

XX Reunião Brasileira de Manejo e Conservação do Solo e da Água

O solo sob ameaça: conexões necessárias ao manejo e conservação do solo e água!

A retomada da microbacia como unidade de planejamento de uso da terra

Palestrante: [Prof. Dr. José Miguel Reichert](#) - UFSM

A pressão econômica sobre o uso e ocupação do solo: consequências ambientais e sociais.

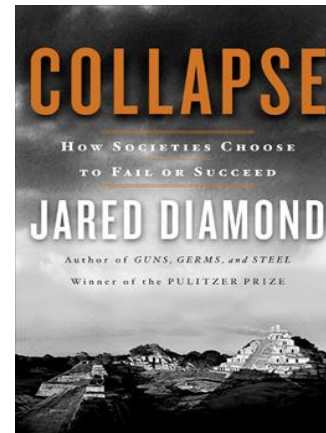
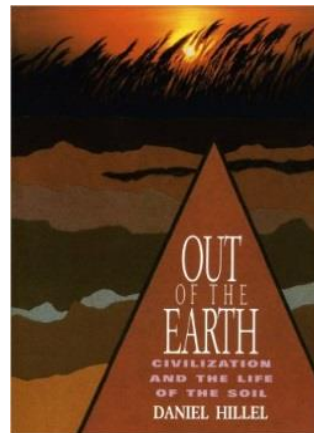
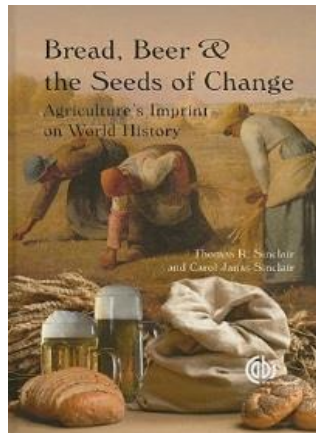
Palestrante: [Prof. Dr. Rattan Lal](#) - The Ohio State University

Bread & beer Soil & water Rivers & climate

J. Miguel Reichert, PhD

Professor titular

Física do Solo - UFSM



Outline

- Agriculture origin
- Eating and drinking / Crops in history
- River basins and agriculture:
Euphrates, Nile, and Yellow rivers
- No single river, but climate change:
Bantu and Maya
- A more recent case: Amu Daria River
- Lessons learned: What history tells us
- How to implement practices: **Regulations vs. incentives**

Agriculture

Adam and Eve's fault?

- Then the Lord planted a **Garden in Eden**, in the East, and there he put the man he had formed. He made all kinds of **beautiful trees grow there and produce good fruit**. In the middle of the Garden stood the tree that gives life and that tree gives knowledge of what is good and what is bad. A **stream flowed** in Eden and watered the Garden ... Then the Lord placed the **man** in the Garden of Eden to cultivate it and **guard** it. He told him, “You may eat the fruit of any tree in the garden, except the tree that gives knowledge of what is good and what is bad.”

Hunter-gatherer food supply

- ... The woman saw how beautiful the tree was and how good its fruit would be to eat, and she thought how wonderful it would be to become wise. So she took some of the fruit and ate it. Then she gave some to her husband, and he also ate it.
- ... Then the Lord said, “Because of what you have done, the **ground will be under a curse**. You will have to work hard all your life to make it produce enough food for you. It will produce weeds and thorns, and you will have to **eat wild plants**. **You will have to work hard and sweat to make the soil produce anything.**”

Agricultural food supply

Genesis

Paradise lost!



Zé de Cafundó

Mineiro

Gaúcho

Ano 1979

Eat and drink to have a life

“We must begin by stating the **first premise** of all human existence and, therefore, history:

Man must be in a **position to live** in order to be able to “make history”.

But **life** involves, before everything else, **eating and drinking.**”

Karl Marx
The German Ideology

Crops in human history

- Wheat, rice, and corn:
 - 2/3 global food from crops
- Plus barley, oats, rice, sorghum, and millet:
 - 92% human caloric intake by humans
- **PRESENT AND PAST!**
- 8 out 10000 grass species
- High carbohydrate for **BREAD** and **BEER** (**body and spirit – mood changing!!!**),
easy storage, fibrous root structure
- Selection: a long journey ...

Cropping in agricultural history

1. Water
2. Nitrogen
3. Weed control

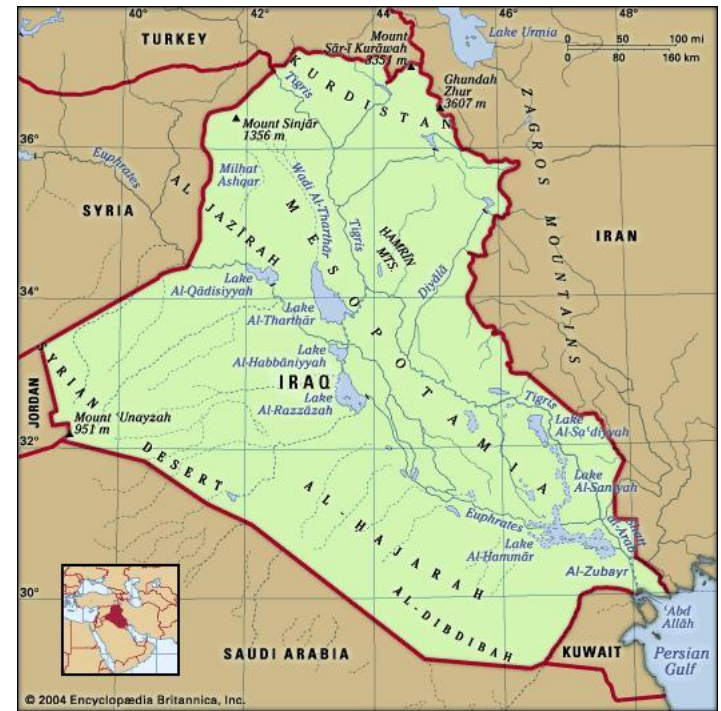
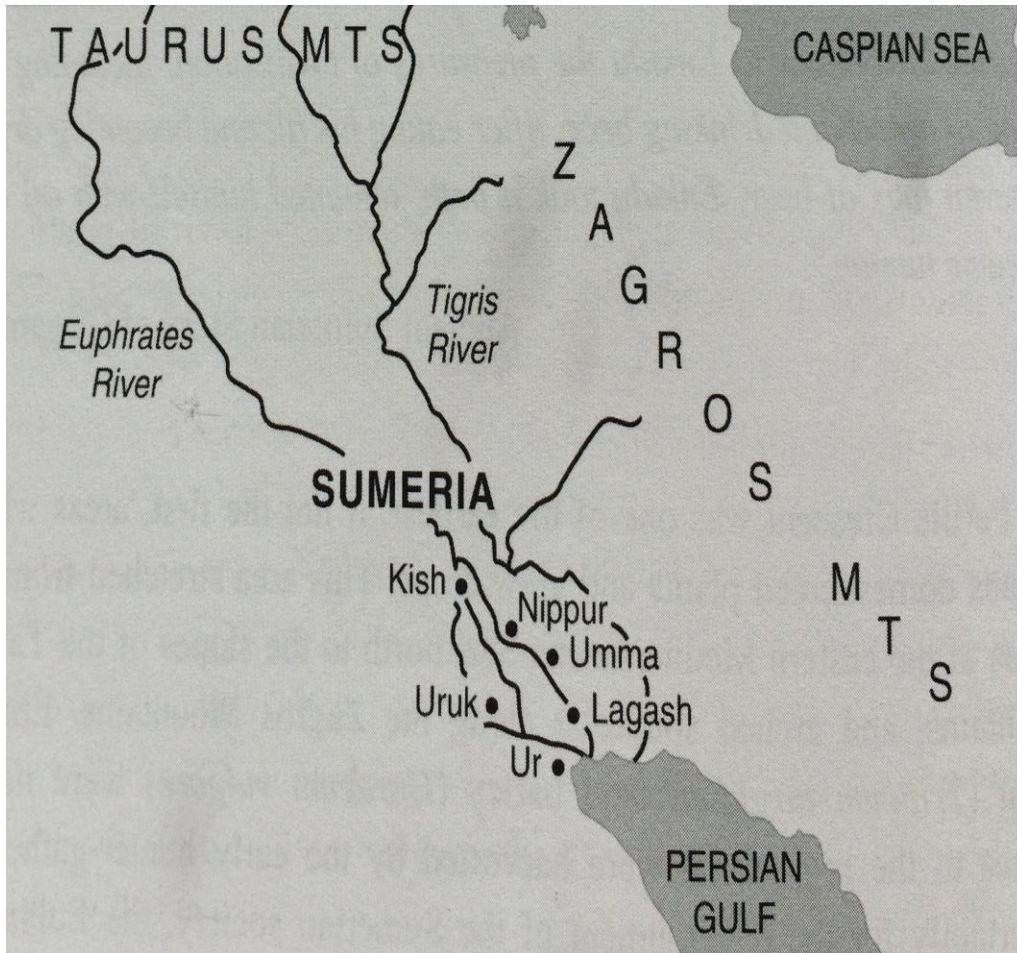
Wheat and barley

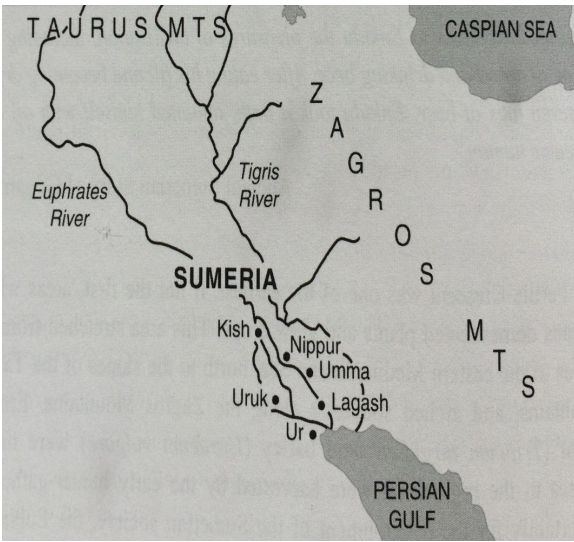
Two basins, two destinies



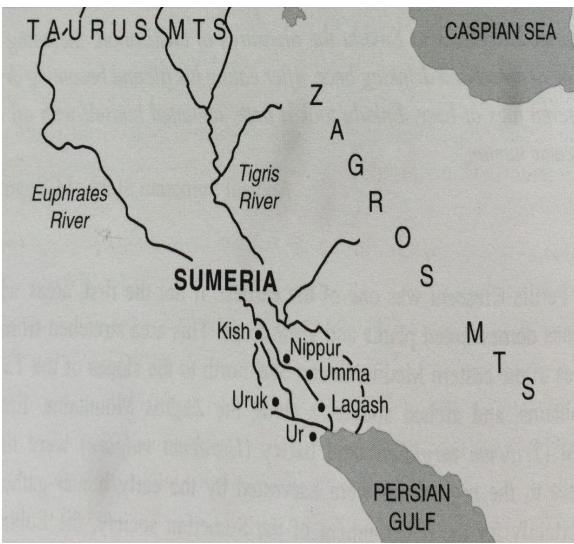
Mesopotamia – Sumerians

~3500 – 2334 BC

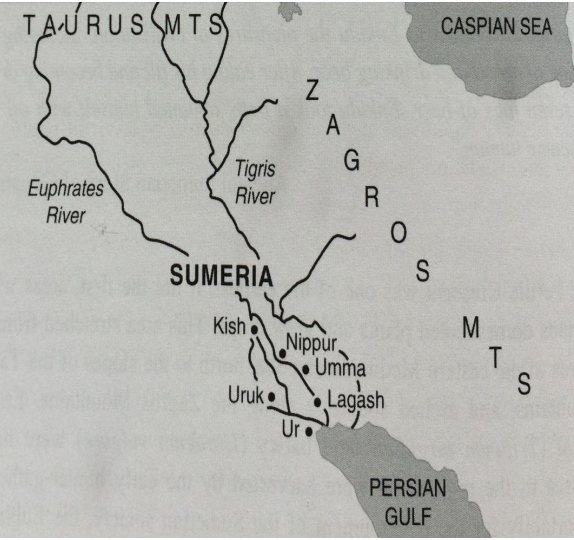




- Wheat and barley – native grasses
- First agriculturists
- Two rivers, different behaviors
- Flat flood plain
- Soil easily tilled
- City-states called Sumeria
- First governments, writing, and mathematics → administrative control in crop production



- Flooding:
silty soil, organic matter + water
- Peak flow in end of summer. Thus, irrigation during low river flow
- 2700 km. Silt load. High ET. Salinity!
- River elevation due silt deposits
- Canals maintenance (siltation)
→ hard work, ruling class
- Agriculture: WATER + N (OM)
but lots of weeds!



- BEER? Many types, salary in beer
- BREAD? 300 types

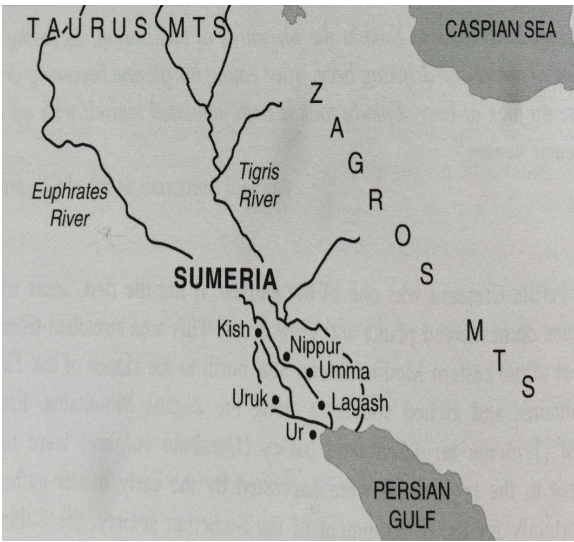
• 1000 years of Sumerian society

- What went wrong?
Floods (high river)
Salinization (seepage, no drainage)

Barley ok, Wheat not

→ more BEER!





- Finally,
- Migration to the North
- Conflict with the Akkadians
- Akkadians Empire for ~100 yr
- Increased population + challenges
viable cropping system
→ end of Empire!
- (A Arca de Noé!!!)

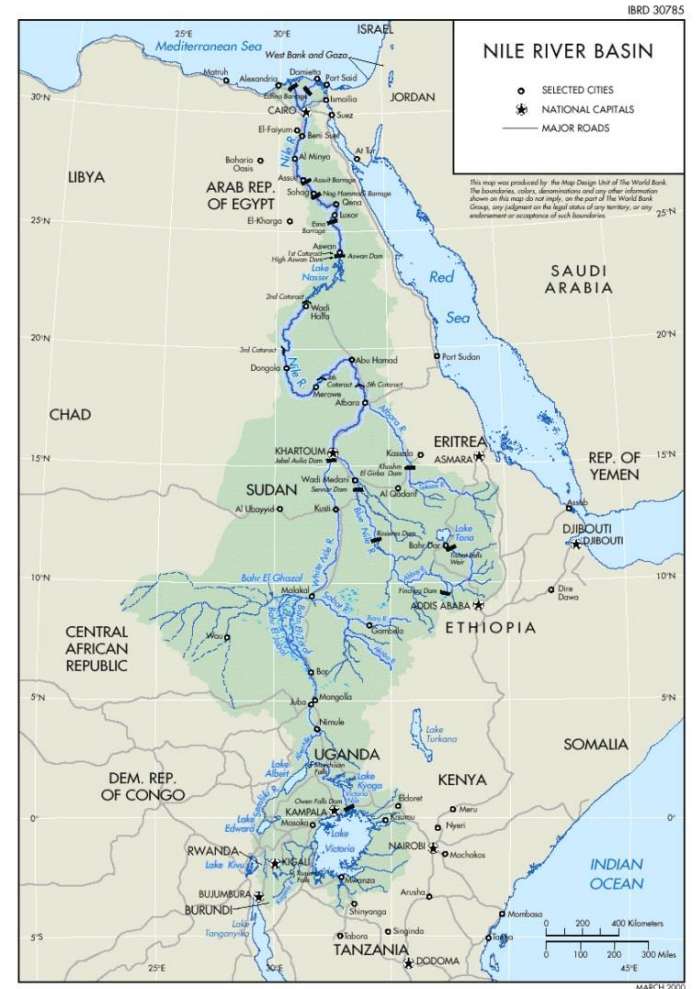
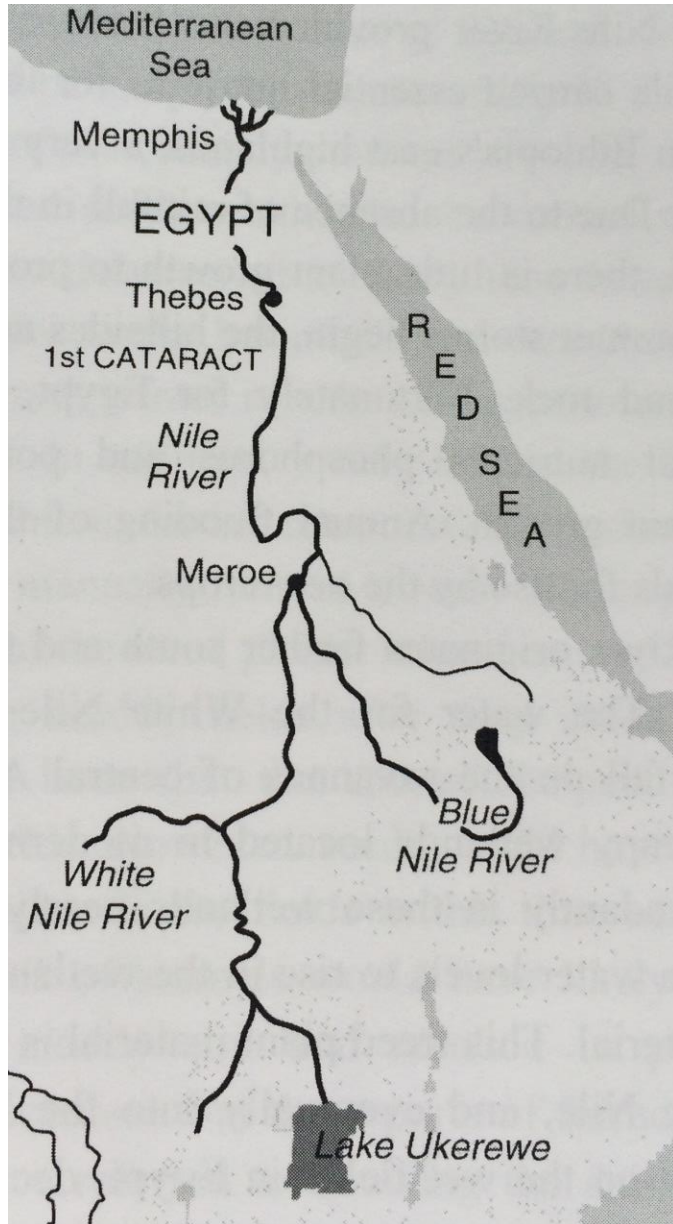


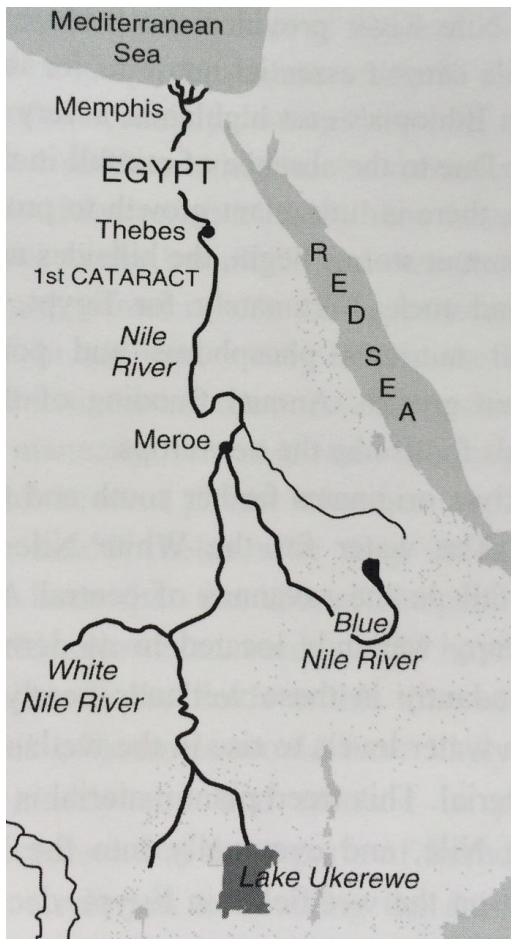
OIL

SOIL

EARTH 4 20 16
WANTED N.Y.
& POTR

Nile River – Egyptians ~3000 – 1070 BC





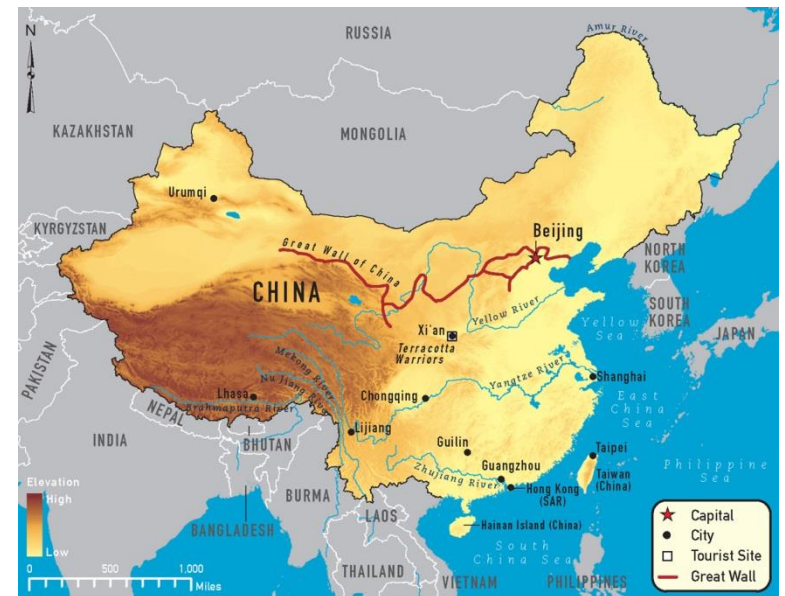
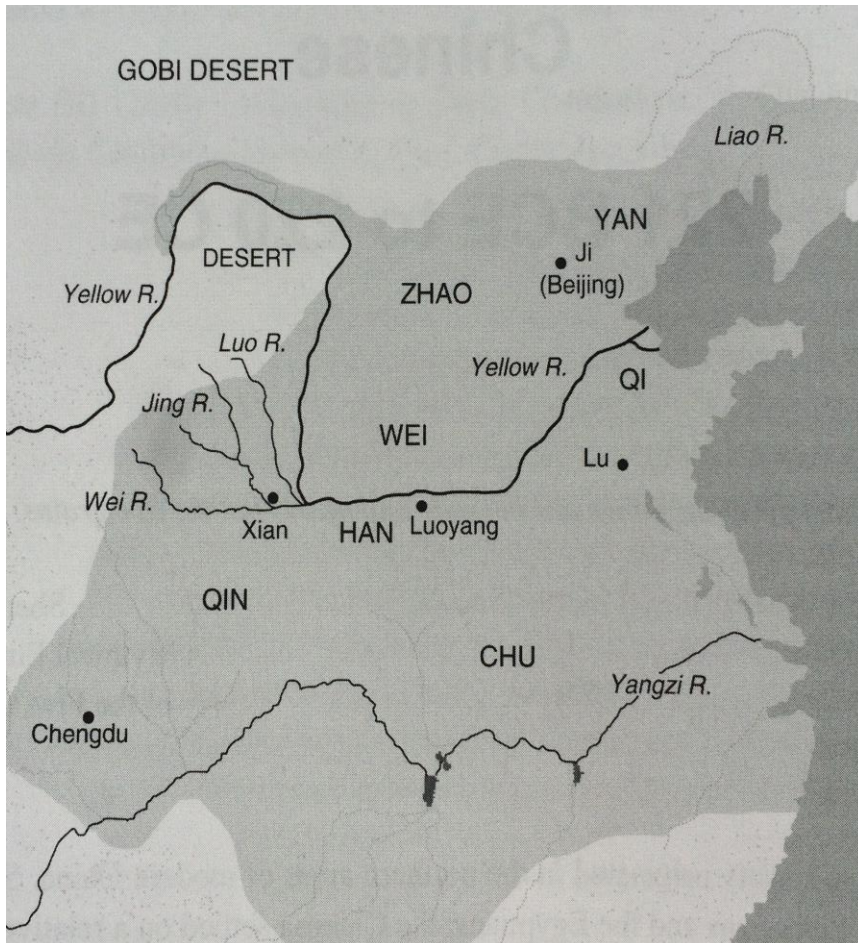
- Flooding not a treat, but a blessing
- Flooding before planting
- **Blue and White rivers fed by monsoonal rains**
(Joseph of Egypt: 7 yrs hunger and drought x 7 yrs abundance)
- **Blue River → P and K nutrients**
- **White River → N (OM from swamps)**
- Weeds + salinization not problems
- Little need for irrigations systems
- Less work needed.
Time for building monuments.
- **Domination by Athens and Rome**

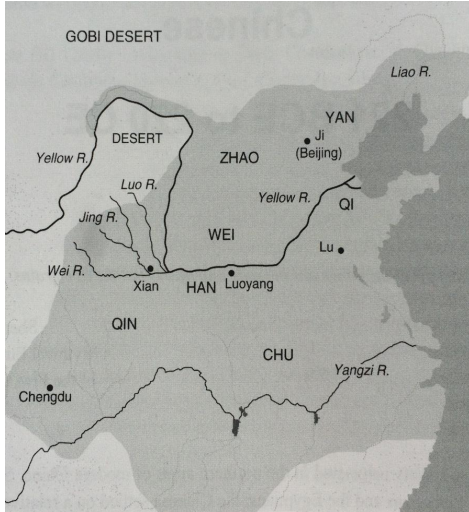
Yellow and Yangzi Rivers

Chen and Han Dynasties

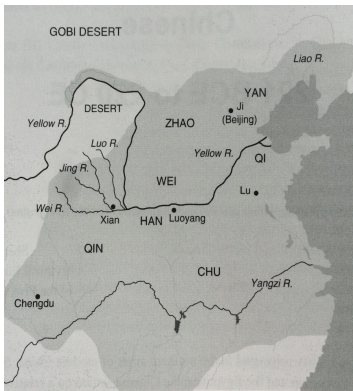
221 BC – 200 AD

Millet, soybean (and rice)





- Loess, desert, cold → Yellow R.
- Siltation raised river channel and banks → River of Sorrow (inundate villages and crops)
- Irrigation was dangerous
- Little OM and nutrients in water → other **SOURCES** of N (animal, human waste; **soybeans**) and millet lower N demand
- **Rice** (not important in Han Dynasty) produced only in Yangzi River basin
- Plenty of food. People moved to cities
Increased taxation of farmers
Periodic peasant rebellions
Dynasty ends!



Han Dynasty - China

Common crop rotation

4 crops in 3 fields

3 ha per family. Labor intensive

| Field | Summer | Winter | Summer | Winter | Summer | Winter |
|-------|---------------------|--------|---------------------|--------|---------------------|--------|
| 1 | Short-season Millet | Wheat | <u>Soybean</u> | - | Spiked Millet | - |
| 2 | Spiked Millet | - | Short-season Millet | Wheat | Soybean | - |
| 3 | Soybean | - | Spiked Millet | - | Short-season Millet | Wheat |

No Rivers Climate change

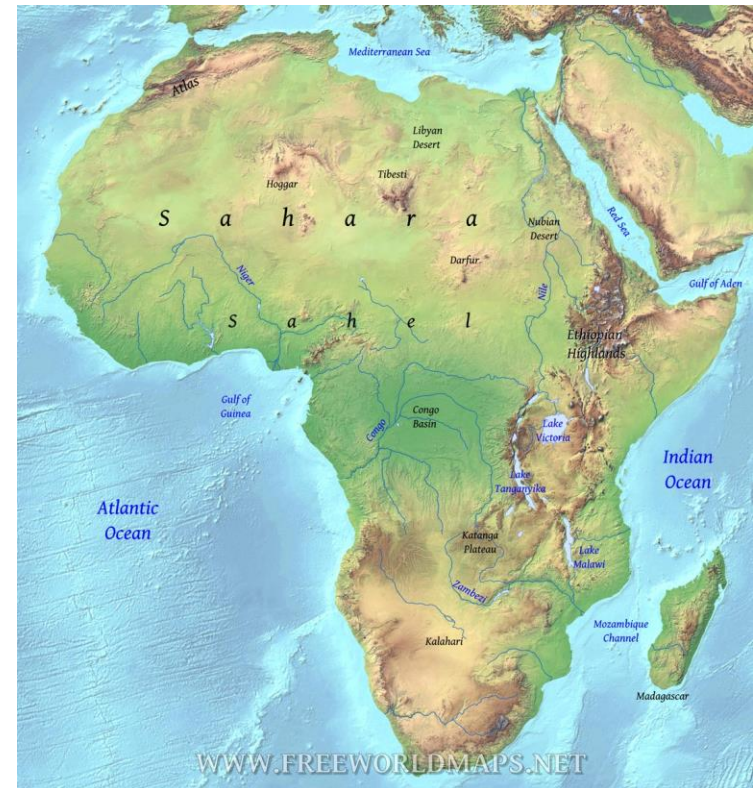
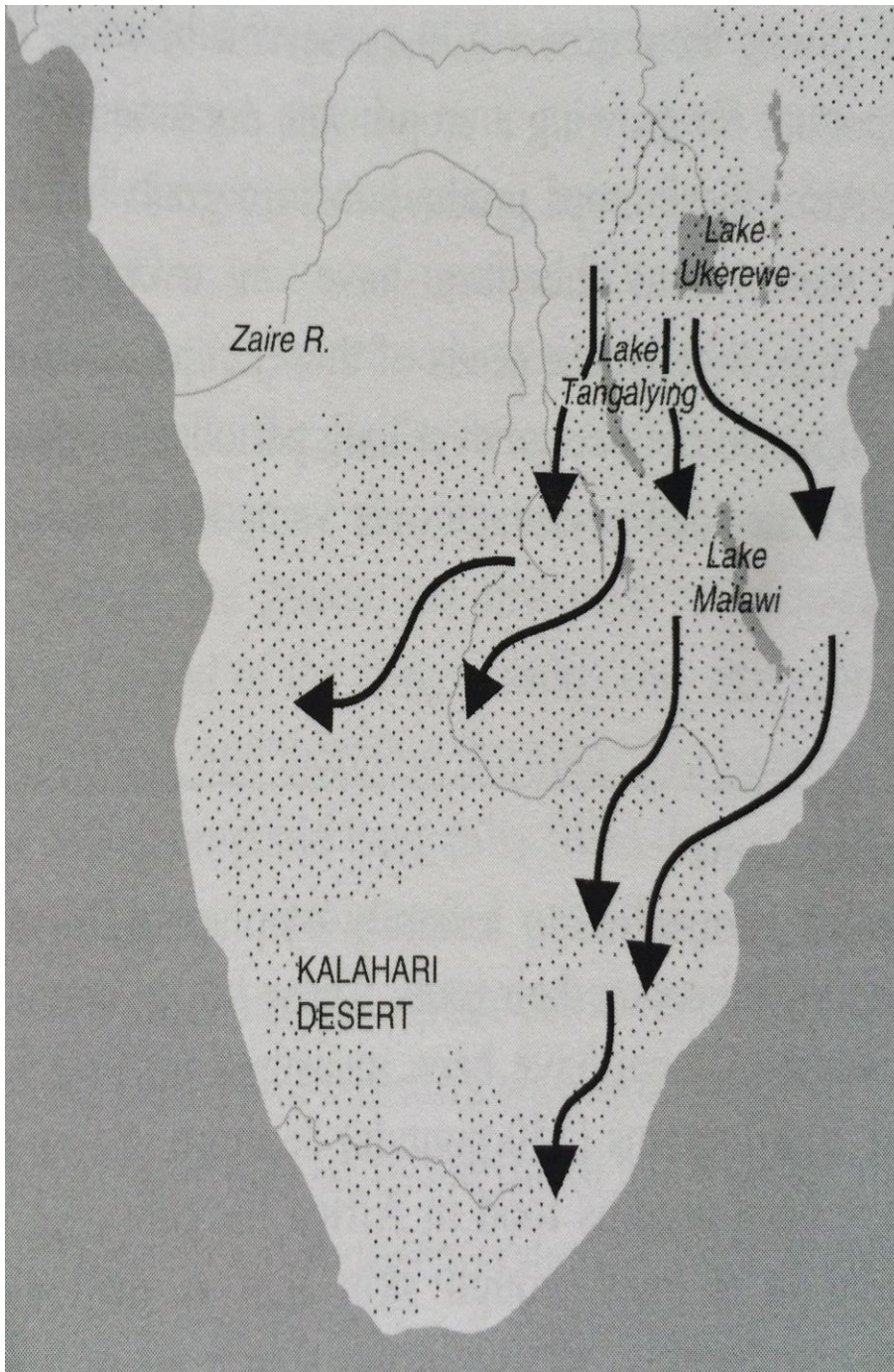
Bantu civilization

Maya civilization

Bantu of Africa

~400 BC – 300 AD

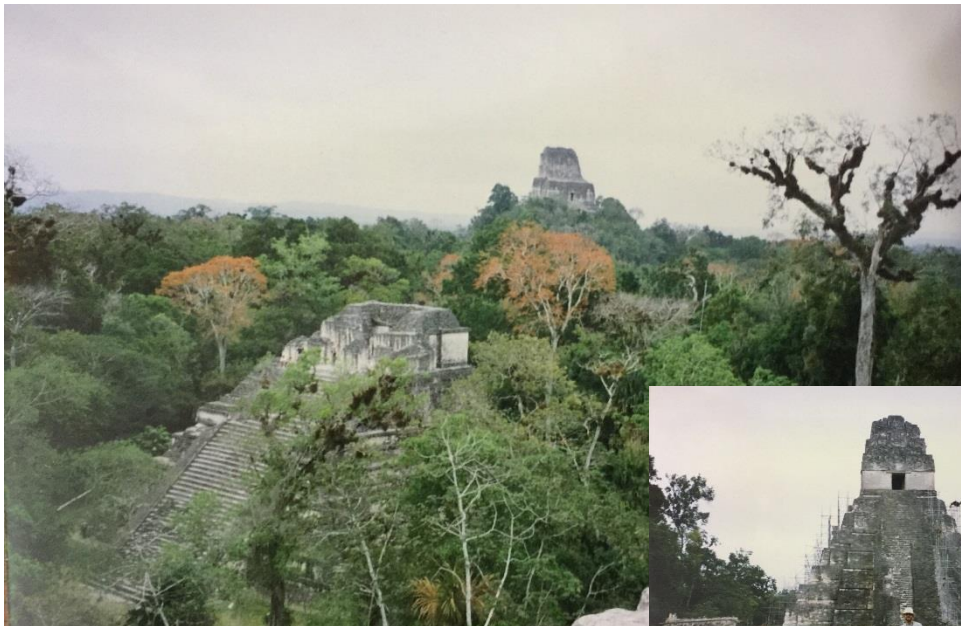
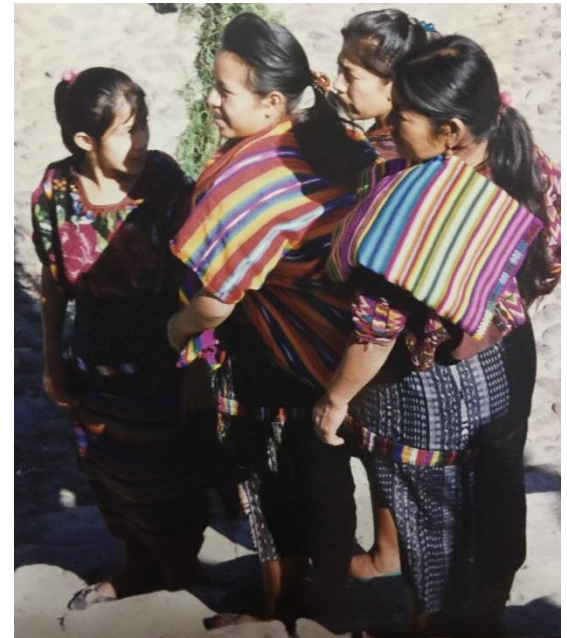
Mixed crops
yams, millet, sorghum



Maya

~150 AC – 910 AD

“Trinity”: corn, beans, and squash



1995

Maya

~150 BC – 910 AD

“Trinity”: corn, beans, and squash



| | | |
|--------------------|-----------------------------|----------------------------|
| Area: | | Yucatan Peninsula |
| Highlands | Lowlands | |
| Terrain: | | |
| Mountains | Swamps | Rain Forest |
| Technique: | | |
| Steppe Agriculture | Raised-Platform Agriculture | Slash-and-burn Agriculture |

More on crop rotations

British 1700 – 1850 AD

The Norfolk 4-field rotation. 5 crops per year.

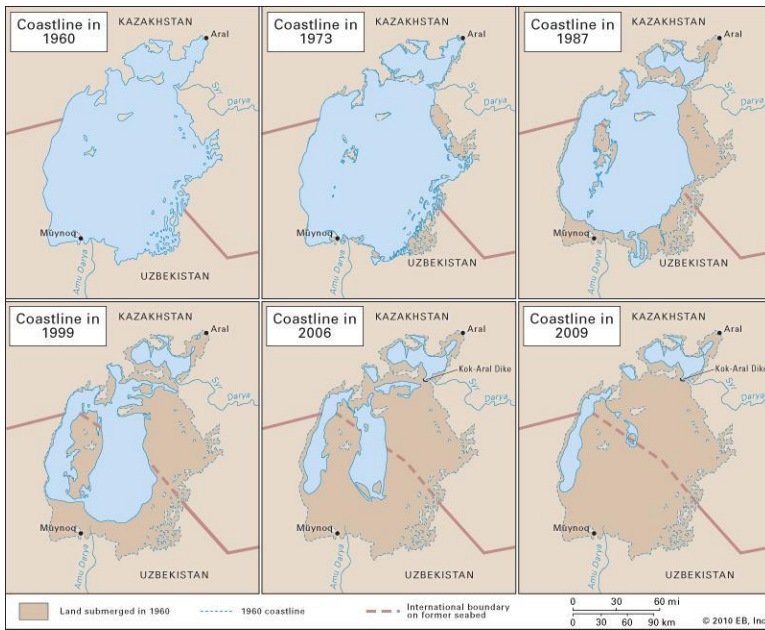
| Field | Summer 1 | Winter 1 | Summer 2 | Winter 2 |
|-------|-------------------------|-----------------|-----------------|-----------------|
| 1 | Clover/Ryegrass | Clover/Ryegrass | Clover/Ryegrass | Wheat |
| 2 | Turnips (NABO) | Barley/Oats | Clover/Ryegrass | Clover/Ryegrass |
| 3 | - | Barley/Oats | Turnips | Barley/Oats |
| 4 | Clover/Ryegrass | Wheat | - | Barley/Oats |

| Field | Summer 3 | Winter 3 | Summer 4 | Winter 4 |
|-------|-----------------|-----------------|-----------------|-----------------|
| 1 | - | Barley/Oats | Turnips | Barley/Oats |
| 2 | Clover/Ryegrass | Wheat | - | Barley/Oats |
| 3 | Clover/Ryegrass | Clover/Ryegrass | Clover/Ryegrass | Wheat |
| 4 | Turnips | Barley/Oats | Clover/Ryegrass | Clover/Ryegrass |

Very recent!

Ex-Soviet Republics

Aral Sea



2005-2006

Boundaries and locations are approximate and should not be considered authoritative.

Lessons

- Basins/watersheds
- Erosion/sedimentation
- Water-N-weeds

- Organic fertilization and N fixation
- Crop rotations
- Intercropping
- Grains / forage (**ILP**)
- Climate change

The nature of the Beast



Slow processes
Long time frame



Money, money, money ...
Time is money!
Does long-term pay?



Regulation vs. Incentives



Incentives Spectrum

Regulatory
(Polluter pays principle)



Mandatory regulations

Prohibition of use

Taxes/charges

Property use rights

Mandatory farm set-asides



Flexible regulations

Subsidies

Conservation easements

Permits and quotas

Marketing labels - certificates and standards

Offsets



Voluntary investments -
Linked to input

Green Public Procurement (GPP)

Voluntary farm set-asides

Conservation concessions

Direct Payments for
Ecosystem Services

Corporate Social Responsibility (CSR)

Voluntary
(Provider gets principle)



Voluntary investments -
De-linked to input

Cultural and social norms

Rewards for Ecosystem
Services (RES)

Marketing labels
(without certificates/standards)

Our faith never fades away!



- Human knowledge is doubling every 10 years.
- In the past decade, more scientific knowledge has been created than in all of human history.

– E para a CS?

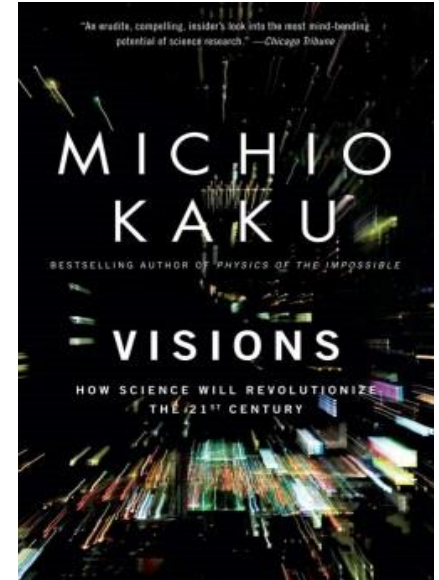
– Falta conhecimento/tecnologia?

educação/instrução?

legislação?

ação?

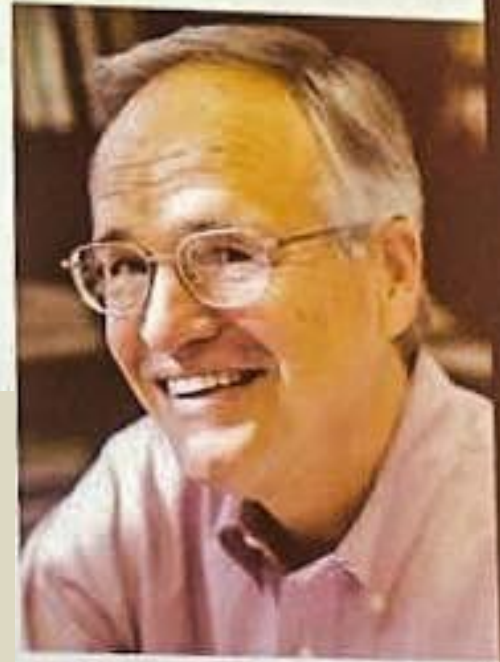
ou ... ?



“We scientists don’t know how to do that”

“I used to think the top environmental problems were biodiversity loss, ecosystem collapse and climate change.

I thought that with 30 years of good science we could address those problems.



Gus Speth

“We scientists don’t know how to do that”

“I used to think the top environmental problems were biodiversity loss, ecosystem collapse and climate change.

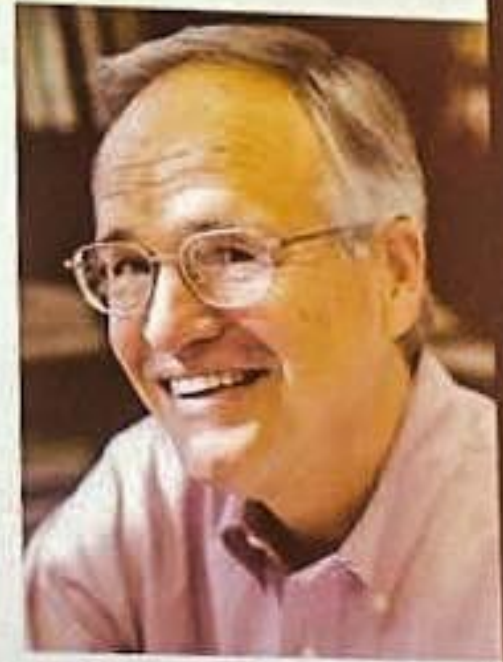
I thought that with 30 years of good science we could address those problems.

But I was wrong.
The top environmental problems are selfishness, greed and apathy...

...and to deal with those we need a spiritual and cultural transformation

- and we scientists don't know how to do that.”

Gus Speth



“Como é difícil convencer o caipira, que sempre plantou seu milho em fileiras quadriculadas, a mudar tudo e plantar em curvas de nível. Atrás de si estão colheitas e mais colheitas... Provas, evidências. Mudar, para quê?

E não pensem que com os cientistas ocorre de forma diferente. Nem todos são aqueles que têm visões. A grande maioria está imersa nas suas rotinas. Por que haveriam de mudar a tradição se tudo funcionou tão bem até agora? O sol no centro do universo? Loucura... E os séculos de Ptolomeu? E Galileu?”

Rubem Alves
Filosofia da Ciência



**EU FICO PUTO
COM ESSA GALERA
QUE PENSA SER MELHOR
QUE O OUTRO.**

**MAS PAULO,
NÃO PODEMOS
ESCREVER ASSIM.**

**ENTÃO ESCREVE AÍ :
"NÃO HÁ SABER MAIOR
OU SABER MENOR,
HÁ SABERES DIFERENTES"**

Extremes



Notícias Agrícolas
Seja o porta-voz de si mesmo!  Curtir 153 mil

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Erosão de volta e Ministério Público pronto pra multar o produtor rural do Paraná

Publicado em 08/11/2016 17:17 e atualizado em 09/11/2016 18:50



3766 exibiçõ

Técnicas de conservação do solo devem voltar a fazer parte da rotina do produtor rural no Paraná. Diversificação de culturas no plantio direto e terraceamento das áreas precisam ser observados

Confira a entrevista de Henrique Debiasi - Pesquisador Embrapa Soja



Achieving unity and cooperation

“The profound and far-reaching changes, the unity and unprecedented cooperation required to reorient the world toward an environmentally sustainable and just future, will only be possible by touching the human spirit, by appealing to those universal values which alone can empower individuals and peoples to act in accordance with the long-term interests of the planet and humanity as a whole.”

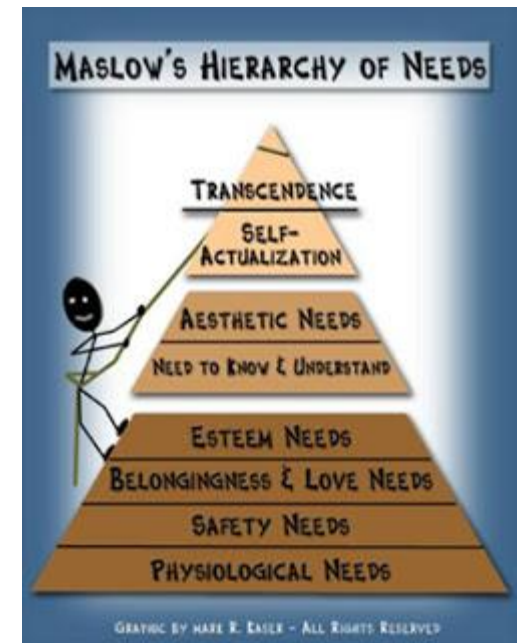
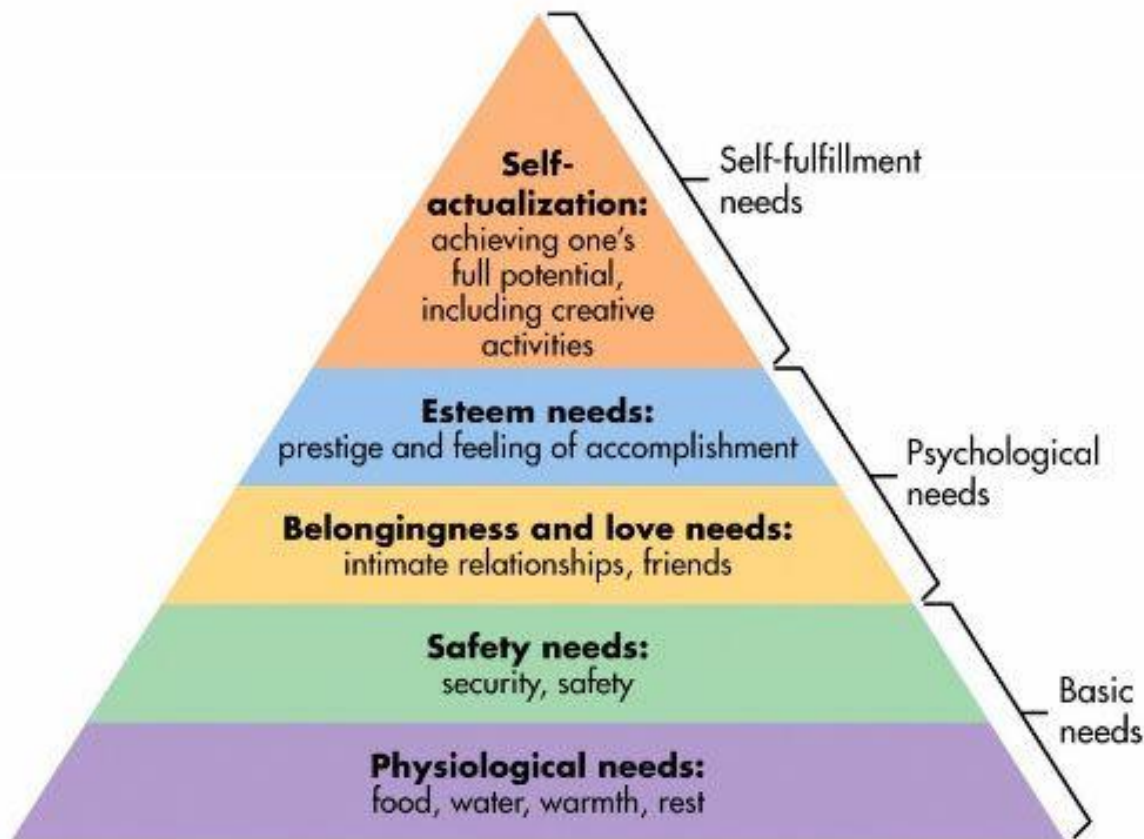
(Earth Summit, NGO Statement, Río, 1992)

Maslow's Hierarchy of Needs

People are motivated to achieve certain needs, and that some needs take precedence over others.

Our most basic need is for physical survival, and this will be the first thing that motivates our behavior.

Once that level is fulfilled the next level up is what motivates us, and so on.

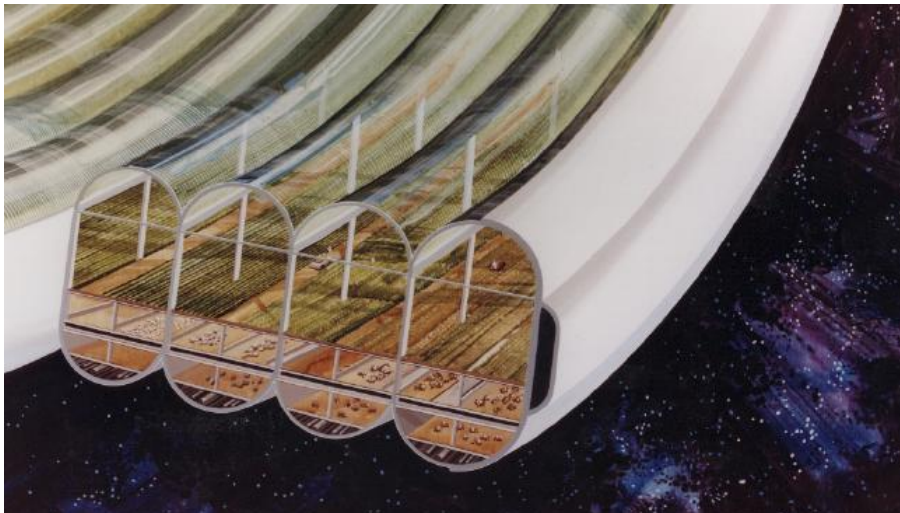




Muito obrigado!

- **A História** é um carro alegre
Cheio de um povo contente
Que **atropela** indiferente
Todo **aquele que a negue** (Chico Buarque)
- **Caminante, no hay camino,
se hace camino al andar**
Al andar se hace el camino,
y al volver la vista atrás
se ve la senda que nunca
se ha de volver a pisar (Antonio Machado)

How much do we consider future generations?



Soil and plant life would be included in the colony.
Picture: NASA Ames Research Centre