Human Population
2016
Lecture 13
World3.3
Delays
Cycles
Questions?
Thoughts on China's 1-child policy

- Policy "succeeded", but Japan, which had no such policy, decreased its birth rate even more than China.
- Burden on the young (the inverted demographic pyramid argument) is cited as a reason against decreasing the birth rate, but this burden is temporary, lasting only for one generation.
Delays

• Overshoot is the result of delay.

  • problem detection or recognition
    Global warming was not recognized as such until it was well underway. CO$_2$ not recognized as a pollutant until 2009.

  • policy generation and enforcement
    It took 20 years to remove lead from gasoline in the US, over 50 years worldwide. Tetraethyl lead is still produced illegally. Fossil fuels still used legally and widely, despite known dangers.

  • technological development
    Photovoltaic solar cells were patented in 1894. Solar only became cost effective in 2013. Still no way to convert electricity to liquid fuel.
In an imaginary world with no delays, what would happen?

- problem detection or recognition
  Global warming immediately detected. Or better, predicted!

- policy generation and enforcement
  Fossil fuels immediately removed from use!

- technological development
  Photovoltaic solar cells immediately implemented.

- Hypothetical Result: No overshoot due to use of fossil fuels.

Conclusion: **Delays** are an essential component of a realistic global systems dynamics model, since removing them creates an unrealistic scenario.
Important delays

- **CO₂ to global temperature** -- What is the delay time between increasing atmospheric CO₂ and global temperature increase.

- **Global temperature to Ice** -- What is the delay between global temperature and equilibrium global ice cover.

- **Ice to Global Temperature** -- Because of albedo, [Ice] feeds back on Temperature. What is the delay?
Important delays

- **Land recovery rate** -- Use the literature to find out how many years of non-production are required to build 1 mm of soil \((\text{by})\), how many years of production are required to erode the soil by 1 mm \((\text{ey})\).

Amount of degraded land recovered in year \(X\) is \(\text{Delay([degraded],[by])}\).

Amount of agr. land degraded in year \(X\) is \(\text{Delay([agr. land],[ey])}\).
Important delays

- **Investment to Need delay** -- From the time when the investment is made for a certain **Need**, how long does it take before the invested amount (kWh) is applied to the **Need**. For example, if the Need is for Food and we invest in fishing, how many years pass before fishing is increased (by better fishing technology)?
A reasonable schedule of process scale-up will permit widespread deployment on plants of 800 MW as early as 2018. This timing will require legislative cap-and-trade and other measures to provide incentive for the expensive, first-of-a-kind demonstration plants. However, limestone slurry scrubbing was demonstrated and deployed in less than 7 years, and amine scrubbing is understood far better than was slurry scrubbing at an equivalent point of its development. It should be possible to install amine scrubbing on an 800-MW plant that would be operational by 2013*, if some institution would assume the financial risk and the extra cost of a hastily designed and constructed first-of-a-kind plant.

Important delays

- **Birth rate to consumption delay** -- From the time when the investment is made to lower TFR (total fertility rate), how long before TFR is actually lowered, and how long before consumption is lowered.

\[
\text{respiration} = \frac{\text{consumption}}{\left( 1 + (\text{Delay(BR,ym)} - \text{DR}) \right)}
\]

where BR is birth rate, ym is years to motherhood, and Delay(BR,ym) is the birth rate ym years ago.

What about DR? DR has feed-ins that are both delayed (health improvements) and immediate (violence and disease).
"You have noticed that everything an Indian does in a circle, and that is because the Power of the World always works in circles, and everything tries to be round.

In the old days all our power came to us from the sacred hoop of the nation and so long as the hoop was unbroken the people flourished. The flowering tree was the living center of the hoop, and the circle of the four quarters nourished it.

Everything the power of the world does is done in a circle. The sky is round and I have heard that the earth is round like a ball and so are all the stars. The wind, in its greatest power, whirls.

Birds make their nests in circles, for theirs is the same religion as ours. The sun comes forth and goes down again in a circle. The moon does the same and both are round. Even the seasons form a great circle in their changing and always come back again to where they were.

The life of a man is a circle from childhood to childhood, and so it is in everything where power moves."

Black Elk, Holy Man of the Oglala Sioux 1863-1950
Circular vs Linear thinking

CIRCULAR/ Indigenous
- Everyone/thing is connected: Humans, animals, elements, plant life, cosmos etc.
- Circular Worldview: no hierarchy, all are positioned equally and have unique gifts and responsibilities
- Community is the foremost value (“We”)
- Community defined as all life: humans, landscape, elements, animals, etc
- Live in Harmony with Nature
- Karmic/Full Circle Understanding:
  - Knowing what we do, whether good or bad, will come back to us.
- Nature/Life Based
- Practical/Pragmatic
- Science based on material and Spiritual factors.
- Intuitive
- Relative
- Present (“Now”) Oriented
- Creator–God is both Male and Female
- Creator is everywhere and in everything
- Personal Relationship to Creator
- Listening Skills emphasized
- Modesty/Humbleness
- Give and share
- Word is bonding agreement
- Cooperate
- Acknowledgement

LINEAR/ Western
- Separate: lack understanding that all life is connected and interdependent
- Hierarchy Worldview: is always put below or above, considered less or greater than another person or thing
- Individualism is the foremost value (“I”)
- Community (if even considered) is only defined as human
- Nature is to be Conquered
- Karmic Ignorance: thinking one does not affect anything else or that one can evade payment for irresponsible behavior
- Profit/Business Based
- Theoretical
- Science based only on Material factors.
- Logical/Rational
- Absolute
- Future/Past oriented (non-present)
- God is Male Centric
- Creator is a man in the sky
- Relationship to Creator can only be mediated by a priest
- Communication Skills emphasized
- Ego Centric/ Self Attention
- Take and keep
- Agreements need to be in writing
- Compete
- Judgmental

Cycles: Positive feedback loops

- CO2 climate change
- Food supply
- Deforestation
- Violence
- Starvation
- Lizard brain
- Science
- Ice albedo
- CH4
- Sea level

We have control
We don't have control
Mysterious craters in Siberia
Methane release off coast of Oregon

http://robertscribbler.com/tag/methane-monster/
Recent increase in atmospheric methane

Global Atmospheric Methane Levels

- 2012-13: NOAA (up to September 2013)

On Aug 30, 2014, MetOp-1 recorded global mean methane levels of 1858 ppb at 7.5-8.5 km altitude.

Peak daily methane levels: early 2013, averaged 2372 ppb NOAA (MetOp).

http://arctic-news.blogspot.com/
Cycles: Negative feedback loops

- ice
- forest
- CO₂
- ff use
- fuel per capita
- population
- birth rate
- food per capita
- death rate
- violence
- climate change
- T

- energy cost
- renewable energy
- energy

- birth rate
- death rate
- violence
- population
- ff use
- CO₂
- forest
- ice
Meta populations

• In what ways are human populations "meta", meaning "separate"?
  - interbreeding
  - regionality
  - creed
  - information sharing
  - language
  - culture

• Is separation a dichotomy?
  - What kind? Black/white, or greyscale? Can be talk about degree of separation?

• What kind of feedback loops appear only when humans are considered to be multiple meta-populations, each with its own values and capacities?
Serial Socrates
HW3, due Apr 22

group/individual work

• Each person will be asked to complete a feedback loop that involves their part of the model.

• The feedback loop can be positive or negative feedback (whichever is real and appropriate).

• The loop should engage at least one stock.

• The loop should be unique in at least one of its links, from everyone else's.

• Fill in all flows, variables, converters, in the loop using real world and published data wherever possible. Use sliders for variables that are in the greatest doubt.

details to follow.