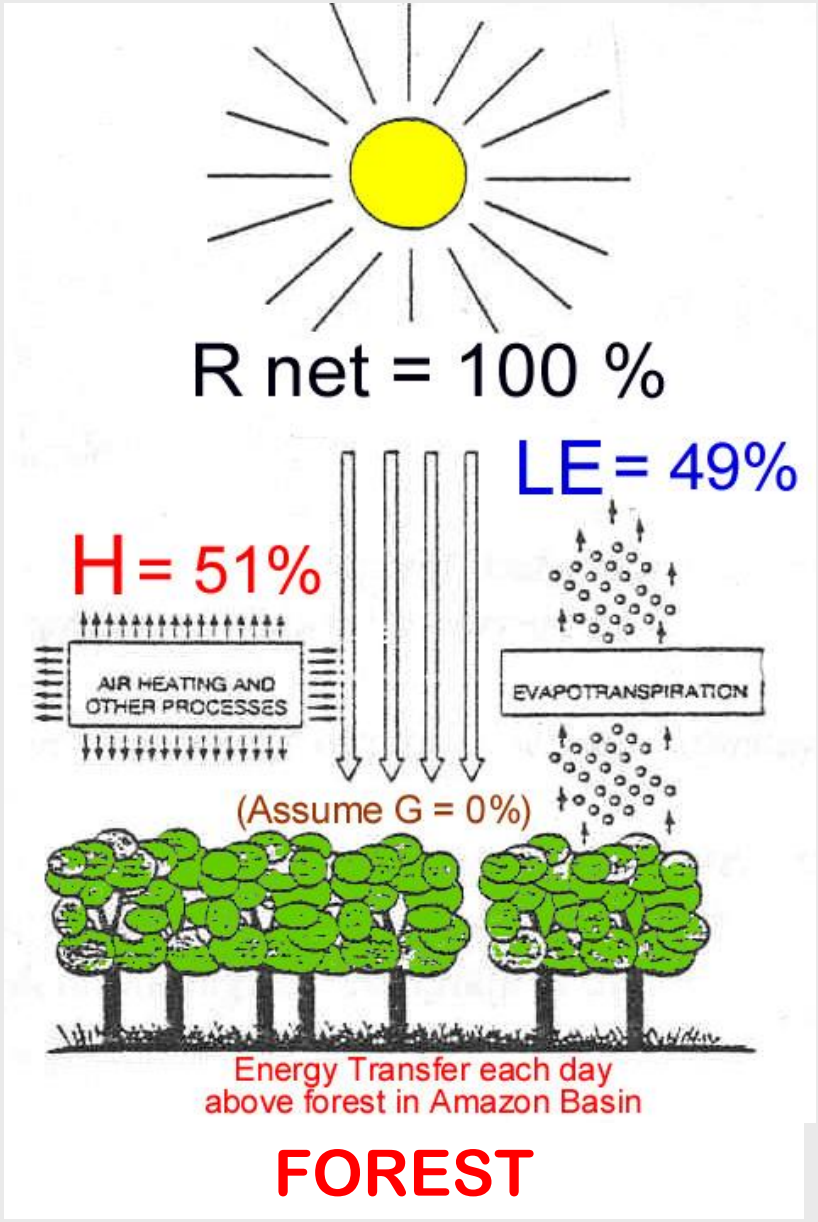


Increase in albedo ➔ COOLING

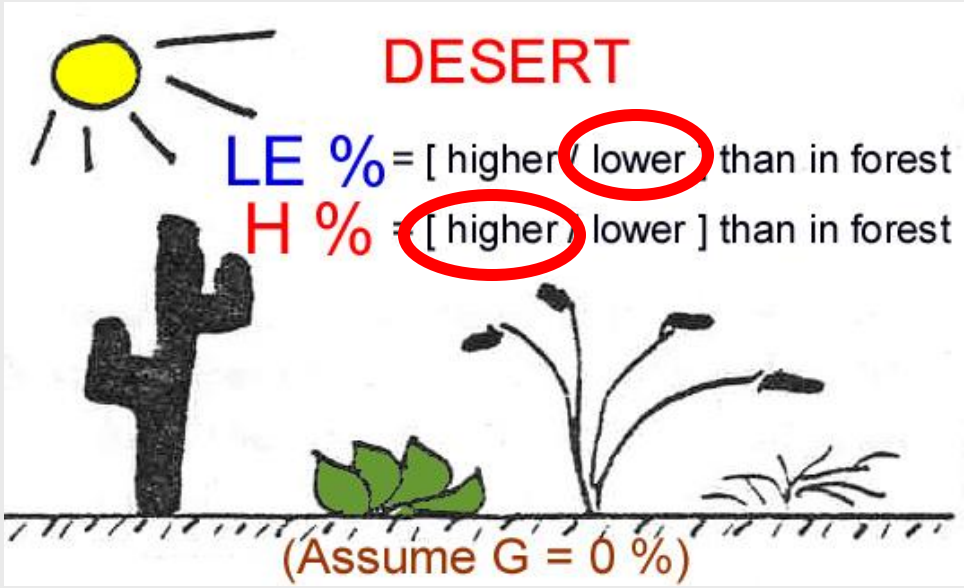

AMAZON RAIN
FOREST




SONORAN
DESERT

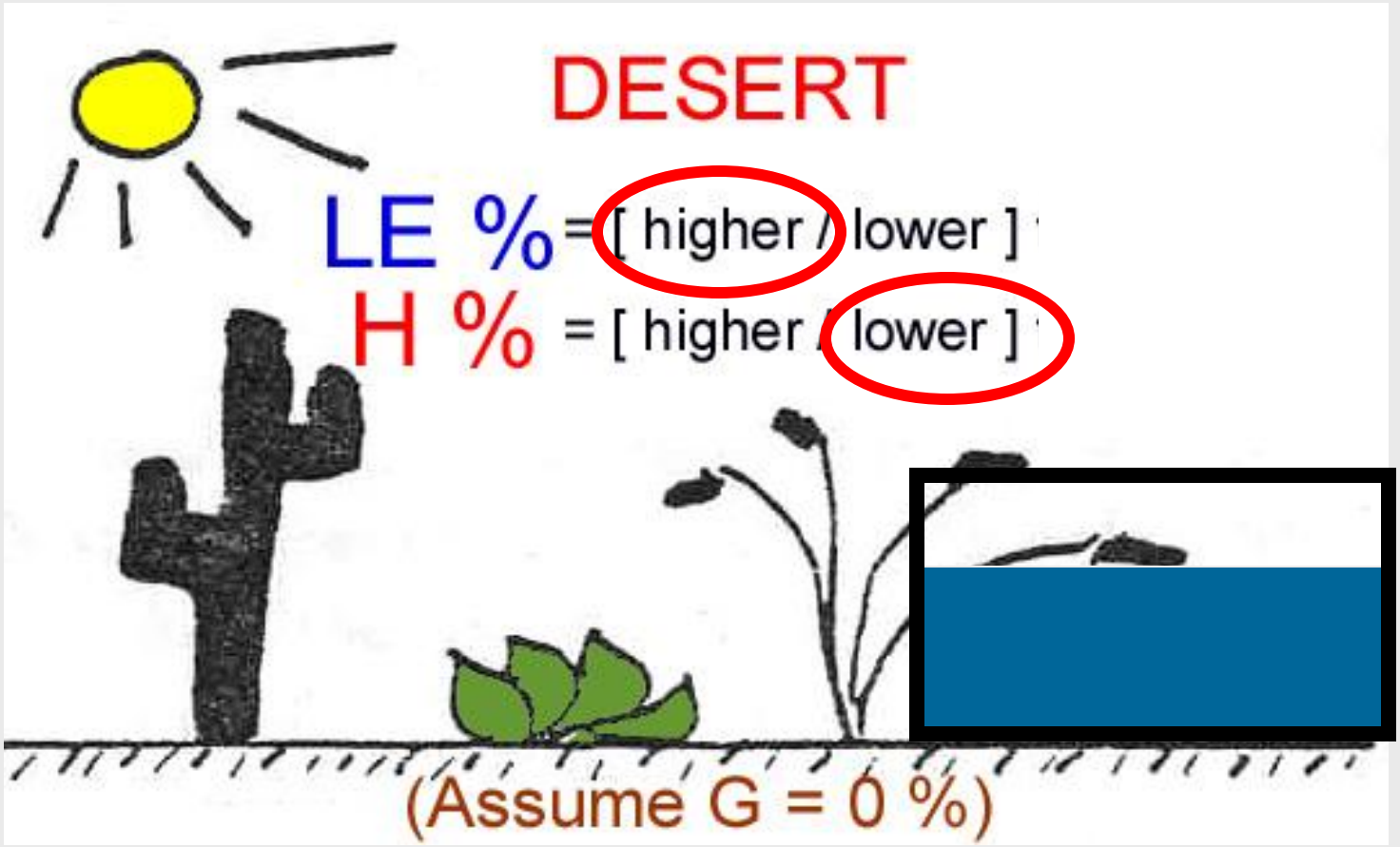


Will the % of net radiation in LE form be HIGHER or LOWER in the Desert, when compared to a Rainforest?



What if humans put in canals (CAP), lakes, & artificial water bodies in a desert?

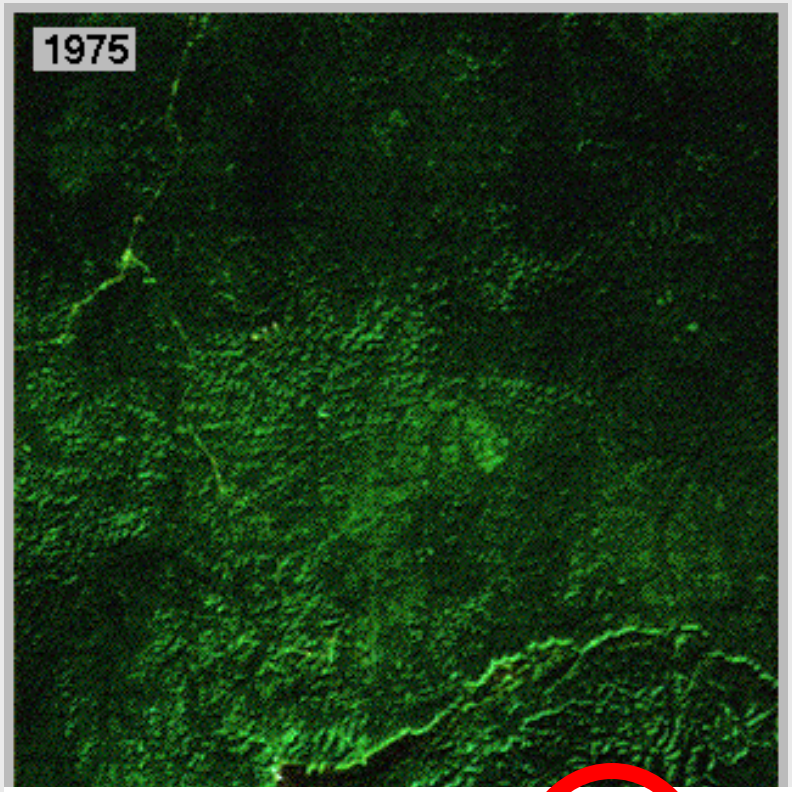
Central Arizona Project (CAP) Canal

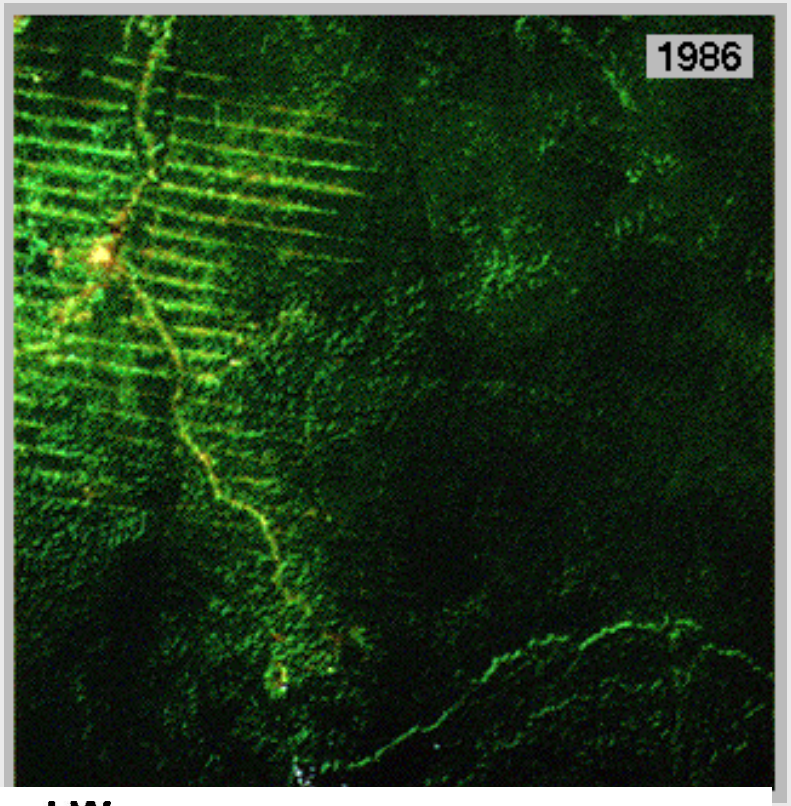


What if humans put in canals (CAP), lakes, & artificial water bodies in a desert?

How would the % of LE in the Desert change?

How does DEFORESTATION change the local energy balance???



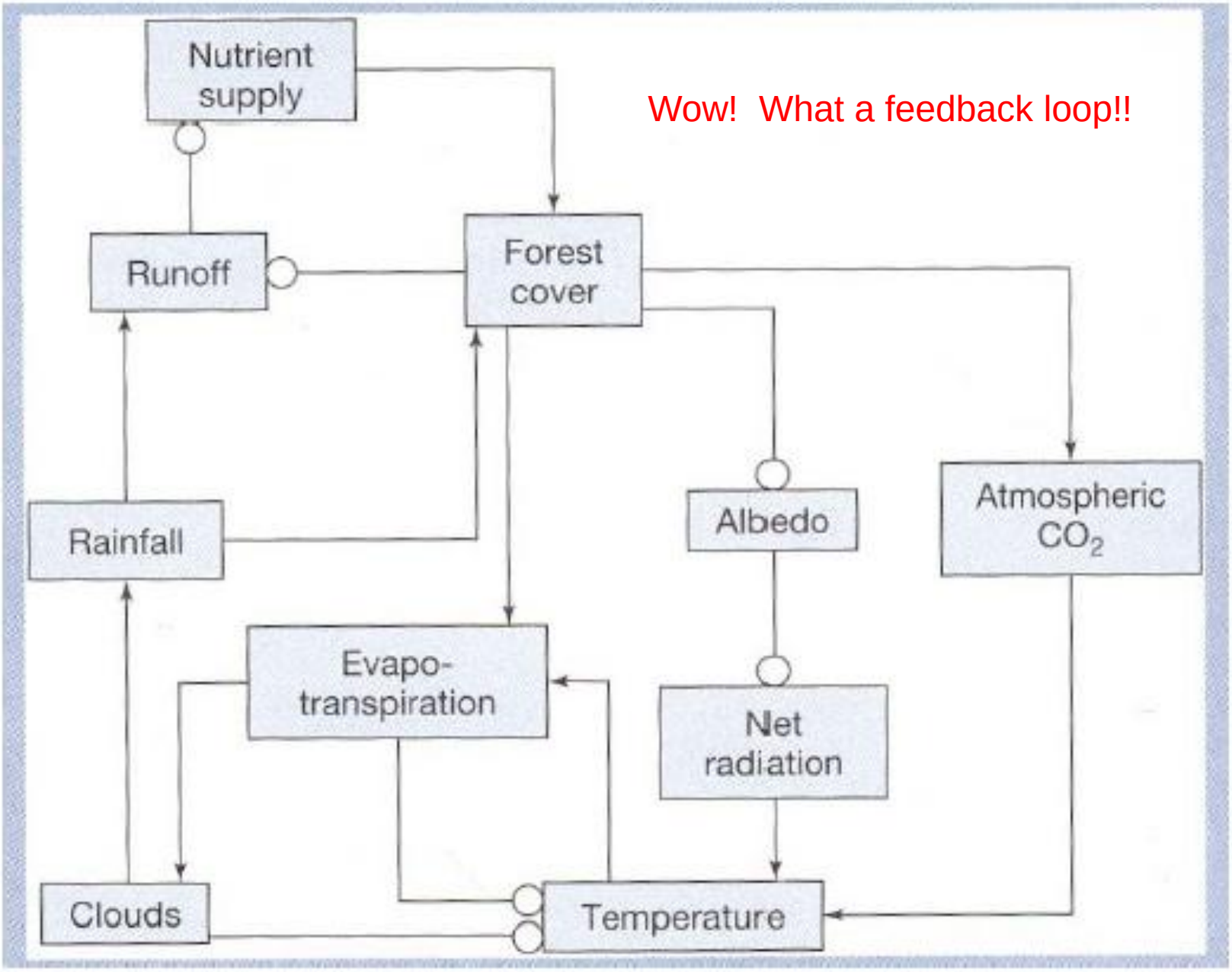


R_{NET} = SW ↓ + SW ↓ − SW ↗ − LW ↕ + LW ↯ = H + LE + G

Less

More → cooler temperatures?

More → warmer temperatures?



Wow! What a feedback loop!!

So does deforestation => warming or cooling?

Results of one study:

Impacts of Deforestation on Local Climate

Surface Variable	*Observed*	*Control**	*Deforested**
Evaporation (mm/d)	3.34	3.12	2.27 (−27.2%)
Precipitation (mm/d)	5.26	6.60	5.26 (−20.3%)
Soil moisture (cm)		16.13	6.66 (−58.7%)
Runoff (mm/d)	2.76	3.40	3.00 (−11.9%)
Net radiation (W/m^2)		147.3	126.0 (−14.5%)
Temperature (°C)	24.0	23.6	26.0 (+2.4°C)

This model's results indicate a slight Temperature INCREASE

BIODIVERSITY & Hot Spots!

- The tropical rainforests have the largest extinction rates, but they are **not** the only places where species are at risk.
- 25 (not 18!) areas spread around the world have been identified as **HOT SPOTS OF HABITAT LOSS**
- These are areas where habitat has been reduced (or is expected to be reduced) to **less than 10% of its original cover**

BIODIVERSITY & Hot Spots!

Hot spots of habitat loss (in red) represent 28% of the Earth but hold 44% of plant species ➔ key regions vulnerable to local, regional & GLOBAL CHANGE!

☺

Recap:

- Tropics play a major role in shaping the biosphere due to high biological diversity.
- Deforestation also affects the carbon cycle by reducing the carbon reservoir (or "sink")
- Deforestation of the tropics will lead to changes in surface hydrology, albedo, & local climate
- "Hot Spots" around the world are threatened by natural habitat loss

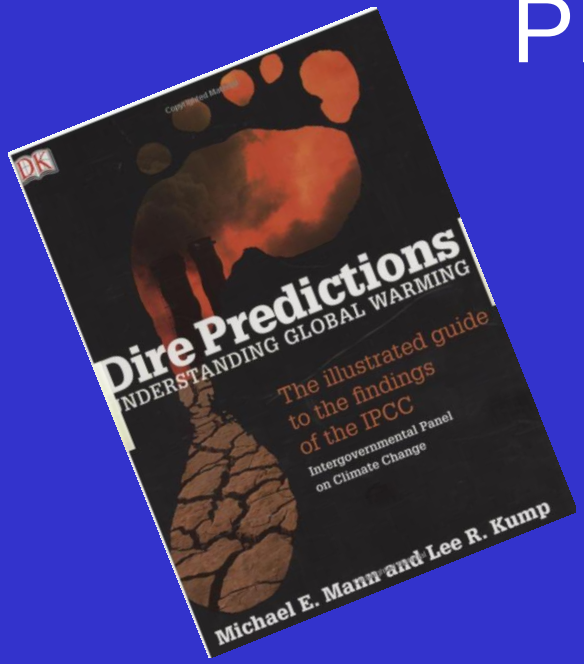
So what do we do about it???

Next Class: MITIGATION & ADAPTATION

POLICIES & POSSIBLE ACTIONS TO SLOW GLOBAL WARMING . . .

And now . . . .

MORE
DIRE PREDICTIONS
GROUP EXTRAVAGANZA
PRESENTATIONS!!



Related article: **Canadian researcher says arctic ice is thinning** (AP) Nov 27, 2009

WINNIPEG, Manitoba — **The permanent Arctic sea ice that is home to the world's polar bears and usually survives the summer has all but disappeared, a Canadian researcher said Friday.**

University of Manitoba Arctic researcher David Barber said experts around the world believed the ice was recovering because satellite images showed it expanding, but the thick, multiyear frozen sheets have been replaced by thin ice that cannot support the weight of a polar bear.

"Polar bears are being restricted to a small fringe of where this multiyear sea ice is. As we went further and further north, we saw less and less polar bears because this ice wasn't even strong enough for the polar bears to stand on," said Barber, who just returned from an expedition to the Beaufort Sea.

Read the entire article here:
http://www.google.com/hostednews/ap/article/ALeqM5gTEP6o9TmljWrpL0TZwKgcR9PwIQD9C85B7O1

G-6 DIRE PREDICTIONS PRESENTATIONS: Lec 40

Group 15	Polar meltdown – Antarctic
Group 12	Polar meltdown – Arctic
Group 5	Earth-Wind & Fire – Earth
Group 14	Earth, Wind & Fire (wildfires)
Group 16	Too Wet, Too Hot
Group 20	Coral Reefs
Group 1	International Cooperation

G-6 DIRE PREDICTIONS PRESENTATIONS: Lec 41

Group 8	Polar Meltdown
Group 11	Beach House (Sea level rise)
Group 12	Floods & Droughts
Group 14	Too Wet, Too Hot
Group 3	Forests
Group 18	Extinctions