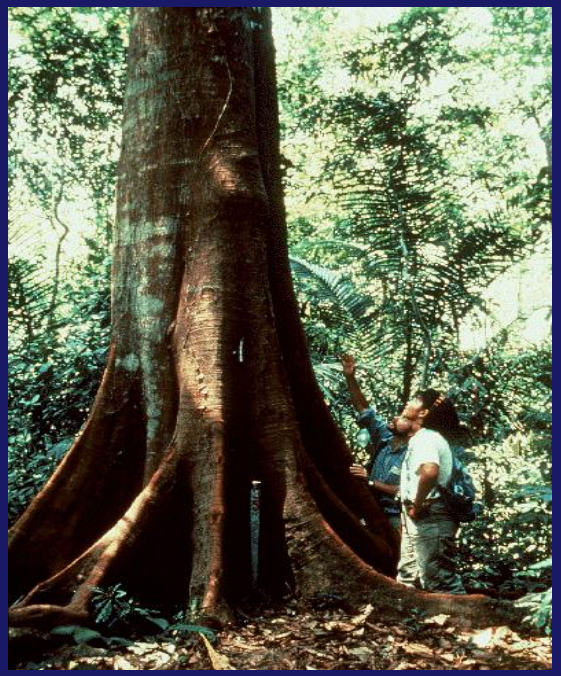
TOPIC #15 (cont)
CLIMATE CHANGE IMPACTS III:

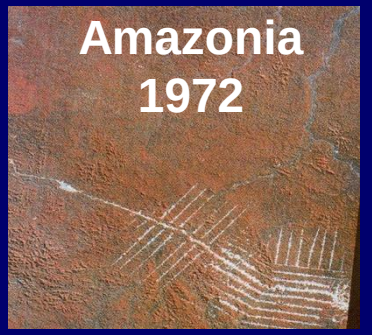
Biosphere Impacts & Issues



Biodiversity = The variety of life forms found in the natural world.

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

DEFORESTATION



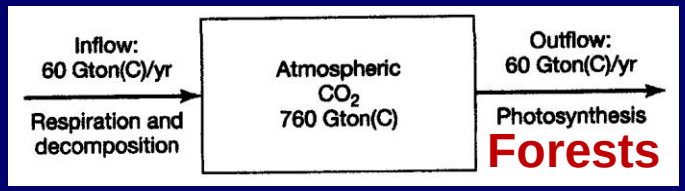
KEY CONCEPT #1 = LOSS OF BIODIVERSITY

- Tropics contain 3/4 of all the living things on Earth, but they cover only 6% of the land surface

- With such diversity, deforestation of the tropics could lead to immense species lost

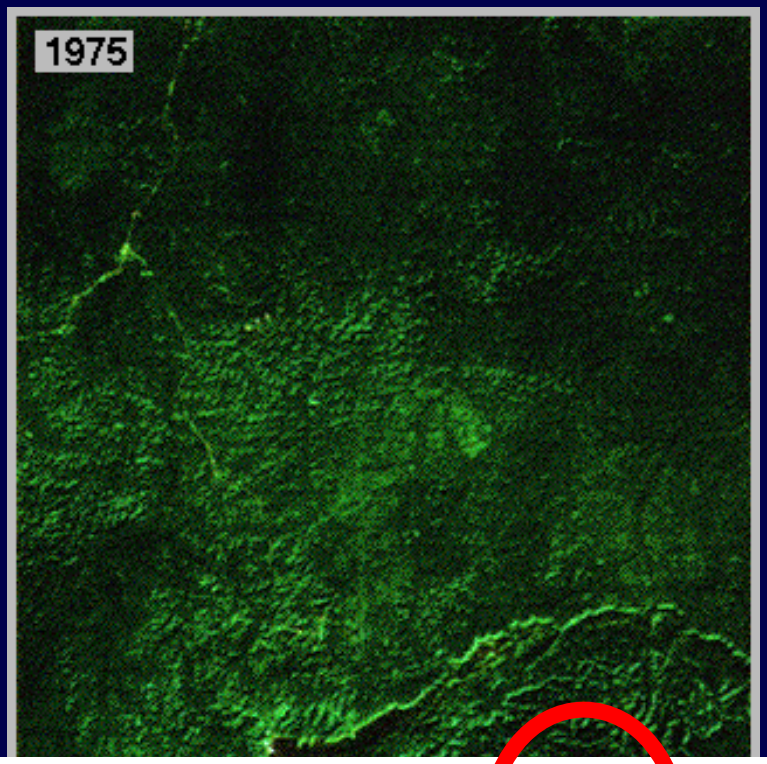
KEY CONCEPT #2 = LOSS OF LARGE PORTIONS OF NATURAL CARBON SINK

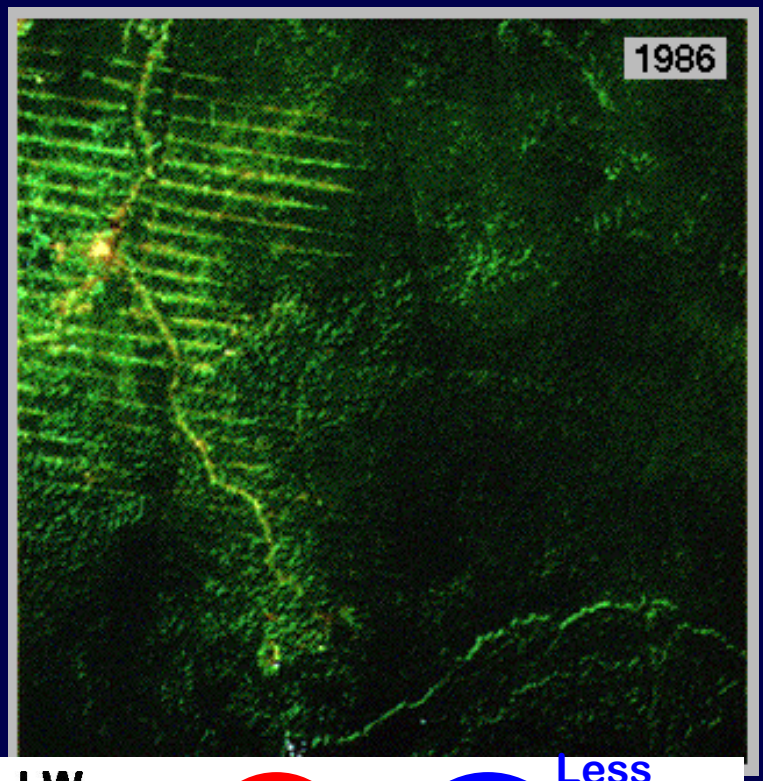
- Forests are a major SINK for atmospheric CO2



-Deforestation → an increase of CO2 in the atmosphere → will it lead to warming both Globally and Locally?

REVIEW: It's COMPLEX! We have to look at all parts of the ENERGY BALANCE, including the local energy balance???





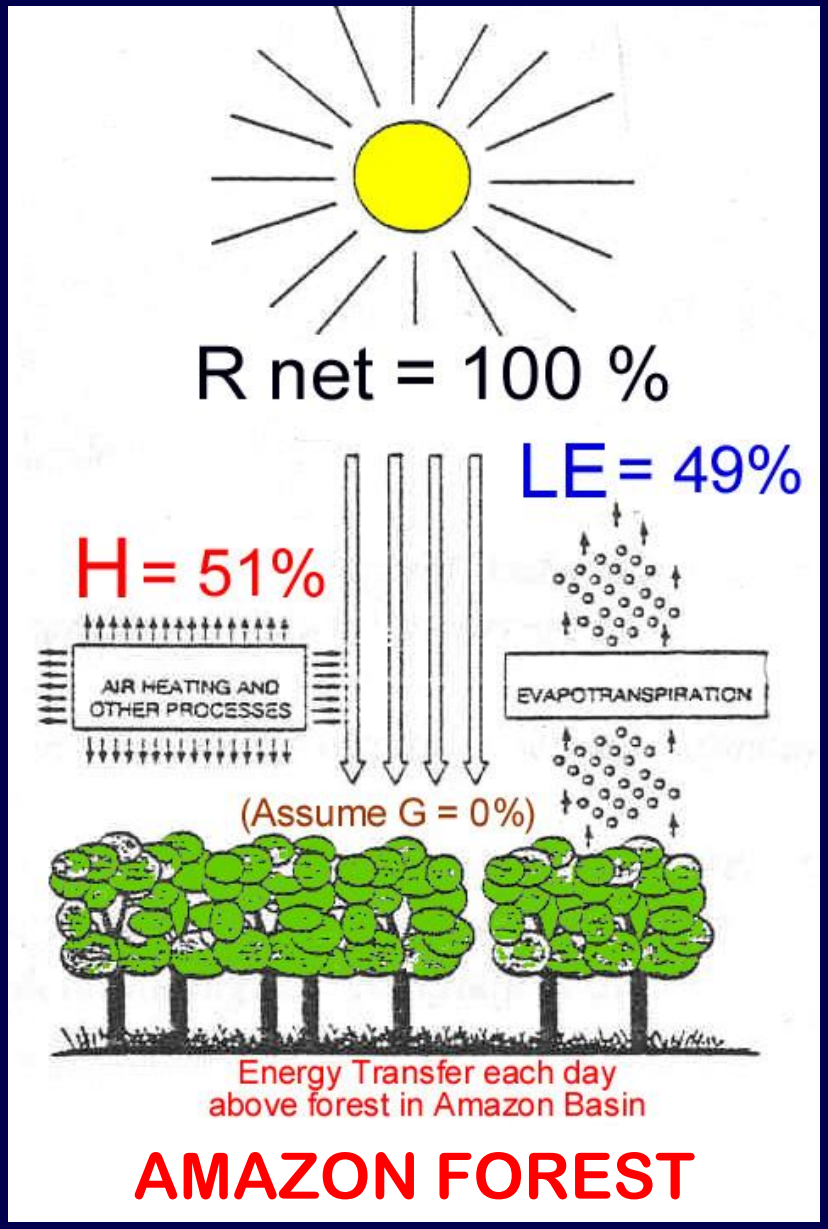
$$R_{NET} = SW_{\downarrow} + SW_{\downarrow} - SW_{\uparrow} - LW_{\uparrow} + LW_{\downarrow} = H + LE + G$$

Less

More reflection → cooler temperatures?

OR

Less LE → More H → warmer temperatures?



REVIEW:

Deforestation will lead to a DECREASE in the amount of energy stored in

H or LE *[circle one]*

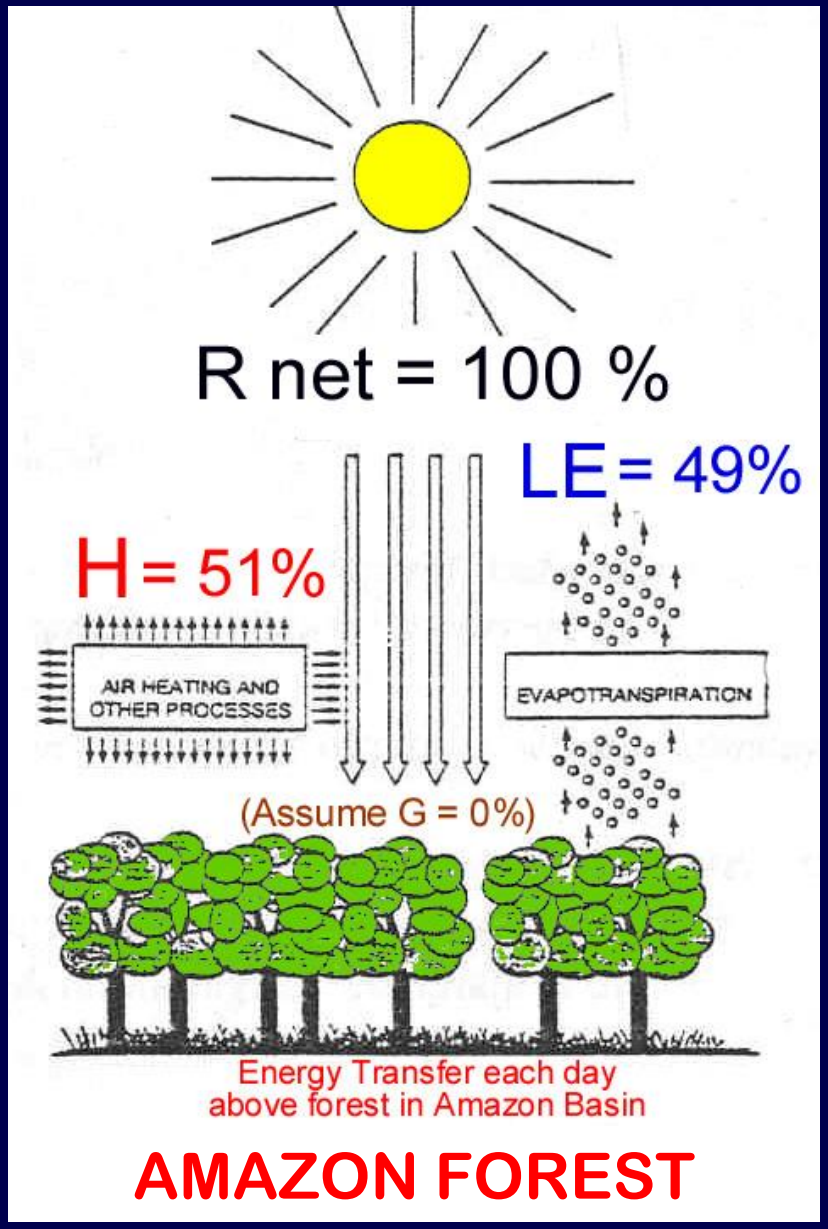
and an INCREASE in the amount of energy stored in

H or LE *[circle one]*

Q1. Would this lead to local COOLING or WARMING in the region?

1) Cooling

2) Warming



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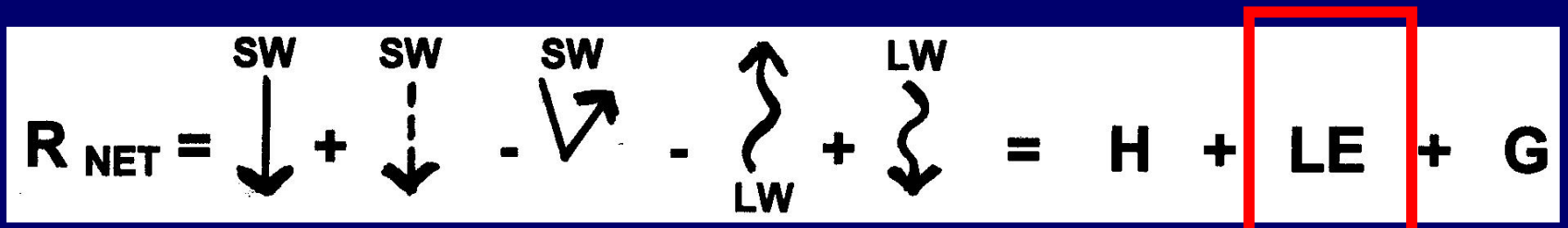
Q1. Would this lead to local COOLING or WARMING in the region?

1) Cooling

2) Warming

Explanation:

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



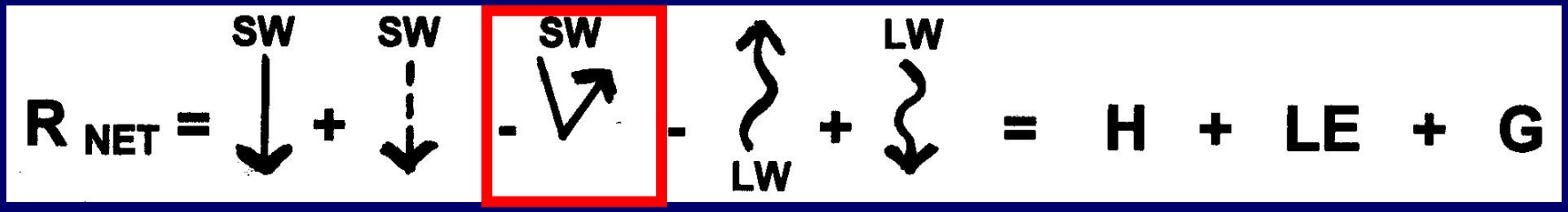
Affects RIGHT side of ENERGY BALANCE EQUATION through LE (evapotranspiration)

Less energy in LE ➔ more in H ➔ WARMING

Another consequence of Tropical deforestation:

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

➔ affects Energy Balance (on the left side)



Will albedo [INCREASE / DECREASE] with deforestation?

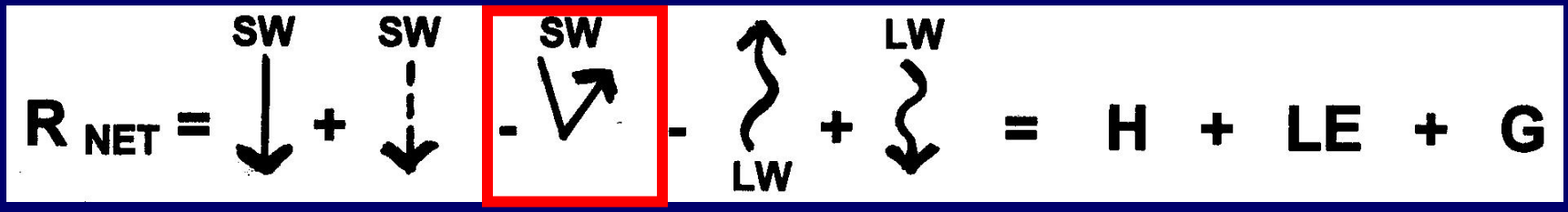
Q2. Would this lead to local COOLING or Warming?

1) Cooling 2) Warming

Another consequence of Tropical deforestation:

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

➔ affects Energy Balance (on the left side)



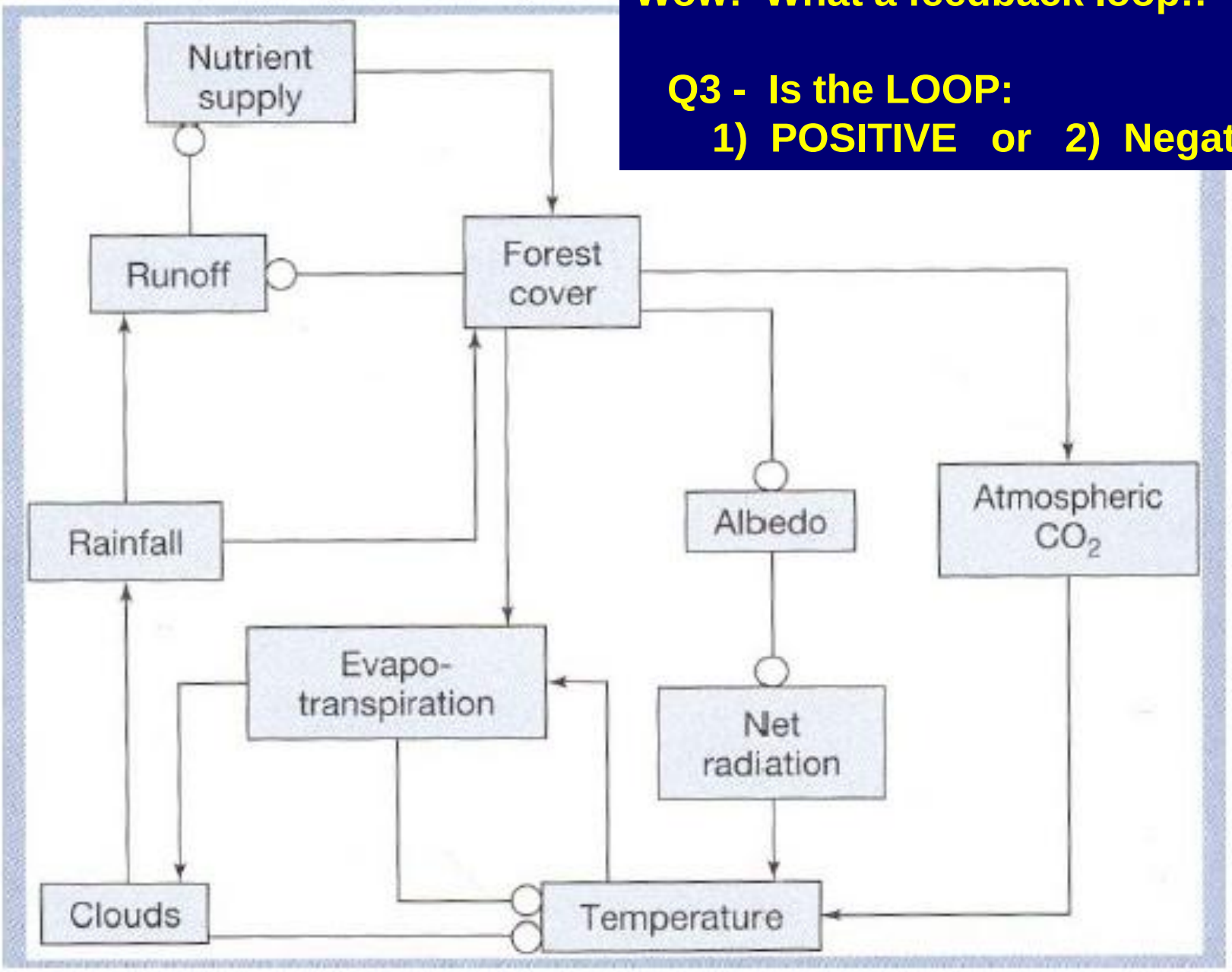
Will albedo [INCREASE / DECREASE] with deforestation?

Q2. Would this lead to local COOLING or Warming?

1) Cooling **2) Warming**

Wow! What a feedback loop!!

Q3 - Is the LOOP:
1) POSITIVE or 2) Negative?



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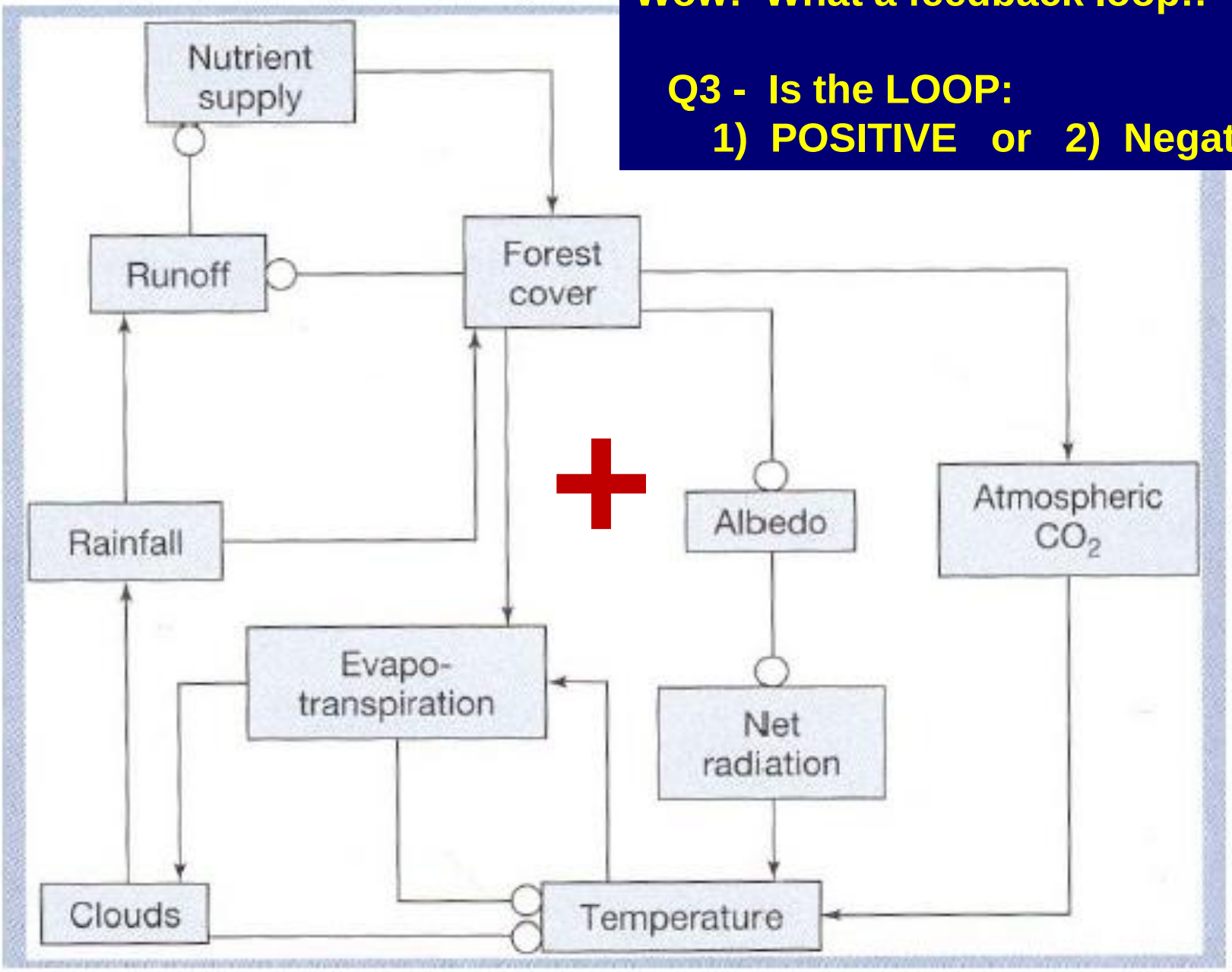


So does deforestation => warming or cooling in the LOCAL Climate?

Results of one study based on a climate model:

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 indicated a slight Temperature INCREASE

TO THINK ABOUT FOR THE FINAL EXAM . . . .

AMAZON RAIN FOREST

VS.

SONORAN DESERT

How will their local energy balances differ??

So what do we do about all of these impacts???

TOPIC #16 CLIMATE CHANGE ADAPTATION & MITIGATION SOLUTIONS

POLICIES & POSSIBLE ACTIONS
to SLOW
GLOBAL WARMING . . .
& ADAPT to the warming we
can't prevent!

READ: the rest of CHAPTER 16 in SGC E-TEXT
(will help with your I-4 Debate Prep and SELF TEST & RQ-9)

“ A world civilization able
to envision God and the afterlife,
to embark on the colonization of space,
will surely find the way
to save the integrity of this magnificent planet
and the life it harbors because quite simply

it's the right thing to do,
and ennobling to our species.”

-E. O. WIlson

ADAPTATION: Adjustments made in response to (or anticipation of) climatic impacts in order to:

(a) lessen or reduce harm or
(b) take advantage of beneficial opportunities

ADAPTATION

How can humanity adapt to current and projected Climate Change Impacts both Globally and Regionally?

ADAPTATION

The IPCC Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation

November 2011

ipcc
INTERGOVERNMENTAL PANEL ON climate change

Impacts from weather and climate events depend on:

nature and severity of event

vulnerability

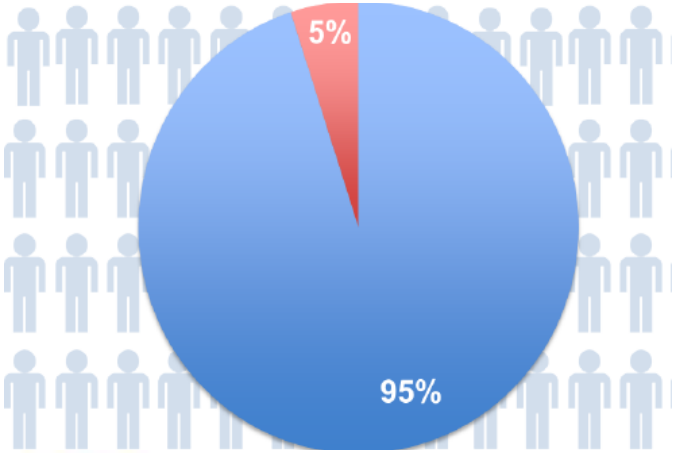
exposure

Impacts of climate extremes can be felt locally or regionally

AGRICULTURE	**"Russia, Crippled by Drought, Bans Grain Exports"** *August 5, 2010,* ***The New York Times***
ENERGY	**"Heatwave hits French power production"** *August 12, 2003,* ***The Guardian***
WATER	**"Lake Mead is at Record Low Levels. Is the Southwest drying up?"'** *August 08, 2010,* ***The Independent***
PUBLIC HEALTH	**"Pakistan floods: Aid trickles in for victims as cholera spreads in Pakistan's worst-ever floods"** *August 14, 2010,* ***The Guardian/Observer***
TOURISM	**"Alpine resorts feel heat during record warm spell"** *December 08, 2006,* ***CNN***
TRANSPORTATION	**"Flash flooding causes train to derail"** *July 30, 2001,* ***Chicago Sun Times***

Economic disaster losses are higher in developed countries

Fatalities are higher in developing countries



From 1970-2008, over **95%** of natural-disaster-related deaths occurred in developing countries

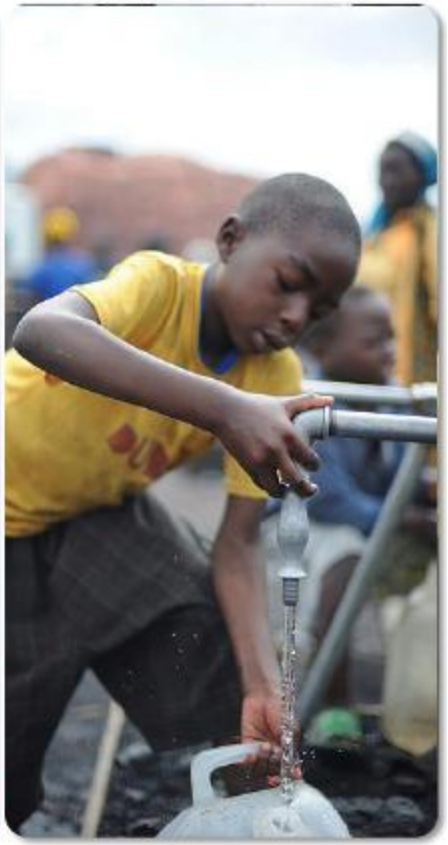
Increasing exposure of people and assets has been the major cause of changes in disaster losses

From 1970-2008, over **95%** of natural-disaster-related deaths occurred in developing countries

Effective risk management and adaptation are tailored to local and regional needs and circumstances

- **Changes in climate vary across regions**
- **Each region has unique vulnerabilities & exposure to hazards**
- **Effective adaptation & risk management must address BOTH exposure & vulnerability of a region**

There are strategies that can help manage disaster risk now and also help improve people's livelihoods and well-being



The most effective strategies offer development benefits in the relatively near term and reduce vulnerability over the longer term

Managing the risks: heat waves in Europe

Risk Factors

- lack of access to cooling
- age
- pre-existing health problems
- poverty and isolation
- infrastructure

France, August 2003 (over 14,000 dead)

Risk Management/ Adaptation

- cooling in public facilities
- warning systems
- social care networks
- urban green space
- changes in urban infrastructure

Projected: *likely* increase heat wave frequency and *very likely* increase in warm days and nights across Europe

Managing the risks: hurricanes in the USA and Caribbean

Risk Factors

- population growth
- increasing property value
- higher storm surge with sea level rise


Hurricane Katrina, 2005

Risk Management/ Adaptation

- better forecasting
- warning systems
- stricter building codes
- regional risk pooling

Projected globally: *likely* increase in average maximum wind speed and associated heavy rainfall (although not in all regions)

ipcc

Managing the risks: flash floods in Nairobi, Kenya

Risk Factors

- rapid growth of informal settlements
- weak building construction
- settlements built near rivers and blocked drainage areas

Risk Management/ Adaptation

- reduce poverty
- strengthen buildings
- improve drainage and sewage
- early warning systems

Projected: *likely* increase in heavy precipitation in East Africa

Managing the risks: sea level rise in tropical Small Island Developing States

Risk Factors

- shore erosion
- saltwater intrusion
- coastal populations
- tourism economies

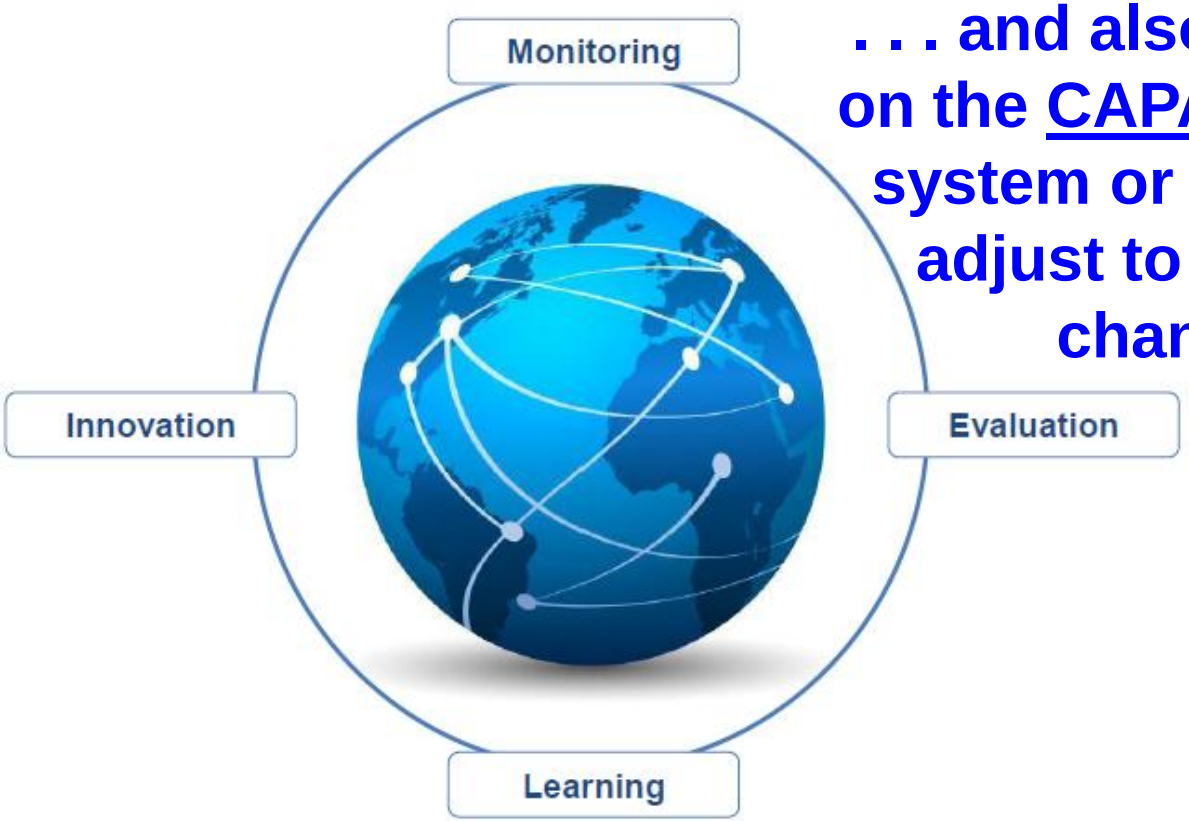
Risk Management/ Adaptation

- early warning systems
- maintenance of drainage
- regional risk pooling
- relocation

Projected globally: *very likely* contribution of sea level rise to extreme coastal high water levels (such as storm surges)

"ADAPTIVE MANAGEMENT"

Managing risks of disasters in a changing climate benefits from an iterative process



. . . and also depends on the CAPACITY of a system or region to adjust to climate change

Learning-by-doing and low-regrets actions can help reduce risks now and also promote future adaptation

MITIGATION

Mitigation: intervention to reduce anthropogenic Forcing on the climate system through:

(a) strategies to reduce GHG emissions

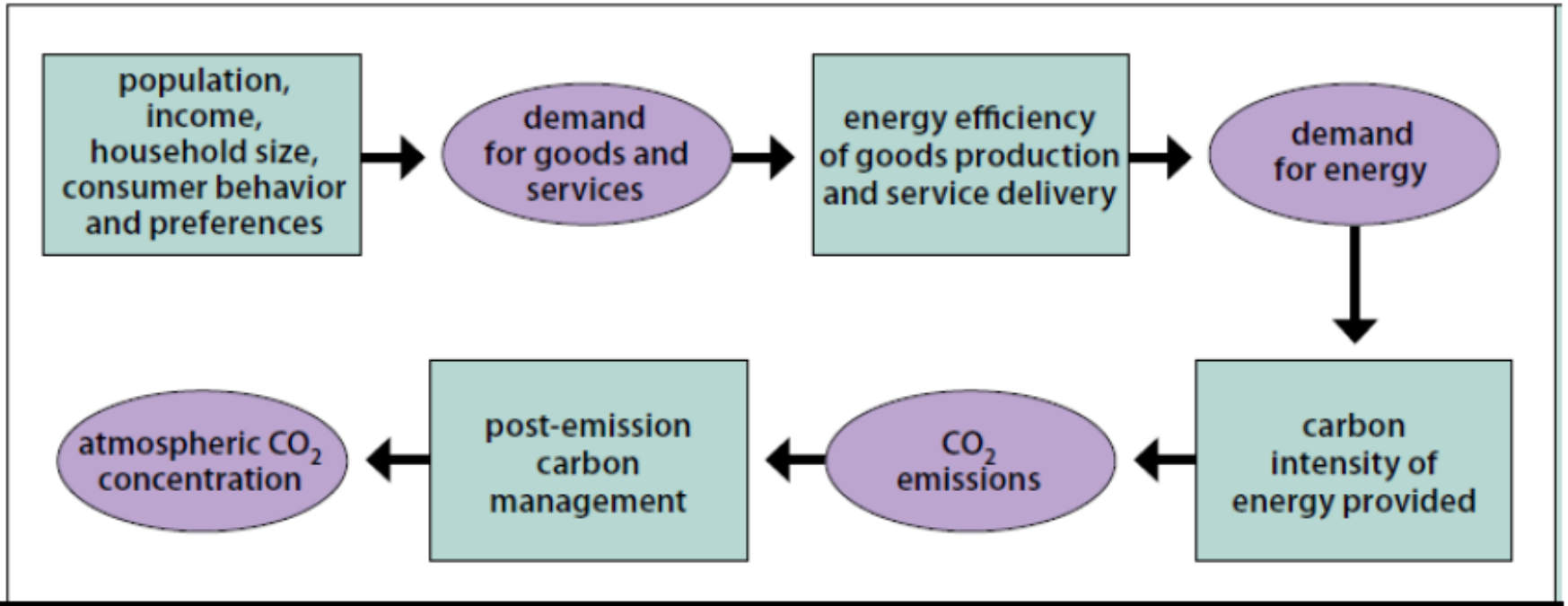
(b) strategies to enhance GHG sinks

planting trees

EXAMPLE OF MITIGATION PROCESS

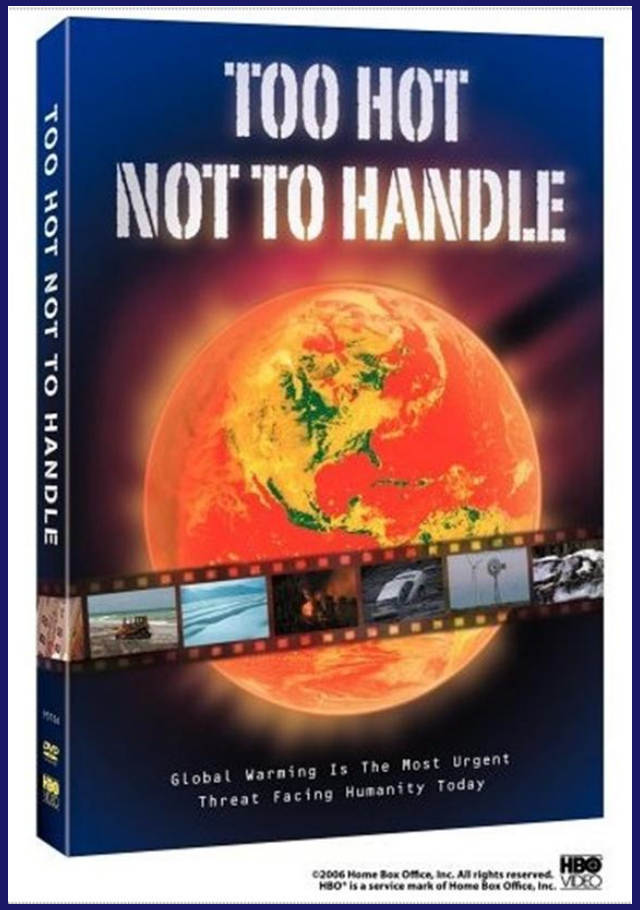
PROBLEM FACTORS! = factors that lead to increasing accumulation of CO2 in atmosphere

SOLUTION FACTORS! = factors that HUMANS can adjust to influence the : (oval) factors

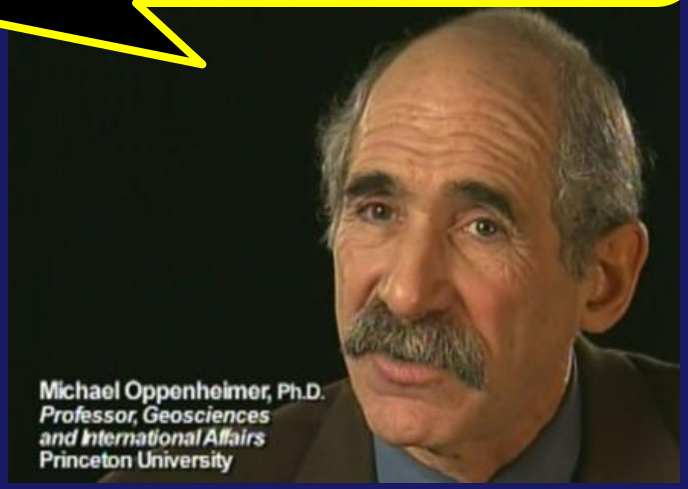


The chain of factors that determines how much CO2 accumulates in the atmosphere. The boxes represent factors that can potentially be influenced to affect the outcomes in the circles.

Several MITIGATION SOLUTIONS were described in:



"Let a thousand flowers bloom".



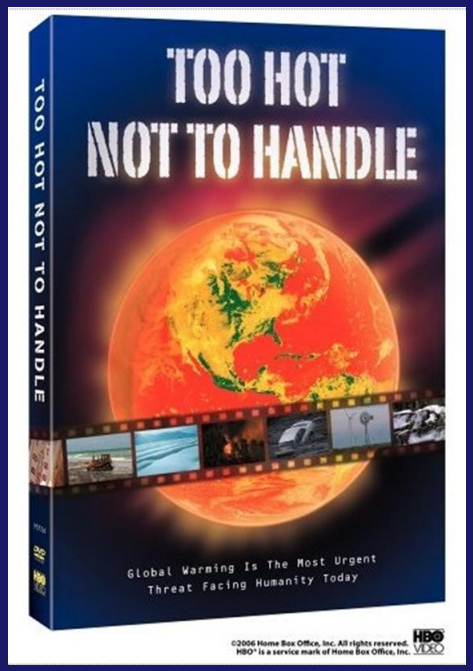
SOLAR

BIOFUELS **WIND**

SUSTAINABLE COMMUNITIES

(Portland, Oregon example)

FILM FOLLOW UP. . . .



In Portland:

SOLAR POWERED PIZZA!

BROOKLYN PIZZA COMPANY®

Welcome to Brooklyn Pizza Company

Brooklyn has gone Solar! The new panels generate 160,000 kWh of electricity per year. Find out how Brooklyn does its part to mitigate environmental impact.

See the PDF.

NOW 100% SOLAR POWERED!

-80,000 gal of water saved each year

-29,700 lbs of CO2 - the biggest contributor to global warming - saved each month

-160,000 lbs of coal saved each year

Your favorite pizzeria goes solar!

In TUCSON (on 4th Avenue)

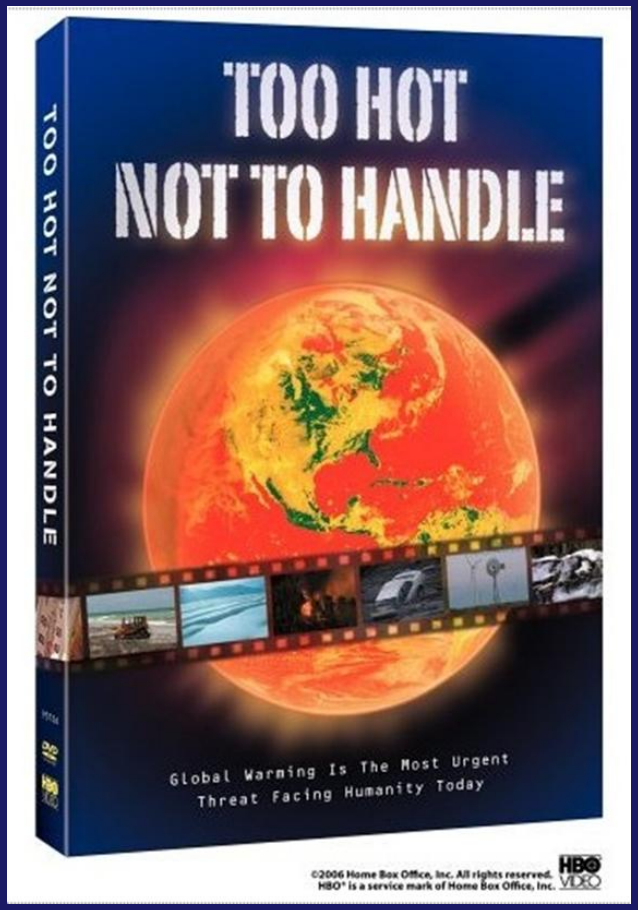
Nov 29 & 30 , 2011

Southwest Biofuels, a Tucson-based startup company focused on the research and development of algae based biofuels and related biomass products . . .

Tucson-based photovoltaics maker Solon Corp. is teaming up with Tucson Electric Power Co. and the University of Arizona's Arizona Research Institute for Solar Energy (AzRISE) to build an energy storage research site at the UA Science and Technology Park.

http://azstarnet.com/business/local/tucson-biofuels-startup-to-go-public-in-deal/article_19d9e63c-1ace-11e1-aaa1-001cc4c002e0.html

http://azstarnet.com/business/local/tucson-tech-solar-energy-storage-project-slow-to-develop-but/article_ff8281ad-5861-59ca-87b5-01cf0aebd8aa.html



TRANSPORTATION ISSUES ARE HUGE!

And also related to the **LAWS OF PHYSICS:**

Energy Conservation &
Newton's Laws of Motion!

GLOBAL CHANGE LINK:

For every gallon of gas you use, you add ~ 22 pounds of CO_2 to the atmosphere.

Newton's
1st Law of Motion:
an everyday life example:

The LAW of INERTIA

A moving object will continue moving in a straight line at a constant speed . . . . . and a stationary object will remain at rest – unless acted upon by a force.

Newton's 2nd Law of Motion

Force = Mass x Acceleration F = ma

RELATES TO FUEL ECONOMY!

Acceleration is EASY & requires LESS fuel
(due to small MASS)

$$\frac{F}{m} = a$$

Acceleration is DIFFICULT & requires MORE fuel
(due to larger MASS)

$$\frac{F}{m} = a$$

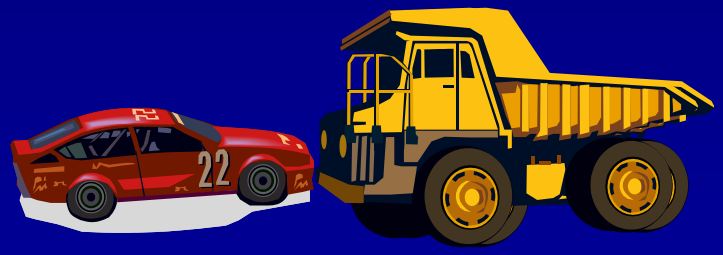
Econo-car vs. SUV!!

Newton's 3rd Law of Motion

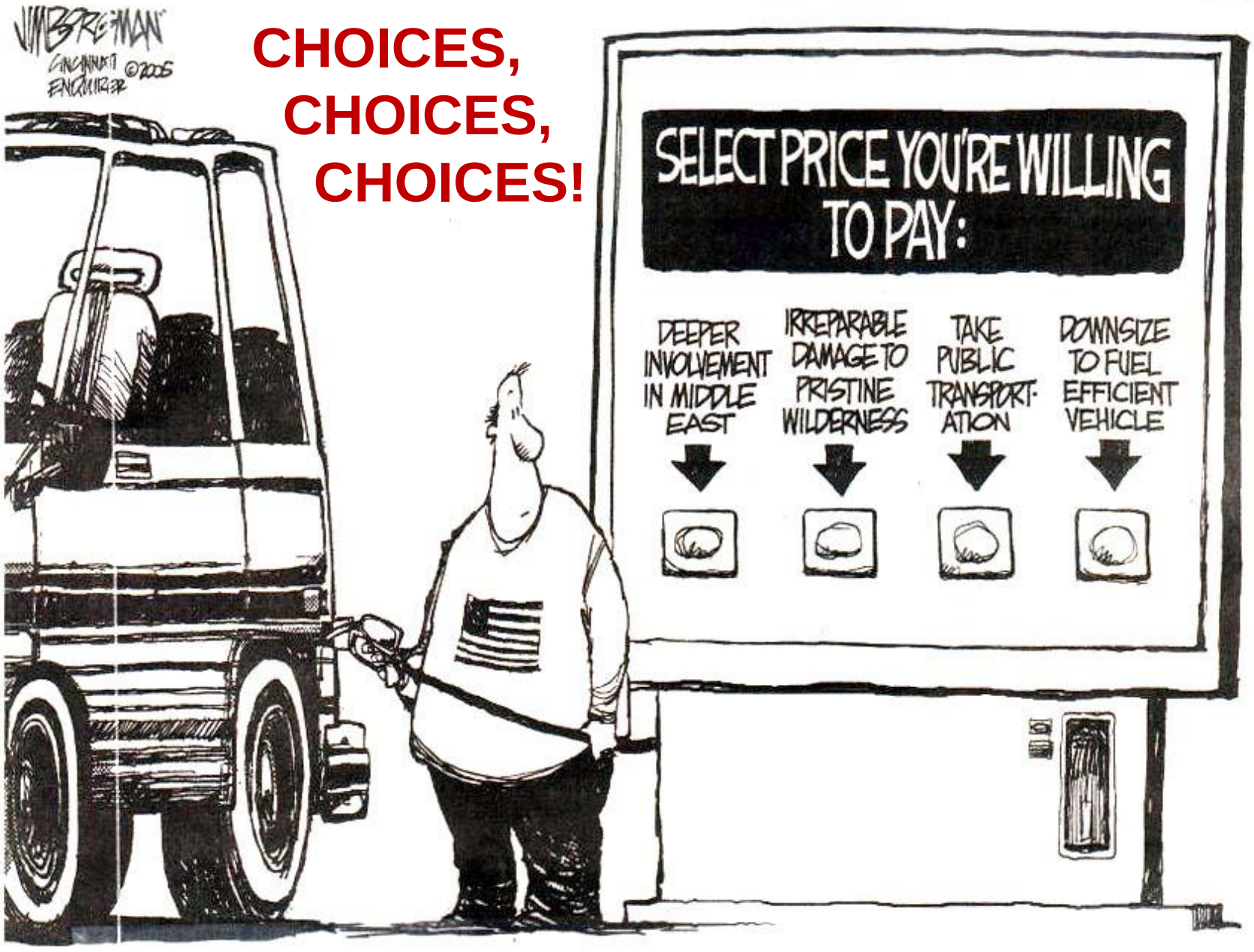
(Law of Force Pairs)

"For every action,
there is an equal and opposite reaction."

RELATES TO VEHICLE SAFETY!



CHOICES, CHOICES, CHOICES!



QUESTIONS TO PONDER!

-- Are large SUVs & Pickups safer just because of their size and mass ?

--- Now that we have **hybrid SUV's** will that solve the problem of their notoriously low gas mileage and larger contribution of CO_2 to the atmosphere – compared to smaller cars?

Q-4 What kind of car does Dr H drive?

1 – Hummer H3
2 – Honda Civic
3 – Toyota Prius
4 – Subaru Forester
5 – Toyota Echo
6 – Honda Fit
7 – Smart Car
8 – None of the above

ME & MY HUMMER!

Just kidding . . . . Here's my faithful & fuel efficient 2000 TOYOTA ECHO!

Until Sep 21 of this year . . . . . .

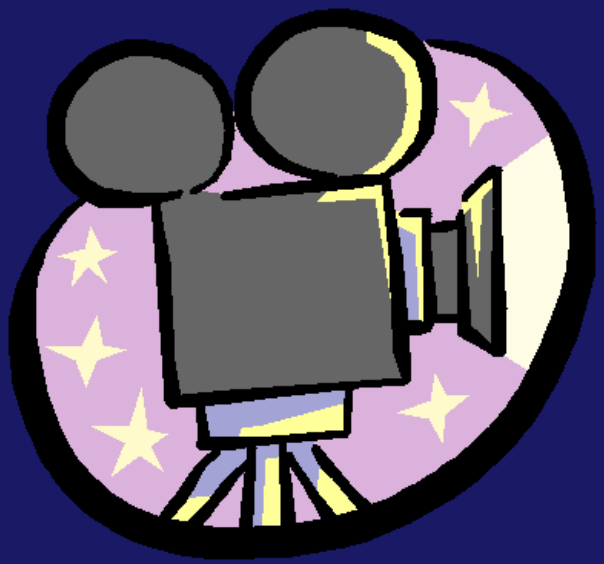
When I took the plunge and went ALL-ELECTRIC . . .

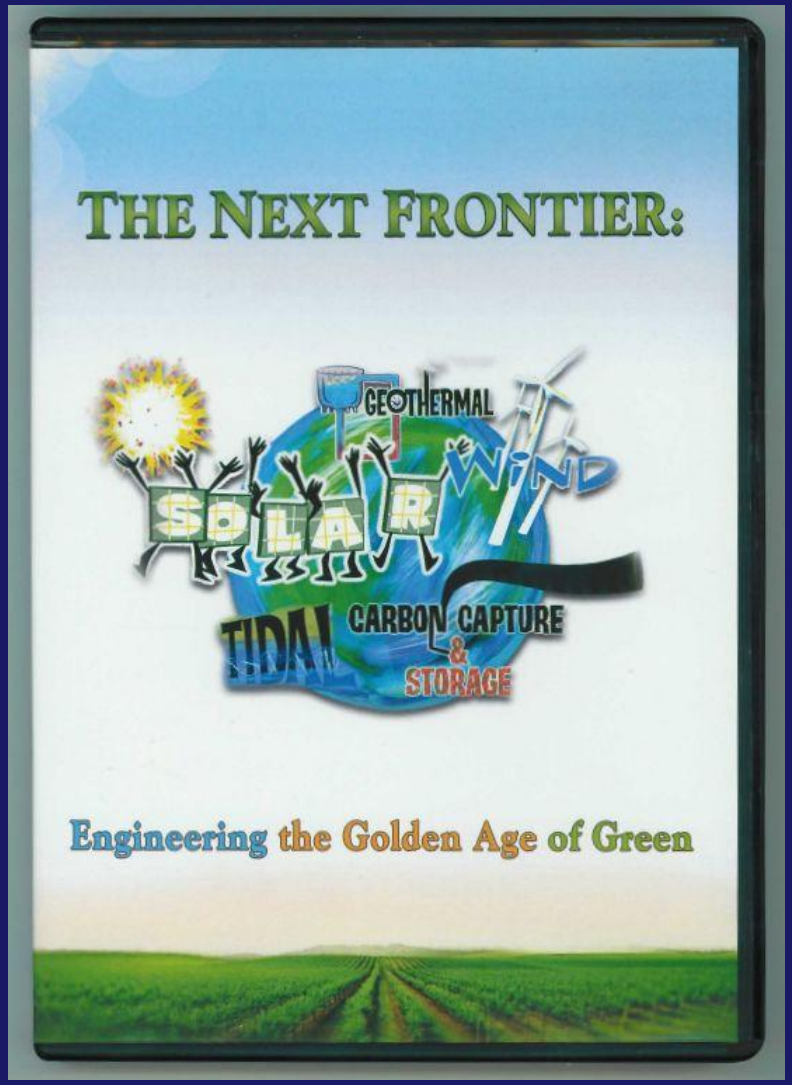
I love my LEAF!

2011
NISSAN LEAF

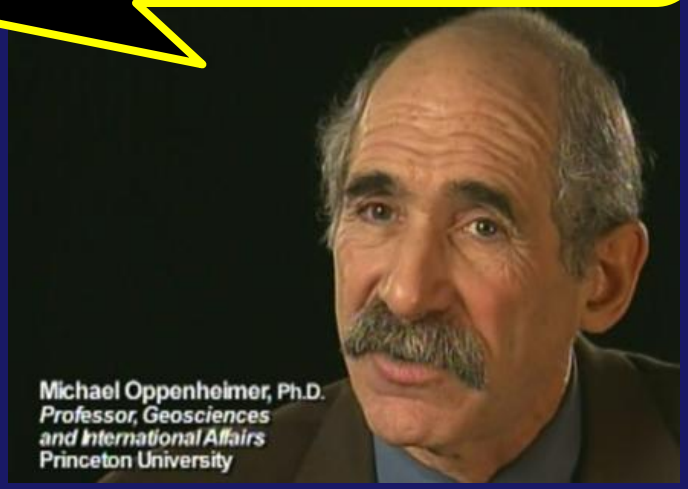
So what other possible MITIGATION SOLUTIONS are out there?

A brand new "Sustainability Segment" film . . . .





“Let a thousand flowers bloom”.



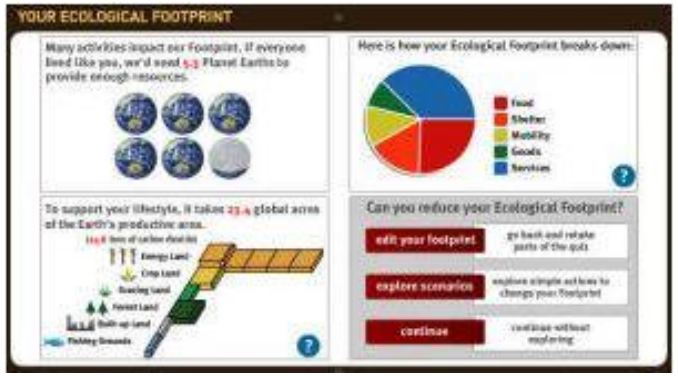
Count the “Flowers” . . . .

When we finish the film . . . You will be asked HOW MANY DIFFERENT SOLUTIONS WERE DISCUSSED IN IT and to give a few examples.

DON'T FORGET:

IMPORTANT: G-6 Assignment will be in class on FRIDAY!

To get credit for the group activity you MUST come to class Friday WITH a printout of your FOOTPRINT RESULTS!!!



Don't let your GROUP DOWN!

(IMPORTANT: email your results to a group-mate before class if you are going to be unavoidably detained!!!)