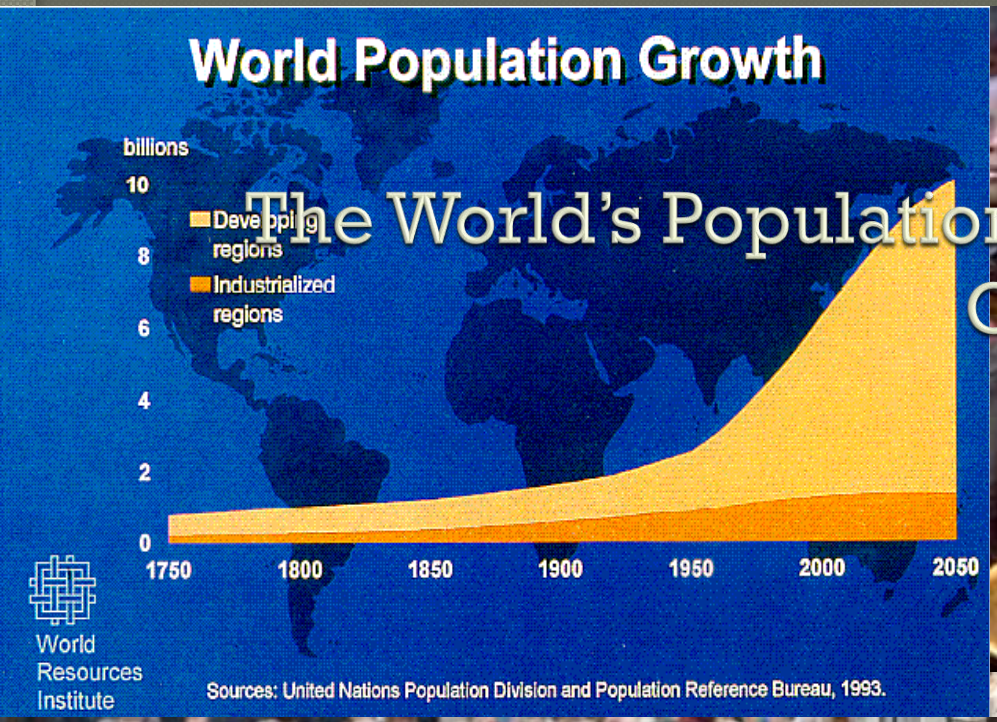
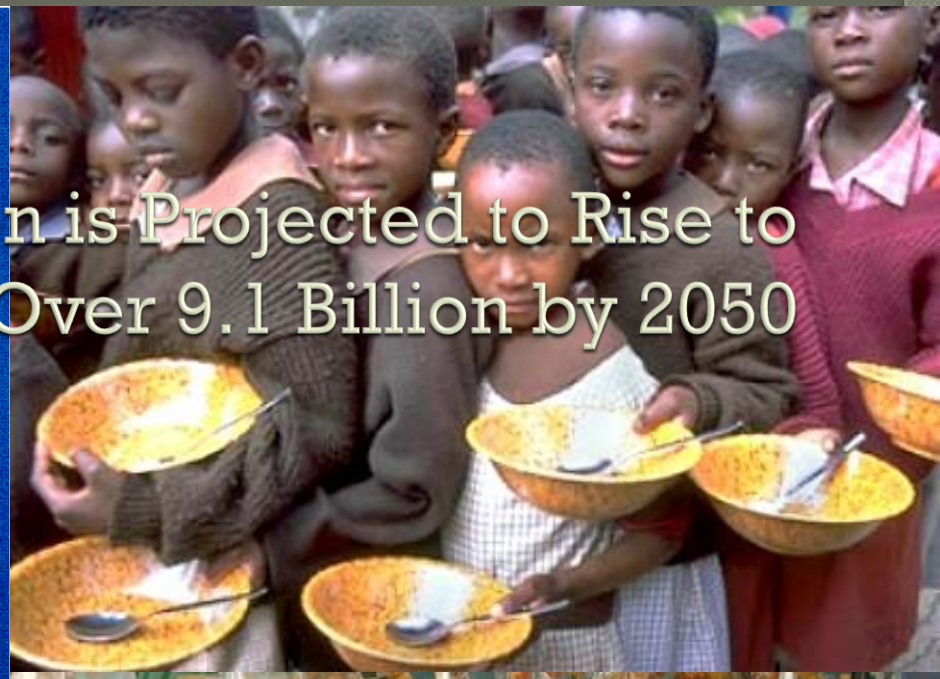
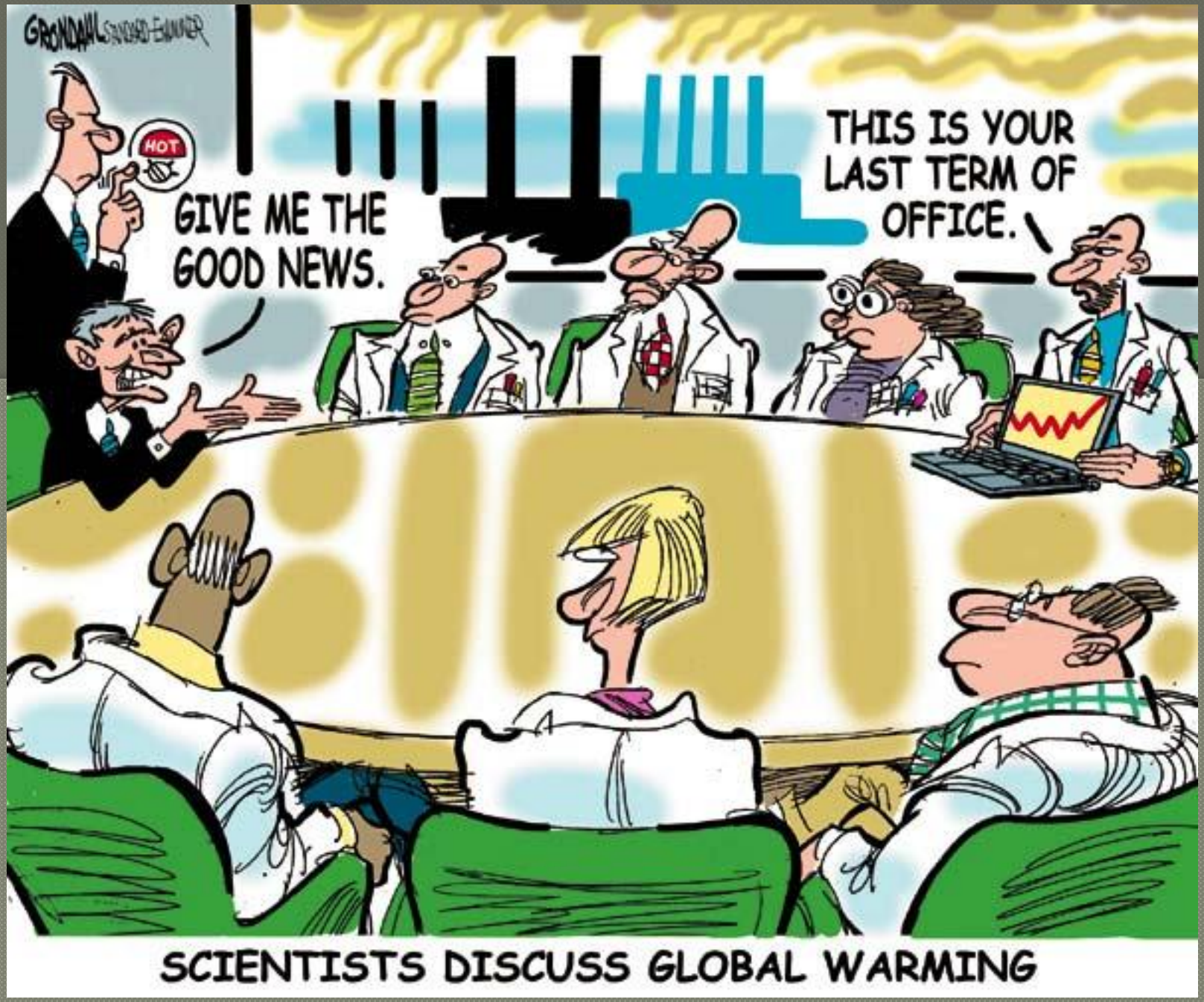


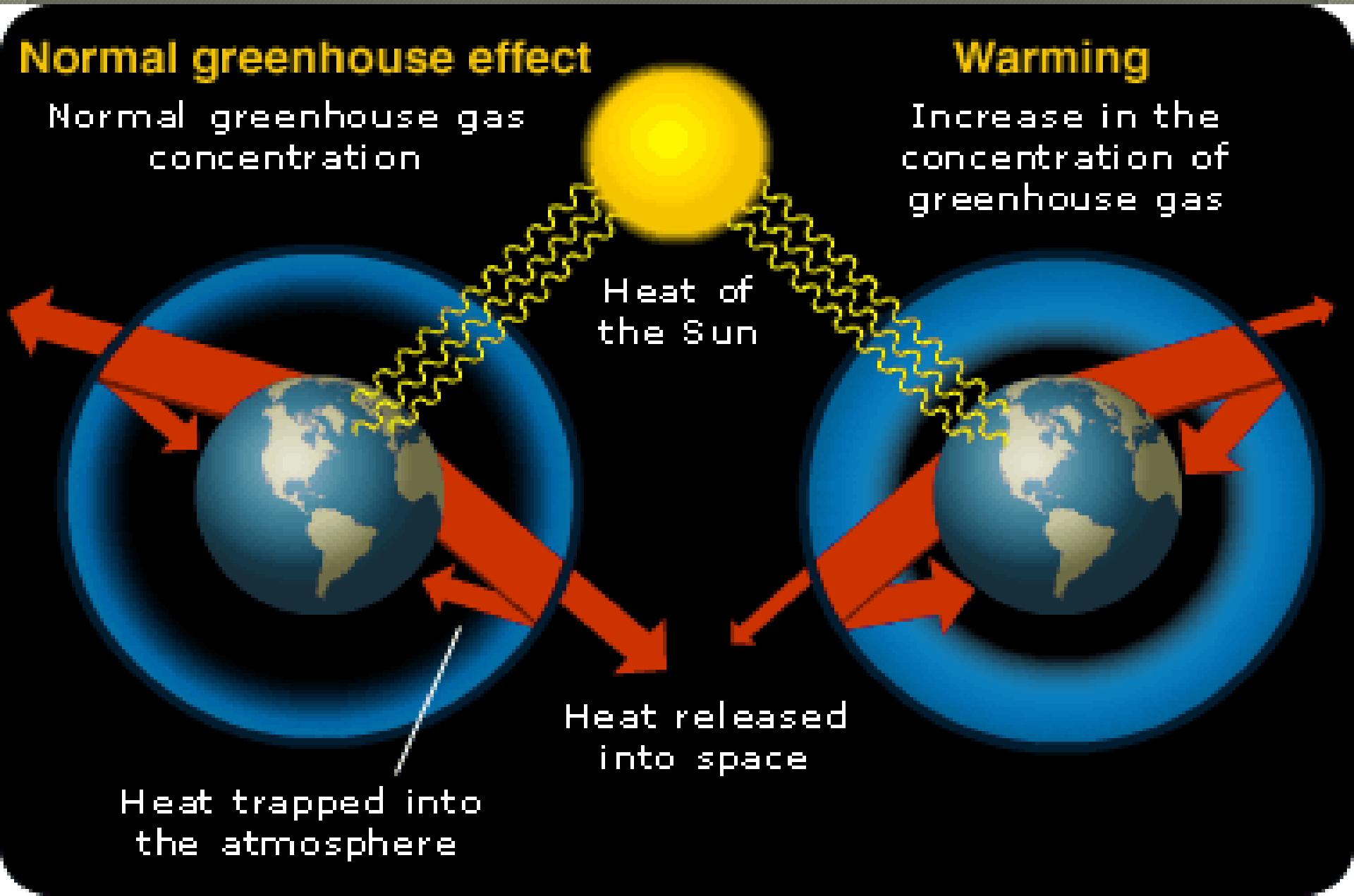
The World's Population is Projected to Rise to Over 9.1 Billion by 2050





SCIENTISTS DISCUSS GLOBAL WARMING

Atmospheric Effects -



Food Production Must Increase To Support The Increasing Population

Only limited land is available for development for food production

Latin American, sub-Saharan Africa, former Soviet Union

Much of the increase needs to come from intensified production on land already in use

Efficient fertilizer use will be essential for sustainable food production

Atmospheric Effects – Greenhouse Gases

- Nitrous oxide is a powerful greenhouse gas
  - More than 250 fold the effect of CO_2
- Agriculture in the major source of nitrous oxide emission
- Can be emitted during nitrification of ammonia to nitrate and denitrification of nitrate to nitrogen gas
- The higher the concentration of reactive N in the system, the greater the risk of loss

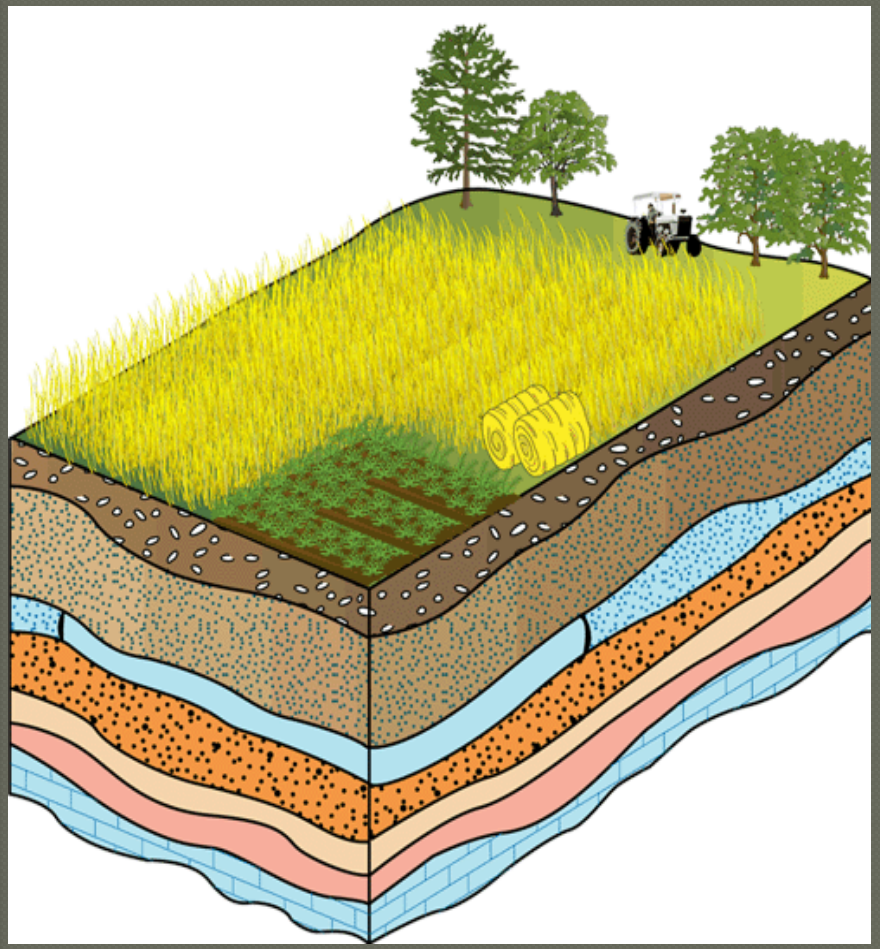
Coral Reef Degradation is Linked with Nutrient


Divulgação
CASE IH

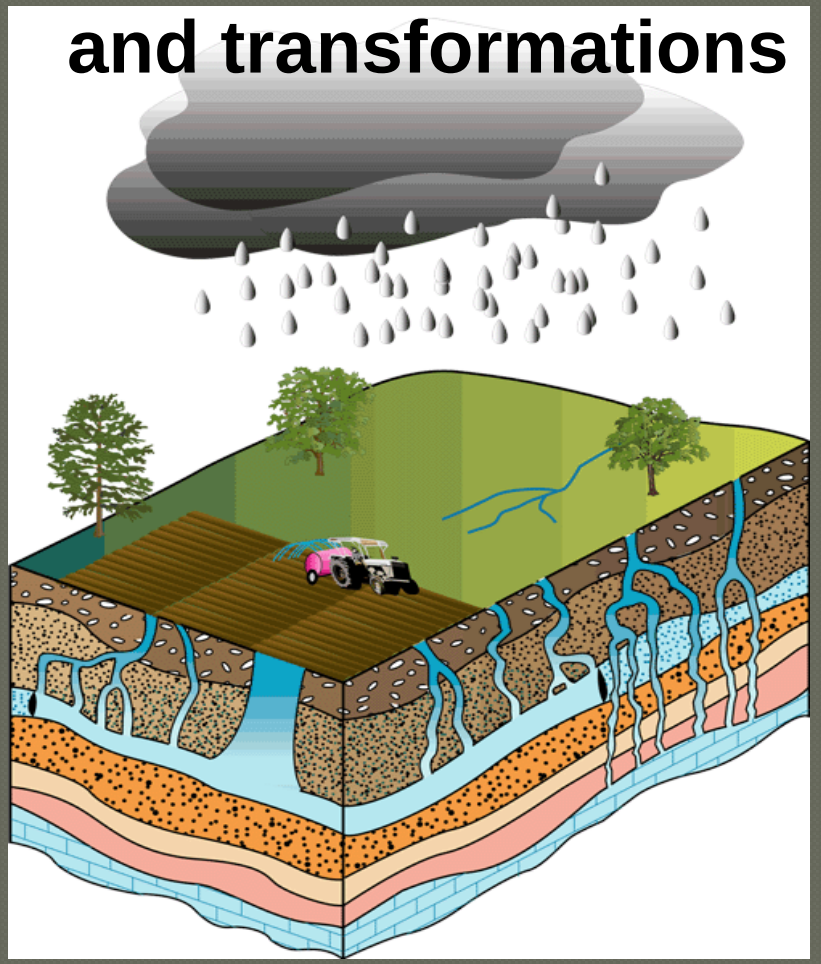

JESUS

Multiple functions of soils

Biomass production

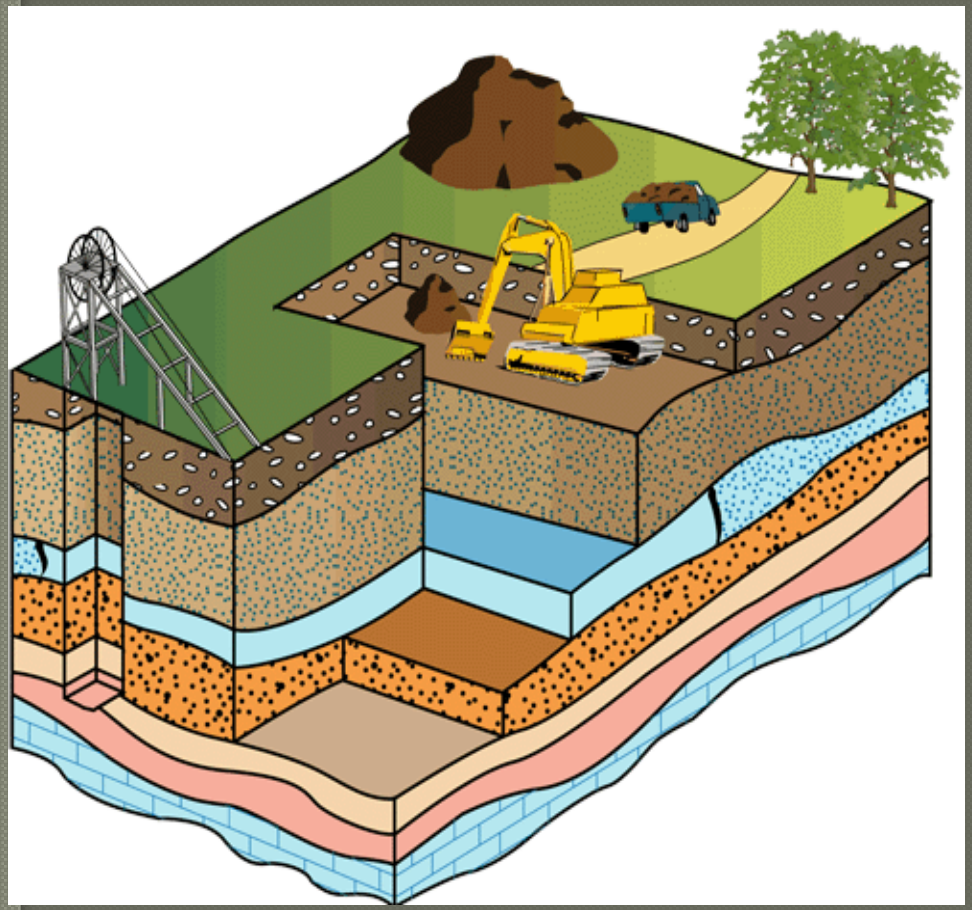


Filtering, storing, buffering, and transformations

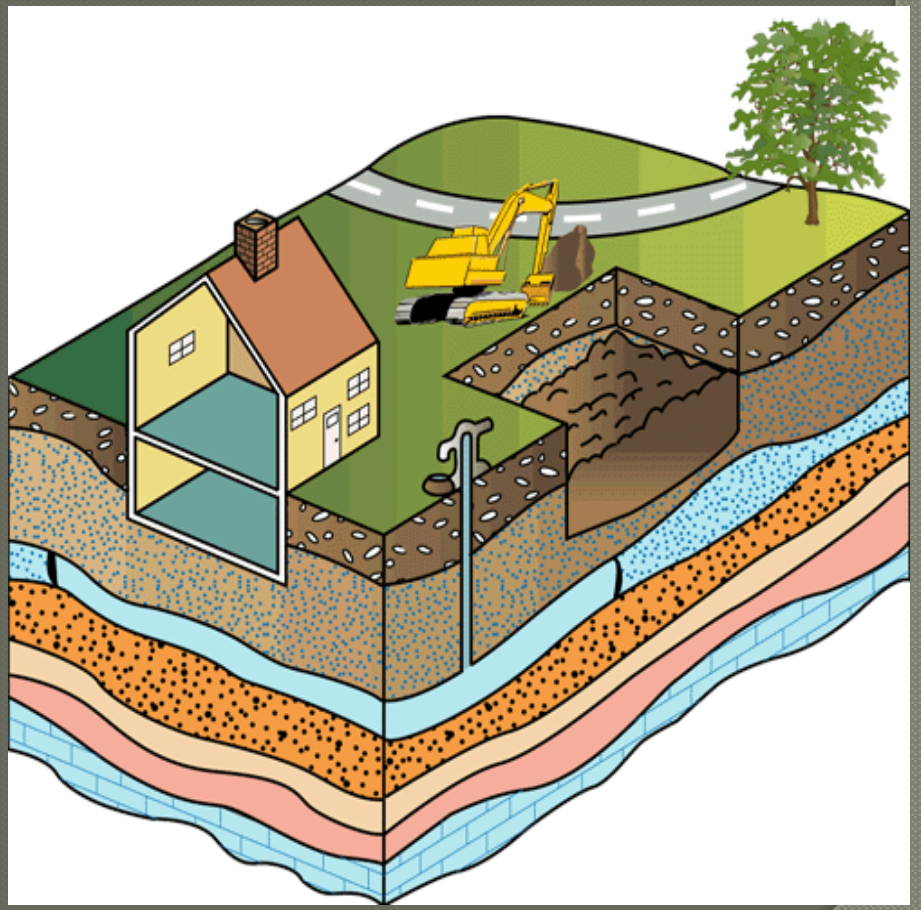


Multiple functions of soils

Source of raw materials

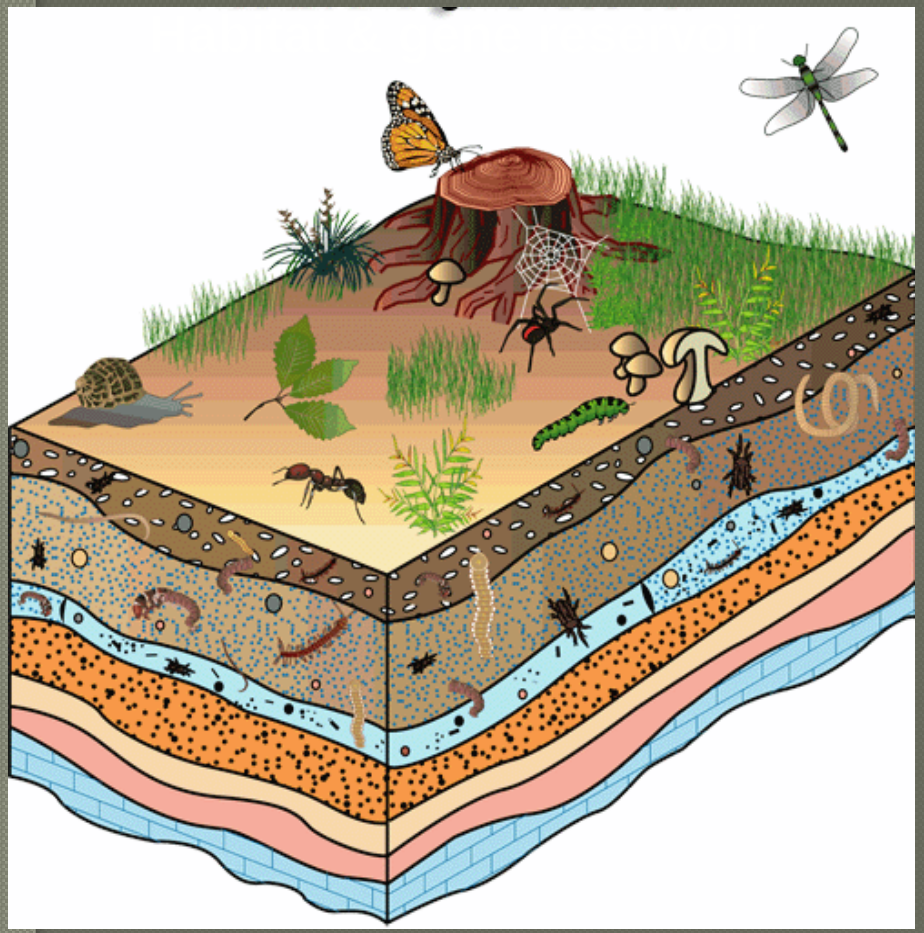


Basis for Infrastructure

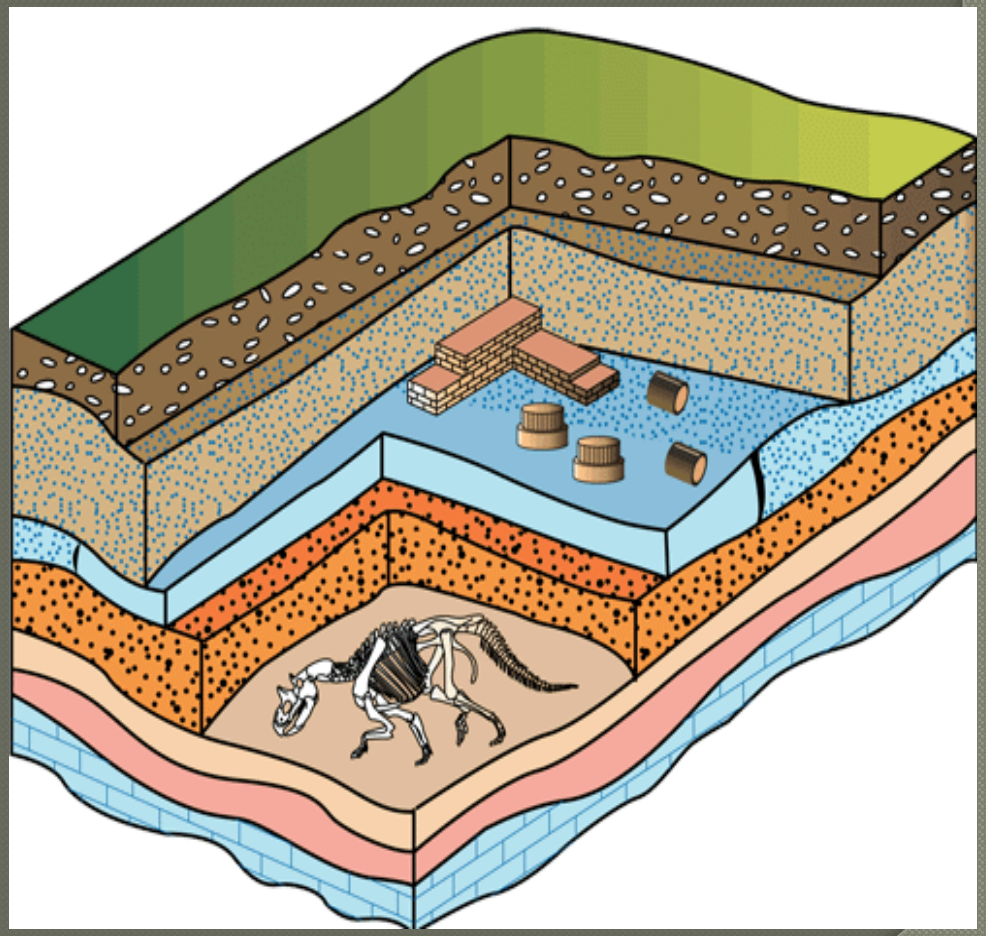


Multiple functions of soils

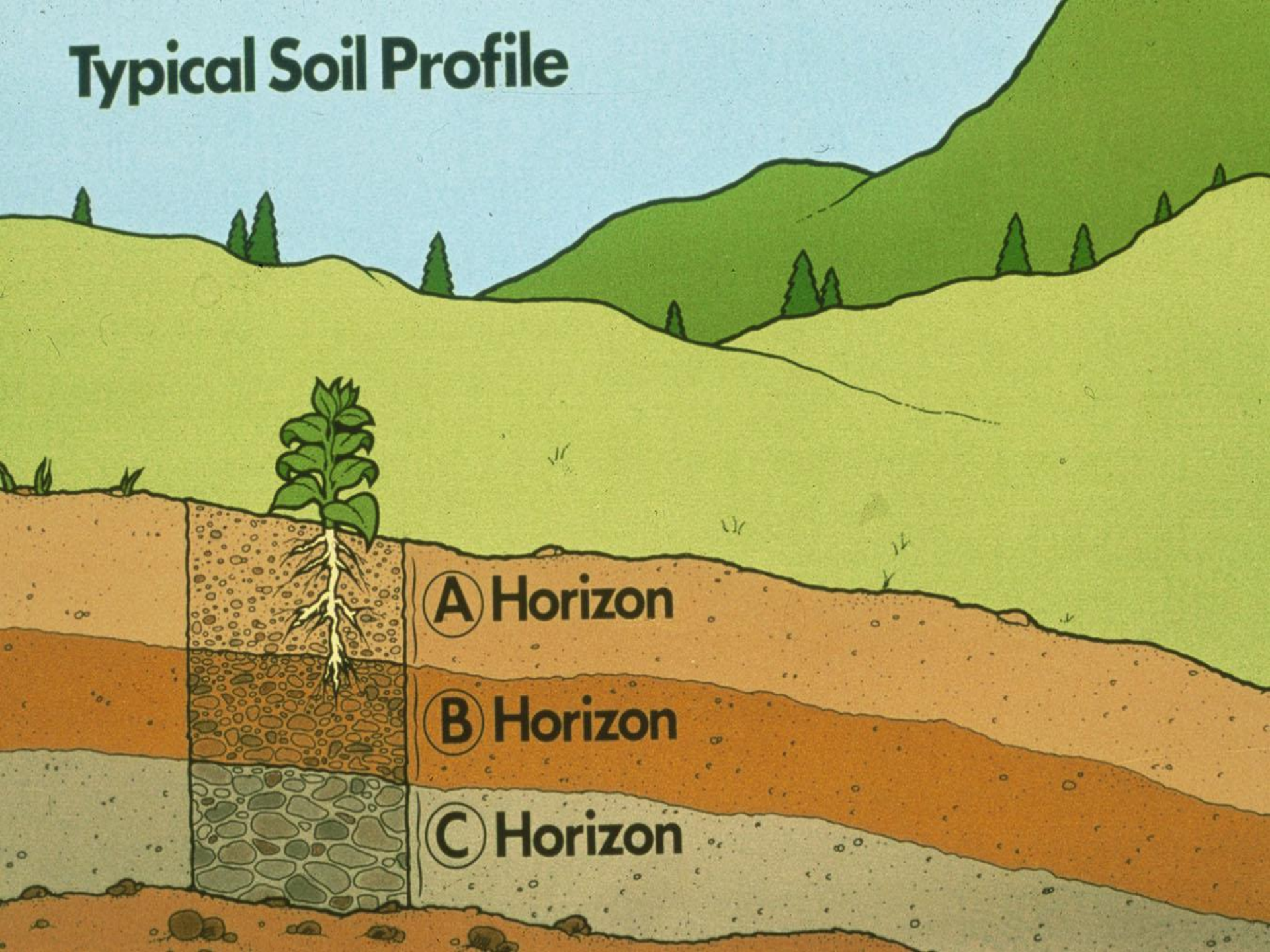
Biodiversity pool



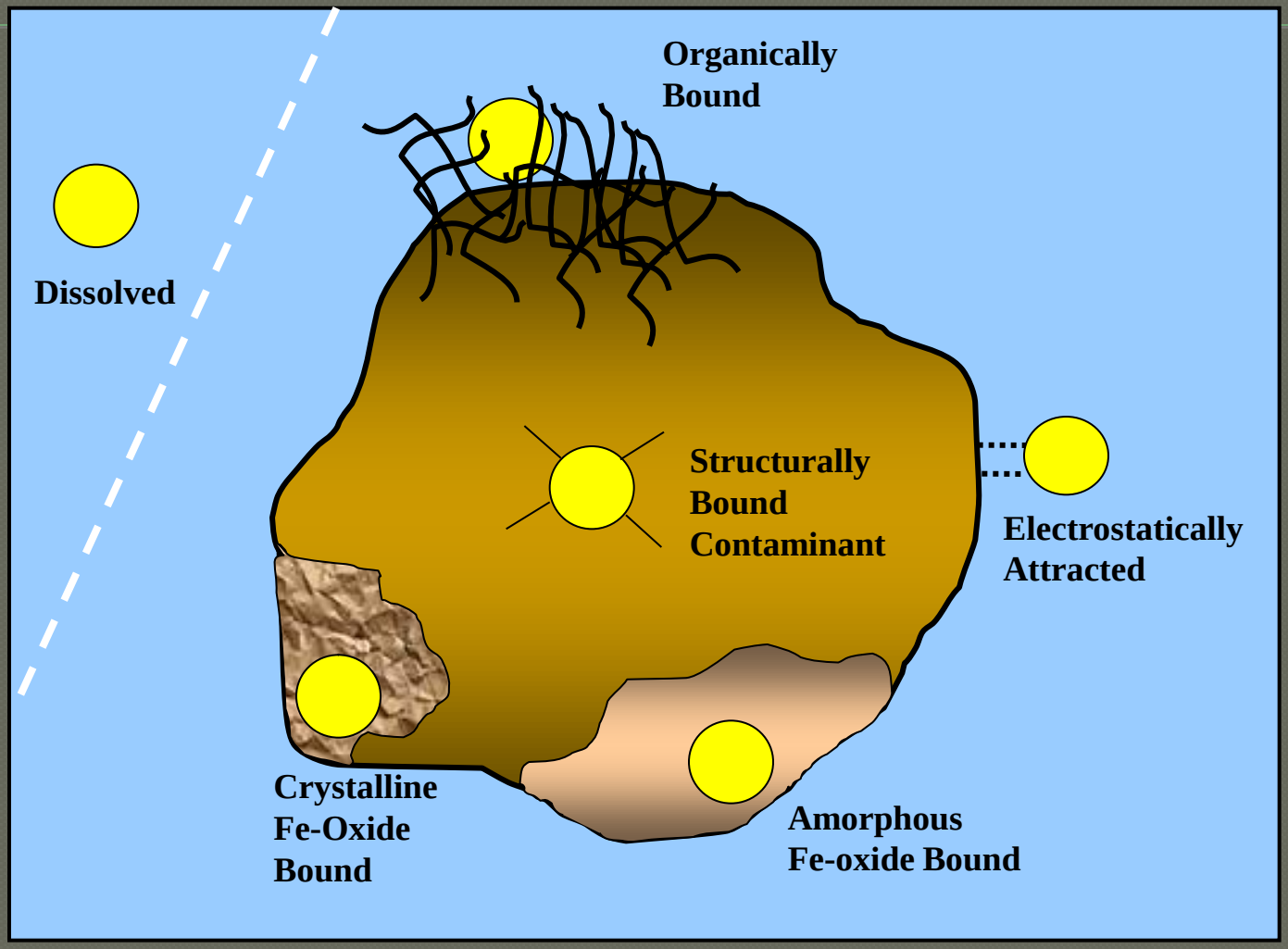
Historical medium

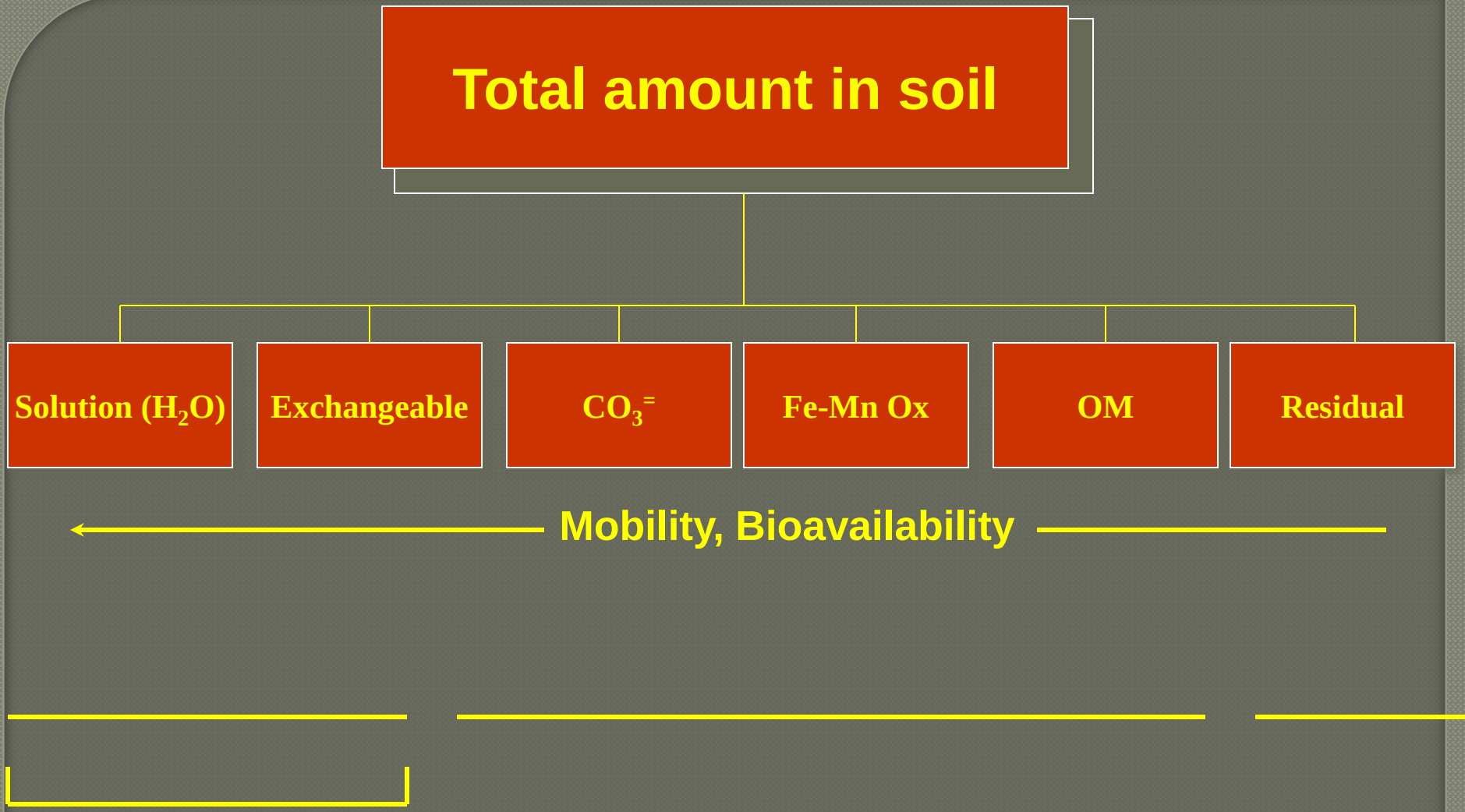


Typical Soil Profile



Contaminant Allocation in Soil/Sediment




Total amount in soil
Solution (H_2O)
Exchangeable
$CO_3^{=}$
Fe-Mn Ox
OM
Residual
Mobility, Bioavailability

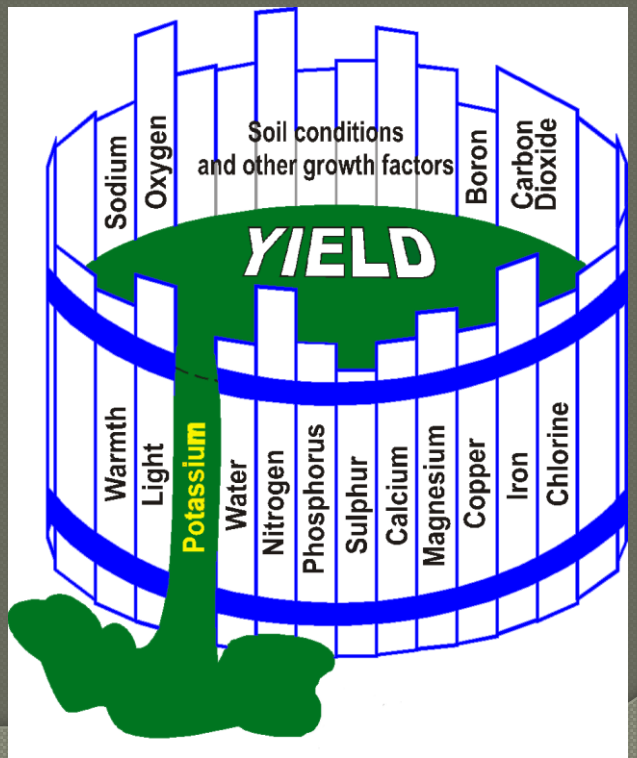

JOHN DEERE

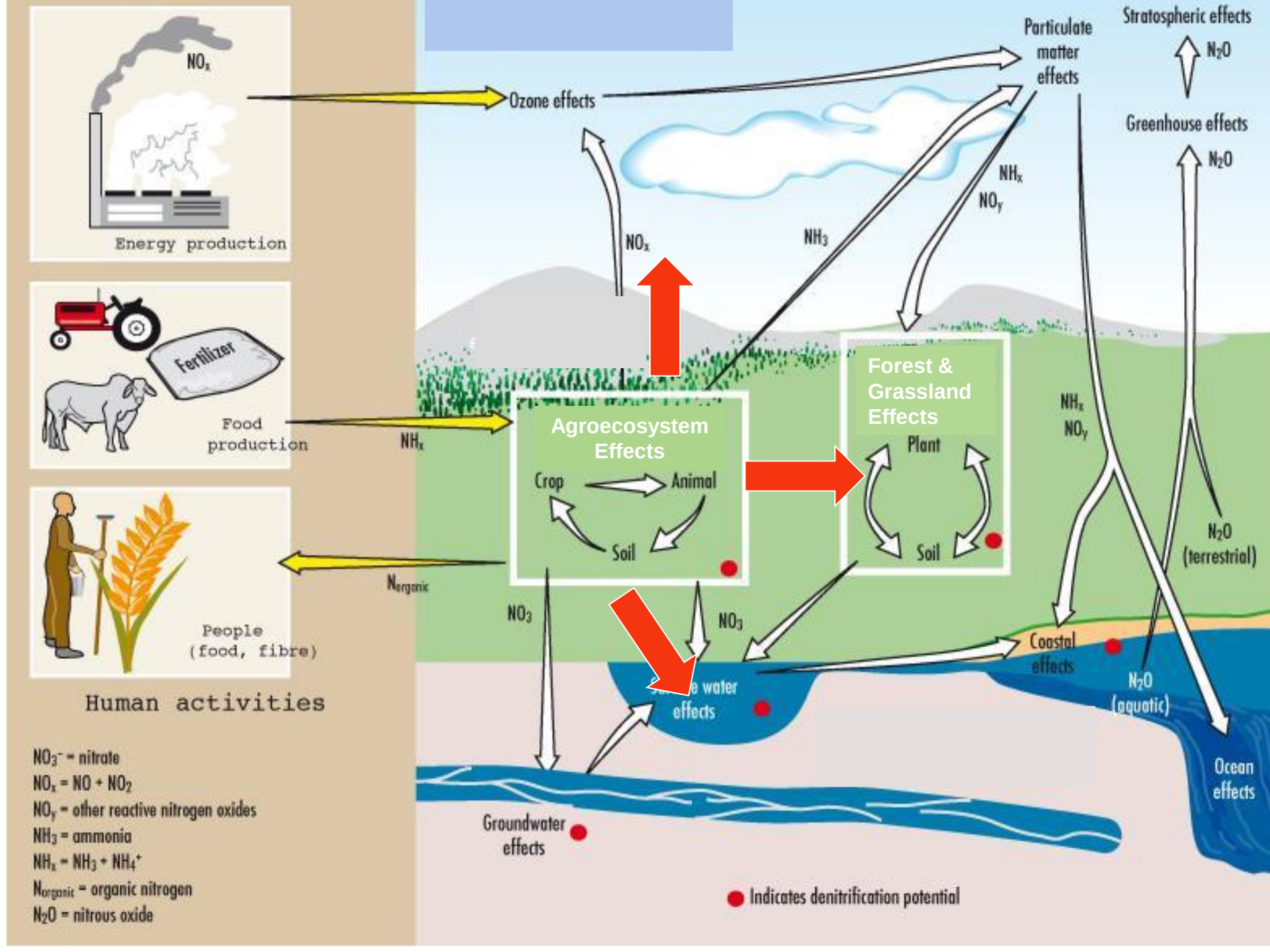

MALSAM TERRACER

Matching Supply to Crop Uptake

Optimize Crop Growth

- A vigorous, productive crop will rapidly use nutrients in the soil solution
- A quickly established crop canopy reduces erosion losses
- Ensure other factors are not restricting crop growth
  - Balanced nutrition
  - Suitable cultivar
  - Seeding rate, timing, seedbed
  - Timeliness of operations
  - Tillage system
  - Well-managed water supply
  - Correct pH
  - Manage soil condition
  - Control insects, weeds and diseases




NO_x
Energy production
Fertilizer
Food production
People (food, fibre)
Human activities
Ozone effects
Particulate matter effects
Stratospheric effects
N_2O
Greenhouse effects
N_2O
NH_x
NO_y
NO_x
NH_3
Agroecosystem Effects
Crop
Animal
Soil
Forest & Grassland Effects
Plant
Soil
NH_x
NO_y
N_2O (terrestrial)
$N_{organic}$
NO_3
NO_3
Coastal effects
water effects
N_2O (aquatic)
Ocean effects
Groundwater effects
Indicates denitrification potential
NO_3^- = nitrate
NO_x = NO + NO_2
NO_y = other reactive nitrogen oxides
NH_3 = ammonia
NH_x = NH_3 + NH_4^+
$N_{organic}$ = organic nitrogen
N_2O = nitrous oxide

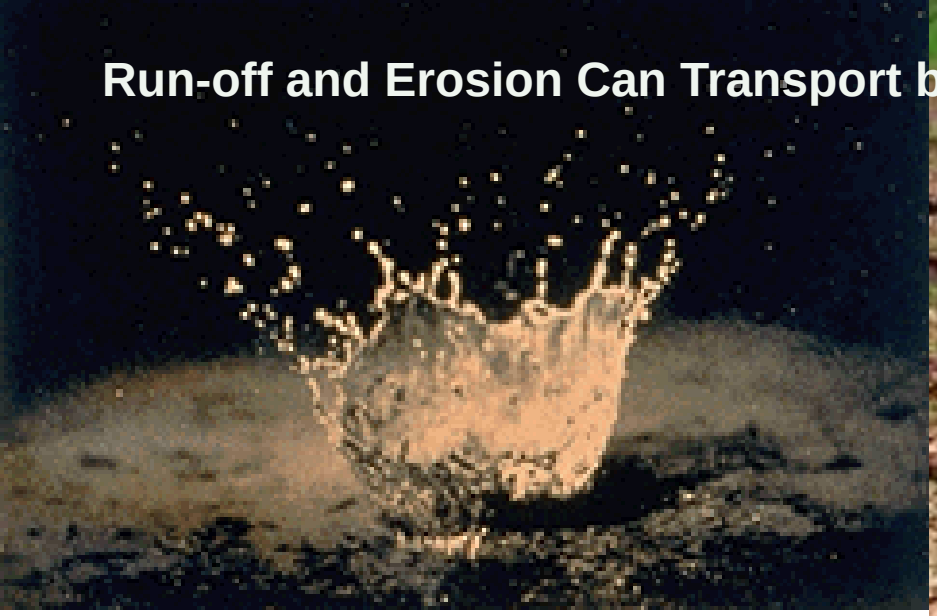
Effects on Water – Nitrates in Groundwater

- NO_3^- is mobile and can move into groundwater
- NO_3^- emissions are a major source of elevated nitrate in wells
- Health effects include increased cancer risk, neural tube defects, other congenital malformations and methemoglobinemia (Blue Baby)
- Livestock can also have health problems from nitrate in water

Nitrogen losses of environmental concern

- Volatilization – NH_3
  - Particulate matter and smog
  - Acidification of water and soil
  - Species shift and loss of diversity
  - Eutrophication
- Leaching – NO_3^{-1}
  - Nitrate movement to surface and groun
  - Eutrophication
- Denitrification – NO, N_20
  - Eutrophication
  - Smog
  - Ozone accumulation
  - Climate change

Run-off and Erosion Can Transport both N and P



Raindrops falling on exposed soil can break off soil particles to be lost in run-off water.

Controlling erosion helps control nutrient movement to water

Use Vegetated Buffer Strips to filter runoff before it enters surface water

Conservation Practices can Reduce Erosion and Nutrient Loss

- A good shelterbelts
- crop is good for the soil!

Organic farming

WATERING THE COMPOST PILE

VISIT TO PINEY WOODS CATTLE


CLASS OF SUMMER, 2011

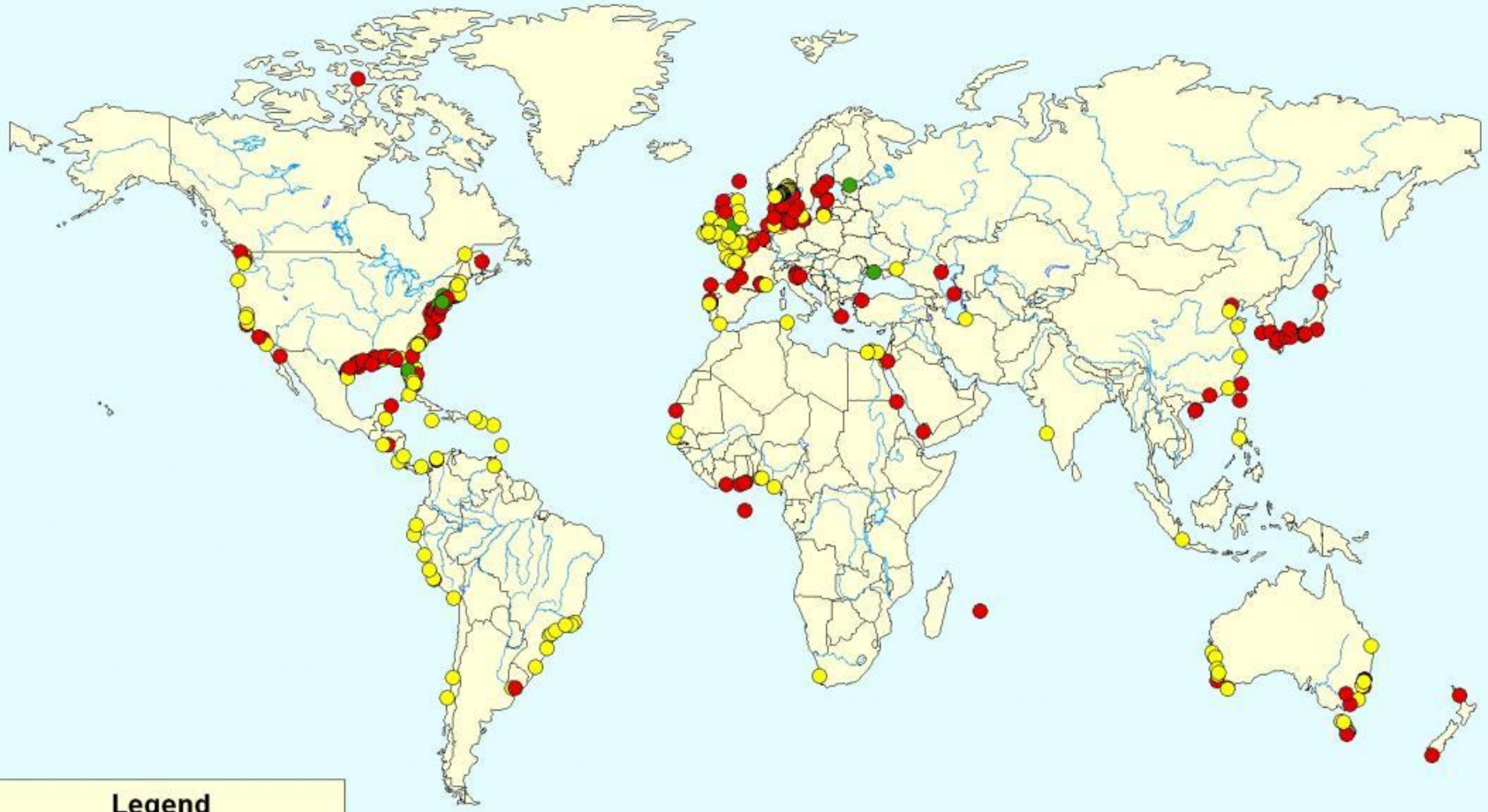





THANK YOU

VIELEN DANK

World Hypoxic and Eutrophic Coastal Areas



Legend

Eutrophic and Hypoxic Areas

- Areas of Concern
- Documented Hypoxic Areas
- Systems in Recovery

http://economicobjectorvism.files.wordpress.com/2008/01/eutrophication-map-wri.jpg

Data compiled from various sources by R. Diaz, M. Selman and Z. Sugg.

Ammonia and Nitrate in Surface Water

- Eutrophication
  - Excessive growth in aquatic ecosystems
  - Oxygen becomes depleted
  - Increases organisms that tolerate lack of oxygen and discourages oxygen-loving organisms
  - Plant and algal growth becomes excessive
  - Fish die

Some Algae can Produce Toxins

- Dinoflagellates lead to reddish water – "Red Tide" in marine systems
- Shellfish are not sensitive to toxin, but can accumulate it
  - Leads to toxicity when shellfish are consumed
  - Paralytic shellfish poisoning
    - Numbness of lips, tongue, fingers, toes
    - Headache, dizziness, rapid pulse
    - Loss of muscular coordination
    - Inability to breath
    - Death in 2-12 hours
- Problem with clams, scallops, mussels, oysters and other bi-valves
- Warnings and fishery closures are common

Natural Terrestrial Ecososystems

- Nitrogen is normally limiting factor in natural forests
- Atmospheric deposition of N can be a major N input
- Adding N can initially increase forest growth
  - N cycles within the system
  - Deciduous trees respond better than evergreen trees
- If N exceeds crop demand
  - NO_3^{-1} accumulates in soil
  - Soils acidify
  - Cations leach from soil
  - Nutrient imbalances occur
  - Species composition shifts
  - Trees are more sensitive to stress

pH		Organic C	Total N	C/N	NH_4 - N	NO_3 - N	P_2O_5	K_2O
H_2O	KCl	%			mg kg^{-1}		mg $100g^{-1}$	
7.89	7.39	0.104	0.031	3.67	7.81	5.95	6.01	5.8

Sustainable revitalization of deposols
(low amount of mineral fertilizers +
manure + biosolids , eg. coal dust)

- Environmental need
- Socio-economical need


Class starts at eight

Vermiculture Project

Sorting out the worms

A usina por dentro

A WEG colocou em funcionamento, abaixo, uma usina com paredes transparentes. Passeando com os olhos, você pode entender tudo o que acontece com a cana-de-açúcar em seu trajeto pela usina.

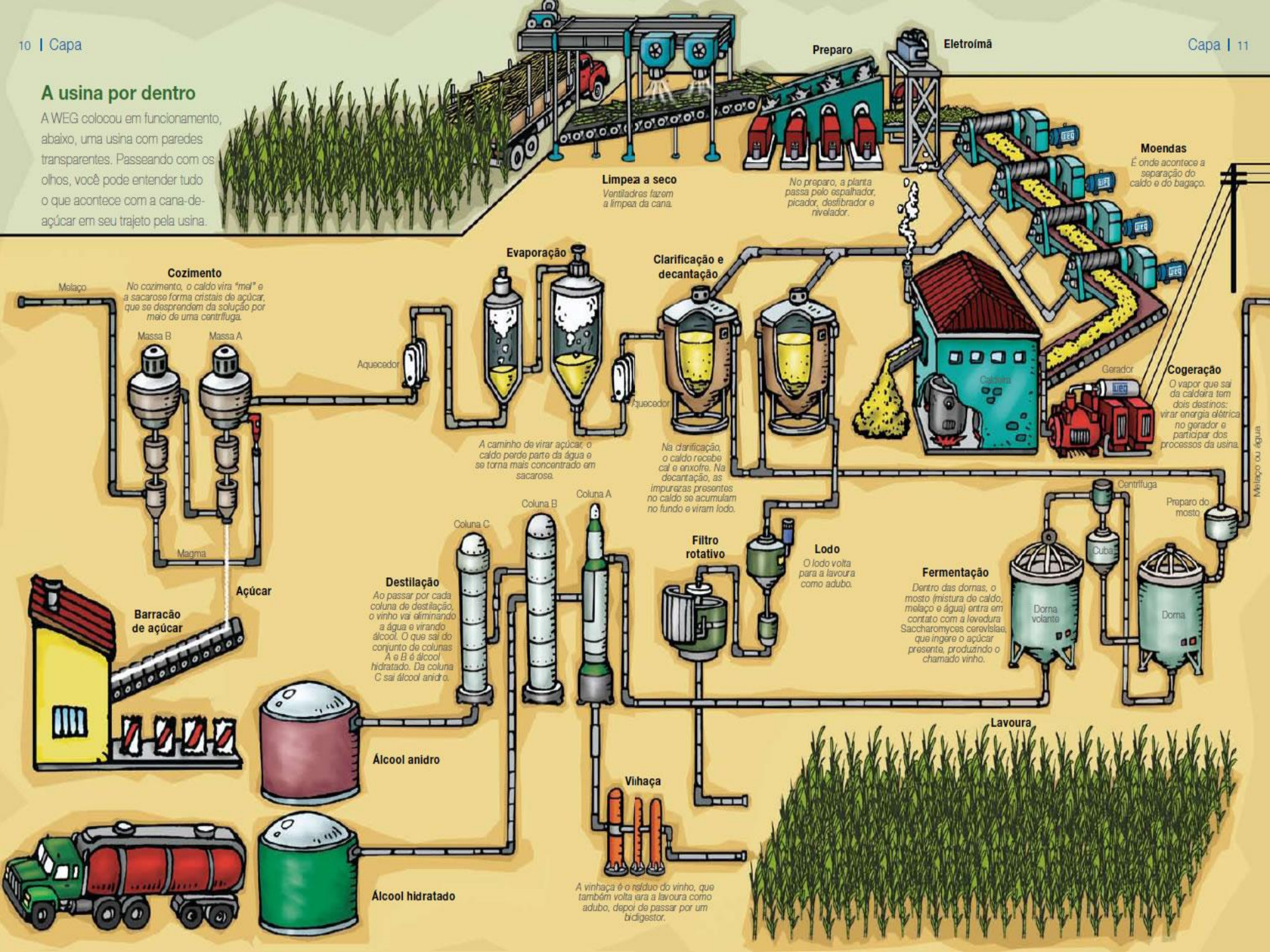


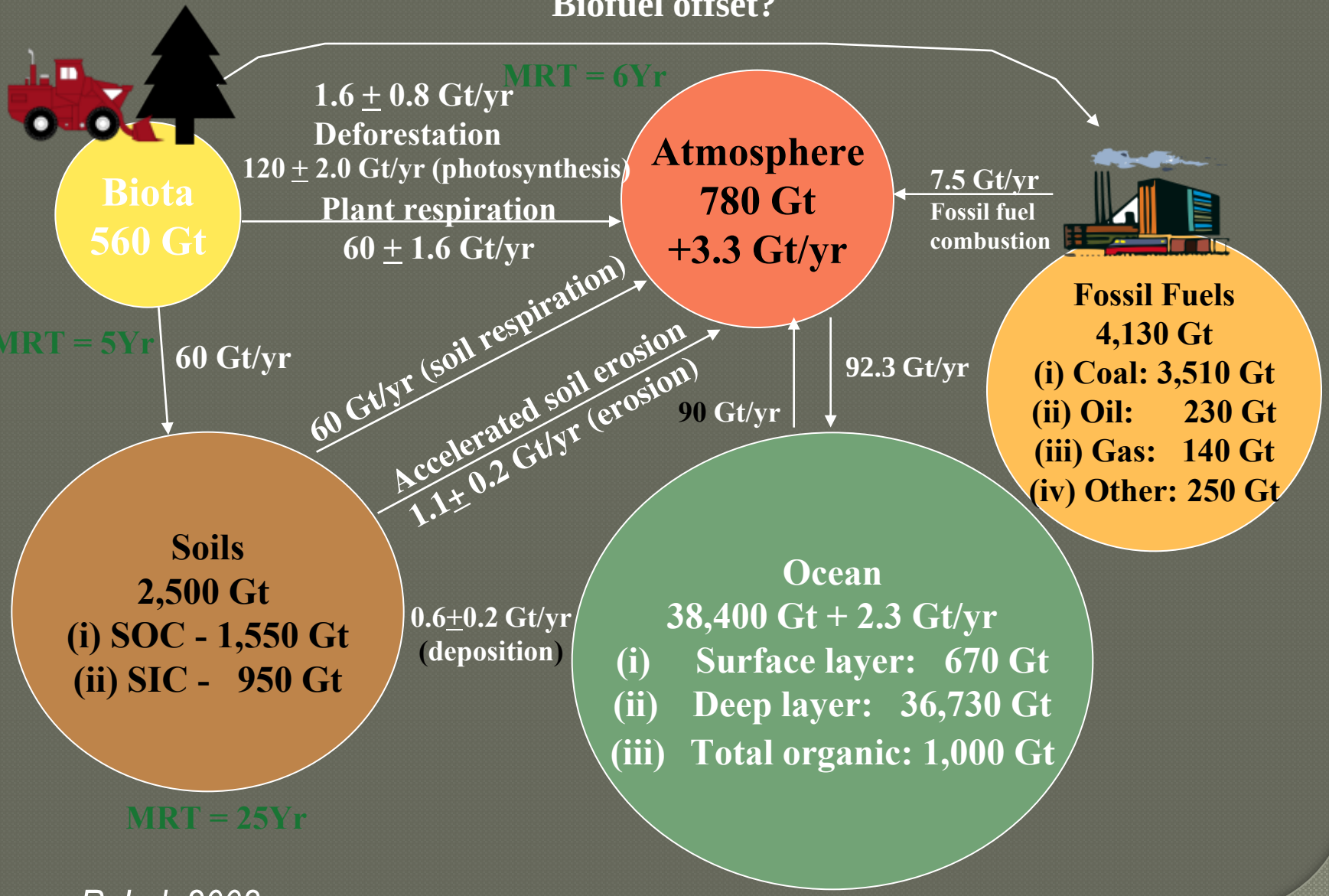
Photo:
Irrigart

ORGANIC AGRICULTURE CLASS

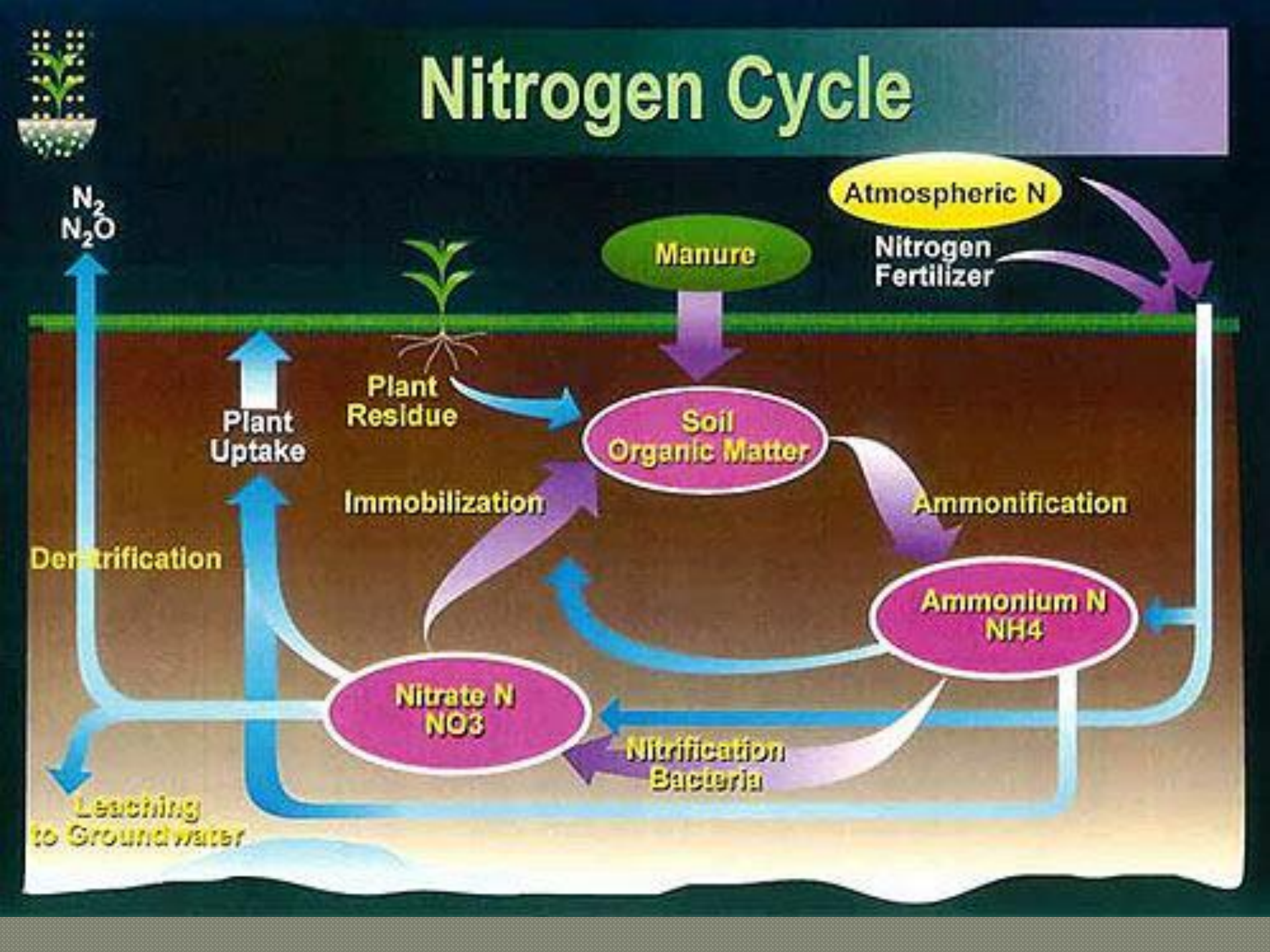
SUMMER, 2011

Multiple functions of soils – carbon pool

The role of the terrestrial carbon pool within the global carbon geochemical cycle



Source: R. Lal, 2008


Nitrogen Cycle
N_2
N_2O
Atmospheric N
Manure
Nitrogen Fertilizer
Plant Residue
Plant Uptake
Soil Organic Matter
Immobilization
Ammonification
Denitrification
Ammonium N
NH4
Nitrate N
NO3
Nitrification Bacteria
Leaching to Groundwater