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Institutional Barriers and Alternative Paradigms on Population: The Case of the Intergovernmental Panel on Climate Change (IPCC)

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Jason Bradford, Ph.D.
Missouri Botanical Garden
& U.C. Davis

> "Tell people something they know already and they will thank you for it. Tell them something new and they will hate you for it."
>
> George Monbiot

Why I have some trepidation tonight

For some or many of you, what I am about to discuss will make you uncomfortable. It unsettles me as well, but a proper understanding of reality is necessary now more than ever. "Hate" may be too strong a word for what some of you may feel towards me by the end of this talk, but I've been on the receiving end of "kill the messenger" reactions many times. So please be kind.
If what I say is totally new to you, don't expect to understand it right away. It may take a long time for new ideas to sink in. You will have to do a lot of mental processing over time.

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Contrasting Paradigms

Choose either:

1. Growth can continue forever…what we wish.
2. What goes up must come down…or at least glide on the power of sunlight…what physical reality allows.

"Never underestimate the power of the human mind…to deny reality."

Jason Bradford, Earth Day 2004

I will contrast two differing paradigms, or worldviews. One I consider "wishful thinking," the other I consider real. I believe the perpetual growth paradigm remains dominant because it is what people want to believe. Most of us are very good at dismissing what we don't like to think about.

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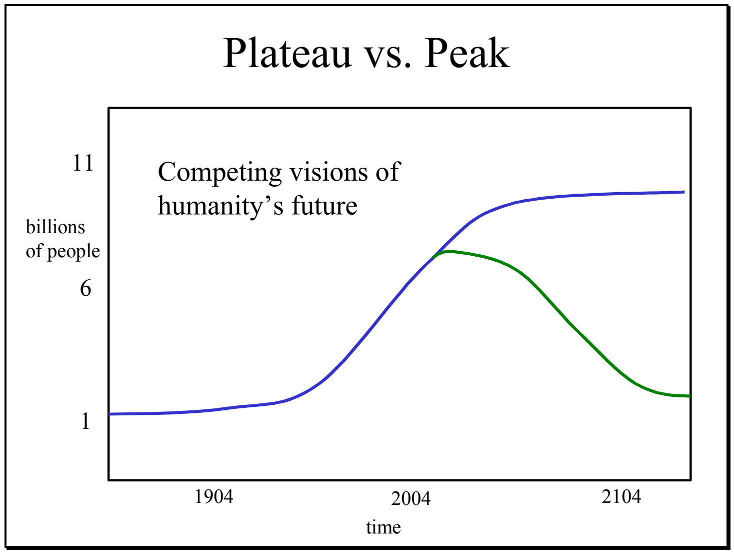

These two different belief systems offer differing views of the future of humanity in terms of population dynamics and means of livelihood.
One envisions a population plateau in which we are all well-off and the world is at peace. The other envisions a population decline that will be disruptive to say the least. But how bad it will be depends upon how we plan and react. It may not be that bad at all, or even nice, if we do a good job at making a transition.

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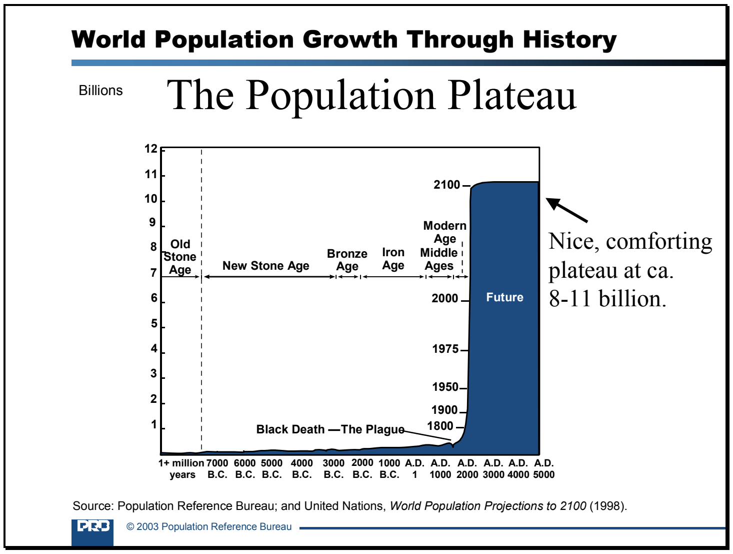

Here you see the politically desirable plateau view from the United Nations population experts.
The big upswing occurs about the time people begin using fossil fuels to build Industrial Civilization.
Before this point, energy income was from above ground sunlight. Since then, our energy has come from below ground, buried sunshine—lots of it!

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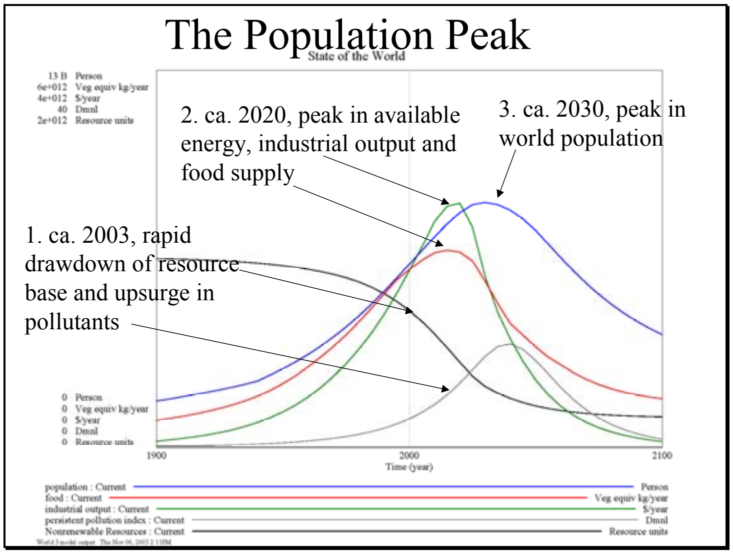

The peak population view gained prominence in the early 70s when a group of MIT ecologists and computer modelers studied the physical basis for industrial civilization and human population.

It explained the rapid rise in population as a result of the use of non-renewable natural resources, such as fossil fuels and mineral ores.

Their conclusion was that industrial civilization and human population size would reach peaks and then decline UNLESS steps were taken to change from a dependence on non-renewable to renewable resources and prevent pollution build up. In other words—become “sustainable.”

This frightens people. So I think it is generally denied, especially when an alternative set of experts is available to provide a more comforting view.

Graph is from the World3 Model of 1992, baseline scenario.

Note that food supply probably peaked in 1999, not 2020 as in this model.

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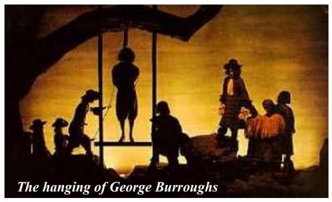
What is a Paradigm

A worldview that governs your interpretation of events and influences your plans, based upon how you believe the universe operates.

Example: Salem, MA in 1692



See. Paradigms matter!

“Hang the witches, they are possessed by Satan.”

Before I go on, let me make sure everyone knows what paradigm means, and realizes that paradigms matter.
The two paradigms I will discuss are not compatible, although people are known to hold incompatible views. One is right and the other is wrong. Importantly, paradigms influence what people do. If your paradigm “gets it right” you are more likely to make good decisions and plans. Otherwise, the results can be truly tragic. For example, the government of MA eventually apologized to the relatives of those hung in Salem in 1692.
Graphic from:
http://www.witchway.net/times/times.html

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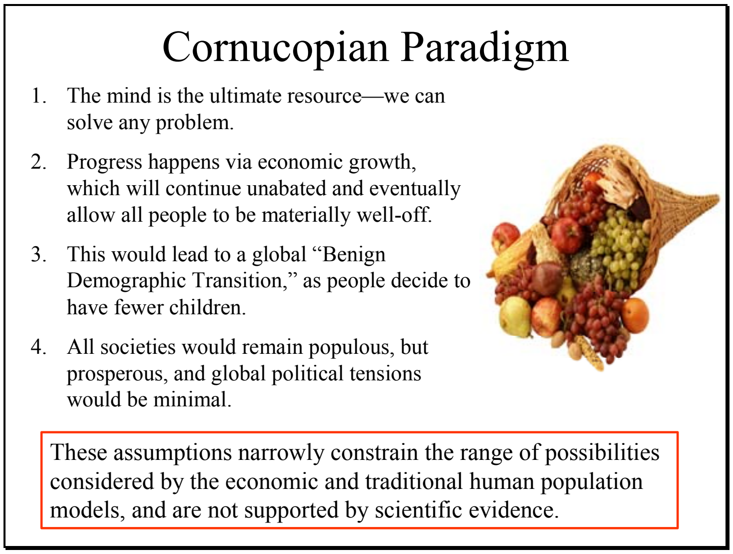

This is the dominant paradigm. Most people are unaware that they even have this paradigm, but due to the influence of advertising and given many people's investment strategy, most people work with these assumptions. The cornucopian paradigm gives a specific model for a human population plateau called the "Benign Demographic Transition."

As far as I am concerned, this paradigm is deeply flawed. It doesn't hold up to scrutiny, but as it is what most people believe and as it is comforting, it may not easily be overthrown.

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Ecological Paradigm

1. Human population size is ultimately limited by food supply and/or other factors such as disease.
2. Food supply is increased by increasing inputs of capital—e.g., machinery, fertilizer.
3. More capital requires more resources, but material and energetic resources have available limits that place practical constraints on human economies.
4. Essential resources are not replaceable—e.g., water, chemical elements used by living cells.
5. Pollution interferes with the growth of food and population.

These principles are well supported by all available scientific data.

This is my paradigm. It stems from my understanding as a scientist for how the world works. It leads me to worry about human population and to see just about everything differently than most people.

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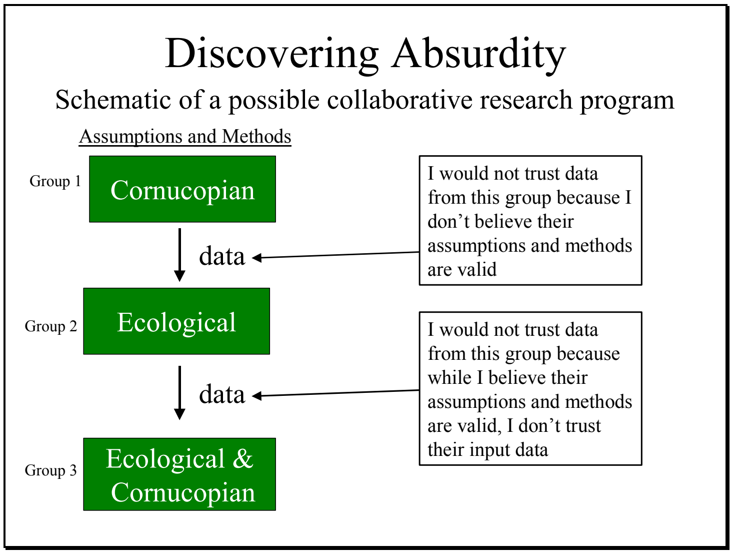

These two paradigms are incompatible. Yet, we can find them blended within the workings of our society. I discovered a prominent example during the course of my research. This is a schematic, in terms of paradigms, for the Intergovernmental Panel on Climate Change--a United Nations organized group of economists, scientists and policy experts with a mission to understand how human activities are influencing the Earth's climate, and what this means for present and future generations. Extremely important stuff! The whole process is termed an "Integrated Assessment." But they are integrating incompatible paradigms, leading to absurdity.

Think about contradictory information you get from media headlines, e.g., "Economic trends suggest that by 2020 there will be X million automobiles in China," versus "China faces famine by 2010 due to water crisis and plummeting food production." Putting the two together you wonder how a nation facing food shortages within a few years will be able to buy so many more cars? Wouldn't food come first? You are getting information from sources with different paradigms. They literally don't recognize one another and the result is a conflicting barrage of information from various experts.

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Outline of Presentation

1. My Background
2. Population Primer & The Human Predicament
3. The Case of the Intergovernmental Panel on Climate Change
4. Explaining Absurdities
5. Where from Here?

I am going to tell you the story of how I uncovered this paradigm conflict.
I will give you some important background about myself so you can understand how and why I think like I do.
Then I will present some more details about the IPCC absurdity.
I will try to explain this absurdity, and at the end briefly suggest what those who share my paradigm should do.

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I love plants. I am especially drawn to trees. I end up liking a particular group of trees and shrubs and decide to study it for my doctoral thesis.

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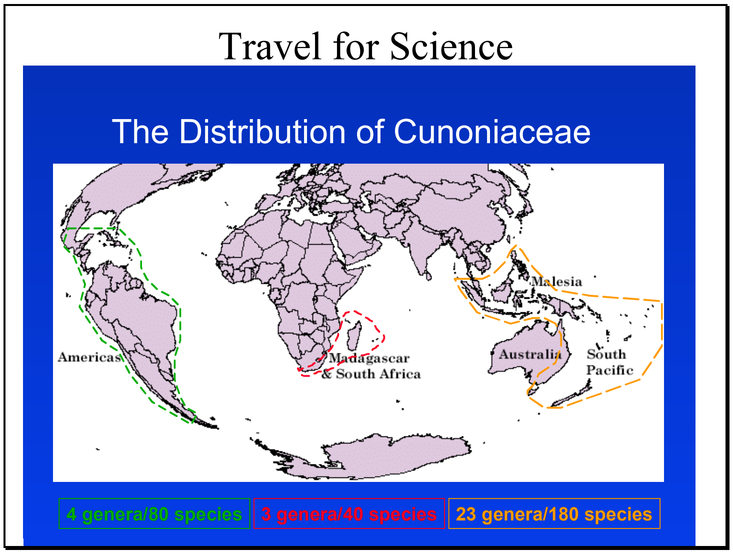

This is a pretty good job. I get to travel to some of the most interesting and biologically diverse places on Earth.

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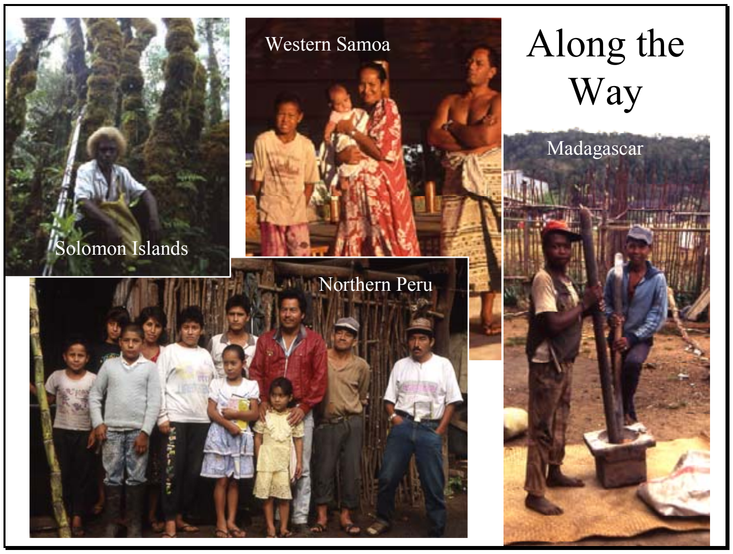

My education is multifaceted.
I meet, work and live with people from totally different cultures.
5 out of 6 billion people live in what are typically considered “poor” countries. I develop some understanding about how most people of the world live.

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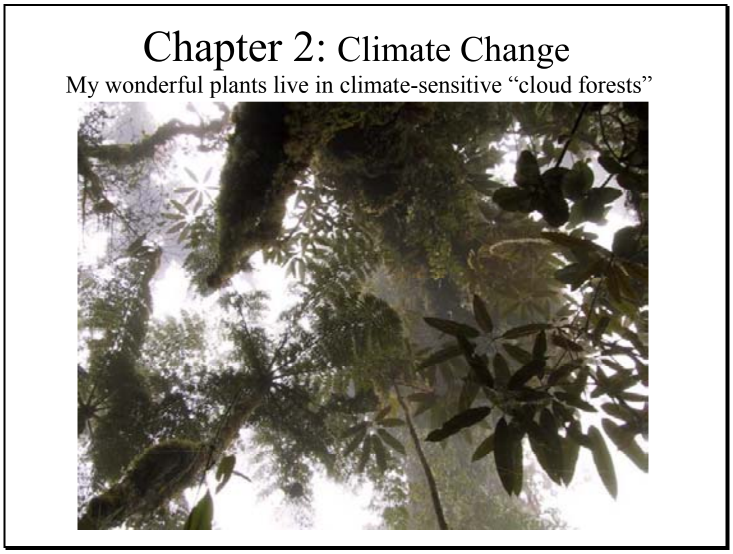

Towards the end of my doctoral research, I become aware that the plants I have been studying may be in serious danger due to climate change.

The tropical cloud forest habitats they inhabit are identified as particularly sensitive to climate change.

I am emotionally bonded with these wonderful plants. This scares me.

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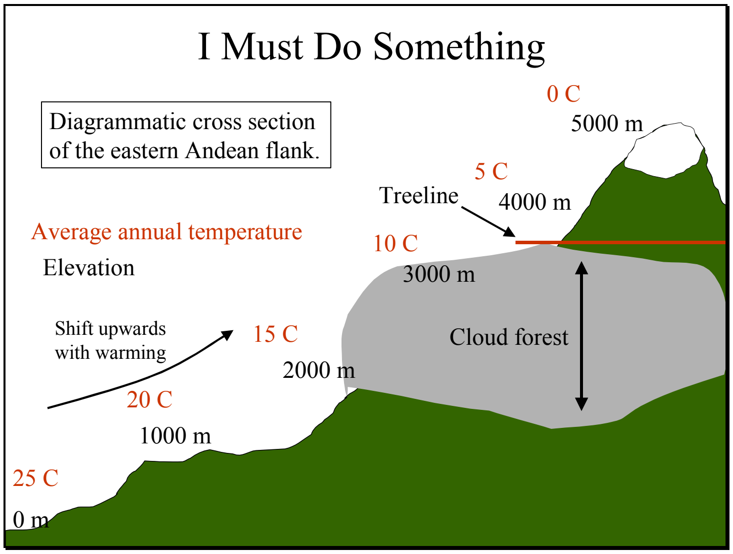

So I decide I must do something.
Here's the problem. The cloud forest occurs between certain elevation ranges that correspond to the prevailing temperature and humidity levels on a tropical mountain. Clouds form as humid air is forced to rise due to the air encountering the mountain slope. As it rises, the air cools and the humidity condenses to form clouds.
The plants and animals that live in cloud forests are specially adapted to these environmental conditions. If the temperatures warm, the cloud band will shift upwards and so too must the species. This may pose some problems if the warming happens too fast.
Also…

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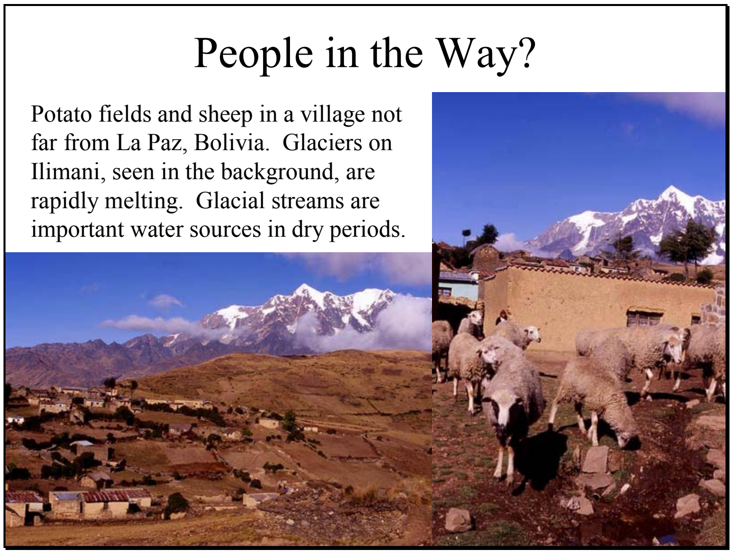

In some places, especially the Andes of South America, people live above the forest zone among alpine grasslands. The forests may want to move into their territory, but I doubt people will allow that. We need more good scientific information about this process to see how people and migrating forests may be able to coexist.

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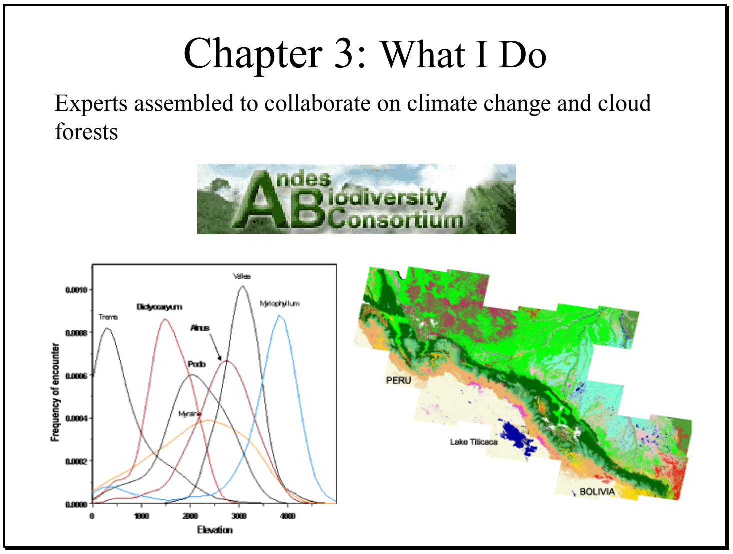

So I start finding other scientists who share my concerns and have different skills than my own. We need to work together because this project is too big and complex for one person to tackle.
We start doing some really interesting research.

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Global Change Research

View from 3400 m, includes ridge of Trocha Union, a trail that descends through cloud forest between 3400 and 1700 m.

Study plots sample the diversity and structure of this forest.

Kosñipata valley, ca. 50 km east of Cusco, Peru.

Here's our primary study site in Peru. We are researching both the forest and the climate, particularly the formation and movement of clouds. In each of our sample plots (see the boxes) we find a very distinct set of species, but with some overlap.

Depending upon the severity of climate change, species from these forests may have to migrate upwards the equivalent of 1, 2 or 3 or more "boxes" and do so very quickly. The more the climate changes, the more likely species will go extinct during this change.

I really want to get this right. I want the best information, I want to understand this system properly because I believe that understanding may help both the biodiversity and the local people fare better.

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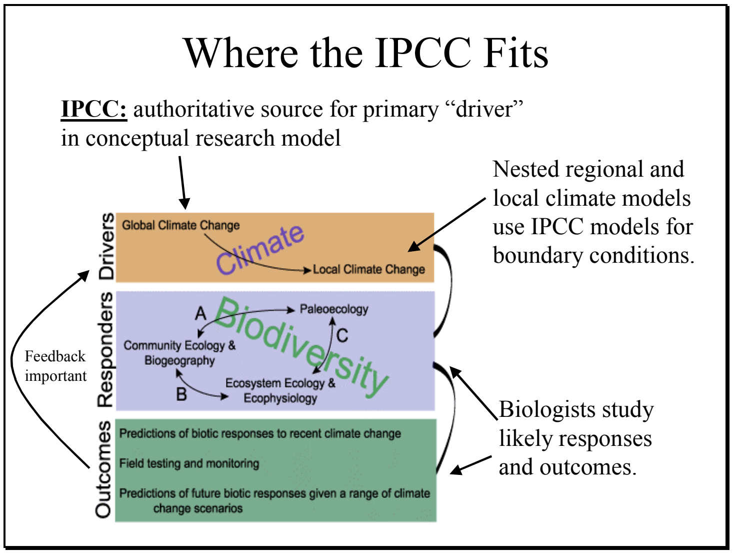

Because we need information about potential future climate change, we intend to use the Intergovernmental Panel on Climate Change as the major authoritative source for global climate models. Our plan is to then make local climate models based on the global conditions. The ecologists would try to figure out how different levels of climate change would affect the forests and what sort of conservation plans would be warranted.

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Chapter 4—This Presentation

Art by James Sebor

I do something very novel and “foolish.”
I read the methods and assumptions that go into the IPCC reports—not just the outputs.
This runs completely counter to how modern science (society?) typically operates.
I have many “Uh ohhh! What now!” moments.
Source of surreal graphic:
http://www.seaboarcreations.com/gallery/gallery.htm

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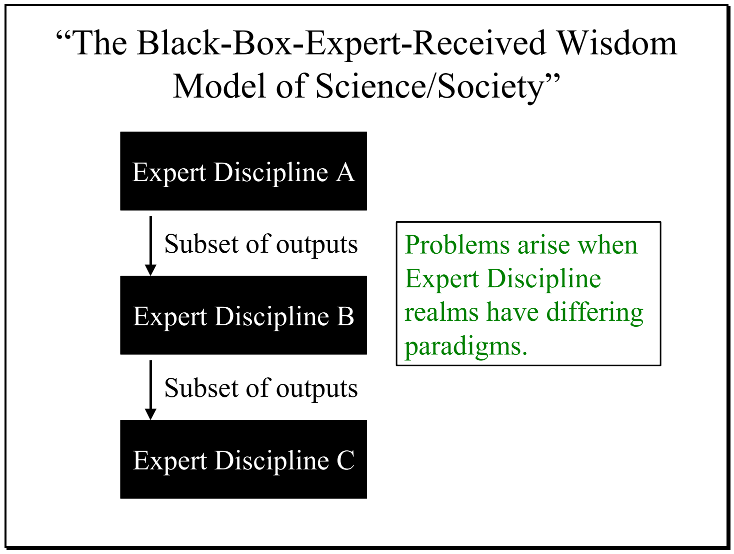

Each discipline is complicated. Nobody can master it all.
Everybody relies on the good judgment of others.
Problems arise when Expert Discipline realms have differing paradigms.
If an expert from one discipline looks too closely at another, and has some criticism, the critic is likely to be ignored or scorned, possibly even by those from his own discipline.
"He was such a good plant taxonomist…shame he went off into that other stuff."

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Primer on Population Ecology

Fundamental Concepts

Tradeoffs	Feedback lag
Exponential growth	Ecological release
Density-dependent feedback	Drawdown
Carrying capacity	Pollution
Overshoot	Dieoff

Before I go on and describe the problems I encountered when studying the IPCC reports, I need to make sure everyone has some understanding of the fundamental concepts of population ecology. These are always in the back of my mind, they are part of my worldview and when I see something contrary to these I am deeply suspicious.
In a naïve sort of way, I tend to assume people think like I do because for much of my time I interact with other biologists who do. But now I am more aware of the fact that most people do not carry these concepts around with them. To me these are basic, the stuff I teach in introductory Ecology classes. Without these as part of the dominant paradigm I fear for the fate of life on Earth, and due to codependency, the well-being of my family and friends.

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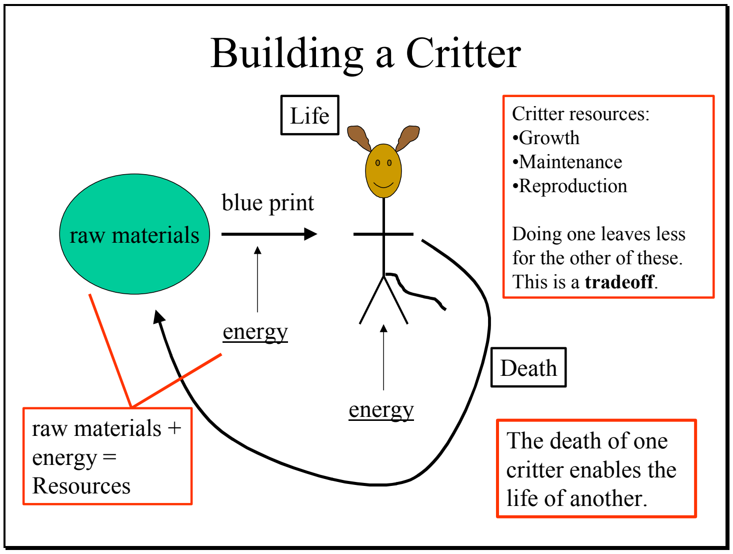

Every critter requires materials and energy to construct.
The energy and materials that make up one critter become those of another. Everything eats something else.
But overall, there can be only so many critters in the world because the mass of the Earth and the input of energy (mostly solar) is finite.

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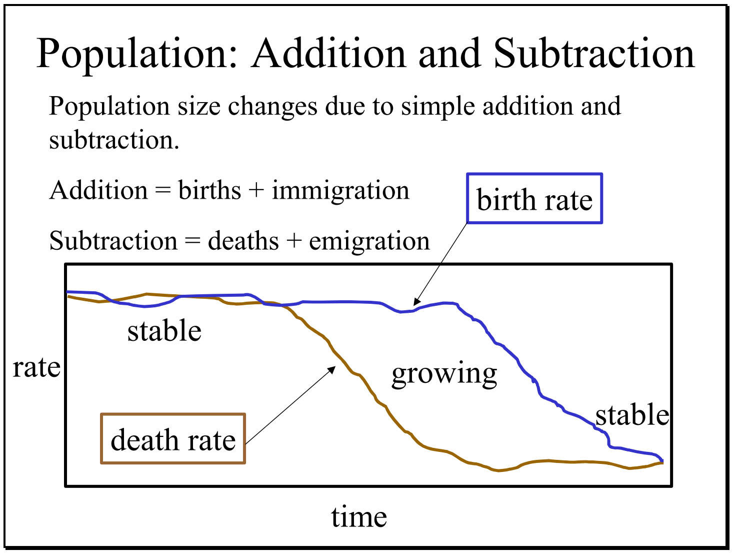

Population change is really based on simple addition and subtraction. Additions include births and immigration, subtraction includes deaths and emigration.

A population changes when rates of birth or death (and immigration or emigration) are unequal.

Ignoring migration for simplicity, a stable population can have either high birth and death rates or low birth and death rates. Population growth can occur even when birthrates are falling as long as death rates remain lower.

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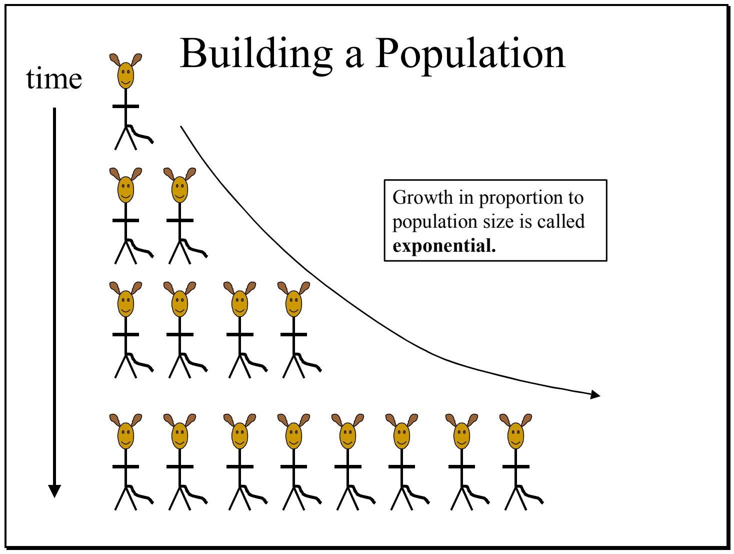

Populations of critters have the structural capacity to grow in proportion to their population size. This is called "exponential" or "geometric" growth.
You can get a sense of this by imagining two critters mating to produce four critters, those four mating to produce 8, those 8 produce 16, and so on….
The inherent capacity for this form of growth can be observed in nature and described by particular equations.

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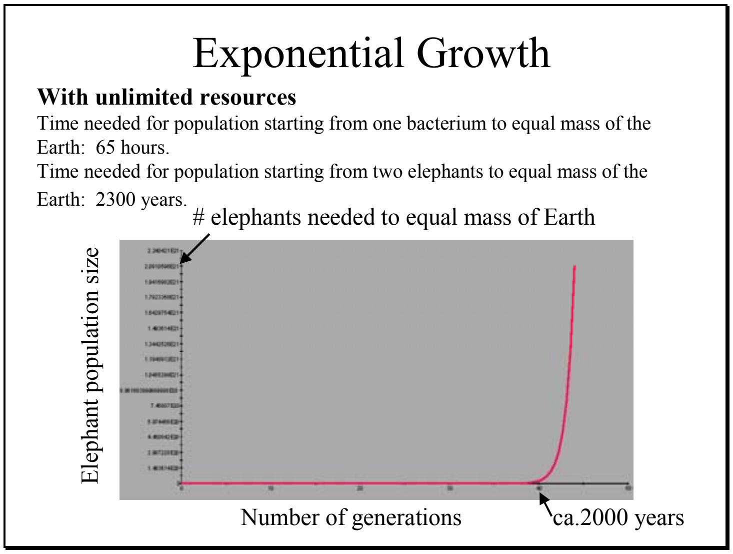

All critter populations have the capacity to grow exponentially if they have abundant raw materials and energy.
For example, a population of bacteria could grow from one individual to a mass equal to the size of the Earth in about 65 hours with unimpeded exponential growth. A pair of elephants could do the same, but they'd take 2300 years. (See calculations below)
Because this is impossible, it is more interesting and informative to consider what keeps this from happening.

<u>Mass of the Earth= $6.0\text{x}10^{27}$</u>g
For bacteria, we'll use the geometric growth equation (similar to exponential one), since they don't have overlapping generations.
$N_t = N_o\lambda^t$
A bacterium cell with a mass of 10^{-11}g divides every 0.5 hr.
$6.0\text{x}10^{38}$ bacteria will equal the mass of the earth.
For convenience we will let t equal units of generation time. Each generation doubles itself.
Solve for t to get number of generations.
$6.0\text{x}10^{38} = 2^t$
$t = \log 6.0\text{x}10^{38}/\log 2$
t (generations) = 129 x 0.5 hours per generation=64.5 hours

For elephants we'll use the exponential growth equation since they have overlapping generations.
$N(t)=N(0)e^{rt}$
A pair of elephants with a combined mass of $3\text{x}10^6$g produce 6 offspring over 50 years.
Only $2\text{x}10^{21}$ elephants are needed to equal the mass of the earth, or 10^{21} female elephants + 10^{21} male elephants.

Each elephant can triple itself per generation, so in the exponential growth equation this equals an intrinsic growth rate potential of r=1.1 when t is equal to generation time (if t is equal to years, r=0.022, or 1.1/50, the results are the same either way, but my simulation software won't go beyond 999 iterations of t).
Solve for t for number of generations.

$10^{21} = e^{1.1t}$

$t = \ln 10^{21} / 1.1$

t (generations) = 46

t (years) = 46 generations x 50 years per generation = 2300

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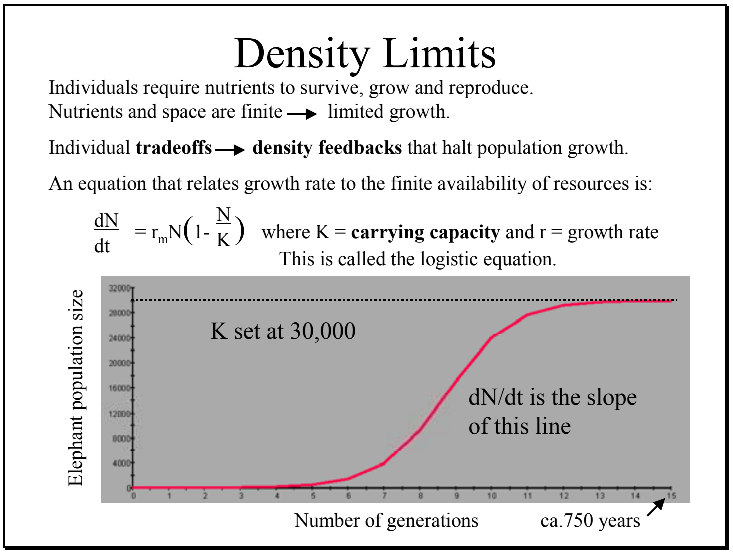

We have already discussed how individuals require certain nutrients in order to survive, grow and reproduce. The fact that these nutrients are in finite quantities, and that space itself is finite, is the basis for limited growth.
It simply takes more work to obtain resources when they are in short supply, and because there are tradeoffs between individual survival, individual growth and reproduction, the population reaches a point where it can no longer grow. Death becomes as frequent as birth. The carrying capacity is the population size that can potentially be supported based on resource availability.
For example, if there are only enough resources to support 30,000 elephants, an initial population of 2 will reach that level in ca. 750 years.
Looking at the equation, you see two components. The rN term means that the population will get bigger in proportion to its current size. This is what we already discussed. The second term, in parentheses, shows that as N approaches K, the term 1-N/K becomes close to 0, meaning no more population growth. If N becomes greater than K, the population will decline.
If the negative feedback between population size and rate of growth is instantaneous the population will never go beyond K.

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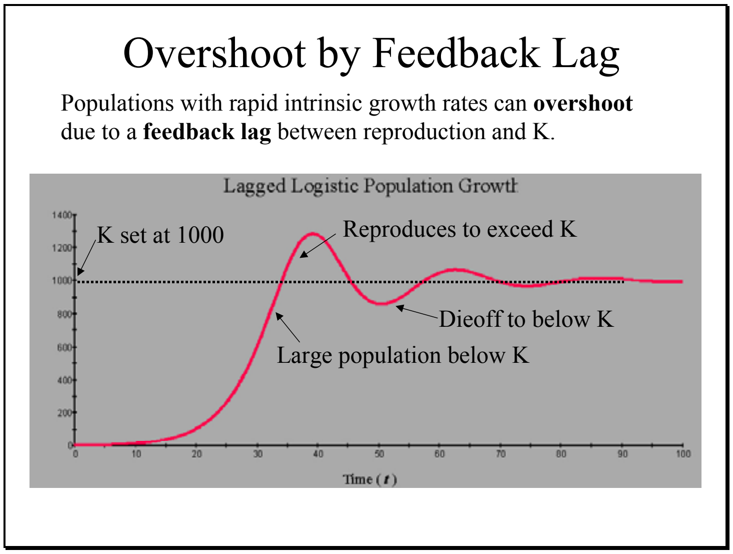

When a population size becomes larger than the carrying capacity, K, it is called an "overshoot."
In some situations a rapidly growing population will overshoot its carry capacity due to the "momentum" of its growth. For example, an adult population may find itself below the carrying capacity but reproduce to yield a juvenile population above it. This can occur because there is a time lag between the population density and the curtailment of reproduction imposed by environmental limits. Another way of saying this is that the negative feedback on growth rates is not instantaneous.

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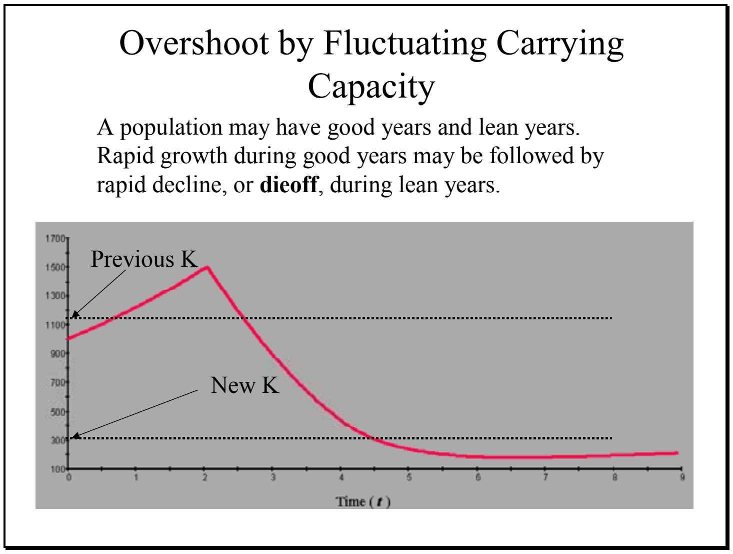

The carrying capacity of the environment is usually not constant. Several good years for a population, or a high K environment, may cause a rapid population rise. This high population may then crash when the environmental conditions are less favorable. This commonly happens in desert regions. A couple good years of rain may be followed by years of drought.

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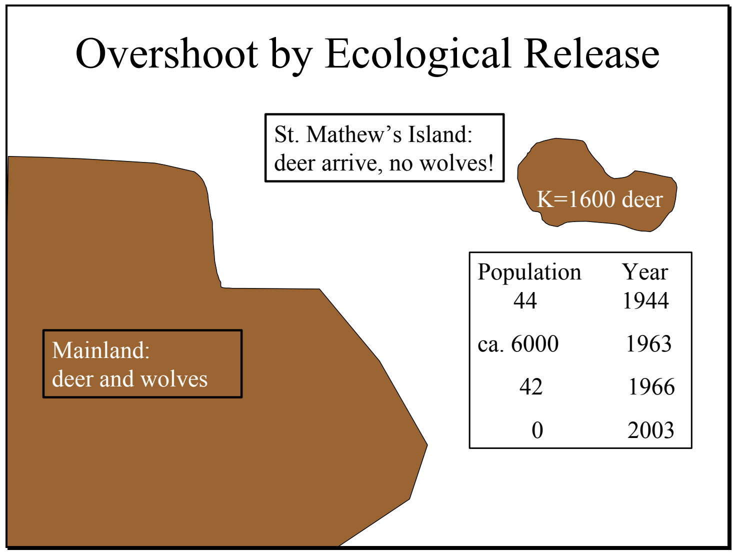

Most populations probably never get near the carrying capacity of the environment. Good thing! What keeps them below K?

Usually interactions with other species. The ecological interactions that limit population growth include:

Competition from other species with overlapping resource needs. E.g., different bird species at the same bird feeder.

Consumption of individuals in one population by those of another. E.g., predators consume prey, herbivores consume plants, parasites and disease organisms kill or weaken their hosts/victims.

Sometimes, a population will find itself without its usually ecological checks. Released from predation or disease, it may rapidly overshoot the carrying capacity. Even big animals do this, such as deer located on an island without predators. They quickly eat the lichens (resource **drawdown**), quickly grow their population, and then rapidly to starve to death.

Citation for St. Mathews deer:

Klein, D.R. (1968). The Introduction, Increase, and Crash of Reindeer on St. Mathew's Island. Journal of Wildlife Management 32: 350-367.

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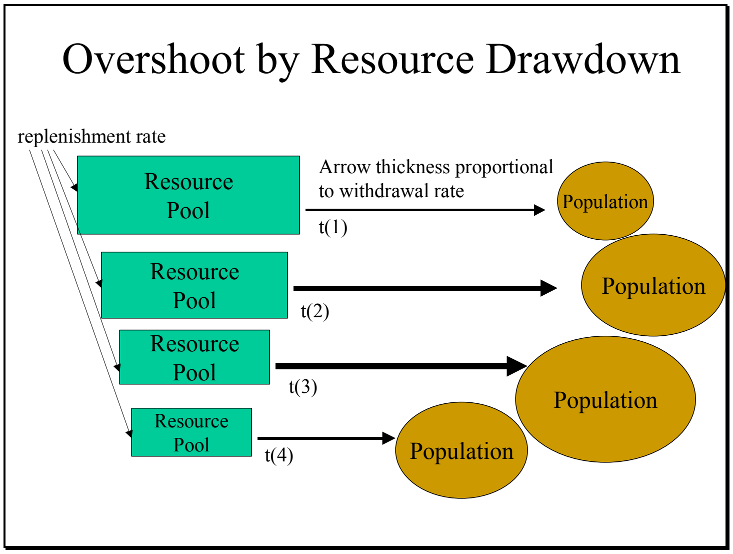

A population may grow by using resources at a faster rate than they are naturally replenished. The key turning point for the population comes not when the resources are exhausted, but when the rate of withdrawal peaks.

This turning point occurs because populations locate and use the most readily available resources first. Once these "easy to obtain" resources are gone, the remains are more difficult to find and use. Because it takes more energy to capture them they are withdrawn more slowly.

The population will find that it does not have enough available energy to continue the rapid withdrawal and is now far above its carrying capacity. Next comes a sharp decline in population size.

Human populations are famous for this. Drawdown of ground water, topsoil, forests, mineral wealth and fossil fuels has led to the collapse of human populations (e.g., Easter Island), the abandonment of once productive regions (e.g., the "fertile crescent"), and mass migration to new areas (e.g., Europeans to Americas and Australia).

Example: "Then one day he was shooting up some food…and out of the ground comes a bubblin' crude. Oil that is, black gold…" Do we find any more geysers in Texas? How many mansions remain vacant around Dallas?

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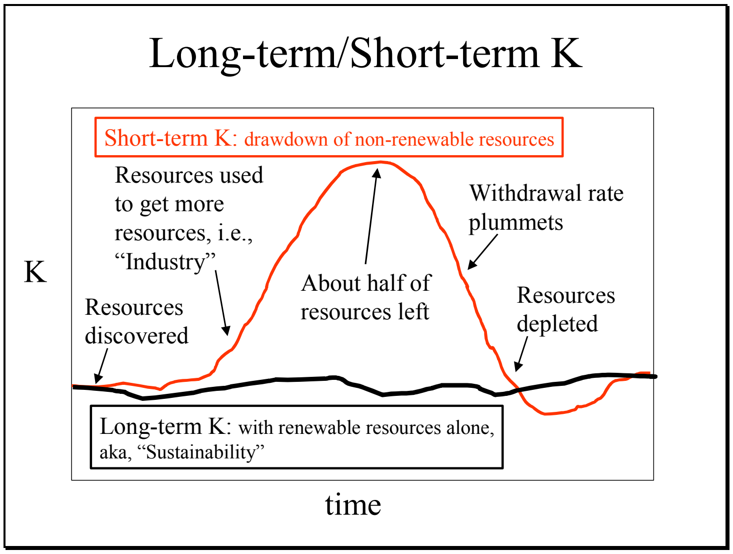

Some resource pools are replenished naturally at such low rates relative to meaningful human time scales that we call them "non-renewable." Fossil fuels and ancient aquifers are a couple classic examples.

Essentially what happens with the drawdown of non-renewable resources is that K is temporarily increased. This is the "short-term K" and may be referred to as a "windfall." When populations use only renewable resources this can be viewed as the "long-term K," and also goes by the name of "sustainability."

Populations in overshoot damage the renewable resources, such as topsoil loss, polluted air, land and water, and K eventually drops below the level it would have been if the population had only relied upon renewables for its maintenance. This is what happened to the deer on St. Mathew's Island. They ate the food resource faster than it could grow back. It then takes time for the K to return to pre-overshoot levels.

Note that with humans, many people utilize far more resources than are required for basic necessities. Less people can be supported with high rates of resource consumption than with low rates of resource consumption. So asking the question: "What is human carrying capacity," will receive the reply, "What is the per capita resource consumption rate?"

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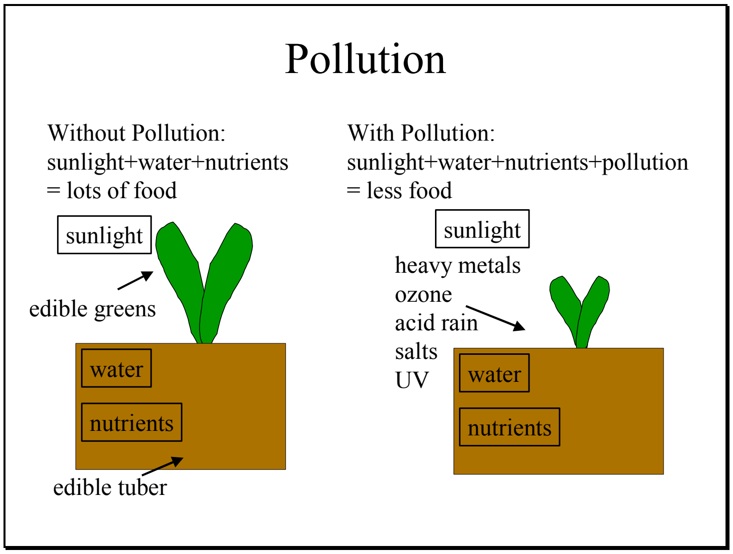

Wastes that are slow to decay in the environment and hinder biological growth or health are pollution.
Pollution makes nutrients and water more difficult to obtain.
Energy spent coping with pollution is not spent growing. Remember the concept of tradeoffs.
When populations create their own pollution, they are actually lowering their own carrying capacity.

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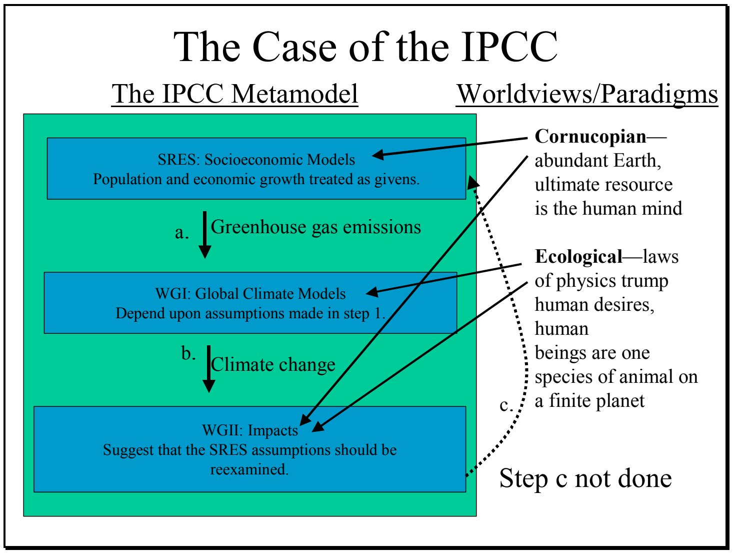

Now with that background, I hope you will follow my explanation of the problems I encountered when studying the IPCC.

Overall, the IPCC operates as a series of "Black Boxes" where one expert group does their work and gives the relevant outputs (data) to the next group, and so on.

My talk will focus on 3 core groups of the IPCC.

The IPCC metamodel (the overall structure that connects submodels) begins with the Special Report on Emissions Scenarios (SRES). This group projects future population size and economic activity. Energy is required for economic activity and so models for fossil fuel burning to support the world economy are developed. These models yield outputs of "greenhouse" gases that are given as data to climatologists.

Working Group I (WGI) uses projections of greenhouse gas concentrations in the atmosphere in its models of climate. Climate change is generally greater, or more extreme, when there are greater additions of such gases.

The effects of climate change are assessed by Working Group II (WGII). They look at possible changes in the growth of forests and crops, shifting rainfall patterns and water supplies, more frequent intense storms, rising sea levels, etc., and ask how these changes may impact human populations.

In truth, these impacts are hard to sort out accurately, but overall, it doesn't look good. This suggests that the assumptions used by the SRES group, which are basically "we are all rich and populous" may be untenable. Unfortunately the IPCC does not have a modeling method that makes this sort of connection—e.g., step c. It is a very non-ecological model, which is ironic and puzzling because climate models are highly complex models that focus attention on biophysical feedback loops.

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Special Report on Emissions Scenarios—Our Dirty/Rosy Future

From IPCC SRES:

> "Each storyline was characterized initially by two quantitative 'targets,' namely global population (15, 10, and 7 billion by 2100 in scenarios A2, B2, and both A1 and B1, respectively) and global gross domestic product (GDP) by 2100 (in 1990 US dollars, US$550 trillion for A1, US$250 trillion for A2, US$350 trillion for B1, and US$250 trillion for B2)."

Compare the above with current population of 6.3 billion and GDP of US$32 trillion.

Okay, so I've made a very serious claim. I need to back it up. This is not hard to do. The IPCC puts all of its reports online. Anyone can check out what they say to make sure I am not quoting out of context and misrepresenting, etc.. Here's a quote from early on in the SRES report.
(http://www.grida.no/climate/ipcc/emission/090.htm)

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We Are Rich and There’re a Lot of Us

The Questions going through my head….

•What happened to “sustainability?”

•Can technological efficiency gains allow this sort of “development” without pollution and resource depletion causing misery?

•What sort of modelers establish “targets” for their models?

•If SRES assumptions are wrong, what does this mean for the climate models?

The bottom line is “we are all rich and there’re a lot of us.”
Right off the bat, a series of questions spin in my head…
I will try to answer these now.

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Neoclassical Economics and Sustainability

From IPCC SRES:

"Neoclassic economic growth theory embraces as a general principle the notion that long-term per capita income growth rate is independent of population growth rate. Thus, a rapidly growing population should not necessarily slow down a countries' economic development."

"Growth," not sustainability, is the imperative.

I keep reading. It becomes clear that the SRES modelers expectation is one of perpetual economic growth. The growth of anything, in my paradigm, is limited. There's no free lunch. You can't just talk about growth because growth is always fleeting and processes that limit growth are more important in the long term. So the concept of "sustainability" is basically ignored and I am very worried about the legitimacy of the whole enterprise. (http://www.grida.no/climate/ipcc/emission/060.htm)

Source of graphic:
http://www.udel.edu/studyabroad/pix/photo_contest/2003/Winning_Photographs/2ndPlace_China-FLLT/Shanghai.jpg

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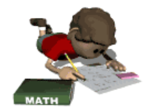
How More Efficient?

Do the math



•Current GDP is ca. U.S.$32 trillion and we are not nearly sustainable.

•SRES targets are U.S.$250 to $550 trillion by 2100.

•If our economies "dematerialize" by an optimistic factor of 10 we'd still be as unsustainable as today.

Questions avoided

•What are the consequences of "being unsustainable?"

•Isn't sustainability inevitable someday?

I start doing some simple math. Knowing that we are not sustainable today, but aware that people are clever and we could be much more efficient, I quickly check these SRES "targets" against my version of reality. It doesn't add up to me. It seems impossible and absurd. There must be a total denial of my worldview at work here. None of the really tough questions are being dealt with.

An aside on GDP:
"GDP per capita is not a perfect estimate of well-being. When individuals grow their own food, build their own houses and sew their own clothes, they are not producing goods and services to be sold in a marketplace and therefore GDP does not change. As a result, many countries South America and Africa have a low GDP per capita that underestimates their well-being." http://www.econedlink.org/lessons/index.cfm?lesson=EM327
Because GDP is such a poor indicator, some more ecologically-mined ones have been developed, such as the Genuine Progress Indicator (GPI).

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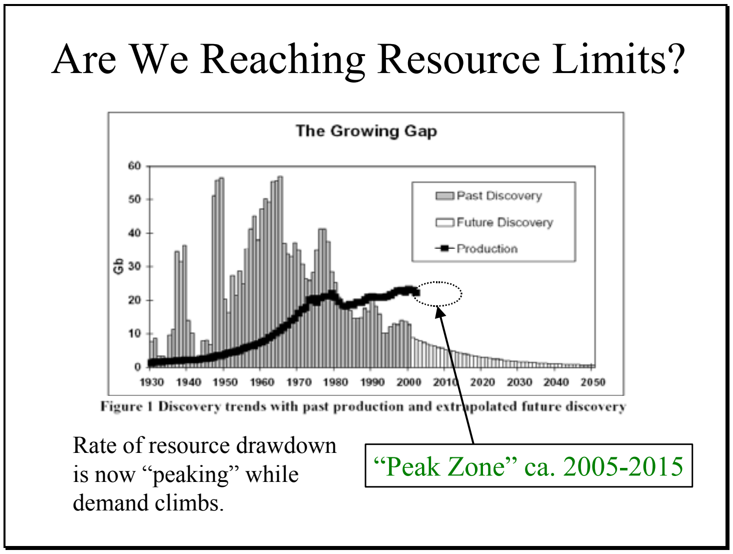

At the heart of the SRES greenhouse gas emissions models are projections of energy demand and supply. Fossil fuels are our major sources and are expected to remain so well into this century.

But recall the concept of drawdown. Fossil fuels are non-renewable. We started running out the minute we started using them. And we have grown our economy and population using them. Do we really have enough left to match SRES projections? Recall that the population using a non-renewable resource starts having trouble not when a resource runs out, but when the rate at which it can be obtained no longer matches the demand. I believe we are approaching that point with fossil fuels, especially oil.

"Oil Depletion—The Heart of the Matter" by C.J. Campbell

http://www.oilcrisis.com/campbell/TheHeartOfTheMatter.pdf

"Production" means what is taken out of the ground.

The area under the "Production" curve can be no larger than the area under the "Discovery" curve.

Most of the oil used today was discovered 40 years ago.

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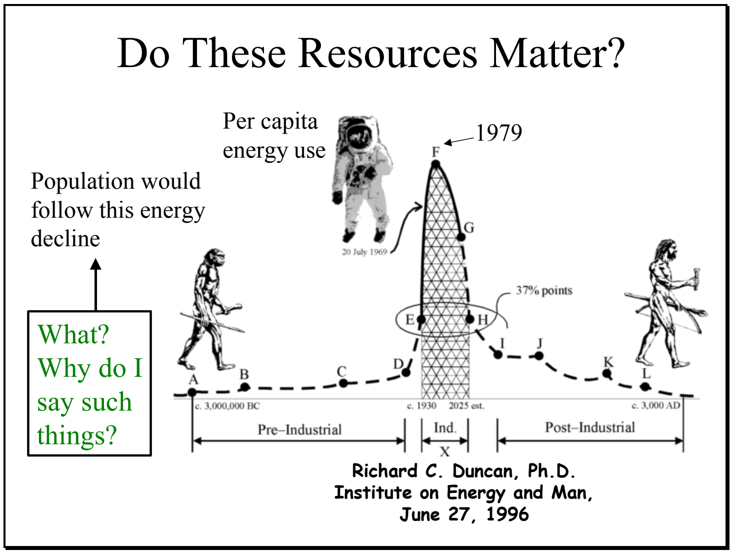

Most people take these resources for granted. We tend to be too caught up in our daily lives to realize how dependent we are on non-renewable resources. Literally speaking, the matter and energy in our bodies is made possible by exploitation of fossil fuels, and fossil fuels are by far the most important energy source we employ. Unless we find another energy source the peak in energy will be followed by a peak in food, which will be followed by a peak in population.

On a per capita basis, the first two peaks have already occurred. Absolute peaks in energy and food have possibly occurred or are about to. Population is likely to peak in the not-to distant future. Therefore, there are clear indications from the data that the prediction of peak, not plateau, is coming true.

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Food and Energy

Triad Nitrogen, Donaldsonville LA
Closing in 2004

•Industrial fertilizer plants use **natural gas.**

•Tractors, pesticides, water pumps, food processing, transportation, food storage—all rely on **fossil fuels.**

•The "**Green Revolution**" is based on unsustainable farming practices.

> "Modern agriculture is the use of land to convert petroleum into food." Albert Bartlett

This may sound farfetched to many. But just start thinking and doing some of your own research on how energy and food are connected.
Pictured here is a prime example. Fertilizer factories have doubled global the supply of nitrogen available to plants (mostly crops) and animals (mostly humans). This has provided an essential nutrient to agriculture that otherwise imposes limits the amount of food we can grow. In fact, for each food calorie produced in a "modern" farm, several fossil fuel calories are burned.
Quote from Albert Bartlett, Professor Emeritus, Physics Department, University of Colorado, Boulder, CO

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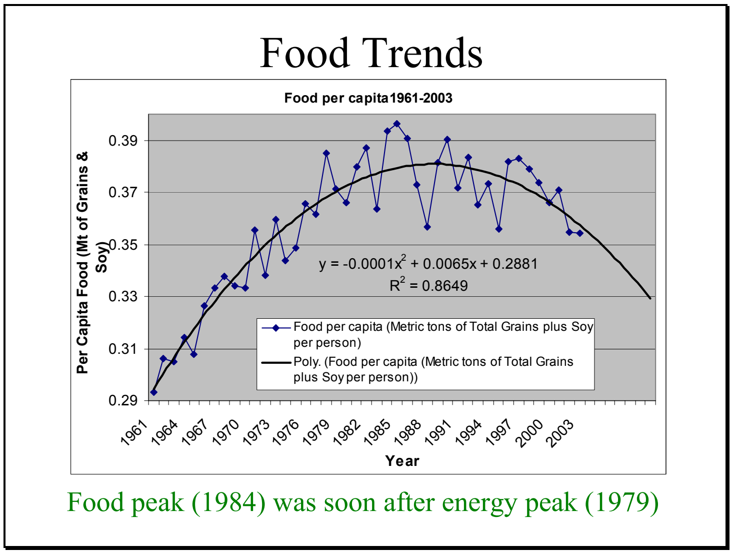

Global per capita food availability, measured as total grains (wheat, rice, corn, barley, oats, sorghum) plus soy, peaked in 1984 and is on a steady declining trend with 2003 levels at a 27 year low (data from: http://www.fao.org/waicent/portal/statistics_en.asp). A second order polynomial regression of the data suggests not an increase or near-term stability of food supply but a steep per capita decline. The same data used in this figure show a decline in total (not just per capita) food production since 1999; with grain reserves now considered dangerously low (FAO, 2003). Most likely, fisheries have also peaked in absolute catch levels (Hilborn et al., 2003).

We still have lots of food, plenty to feed everyone and more in fact, but are now likely entering a steep decline. Trying to overcome this by deepening our dependence on modern agriculture would be the worst response. The best response would be to: 1) transition to sustainable agricultural systems and moderate the decline rate, 2) improve food distribution efficiency to avoid social instability due to rising food costs, and 3) focus on reducing fertility rates so that total human population declines no slower than the decline in food supply. If we falter, population will eventually decline due to higher mortality rates, a more painful “solution.”

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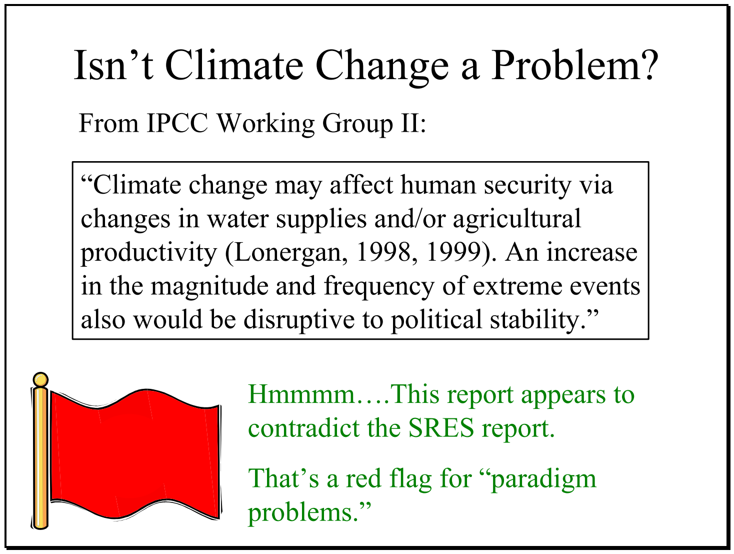

This is an example of what WGII has to say about the overall impacts of climate change. http://www.grida.no/climate/ipcc_tar/wg2/369.htm
To be fair, SRES does have "fortress world" model in which societies have become isolationist, and perhaps not peaceful through economic integration. Still, it is a far more materially wealthy world on average.

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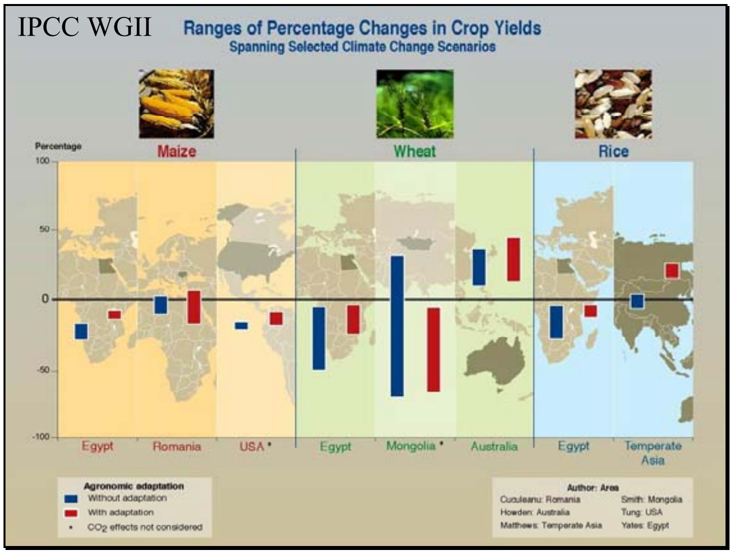

Let's look specifically at what IPCC WGII says about climate change and food production.
The WGII report gives some cause for concern. Although the models are pretty weak overall, their best guess is that food production will decline due to climate change impacts.
Yet SRES "targets" range from 7-15 billion people, with less food. This highlights a flaw in their modeling structure, as there are no means to validate or refine the original assumptions by providing feedbacks from the "Impacts" group to the "Economic Growth" group.
Source of graphic:
http://www.ipcc.ch/present/graphics.htm
see graphic labeled TS4
Note on flawed assumptions of the crop models: 1) continued existence of unsustainable industrial agriculture, 2) only average temperature change modeled, not temperature variance nor precipitation, 3) for adaptation: temperature changes can be predicted and new strains can be bred and utilized in anticipation of future climate.
Even so, food output in most regions down 20% to 50%

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Proximate Explanation of Absurdity

Recall the **Black Box model**—experts live in ignorance of other experts.

But this explanation is incomplete….

Socio-political?

Although the “Black Box” model may partially explain this, I believe it is incomplete. There’s enough dialogue and general knowledge that the glaring problems of the IPCC should be clear. Gee, I figured it out and I am a taxonomic botanist!
My nagging suspicion….it is socio-political and related to differing paradigms.
So before I go on, let me say that I really don’t like doing this. I don’t like pointing fingers and I don’t feel that one person or institution is to blame for our predicament. Remember, a dominant paradigm is a shared worldview, and institutional guidelines simply reflect the common beliefs among people in their organization. The cornucopian paradigm has been at work creating the world we inhabit and all of us have played a part, whether we are aware of this fact or not.

Graphic from:
www.GiftsforHimorHer.com
"See No Evil, Speak No Evil, and Hear No Evil" from the "Liberty Bronze Collection". Polyresin. 5 3/4" x 2" x 4 1/2" high

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Ultimate Explanation of Absurdity

The IPCC is organized by the United Nations
Article 55 of the U.N. Charter states:

> "With a view to the creation of conditions of stability and well-being which are necessary for peaceful and friendly relations among nations based on respect for the principle of equal rights and self-determination of peoples, the United Nations shall promote:
>
> •a. higher standards of living, full employment, and conditions of economic and social progress and development;
>
> •b. solutions of international economic, social, health, and related problems; and international cultural and educational cooperation; and
>
> •c. universal respect for, and observance of, human rights and fundamental freedoms for all without distinction as to race, sex, language, or religion."

Recall the SRES "targets." Peace requires prosperity, prosperity requires economic growth. Equals the cornucopian paradigm.

So let's read an official declaration of the cornucopian paradigm from the organizing body of the IPCC, the U.N. United Nations development programs, and other policies from international financial institutions, guide their activities in much of the world based on their belief system. This was formalized in Article 55 of the Charter of the United Nations to describe the purpose of the Economic and Social Council (http://www.un.org/aboutun/charter/).

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Sounds Great! But….

Make sure your policies don't promote overshoot.

How overshoot can occur:	**How they apply to humans:**
1. Feedback lag	1. Demographic momentum
2. Decreased carrying capacity due to changing environmental conditions	2. Pollution, soil loss, and climate change affect food production
3. Ecological release from competitive and parasitic species interactions	3. Modern medicine, pesticides and herbicides, removal of predators and competitors for livestock and crops
4. Unsustainable drawdown of resources	4. Depletion of fossil fuel and ground water reserves

All the evidence suggests humans are well into an overshoot phase, and we are doing very little to make a transition to a sustainable economy that retains some desired level of material prosperity. These facts are vigorously avoided. Accepting reality would question the validity of the careers, dreams and plans of too many people and powerful institutions.

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Assumptions & Political Taboos

What can promote world peace?	Economic growth.
What can sustain economic growth?	Unlimited resource availability and global economic integration.
What difficult discussions that offend religious and cultural beliefs do we avoid?	Government population and consumption control.
What ensures that member nations and U.N. financiers are not too upset?	Tell the poor world that they can grow, tell the rich world that this means bigger markets.
What scares people more than global warming?	Job losses.

Overshoot is not an existing concept in the cornucopian paradigm. It does not validate these concerns because to do so would mean the end of an entire belief system. Instead, operational assumptions are defended despite abundant evidence that they are false. Tragically, I believe people enjoy the lie. For many, it is a great party while it lasts.

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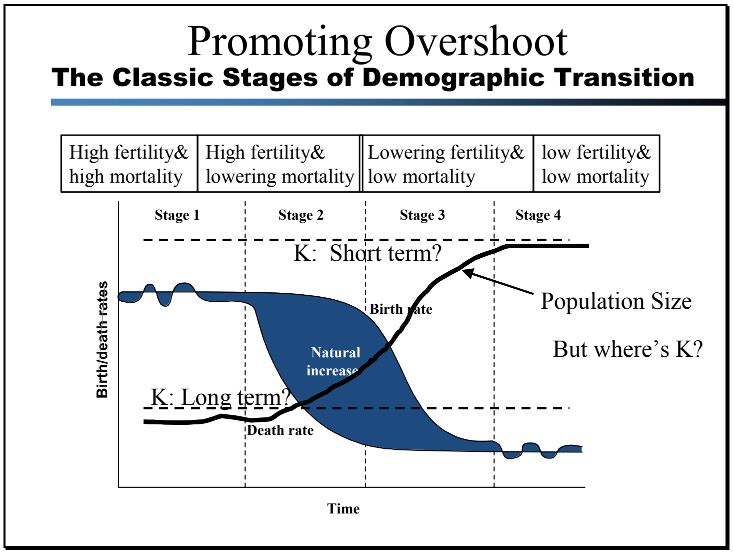

Evidence mounts that we are literally promoting overshoot, raising short term K, with our economic and development policies, while assuming the plateau model and never asking about long term K. This graphic is from the U.N. and portrays the standard demographic transition hypothesis. The "Natural increase" in the model is expected, but demographers never question if it is environmentally possible to maintain. I have overlaid a graph of population size change as a function of the changes in birth and death rates in the demographic transition model.

The question "where's K" is never adequately addressed in the model. In fact, environmental carrying capacity is assumed to be ample, or actually not a relevant concept, yet there are clear signs of planetary stress.

As a biologist, I find this completely crazy. It is fundamental to assess environmental carrying capacity when modeling long-term population dynamics for a species. It is done for other animals and it has been done for many human populations as well (anthropological studies on hunter-gatherer and subsistence agricultural people).

The only conclusion I can make is that many people do not WANT to know the answer. Ignorance is chosen.

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An Analogy

This plane is about to fly for 12 hours across the Pacific Ocean, loaded with over 300 people. Systems are carefully checked and monitored. Enough fuel is loaded for the journey. The pilots maintain control.

By contrast….

Economists use the term "takeoff" regarding economic development, but the fuel load is not measured, the gauge is not checked during flight, cargo is not weighed, no pilots exist, and the control levers work poorly. Yet we are all (6+ billion) asked to hop on board. Bon voyage! At least they give out free booze and have some good movies.

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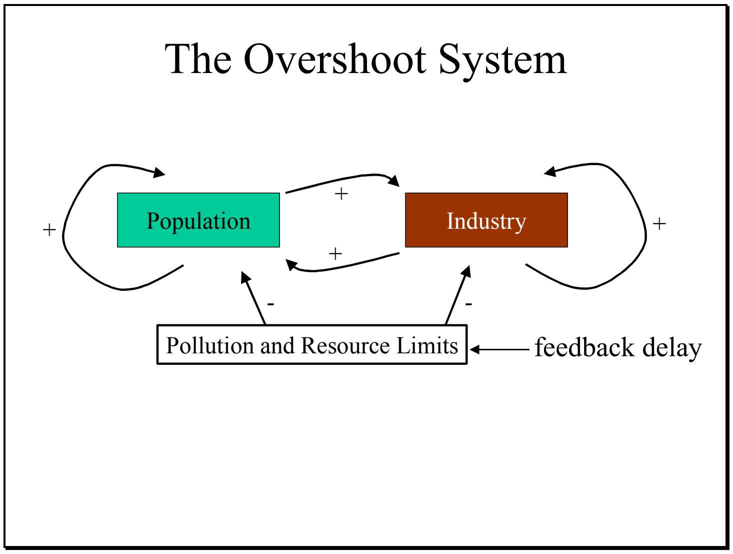

For decades now, those with an ecological paradigm have known that the entire population and industrial system are inherently prone to overshoot.
Population and industry reinforce one another's growth. Population provides labor for industry and industry provides services that populations need, e.g., medical care, shelter, food, transportation.
Rising populations drive demand for more industry and a growing industrial base demands more labor!
The negative feedbacks that check this growth are not instantaneous, therefore overshoot is an inherent threat and only sound management and foresight can prevent it.
Now the data coming in clearly demonstrate a system at its peak and perhaps beginning a decline. The delayed feedbacks are starting to operate.

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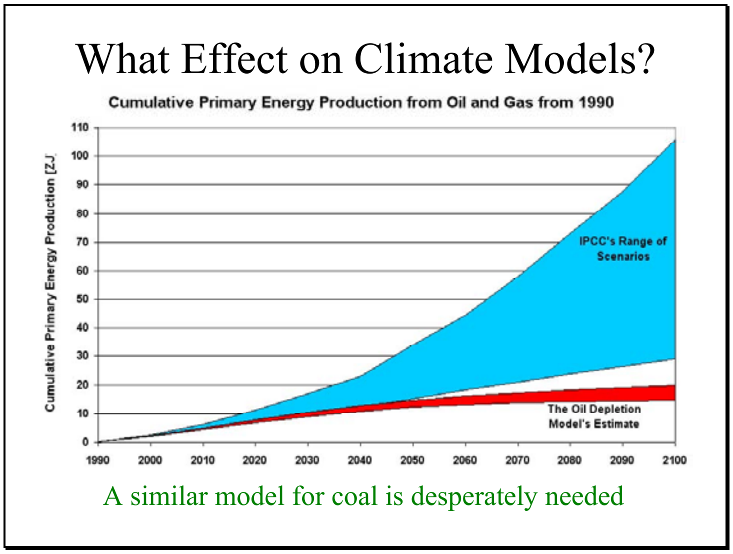

Back to the IPCC. What does this mean for climate change?
A decline in human population and economic output is not within the SRES scenarios. This means that they likely overestimate future greenhouse gas emissions (though I am NOT claiming that climate change is therefore not a concern—it remains a problem based on what we have already done to the atmosphere).
An ecological/biophysical model of the human economy could make much different projections for rates of greenhouse gas emissions compared to the current cornucopian models of SRES.
For example, the IPCC models all assume as much fossil fuel as desired for economic growth will be found. Many geologists (Ecological paradigm) disagree and suggest that oil and natural gas will be used much less than in the range of SRES models, leading to fewer emissions.
Graphic url:
http://www.isv.uu.se/uhdsg/OilIPCC/IPCCsum.html

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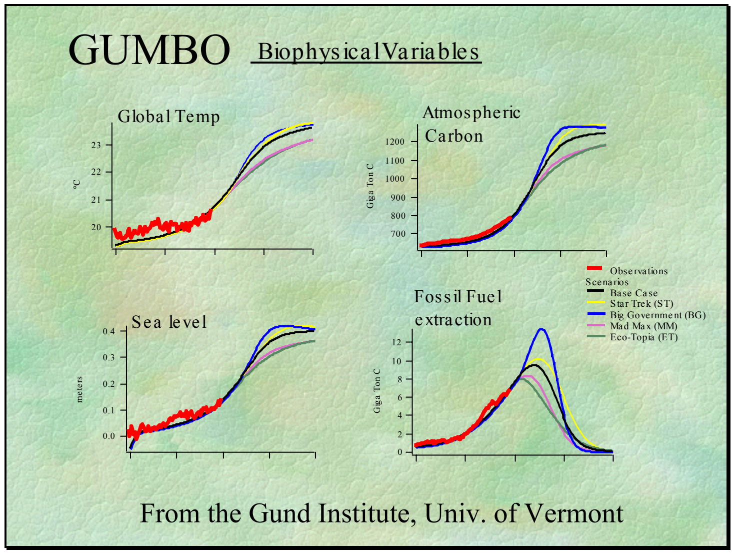

There are alternatives to the IPCC metamodel. The disciplines of ecological economics, biophysical economics, systems dynamics, systems ecology, etc., place human economies as a subset of the Earth system. Feedbacks between human systems and biophysical systems are incorporated into the model, not ignored as in the IPCC.

For example, models can examine the various paths the world population and economy can take given different assumptions regarding resource availability and investment choices. Indeed, these strongly influence biophysical changes in the Earth. E.g., Global Unified Metamodel of the Biosphere, Global Systems Simulator of Robberts Associates. Note the different estimates of fossil fuel extraction yield differences atmospheric carbon, global temp. rise, and sea level rise.

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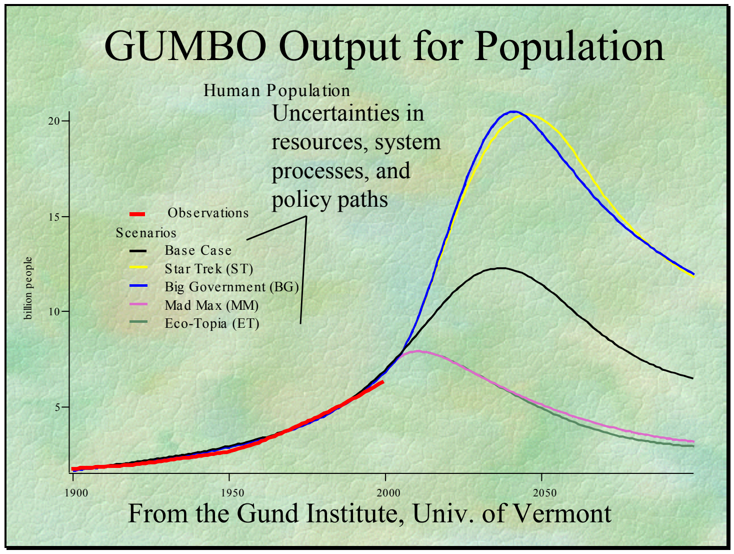

Dramatic differences in human population result from these different assumptions as well. The model permits exploration of a range of uncertainties in both resource availability (including technological gains) and public policy investments (e.g., education, health care, built infrastructure, ecological restoration).
In systems models cause and effect are obscure. The interactions and feedback loops defy simple cause-effect relationships. This is totally different than the linear, cause-effect, structure of the IPCC (1. population and economics, 2. climate change, 3. impacts). Which do you think is more realistic?
Note: Given what I've seen of food production trends and fossil fuel depletion data, I believe the Mad Max or Eco-Topia scenarios are more likely than the others—which are semicornucopian. Data regarding peaks in energy and food are more in-line with the low population scenarios.

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Where from Here?

1. Don't rely on the current economic system to tell you when to change—overshoot is inherent and is our current predicament.
2. Do the opposite of what the system rewards: Localize (not globalize), Generalize (not specialize), Ruralize (not urbanize), Conserve (not consume).
3. Do this now, as a community, and your future (and my cloud forests) will be more secure.

Here are some general suggestions about how to act if you accept the contents of my presentation.

Also, you may want to study books by the following authors:
Donella Meadows, Herman Daly, William Catton, Richard Heinberg, Daniel Quinn, Garret Hardin, Peter Corning, Richard Douthwaite

Thank you for following this presentation to its conclusion. If you have any questions or comments I'd be pleased to hear from you.

jcbradford@ucdavis.edu