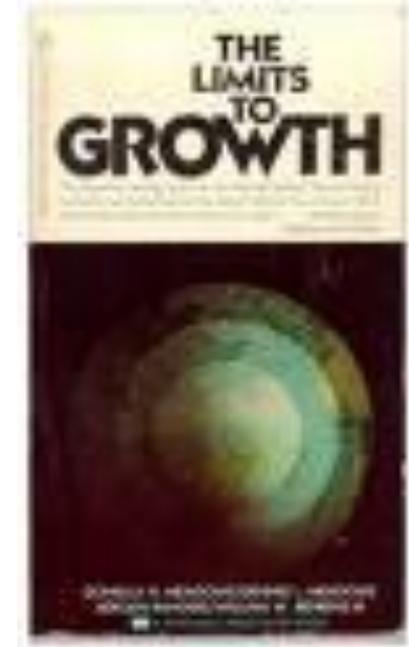
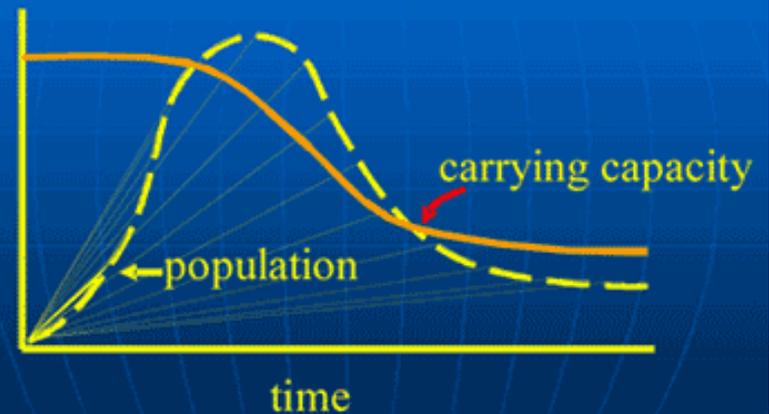


Club of Rome and “Limits to Growth” (1972)

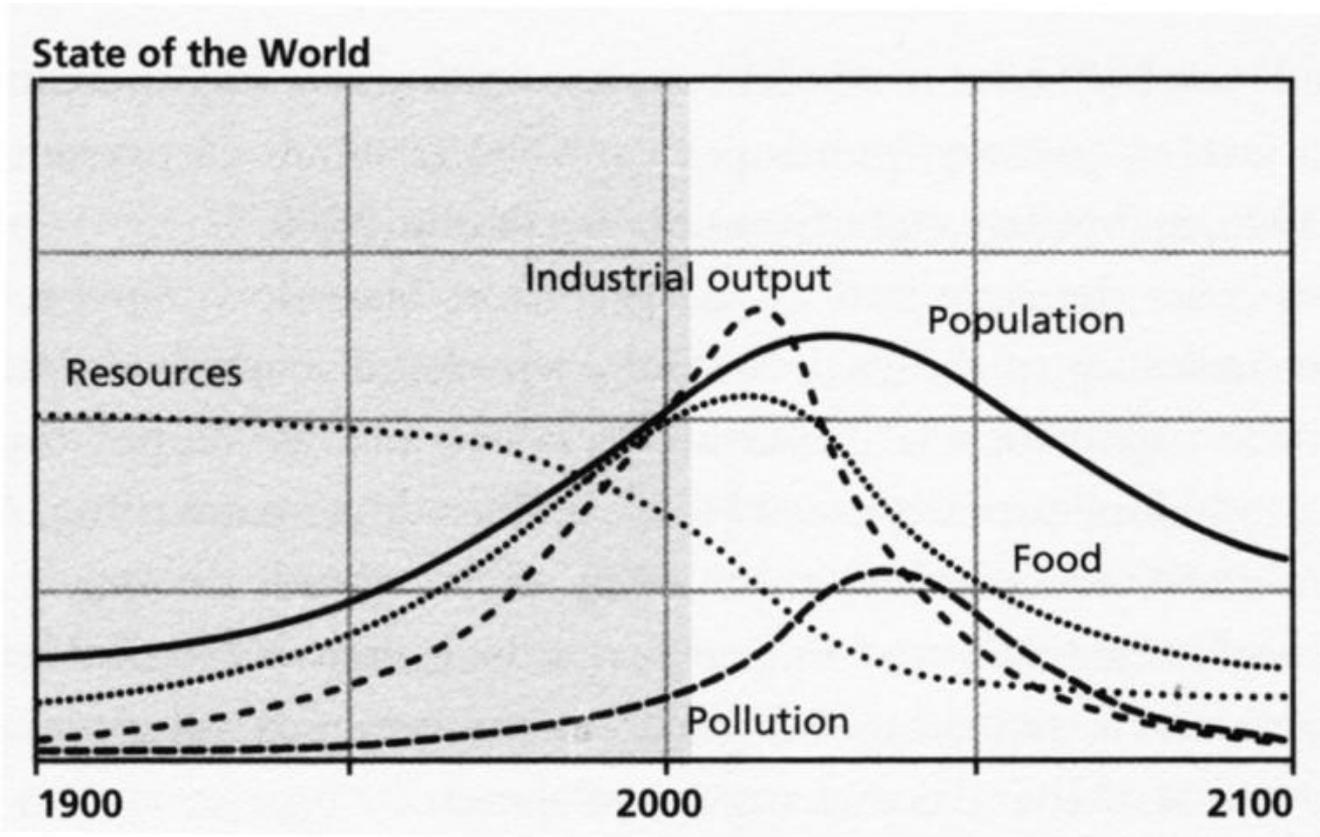
- Simple version – built on basic model of species carrying capacities
- In simple model, carrying capacity = world resources (food, water, air)
- Exponential growth in population adversely affects c.c., leading to greatly reduced population. (“overshoot and collapse”)



Club of Rome and The Limits to Growth



“Limits to Growth” Scenarios



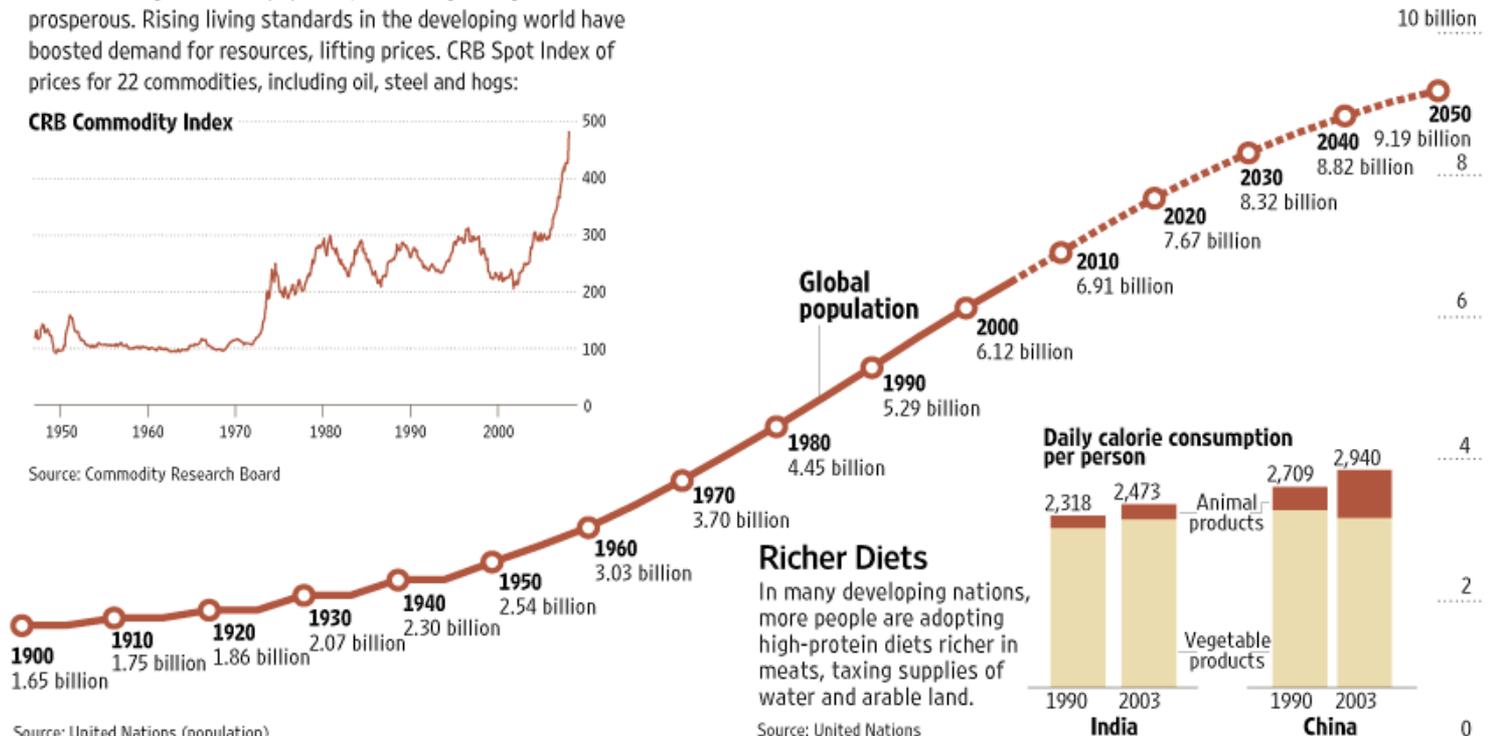
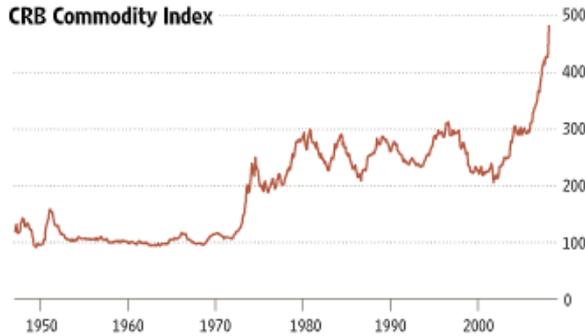
- Modeled trends of 5 interrelated phenomena into the future – industrialization, population growth, malnutrition/food, depletion of nonrenewable resources and deteriorating environment
- Conclusion – without rapid check in population and industrial output, population and industrial capacity will ‘crash’ within 100 years
- Even doubling resources or reducing population only delays the inevitable

- Criticisms of “Limits to Growth”
 - Underestimated ability of technological change to increase supplies of food and resources
 - Underestimated ability to change behaviour in response to scarcity and higher prices of resources
- However, 30+ years later, many trends still occurring:
 - Sea-levels have risen 10-20 cm since 1900
 - Gap between rich and poor is widening
 - Despite increased land food production, world fisheries near collapse for many species
 - 38% of arable land has been degraded

The Global Resource Squeeze

As the world grows more populous, it is also growing more prosperous. Rising living standards in the developing world have boosted demand for resources, lifting prices. CRB Spot Index of prices for 22 commodities, including oil, steel and hogs:

CRB Commodity Index

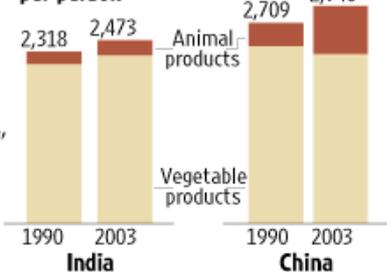


Source: United Nations (population)

Richer Diets

In many developing nations, more people are adopting high-protein diets richer in meats, taxing supplies of water and arable land.

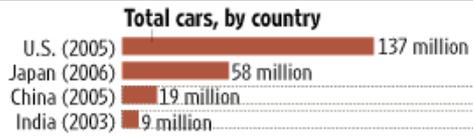
Daily calorie consumption per person



Source: United Nations

Auto Planet

Car ownership rates in China and India are rising, which could add significant new pressure on oil supplies.



Sources: International Road Federation; Japan Automobile Manufacturers Association; Japan Statistics Bureau.

Number of cars if per-capita ownership rates rose to U.S. levels

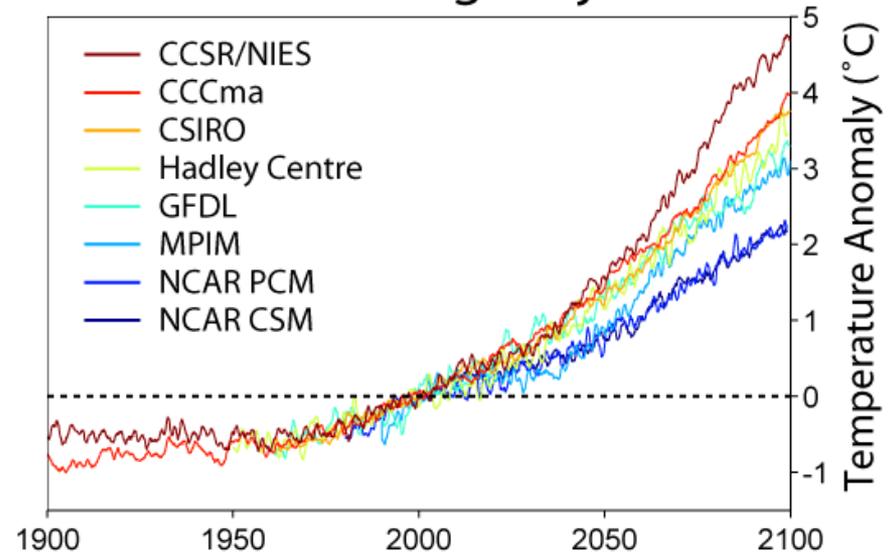


- Increased industrialization (esp. now in developing world) has increased global consumption, demand for resources, commodity prices and pollution

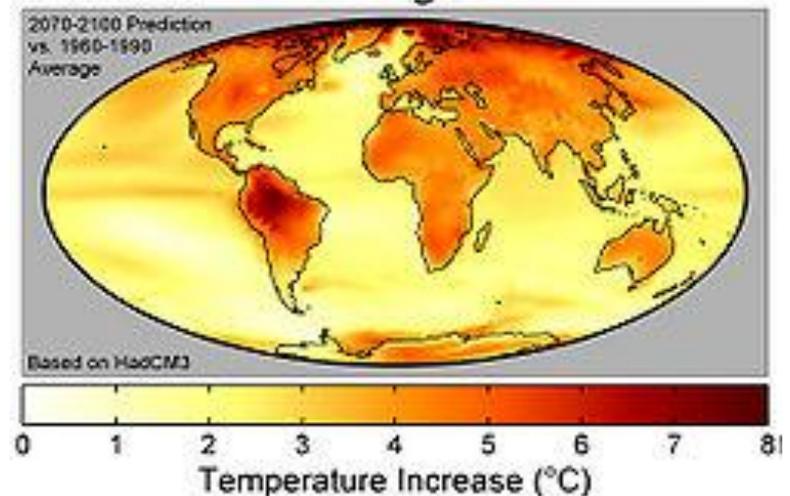
Global Warming Scenarios

- Under all major global climate change models, air temps still expected to increase by 2 to 5 C. by 2100

Global Warming Projections



Global Warming Predictions



Environment and Development: The Tragedy of Commons

- First suggested by Garret Hardin, explanation of overexploitation and how to integrate new approaches to conservation.
 - “central for understanding our ecological problems; why people tend to overexploit common-pool resources, such as public grazing lands, fisheries, and aquifers, and why they pollute (Hardin 1968; Hardin and Baden 1977 qtd in Penn 284).”
 - Humans respond inappropriately to environmental hazards, we tend to ignore large-scale environmental problems
- Example: American consumers learned which companies produced most of the toxic wastes in the U.S., environmentalists publicly shamed these companies and disseminated the information to others. These companies responded rapidly to avoid public humiliation and save their reputation (Graham qtd. in Penn).

The Rusty Muffler ORACLE

HERE'S NO TECHNOLOGICAL FIX FOR THE TRAGEDY OF THE COMMONS*

...IMAGINE THERE ARE FOUR SHEPHERDS WHO EACH OWN FOUR SHEEP THEY GRAZE TOGETHER ON A COMMONS THAT PROVIDES ENOUGH GRASS FOR SIXTEEN SHEEP...



... AS LONG AS EACH OF THE SHEPHERDS LIMIT THEIR FLOCKS TO FOUR SHEEP, THE COMMONS WILL SUSTAIN THEM INDEFINATELY....



...THE "SMART" SHEPHERD FIGURES HE CAN ADD A SHEEP TO HIS FLOCKS AND GET A POSITIVE BENEFIT OF +1...



...WHILE THE NEGATIVE EFFECT OF OVERGRAZING, A FRACTION OF -1 IS SHARED BY ALL FOUR OF THE SHEPHERDS...



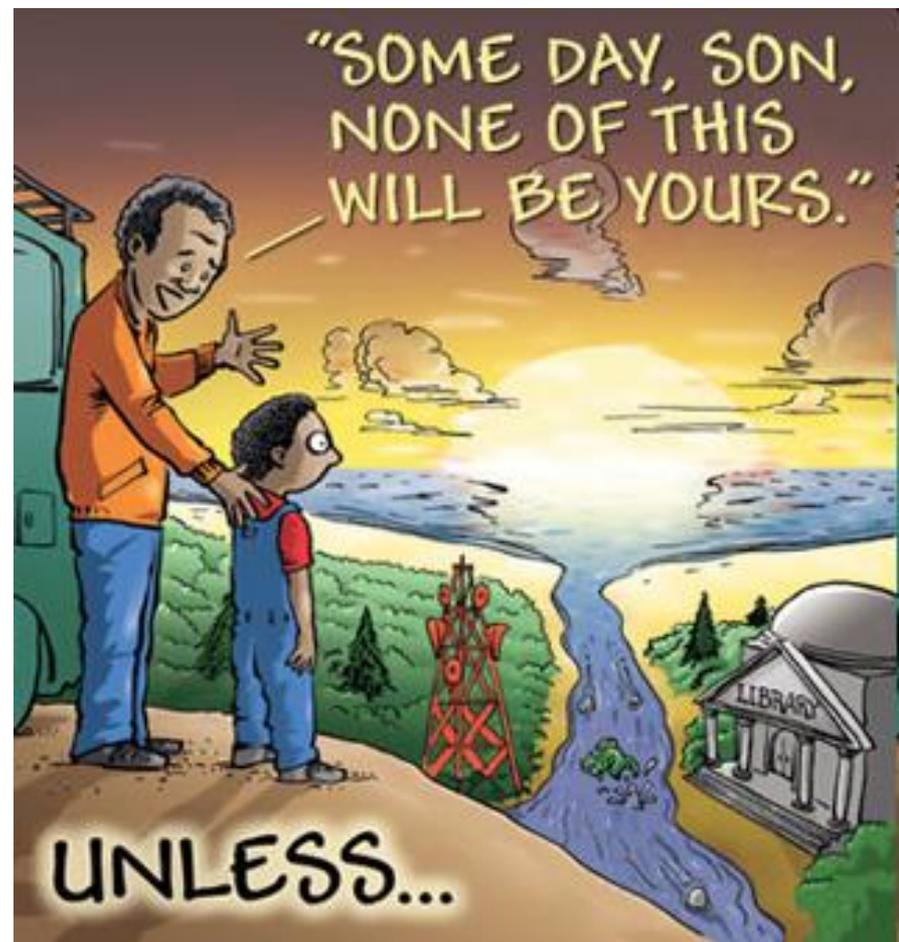
... EACH SHEPHERD MUST ADD ANOTHER SHEEP... THEN ANOTHER, UNTIL THERE'S NO GRASS LEFT ON THE COMMONS...



...IN FISHERIES, FORESTS AND FARMLAND WE SEE HOW THE LOGIC OF SELF-INTEREST ALWAYS LEADS HUMANS INTO A CYCLE OF BOOM & BUST...



...AIR AND WATER ARE ALSO A COMMONS. INSTEAD OF TAKING STUFF OUT, HUMANS ARE PUTTING STUFF IN ... A TRAGEDY OF THE COMMONS IN REVERSE!



*GARRETT HARDIN - SCIENCE 162 (1968)

Picture Sources:

http://www.garretthardinsociety.org/info/cartoon_commons2.html (left) and <http://www.tomales.org> (right)