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• Environmental Ethics and Land Management  
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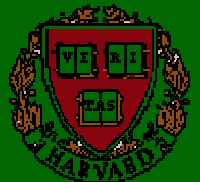
<http://courses.dce.harvard.edu/~envre120>

Elements of Ethical Reasoning

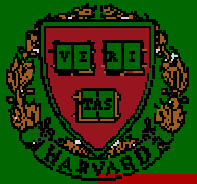
Timothy C. Weiskel

Session 3 – Part 1  
5 October 2006

Harvard University Extension School  
Fall Semester 2006

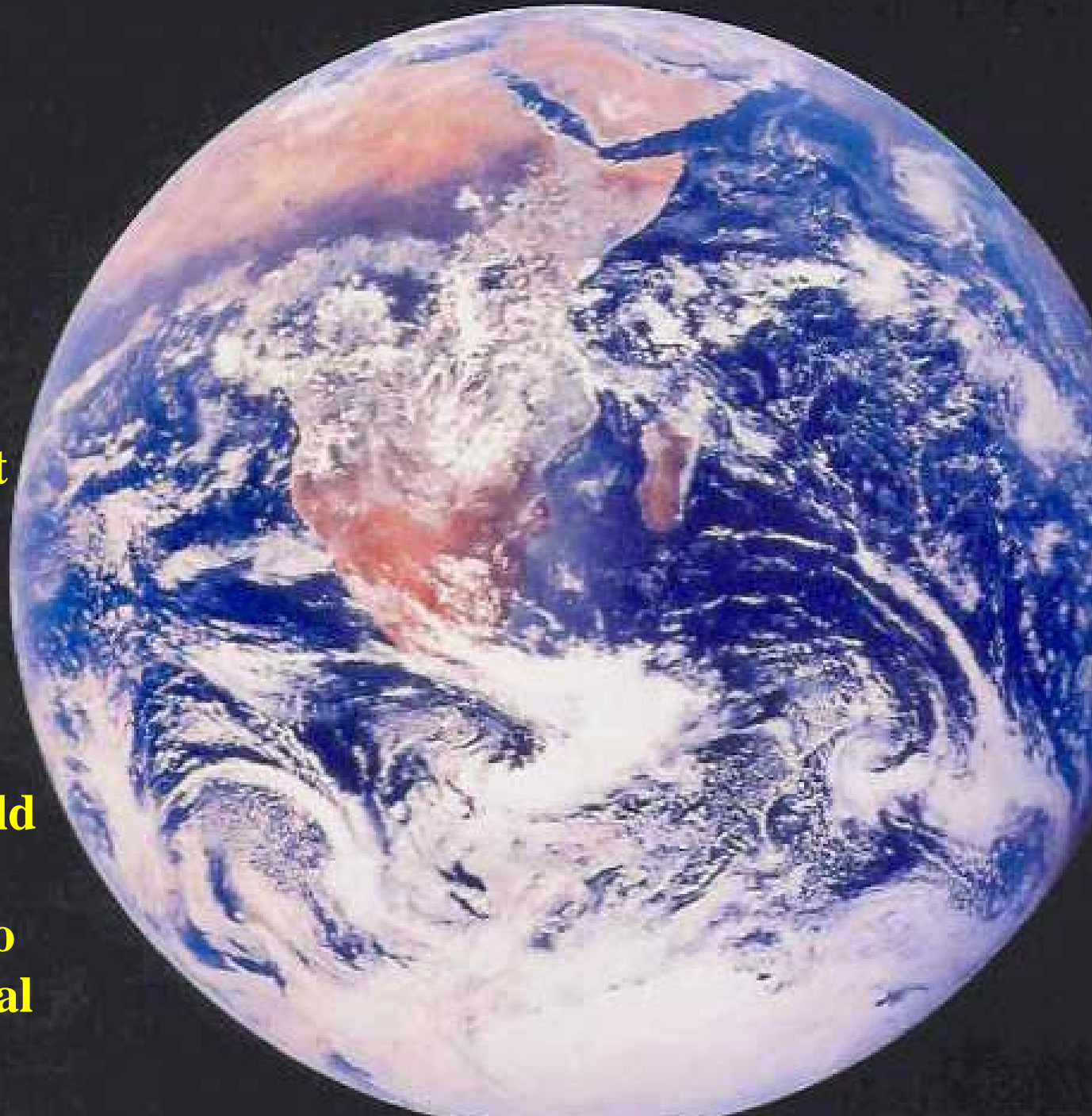


We need to  
situate  
environmental  
ethics – the  
principles of  
choice in an  
ecosystem --  
*within* the context  
of the system  
within which it  
operates.



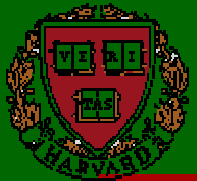
We need to situate environmental ethics – the principles of choice in an ecosystem -- *within* the context of the system within which it operates.

If we want to survive, we should not design our ethical systems to contradict natural systems.





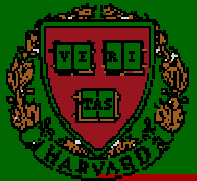
Even the casual observer can see evidence of patterned activity – non-random events that have left their mark...



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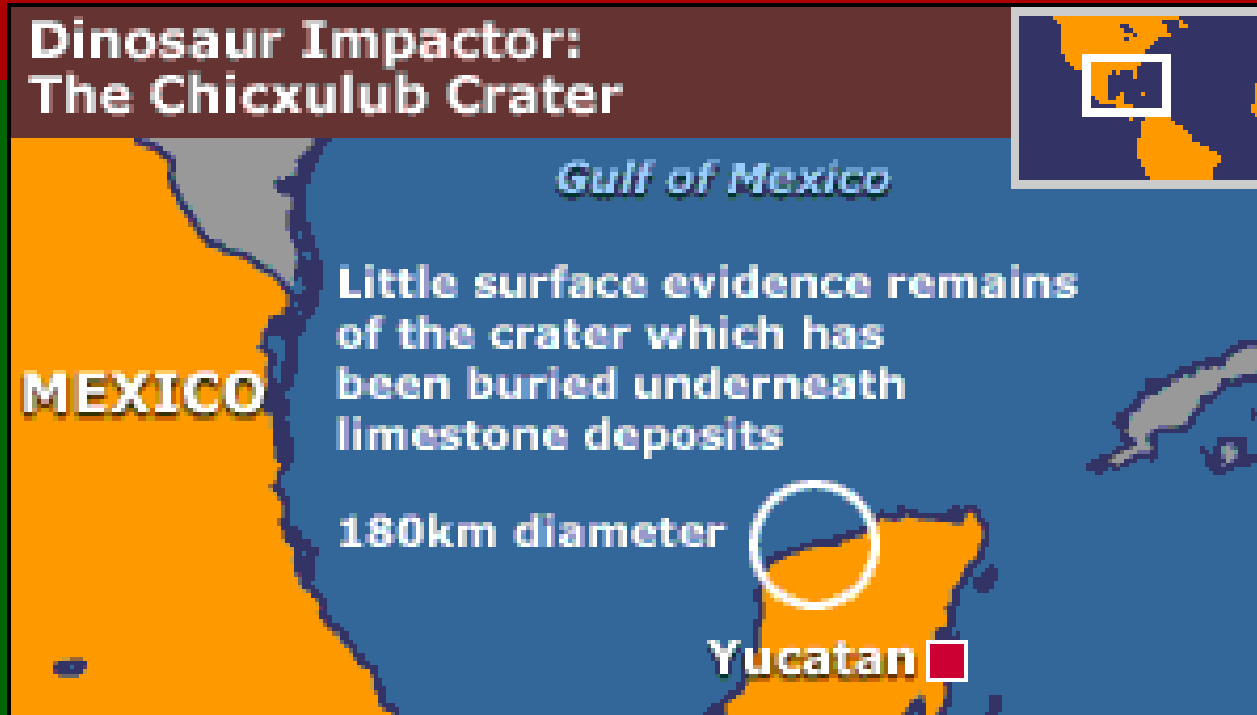


Even when we can't "see" the evidence, we are learning that it is there and that we can learn about that evidence if we extend our scientific gaze.

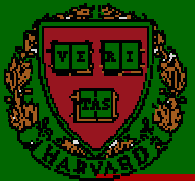


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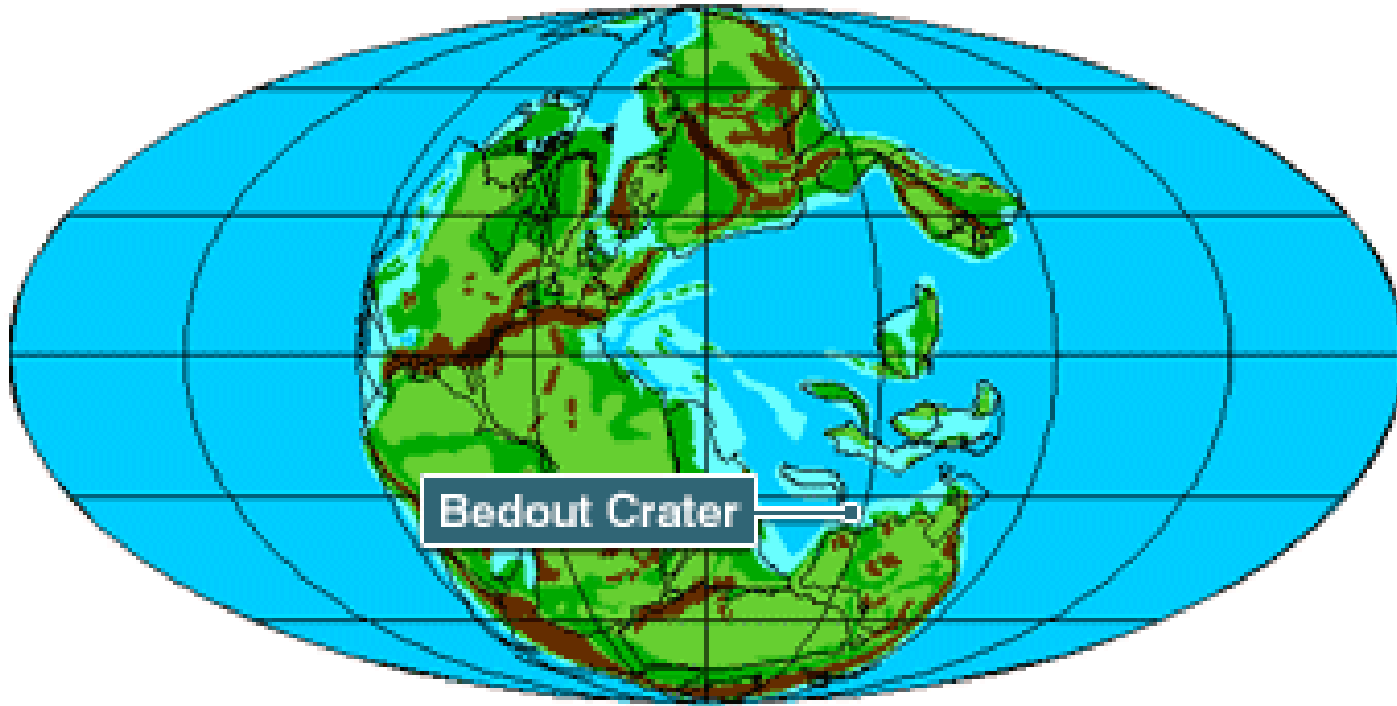
## Dinosaur Impactor: The Chicxulub Crater



Thus, we are learning about life-transforming events in Earth's history that occurred that are not immediately visible to the naked-eye...

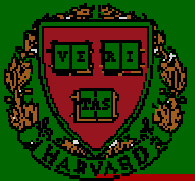


## THE PANGEAN SUPERCONTINENT - 250 MILLION YEARS AGO



The Chicxulub crater is not the only major event we need to pay attention to...

The Bedout Crater has its story to tell as well.



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First shown: **Thursday 5 December 2002**

The Day The Earth Nearly  
Died

Coming up on Horizon

Programme summary  
Questions and answers  
[Transcript](#)  
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Archaeologists search  
the Amazon for **The  
Secret of El Dorado.**

## The Day The Earth Nearly Died - programme summary

250 million years ago, long before dinosaurs roamed the Earth, the land and oceans teemed with life. This was the Permian, a golden era of biodiversity that was about to come to a crashing end. Within just a few thousand years, 95% of the lifeforms on the planet would be wiped out, in the biggest mass extinction Earth has ever known. What natural disaster could kill on such a massive scale? It is only in recent years that evidence has begun to emerge from rocks in Antarctica, Siberia and Greenland.

The demise of the dinosaurs, 65 million years ago (at the so-called K/T boundary), was as nothing compared to the Permian mass extinction. The K/T event killed off 60% of life on Earth; the Permian event 95%. Geological data to explain the destruction have been hard to find, simply because the rocks are so old and therefore subject to all kinds of erosion processes. It seems plausible that some kind of catastrophic environmental change must have made life untenable across vast swathes of the planet.

**The world's biggest volcanoes**

**"At the end of  
the Permian  
you'd see  
virtually  
nothing alive"**

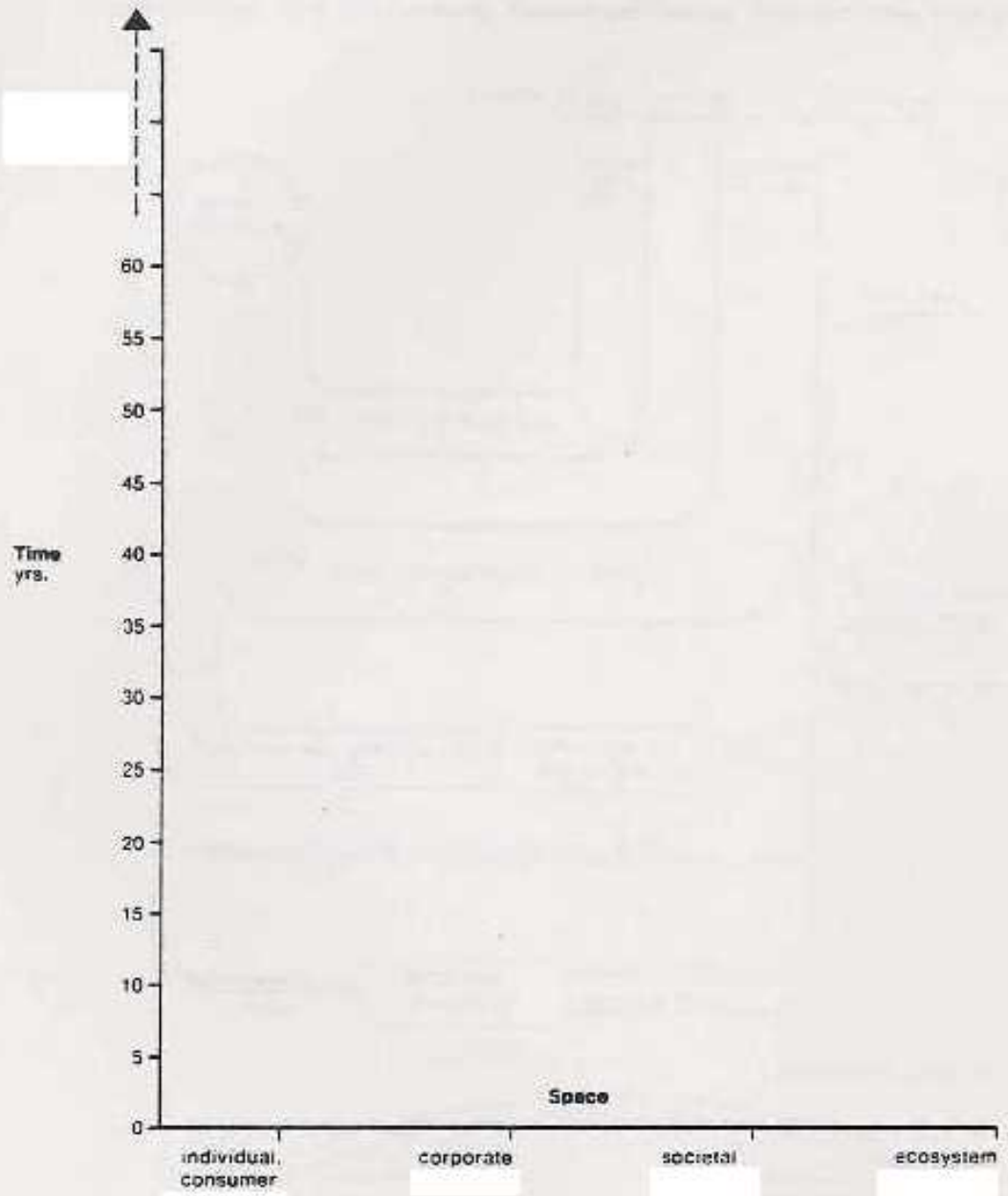




So, we have reminded ourselves that Earth and the life forms that have emerged on Earth have been shaped by cosmic events.

Further, these cosmic events continue to occur and “frame” all we undertake...

In short, in the ecosystem some very important things remain *beyond human control*. They always have been, remain now and always will be beyond our control.



In reality, all decisions are made in a time-space continuum.

That is, all ethics are “situated” in time and space.

The question is what is the relevant time-space ‘frame’ for ethical choices in an ecosystem?

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Tuesday, 1 October, 2002, 11:30 GMT 12:30 UK

[News Front Page](#)**Life may swim within distant moons**[Africa](#)[Americas](#)[Asia-Pacific](#)[Europe](#)[Middle East](#)[South Asia](#)[UK](#)[Business](#)[Entertainment](#)[Science/Nature](#)[Technology](#)[Health](#)[Talking Point](#)

From: Calculations suggest life may have an ocean\*

[Country Profiles](#)[In Depth](#)[Programmes](#)[BBC SPORT](#)[BBC WEATHER](#)[SERVICES](#)[Daily E-mail](#)[News Ticker](#)[Mobile/PDAs](#)[Text Only](#)**By Dr David Whitehouse**

BBC News Online science editor

Oceans of water beneath the icy surfaces of distant moons may be far more common in the outer Solar System than had been thought, according to new calculations.

Some, in theory, could harbour life, claim scientists.

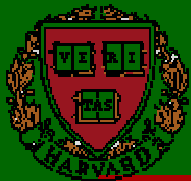
Until now it was believed that oceans might be found under the icy crust of Jupiter's moons Ganymede, Europa and Callisto.

But new calculations, by Christopher England of Nasa's Jet Propulsion Laboratory (JPL), to be presented at a major astronomy conference, suggest that this may be the case on other moons, such as Titan - which orbits Saturn - and Neptune's large moon Triton.

Even Varuna, the largest so-called Trans-Neptunian object

Considering the larger cosmic context, we have learned that life systems may not be confined to Earth....

In fact, they may not have originated "here" on Earth.



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Wednesday, 26 January, 2000, 19:01 GMT

## How life may live on Europa



Impression of a probe searching for life in Europa's ocean

**By BBC News Online Science Editor Dr David Whitehouse**

A radiation-driven ecosystem could exist in the ocean thought to lie beneath the surface of Jupiter's moon Europa, a scientist has suggested.

Ever since the Voyager spacecraft flew past the Jupiter system in the 1970's, astronomers have been fascinated by Europa and its bizarre striped surface and the prospects for primitive forms of life on the satellite.

But life needs energy. It has been suggested that on the floor of the suspected subterranean ocean there may be hydrothermal vents like those found on Earth.

These vents, which gush hot water and minerals, could provide both the energy and the food sources for primitive Europeans.

Further, we have learned that not all life systems need to be based on carbon, just because “life as we know it” on the Earth’s surface is based on carbon.

Non-carbon-based life forms may exist elsewhere because we know they exist in remote regions of Earth itself.

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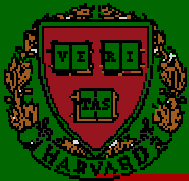
# The Notion of Causality

In addition, we have observed that notions of simple causality do not really work very well in a complex ecosystem.

Simple causality implies that there is a linear relationship between cause and effect.

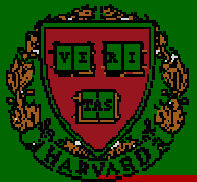
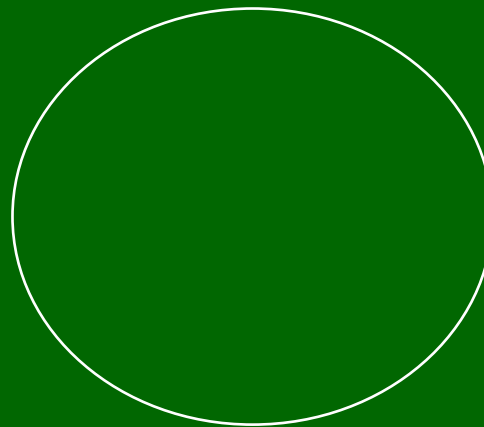
A “causes” B

therefore, if “B” then there must be a prior causal A



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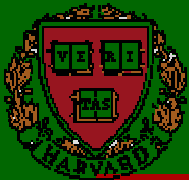
# But what about complex systems?



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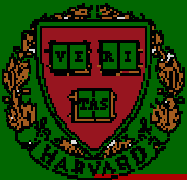
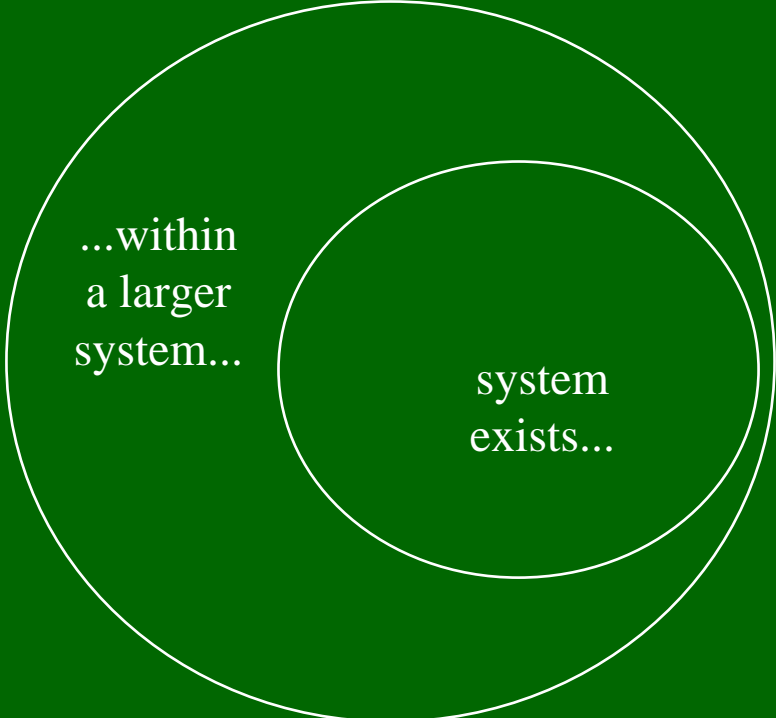
system  
exists...



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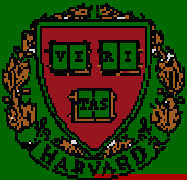
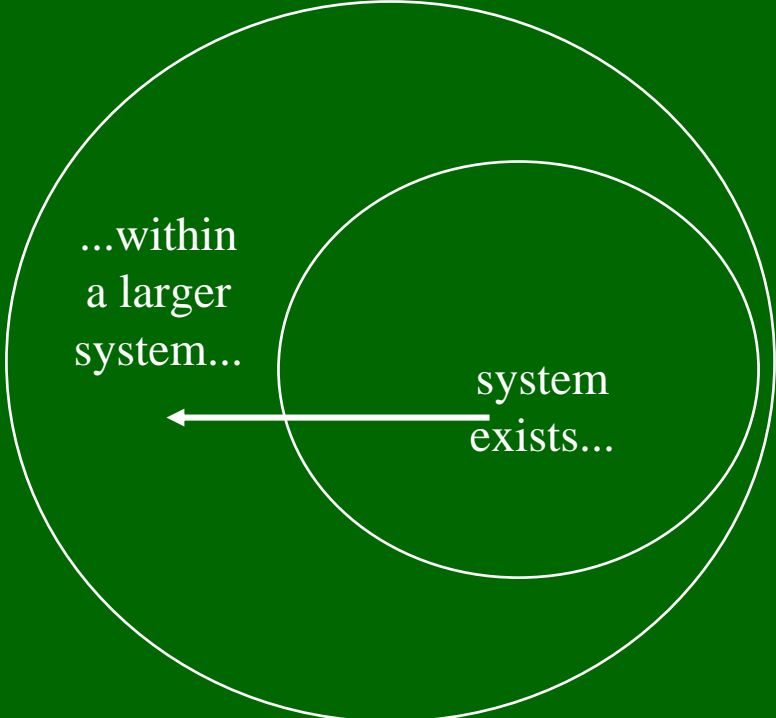
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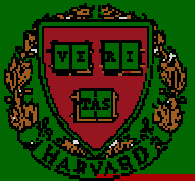
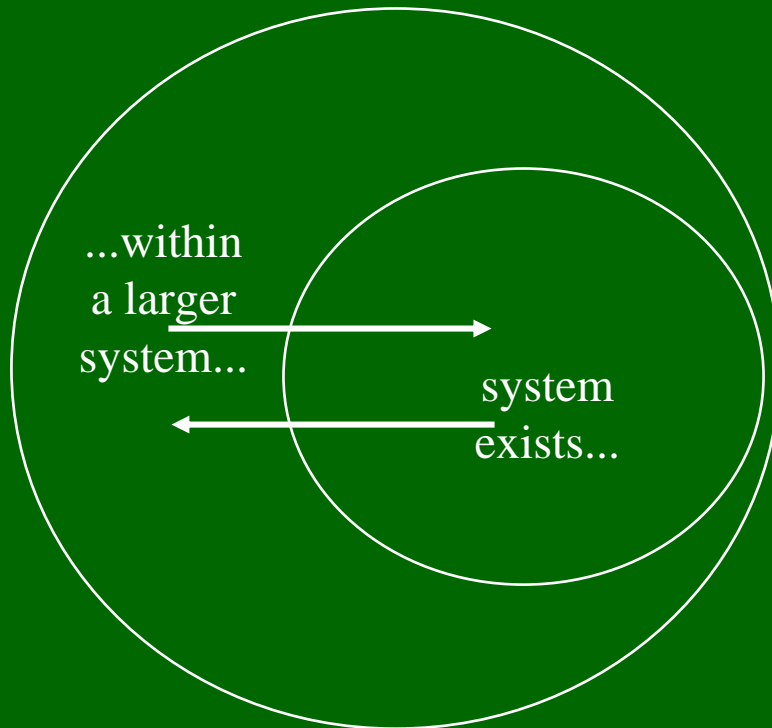


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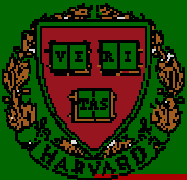
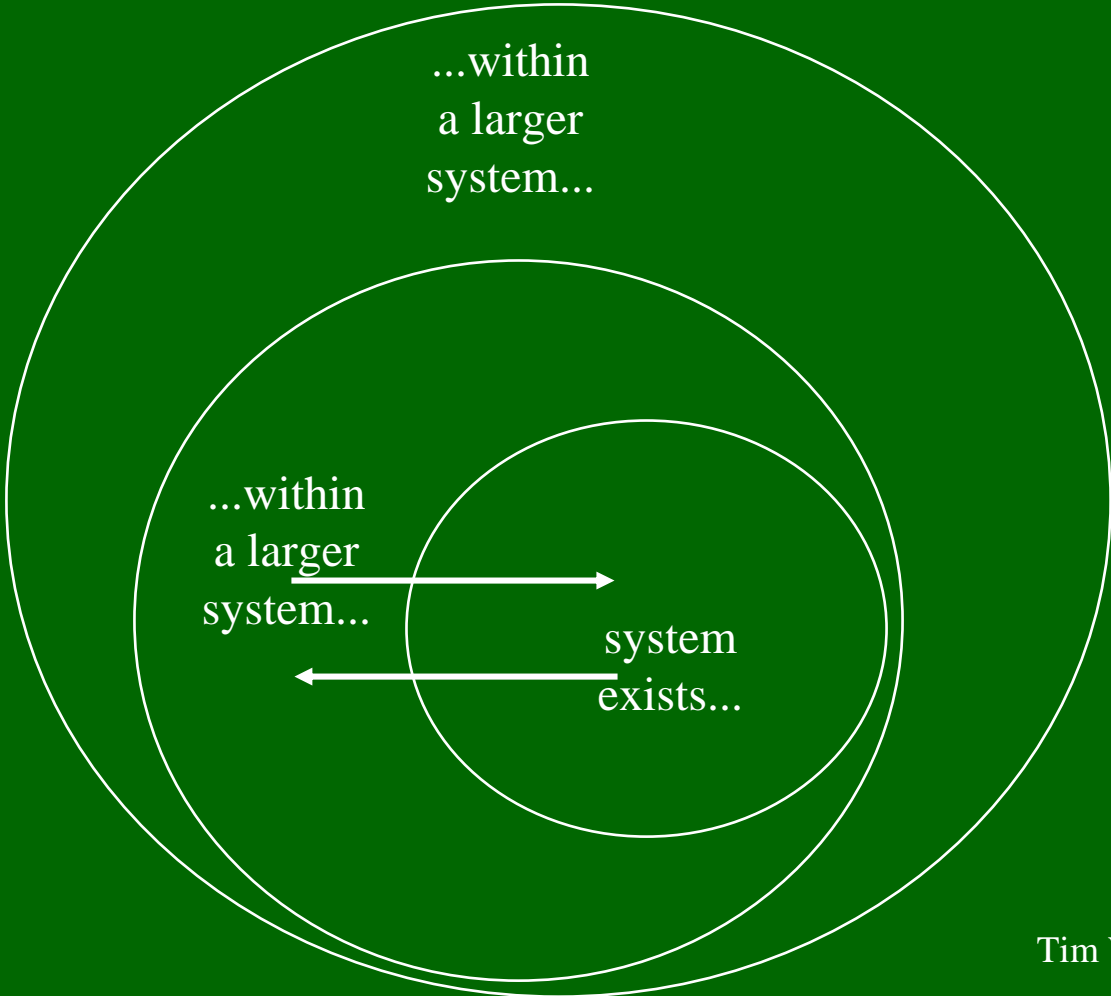
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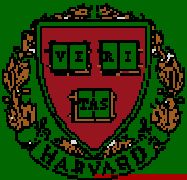
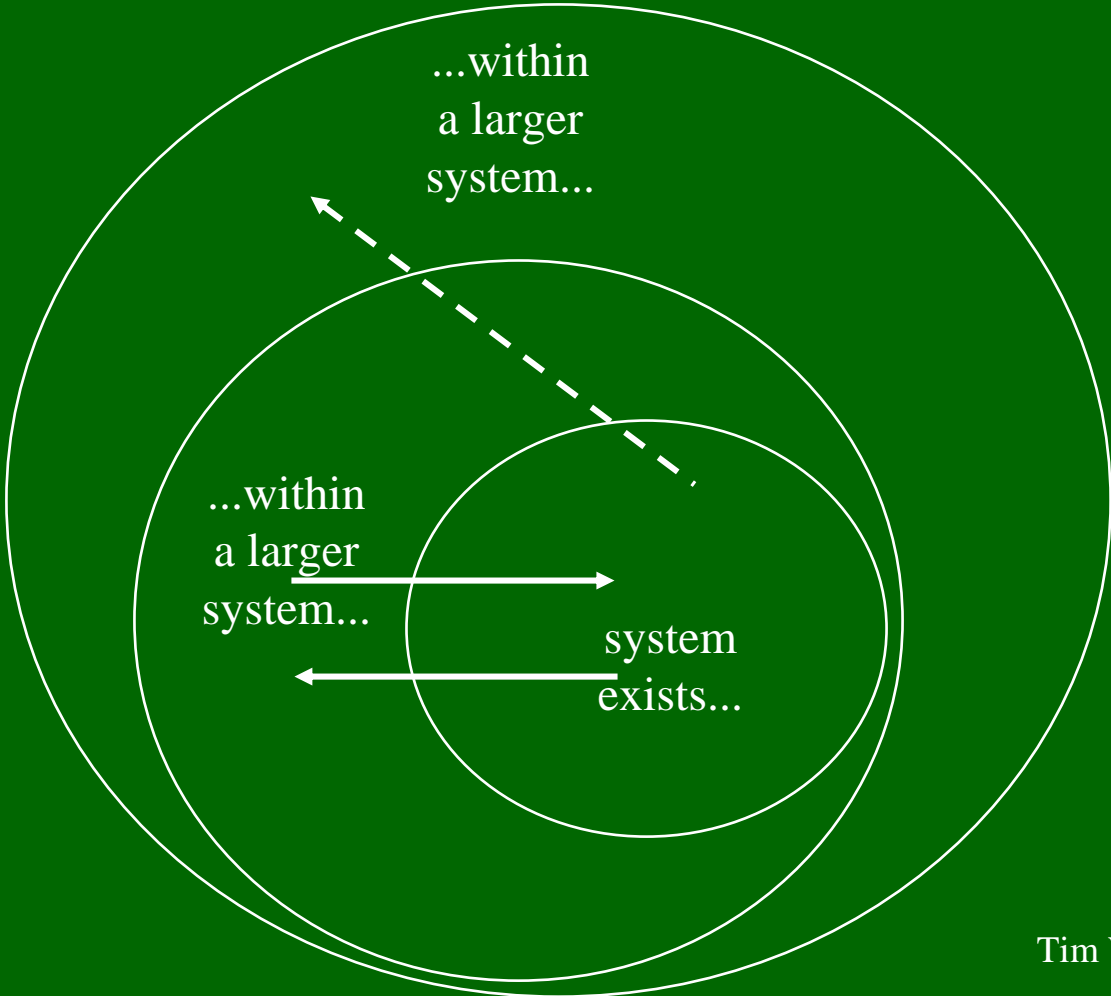
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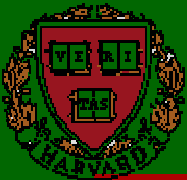
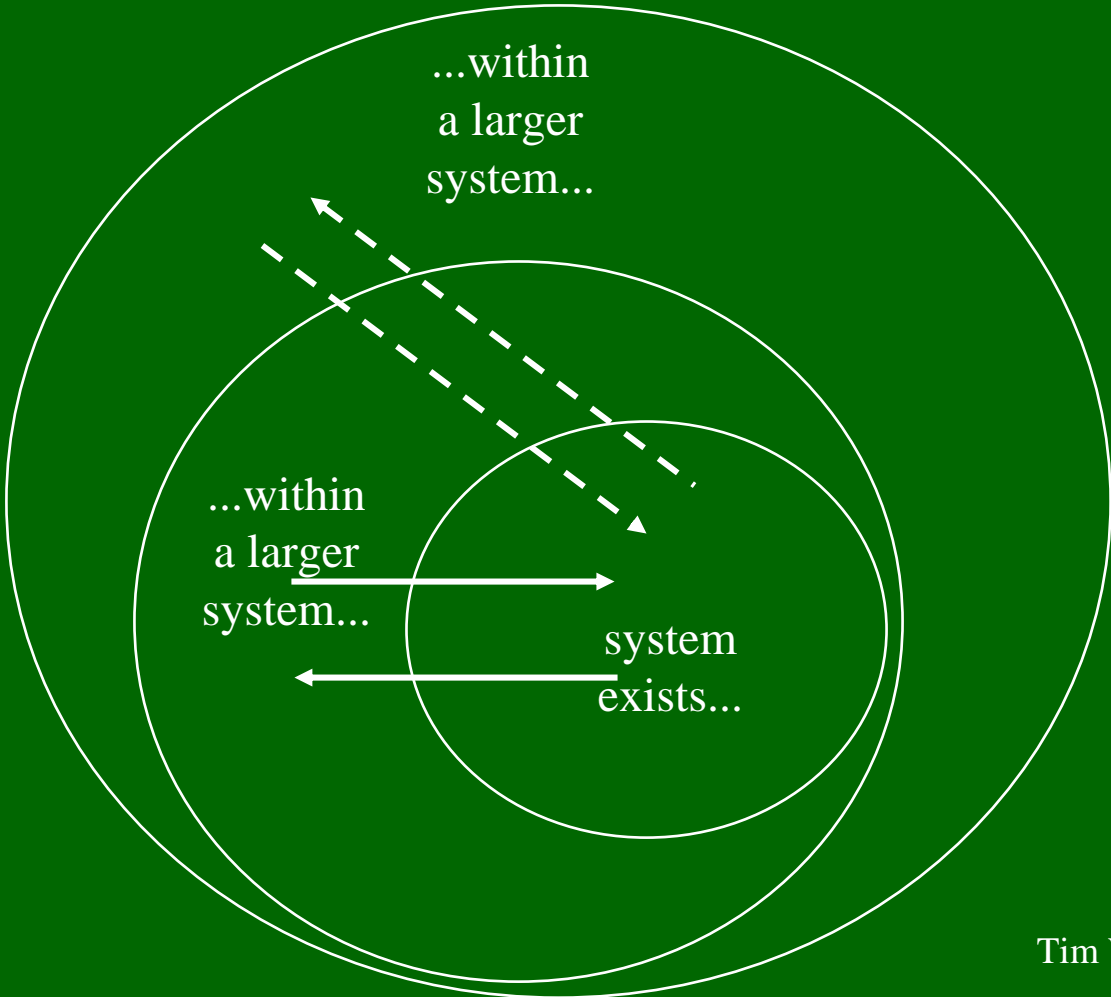
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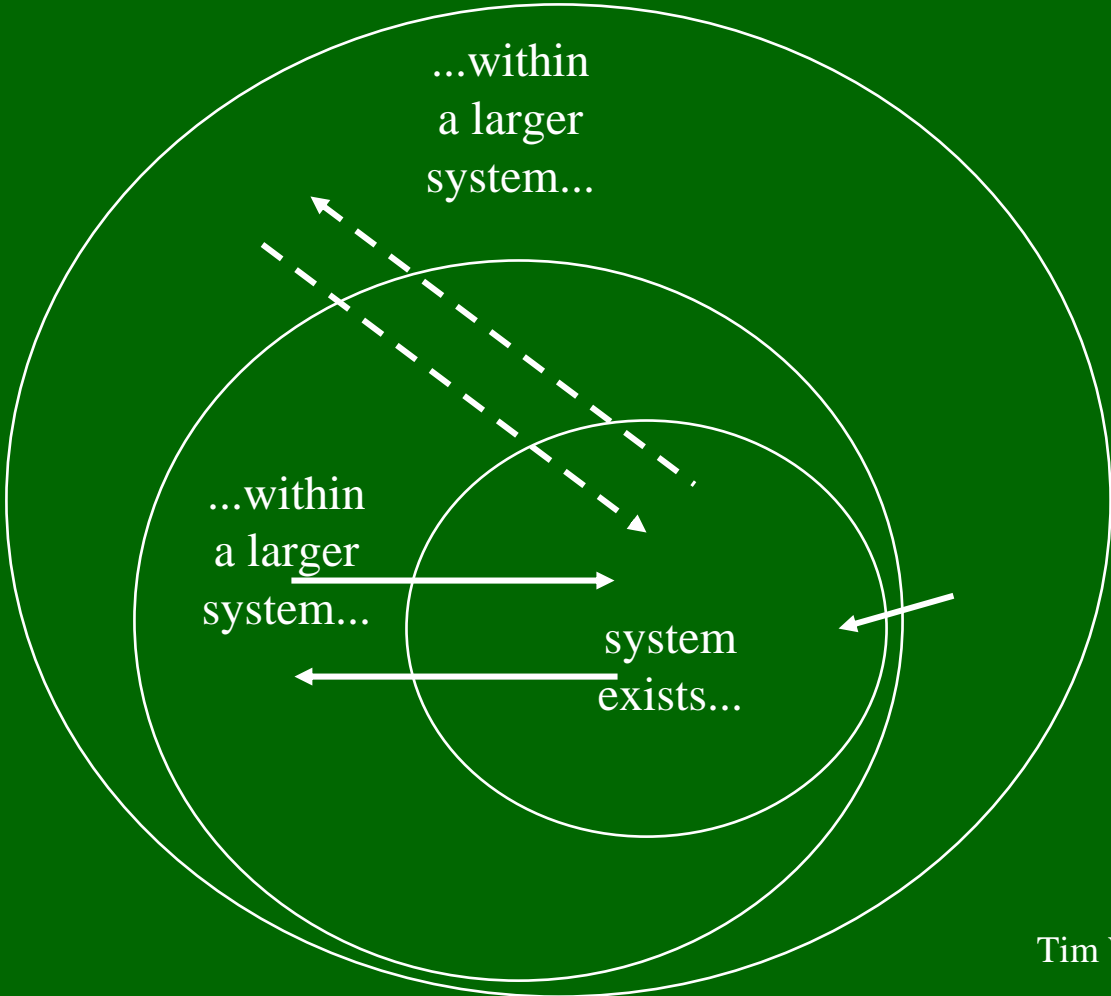
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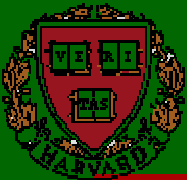
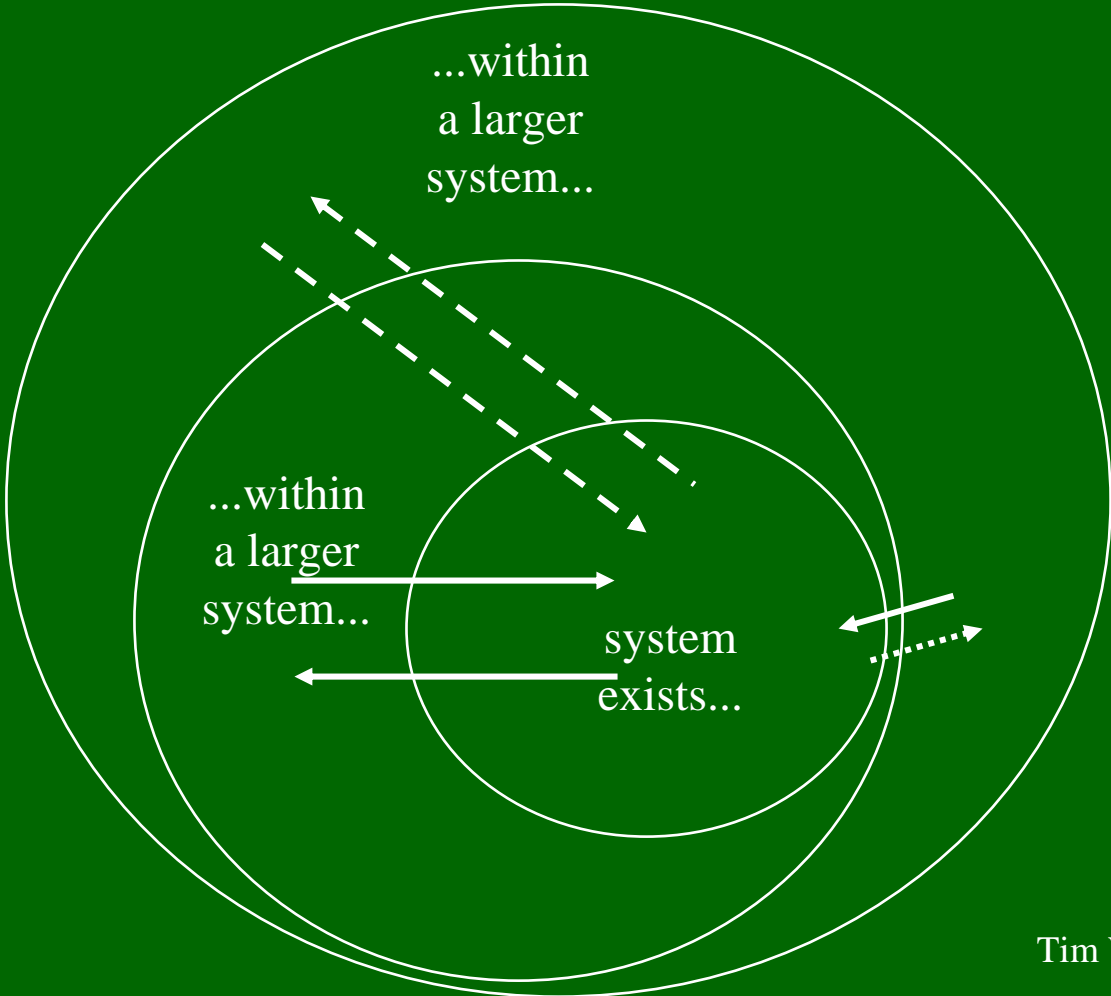
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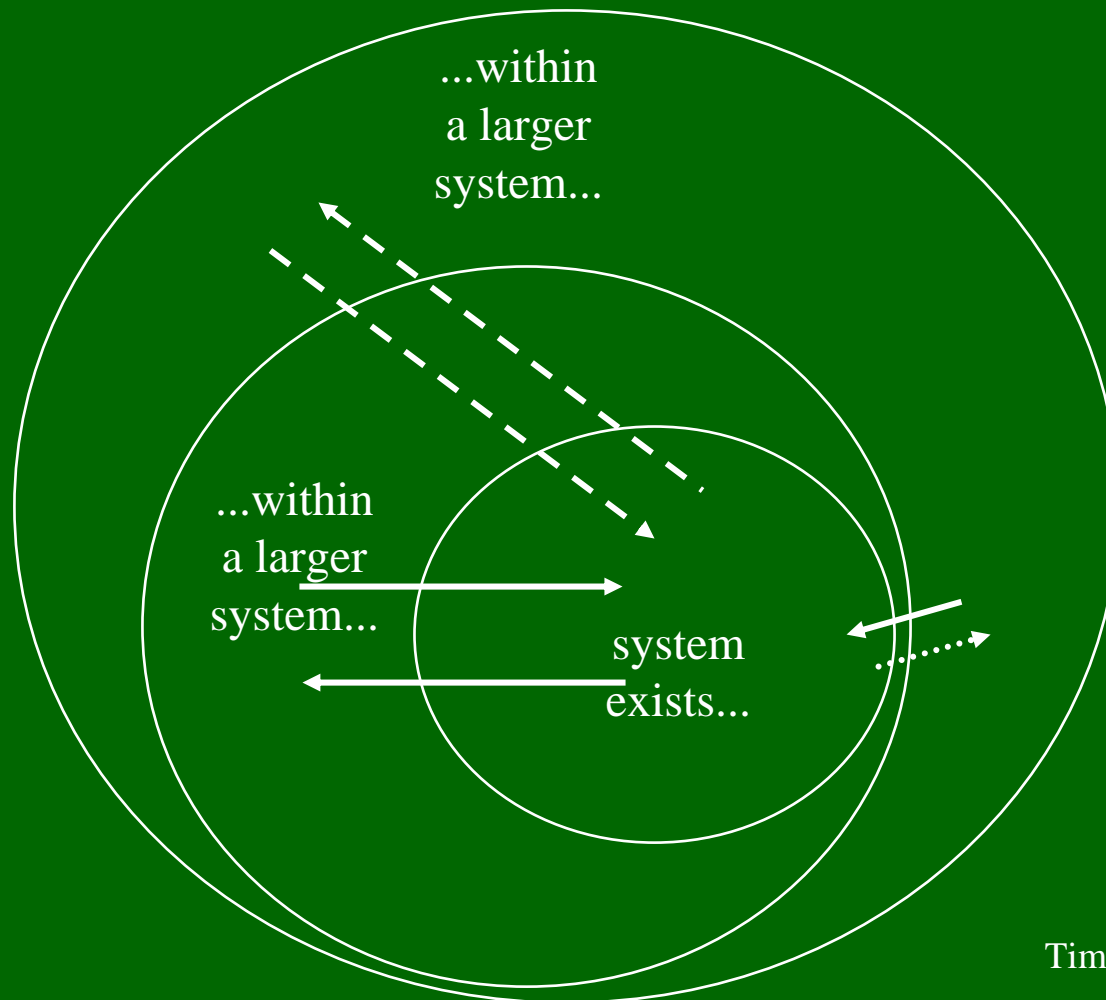
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# How can we locate causality in ‘non-linear’ systems?

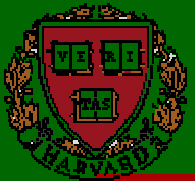
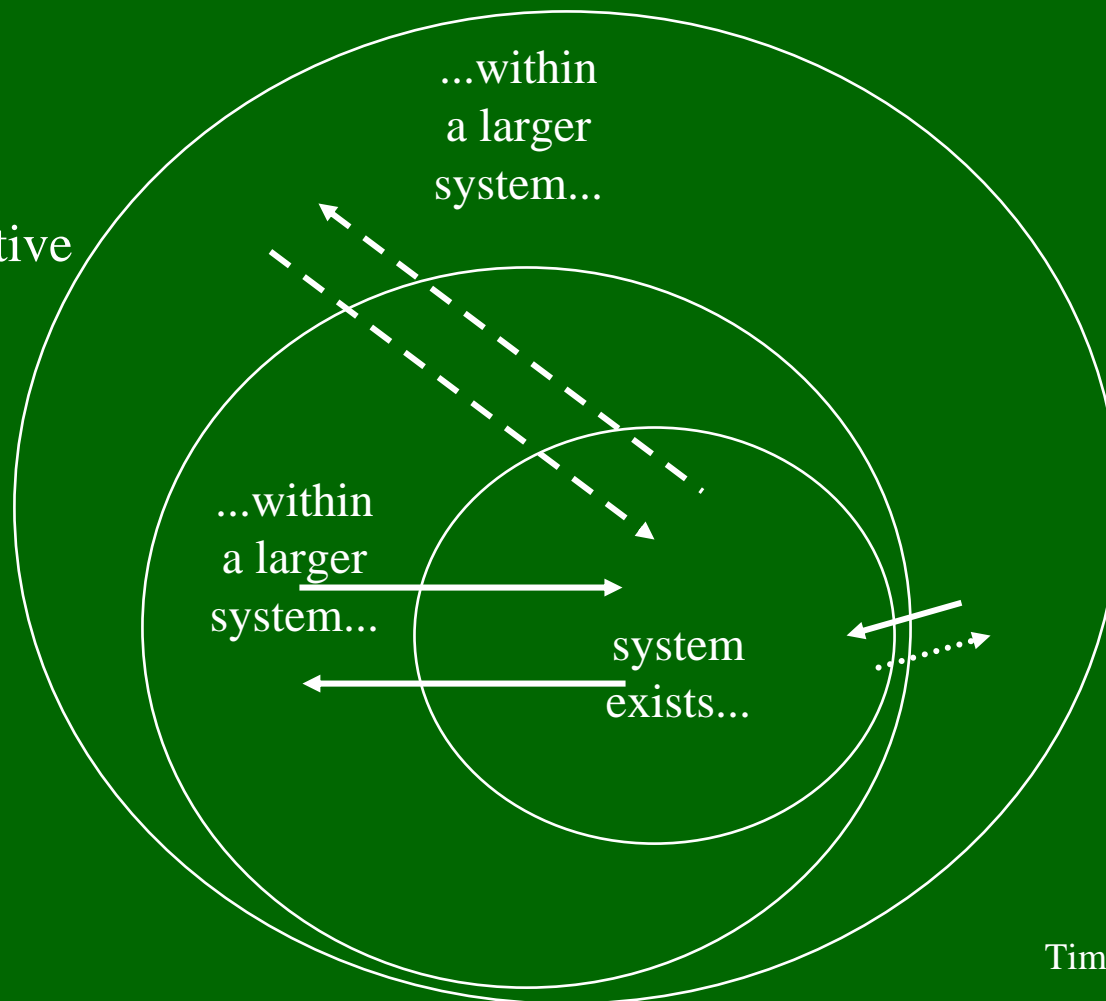




# How can we locate causality in 'non-linear' systems?

Causality is:

- nested
- reciprocal
- and cumulative



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Last Updated: Thursday, 1 April, 2004, 15:57 GMT 16:57 UK

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## Double whammy link to extinctions

By Paul Rincon

BBC News Online science staff

**The chances that asteroid impacts and huge bouts of volcanism coincide randomly to cause mass extinctions may be greater than previously imagined.**

UK researchers conducted statistical tests to determine the probability of such catastrophic events happening at the same time in Earth history.

They found massive releases of lava and space collisions should have overlapped three times in the last 300 million years.

Details will be published in a future issue of the geological journal *Lithos*.



What are the chances of such great events occurring together?

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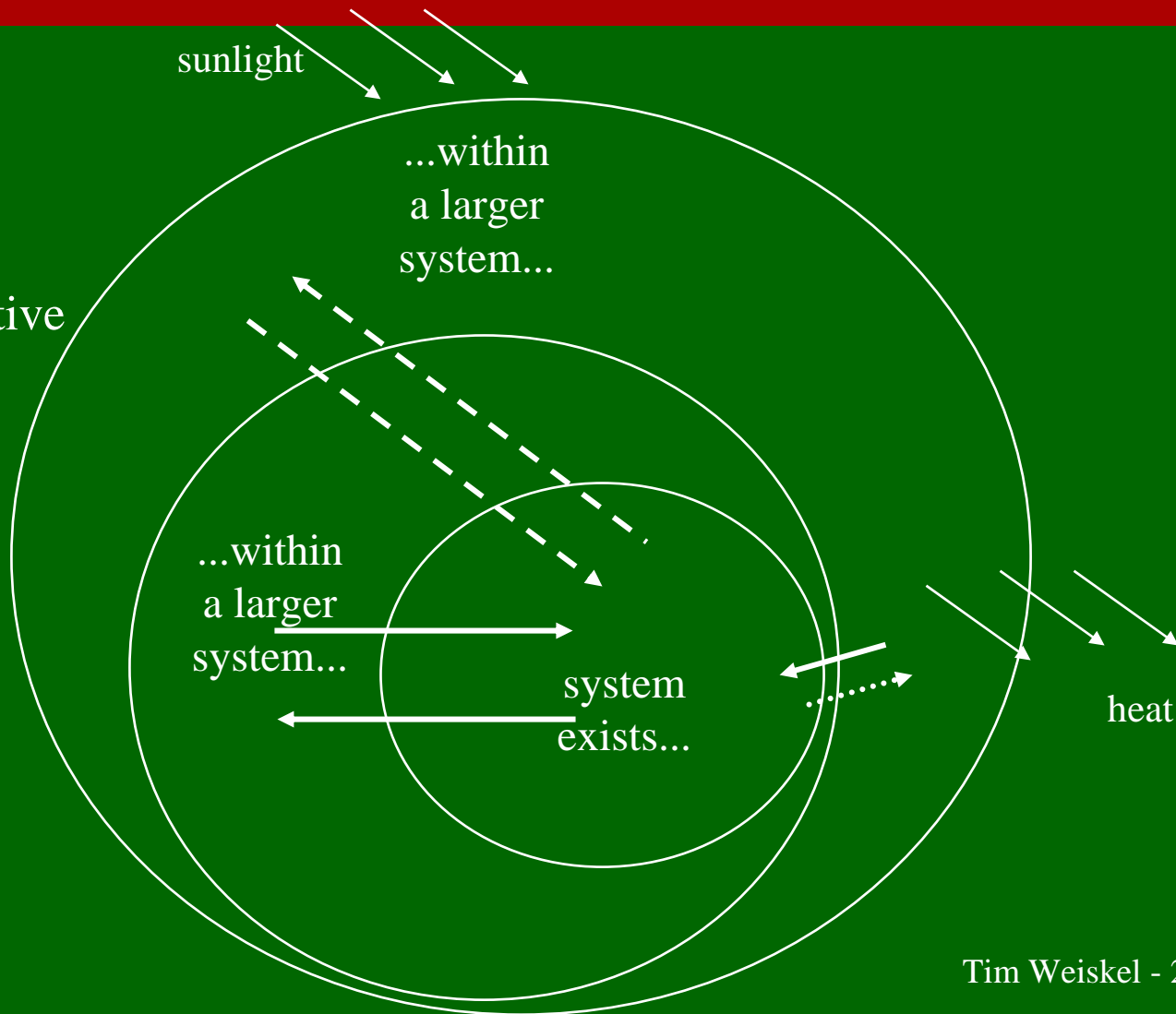


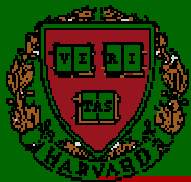
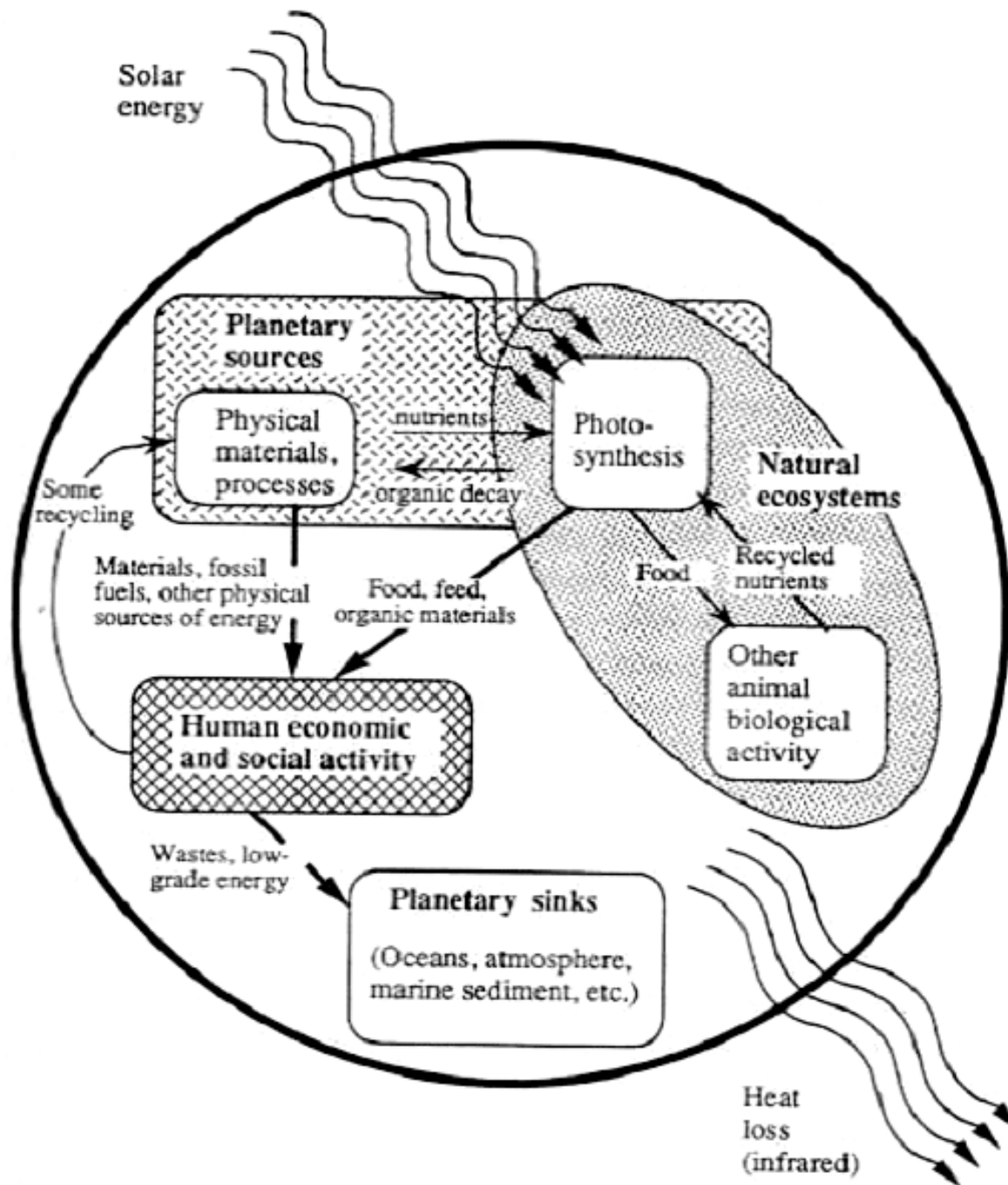
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Causality is:

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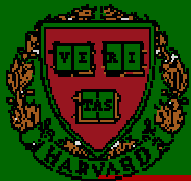
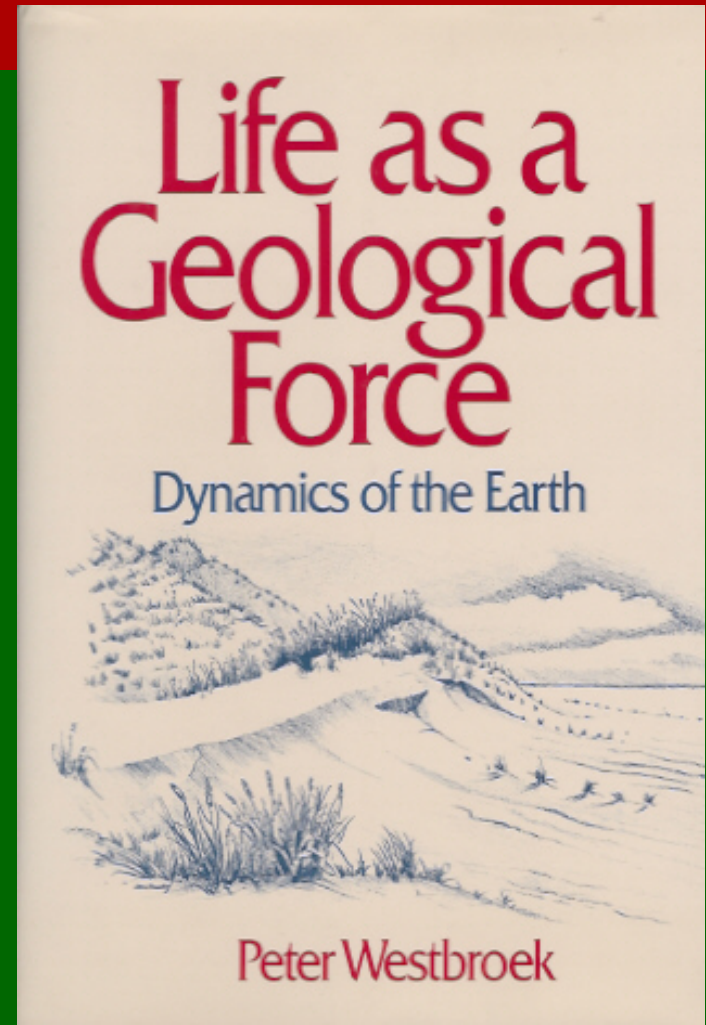
... in an overall system governed by the first and second laws of thermodynamics.





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So, with nested, reciprocal and cumulative causality, while larger systems seem to condition smaller systems within them, the reverse is also true.







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Tuesday, 1 October, 2002, 17:23 GMT 18:23 UK

## Land use 'alters climate'

News Front Page



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Before humans, it snowed in areas that change the climate

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**By Alex Kirby**

BBC News Online environment correspondent

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The way humans alter the surface of the Earth may be a key factor in climate change, scientists believe.

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They say land-use changes are probably just as important as greenhouse gas emissions.

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They think tropical land surface changes are probably a greater influence on climate than the seasonal El Nino weather disturbances in the Pacific.

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And they suggest a new formula for measuring all human-caused climate influences.

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The scientists, whose work was funded by the US space agency Nasa, published their findings in the Philosophical Transactions of London's Royal Society, the UK's national academy of sciences.

And we are learning that changes in behavior of some species can lead to changes in the larger systems of which they are a part...

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By **Alex Kirby**

BBC News Online environment correspondent

The way humans alter the surface of the Earth may be a key factor in climate change, scientists believe.

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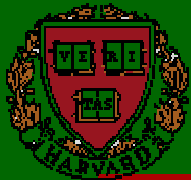
For example, the way landscapes change over time, may in turn change climate in some measurable ways.



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## Sometimes Humans behave as a “Geological Force”

Human behavior has been an increasingly important ‘geological force,’ altering land, water and air.



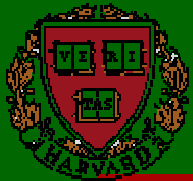
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## Sometimes Humans behave as a “Geological Force”

Human behavior has been an increasingly important ‘geological force,’ altering land, water and air.

**But all human activity operates *within the “laws of nature.”***

(On this issue, among others, some of our leadership seems to be sadly mis-informed.)

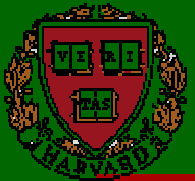


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# Laws of Thermodynamics Govern the Known Universe

## First Law:

Energy is neither created nor destroyed; it changes form from one form into another.



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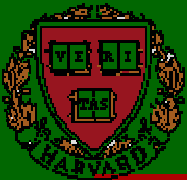
# Laws of Thermodynamics Govern the Known Universe

## First Law:

Energy is neither created nor destroyed; it changes form from one form into another.

## Second Law:

In spontaneous transformations, energy moves from more highly organized forms to less organized forms. That is, for example, from the high energy wave lengths of light to the dissipated long wave lengths of heat.



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# Laws of Thermodynamics Govern the Known Universe

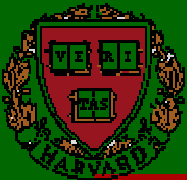
## First Law:

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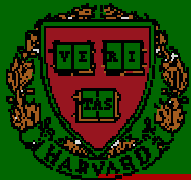
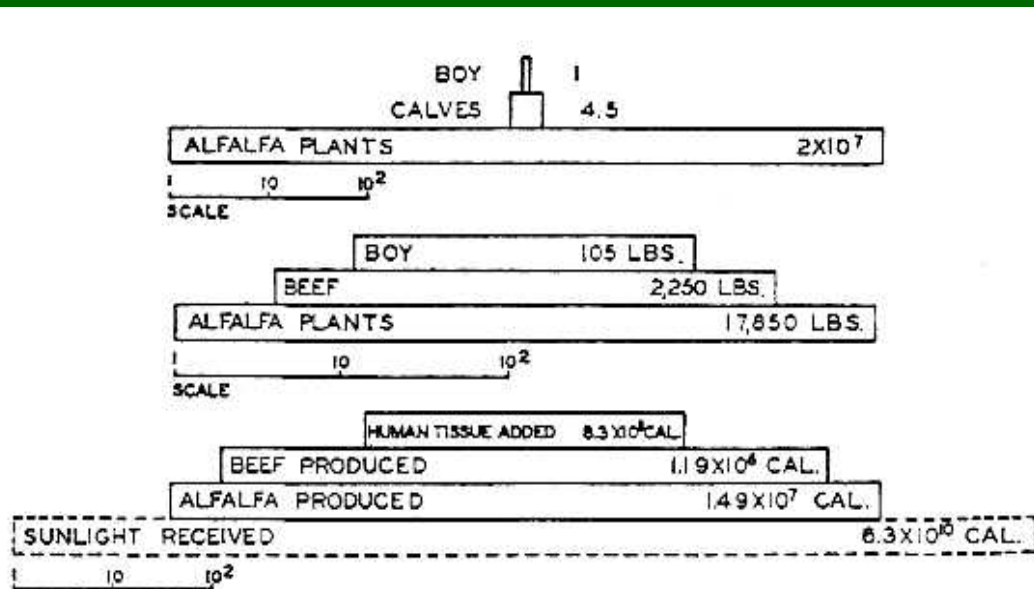
In spontaneous transformations, energy moves from more highly organized forms to less organized forms. That is, for example, from the high energy wave lengths of light to the dissipated long wave lengths of heat.

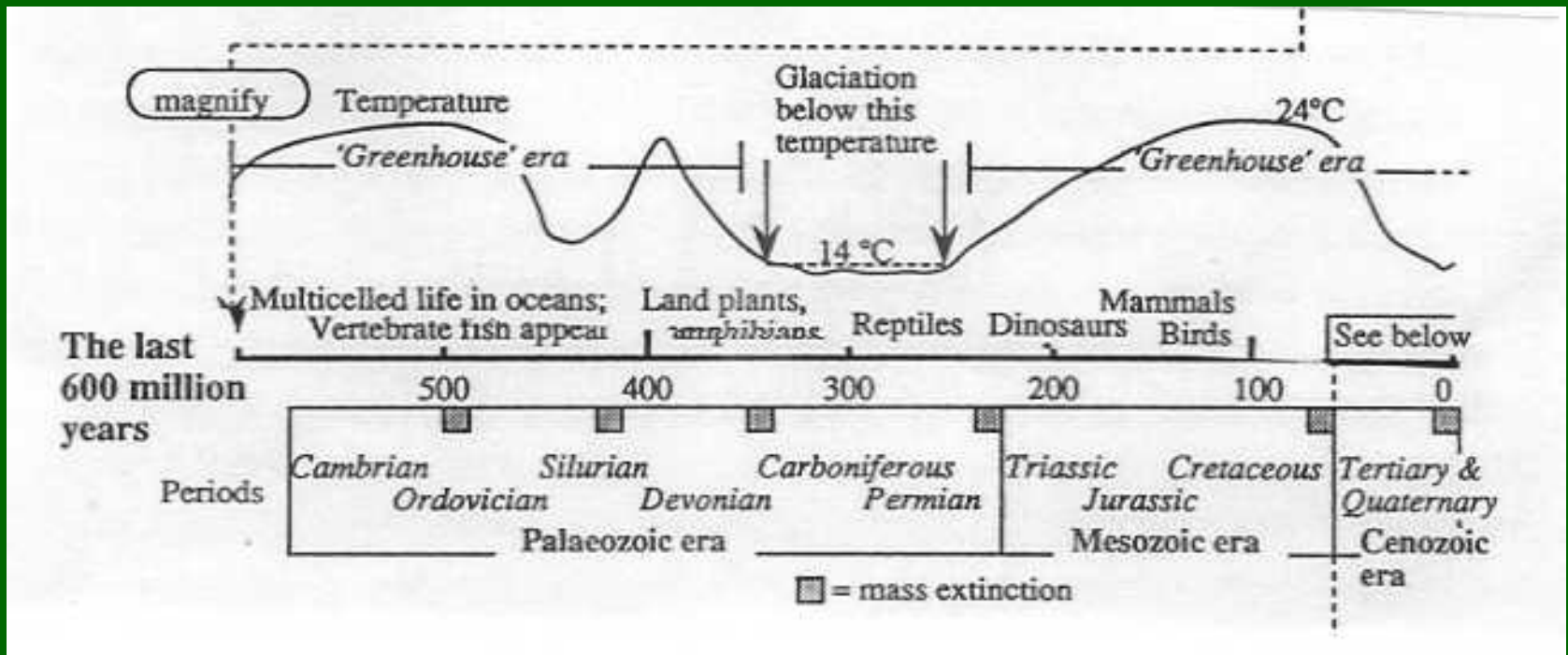
Thus, all “work” in the system requires the dissipative expenditure of energy. This is the “no free lunch principle” of the universe.

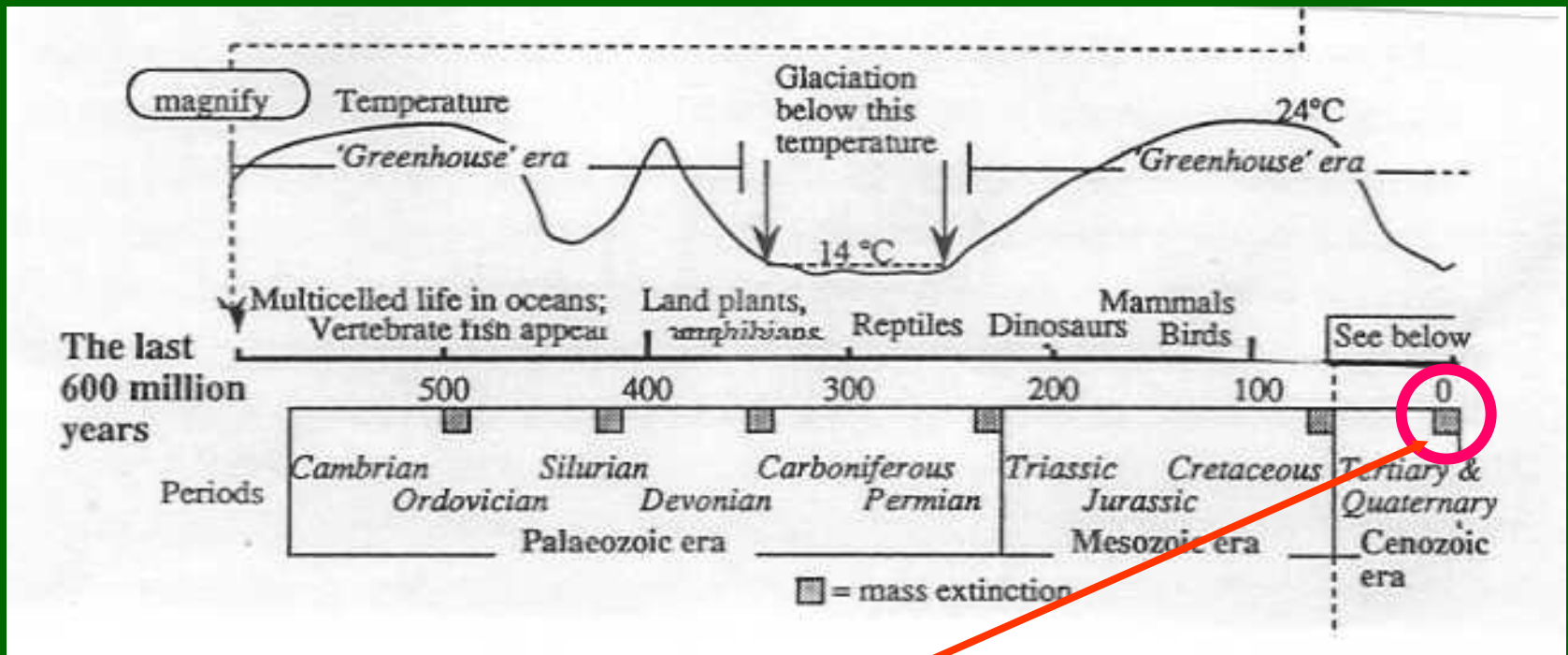


# Where are we located in this system?

Where are we located as individuals -- and *as a species* -- in the circulation of materials and the flow of energy? Where are we in the web of life on earth?



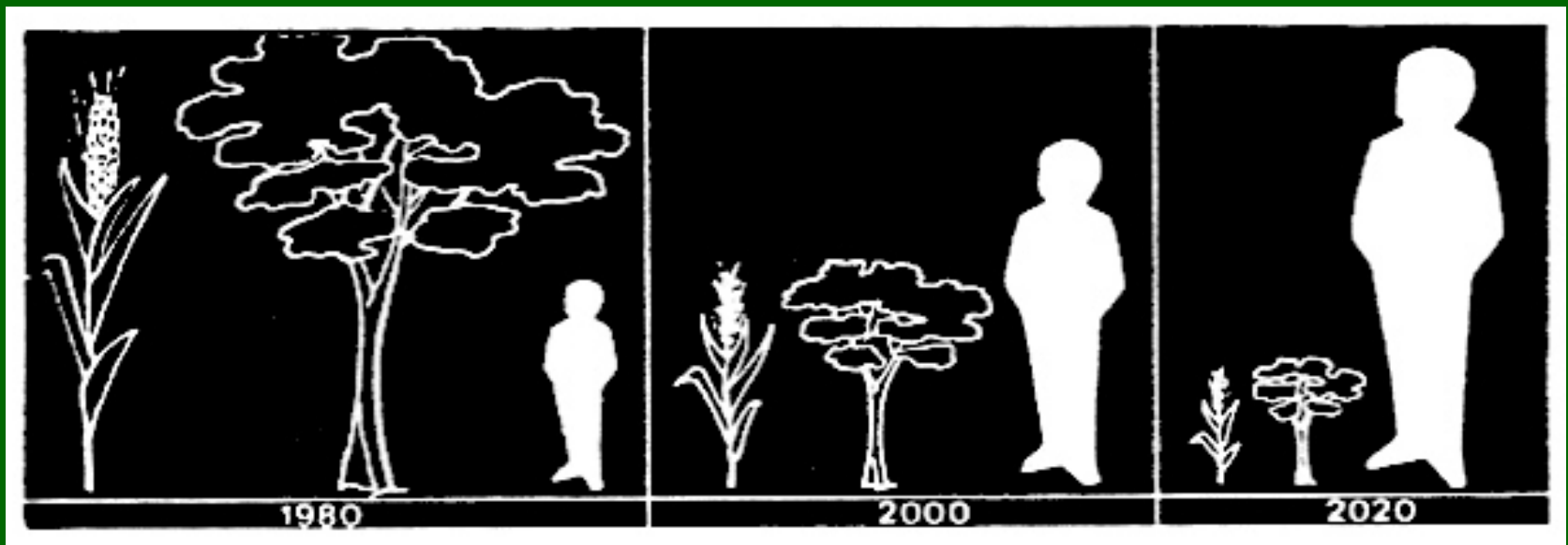




Sixth major mass extinction “episode” = now

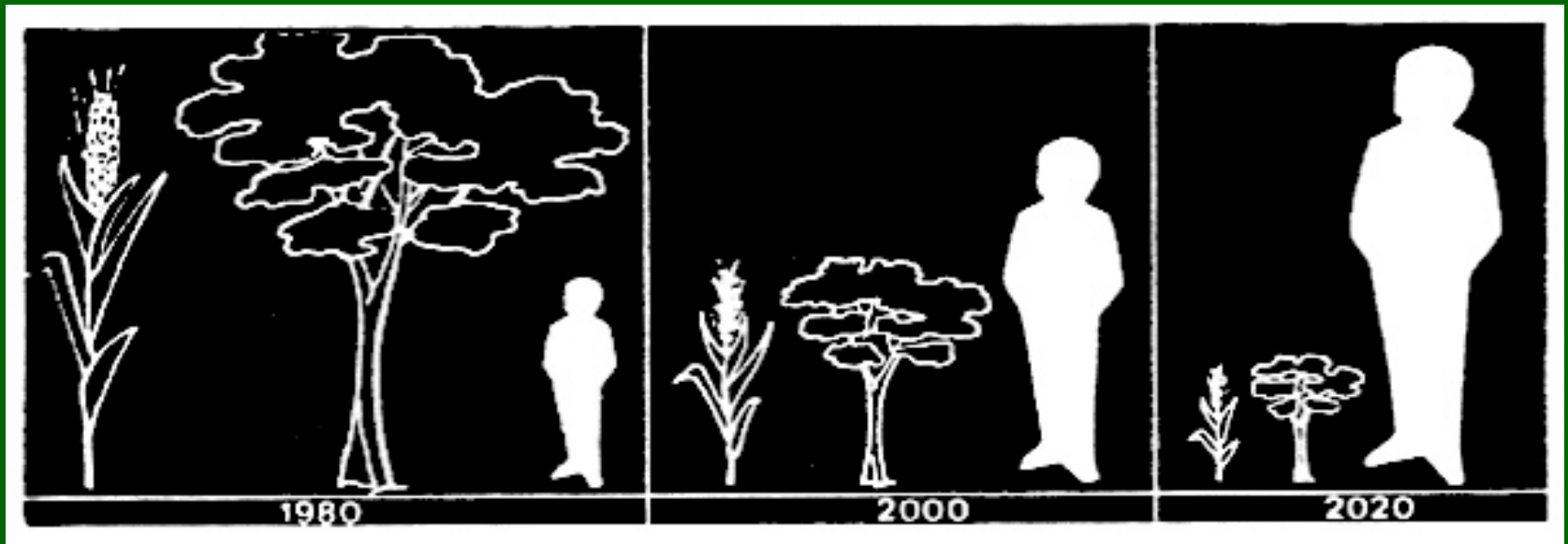






Schematic representation of species ratio transformations through time. *Note bene* the pace and magnitude of the transformations we have become accustomed to as “normal” are systemically quite abnormal and cannot persist much longer.





Remember, ... the trophic structure of  
the ecosystem is crucially important.  
Ratios matter.



Naturalists have been warning scientists for quite some time about the “biodiversity crisis.”

Richard Leakey  
and Roger Lewin

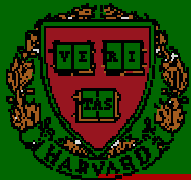


## the Sixth Extinction

PATTERNS OF LIFE AND THE  
FUTURE OF HUMANKIND

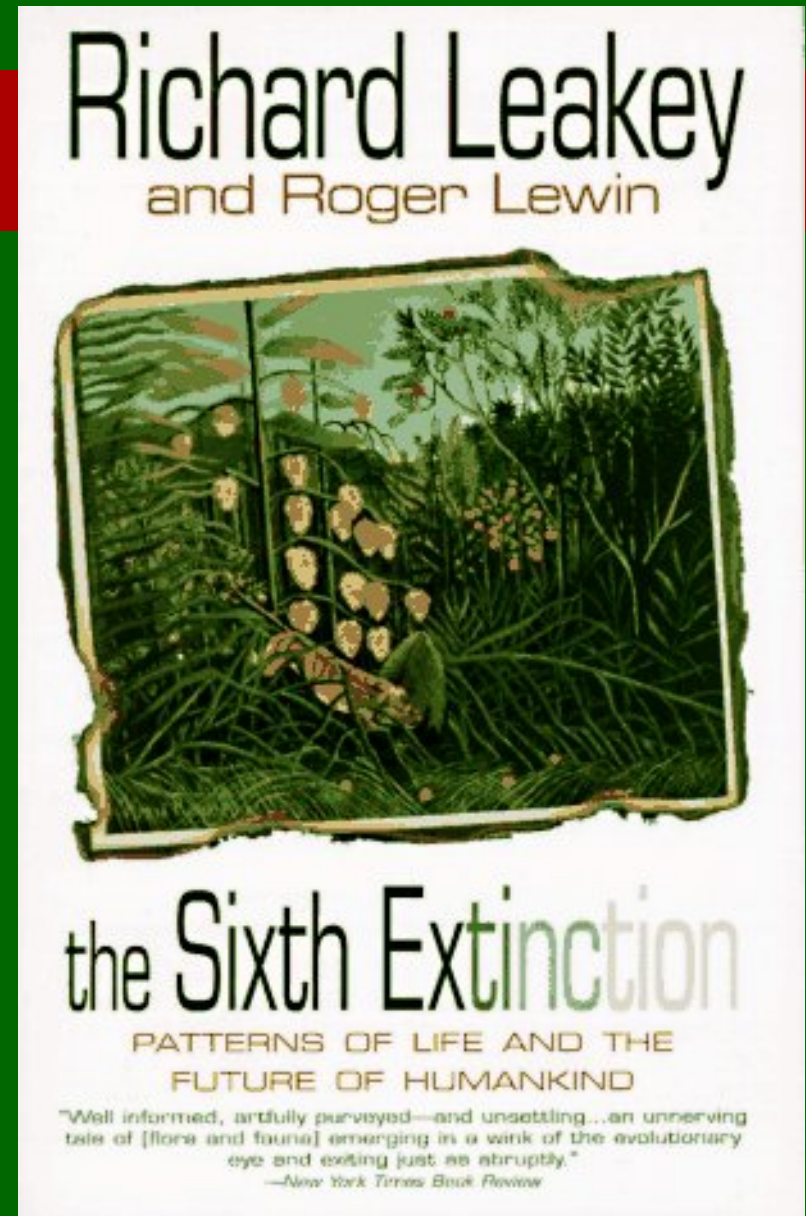
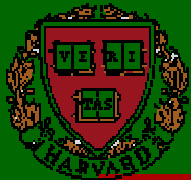
"Well informed, artfully portrayed—and unsettling...an unnerving tale of [flora and fauna] emerging in a wink of the evolutionary eye and exiting just as abruptly."

—*New York Times Book Review*



Naturalists have been warning scientists for quite some time about the “biodiversity crisis.”

The “loss,” destruction or displacement of biodiversity appears to be taking place on the scale of a “geological extinction event” – comparable in scope and scale to those witnessed before in Earth’s history.





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Last Updated: Wednesday, 5 October 2005, 23:03 GMT 00:03 UK

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## Animals 'hit by global warming'

By Tim Hirsch

Environment Correspondent, BBC News

**Climate change could lead to the extinction of many animals including migratory birds, says a report commissioned by the UK government.**

Melting ice, spreading deserts and the impact of warm seas on the sex of turtles are among threats identified.

The report is being launched at a meeting of EU nature conservation chiefs in Scotland.

It says that warming has already changed the migration routes of some birds and other animals



Habitat for seals is disappearing

### BBC NEWS:VIDEO AND AUDIO

See the polar bears and seals affected by the change

 [VIDEO](#)

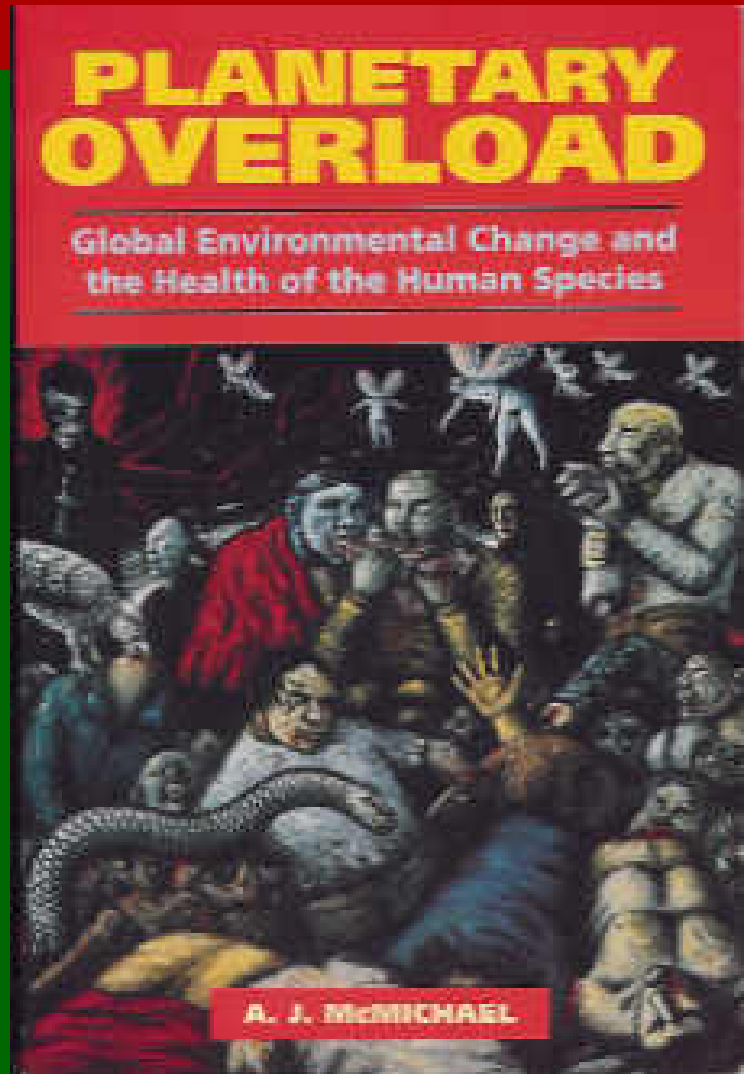
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We can begin to ask about “overload” questions, but answering these questions will inevitably raise further questions of ratios.



**Georg Borgstrom**

\$2.95

author of *The Hungry Planet*

An international food science authority spells out the stark realities facing man if we continue to push our earth to its biological limits.

# TOO MANY

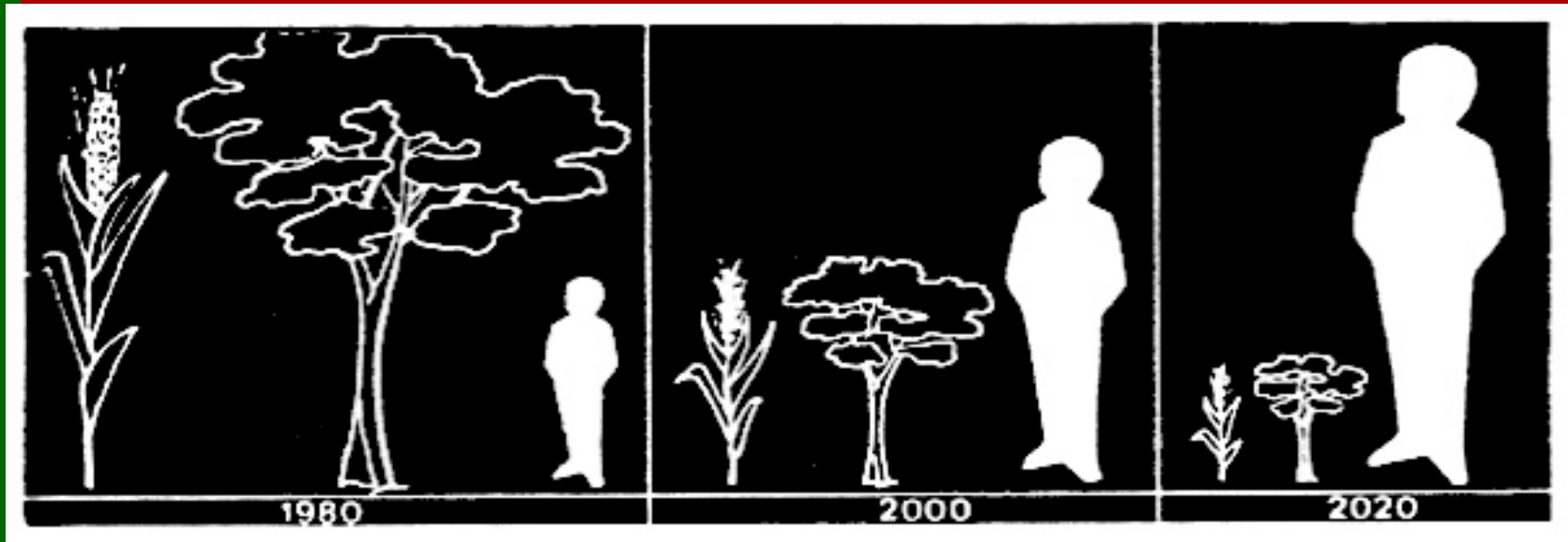
AN ECOLOGICAL OVERVIEW OF EARTH'S LIMITATIONS

"Level-headed, factual and scary . . . not a book for those who would remain complacent."  
—*Los Angeles Times*

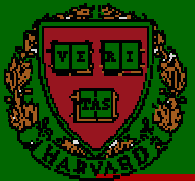


Some have already argued that there are too many humans currently alive and about to live for the planet to sustain them.





The international scientific community has been convened to address this question. And they have issued the *Millennium Ecosystem Assessment Report* (March 2005).







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<http://courses.dce.harvard.edu/~envr120>

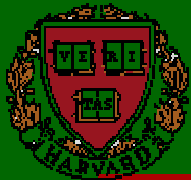
[Timothy C. Weiskel](#)

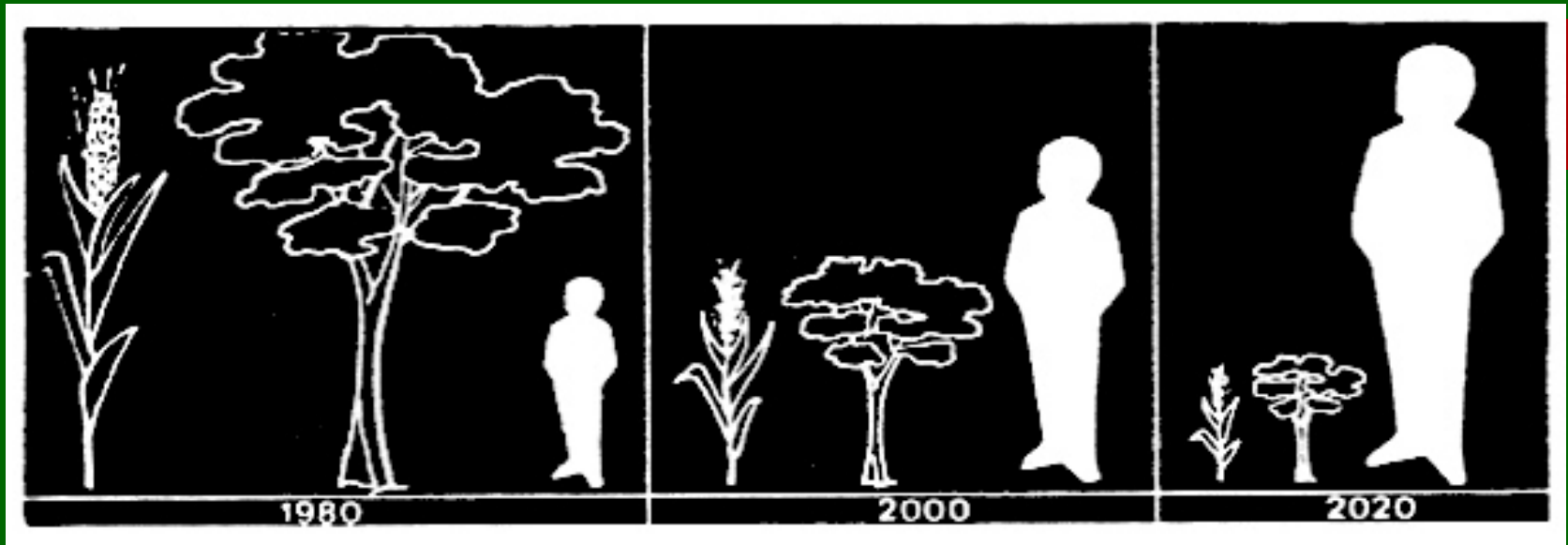
[TWeiskel@FAS.Harvard.Edu](mailto:TWeiskel@FAS.Harvard.Edu)

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David Malakoff, "Report Urges Action Against Ecosystem Damage," *NPR - Morning Edition*, (30 March 2005).

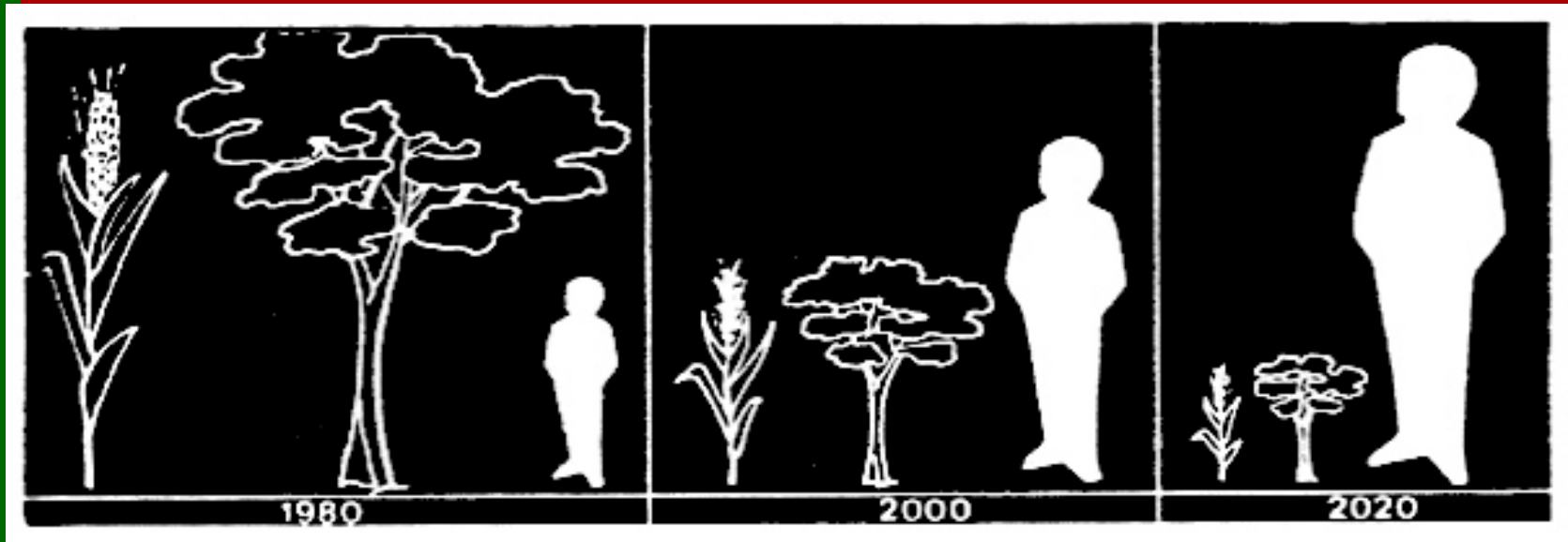




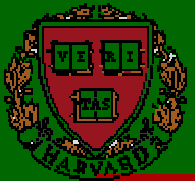
Part of the problem comes from transforming the ratios between the “wild” species (forest tree), the “cultivated species” (stalk of wheat) and ourselves.

This 1995 UN Ecosystem Assessment Report is the largest and loudest warning signal from the environmental scientists ever.





To understand these questions we need to address the concept “**niche**” in an ecosystem.



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•  
• Environmental Ethics and Land Management  
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ENVR E-120

<http://courses.dce.harvard.edu/~envre120>

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# Elements of Ethical Reasoning

Timothy C. Weiskel

Session 3 – Part 2  
5 October 2006

Harvard University Extension School  
Fall Semester 2006



Well, we each have our “niche” in life’s matrix (whether we know it or not)...

How do you define *your* “niche?”

How can we define it more generally in ecosystemic terms?



*“That niche used to be the cigarette-machine niche, then it was the water-cooler niche, and now it’s Mr. Pendleton’s niche”*

(Booth)

Tim Weiskel - 53



One way to describe a “niche” is to define it as a “position” in a food chain (or more precisely) a resource web.

## Life's not so complicated web

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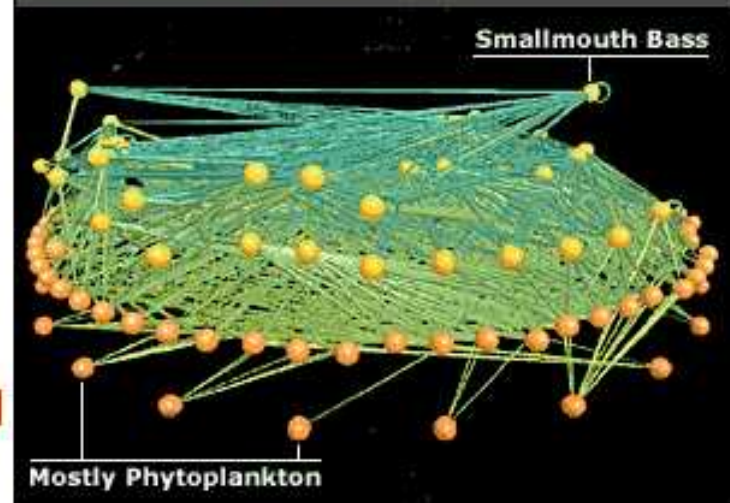
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### FOOD: HOW THE WEB WORKS



Working at Little Rock Lake in Wisconsin, researchers tracked the connections in the food web - predators like the smallmouth bass at the top and tiny free-floating plants (phytoplankton) at the bottom

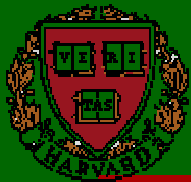
### By Arran Frood

It is easy to claim that everything is connected to everything else, but a hard proposition to test scientifically.

Now research by ecologists studying food webs has shown this may after all be the case.

They found species are much more closely linked to each other than previously thought.

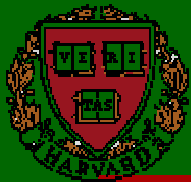
“**People should not be so confident that they can predict the consequences of species extinctions**”





One way to describe a “niche” is to define it as a “position” in a food chain (or more precisely) a resource web.

Or a “stage” in the flow of energy through biomatter.



## Life's not so complicated web

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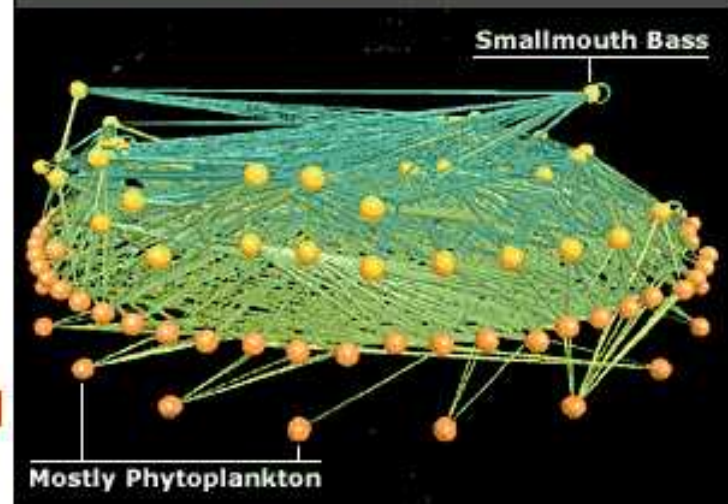
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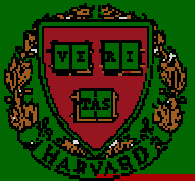
Now research by ecologists studying food webs has shown this may after all be the case.

They found species are much more closely linked to each other than previously thought.

“**People should not be so confident that they can predict the consequences of species extinctions**”

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- A more accurate way to define a niche is to say...

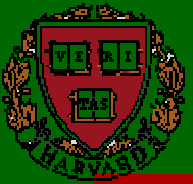
A Niche is an “N-dimensional hypervolume”





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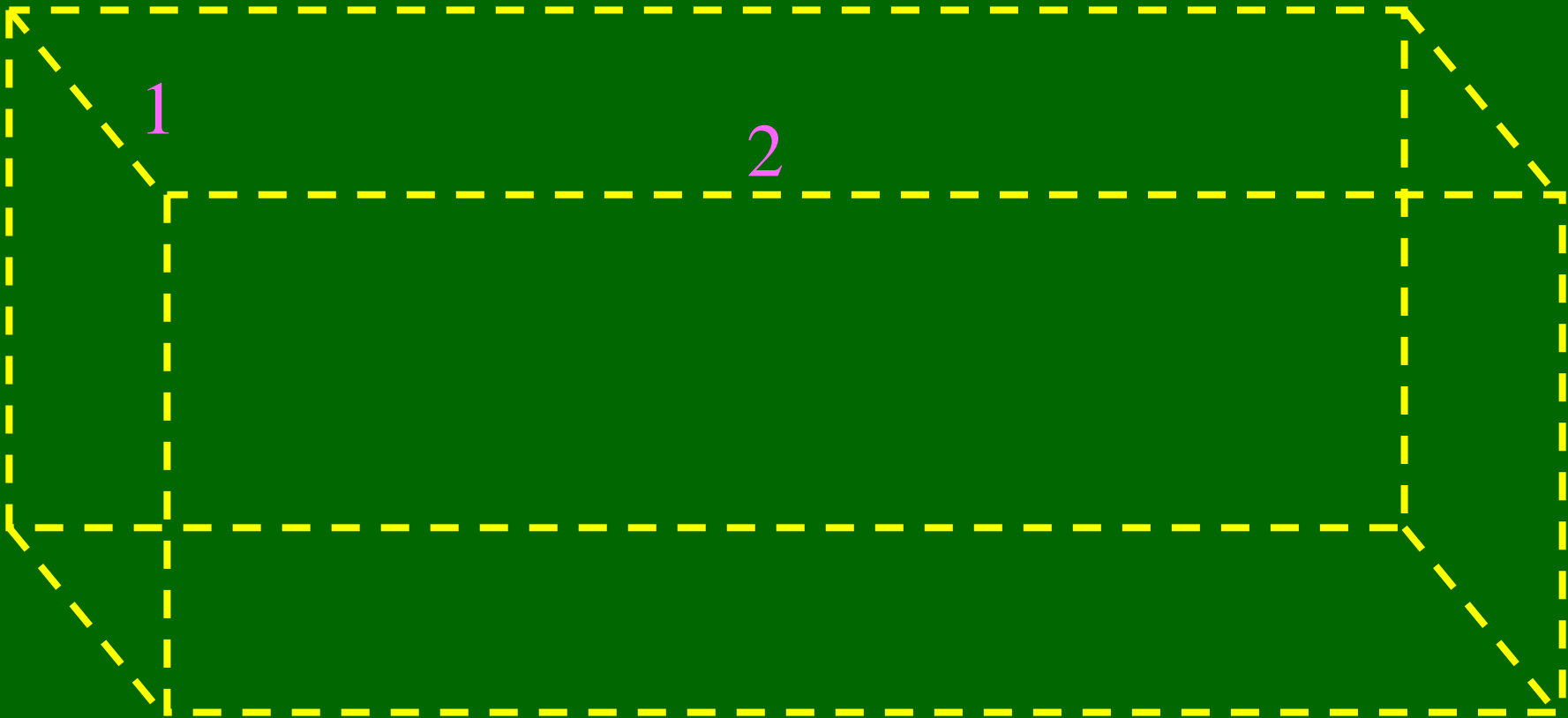
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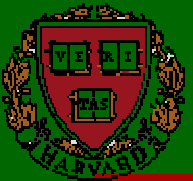
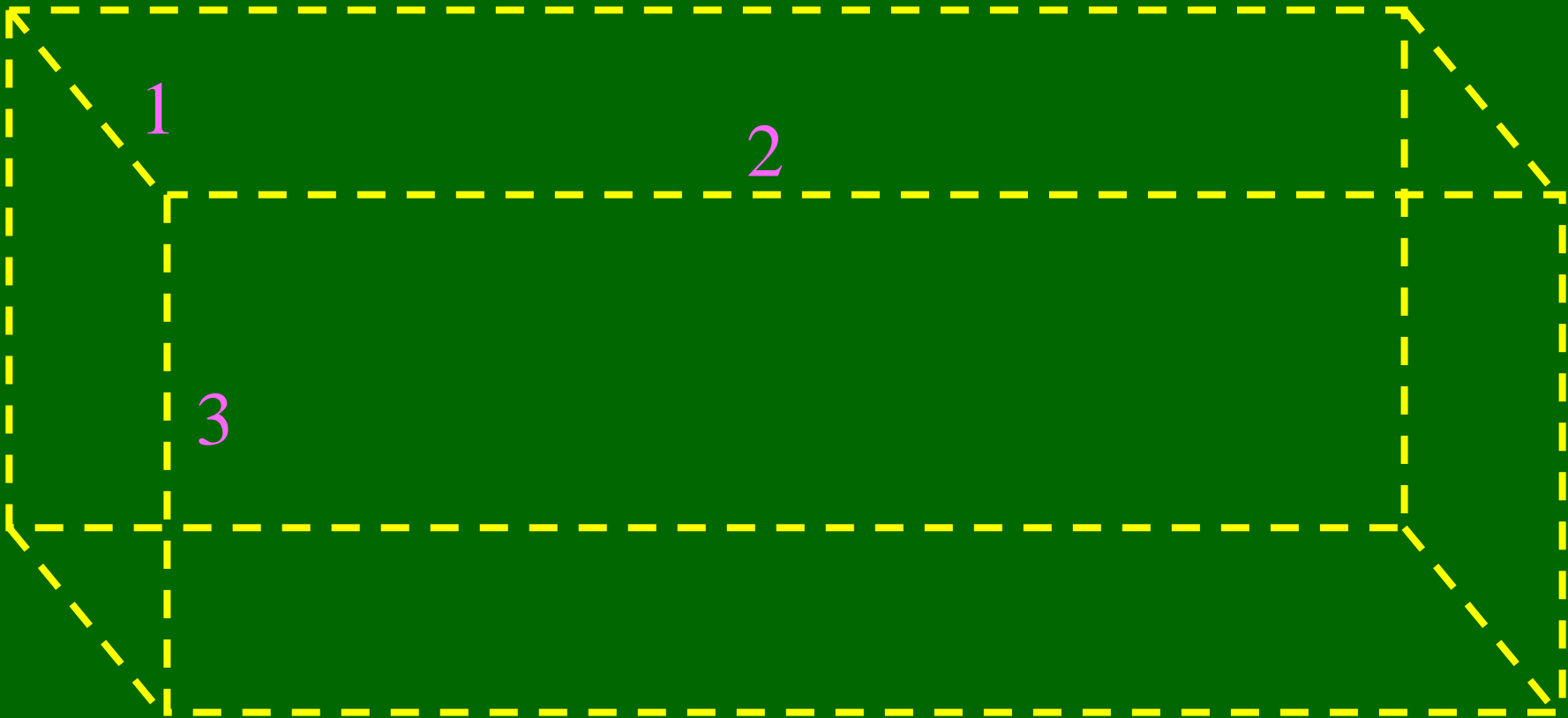
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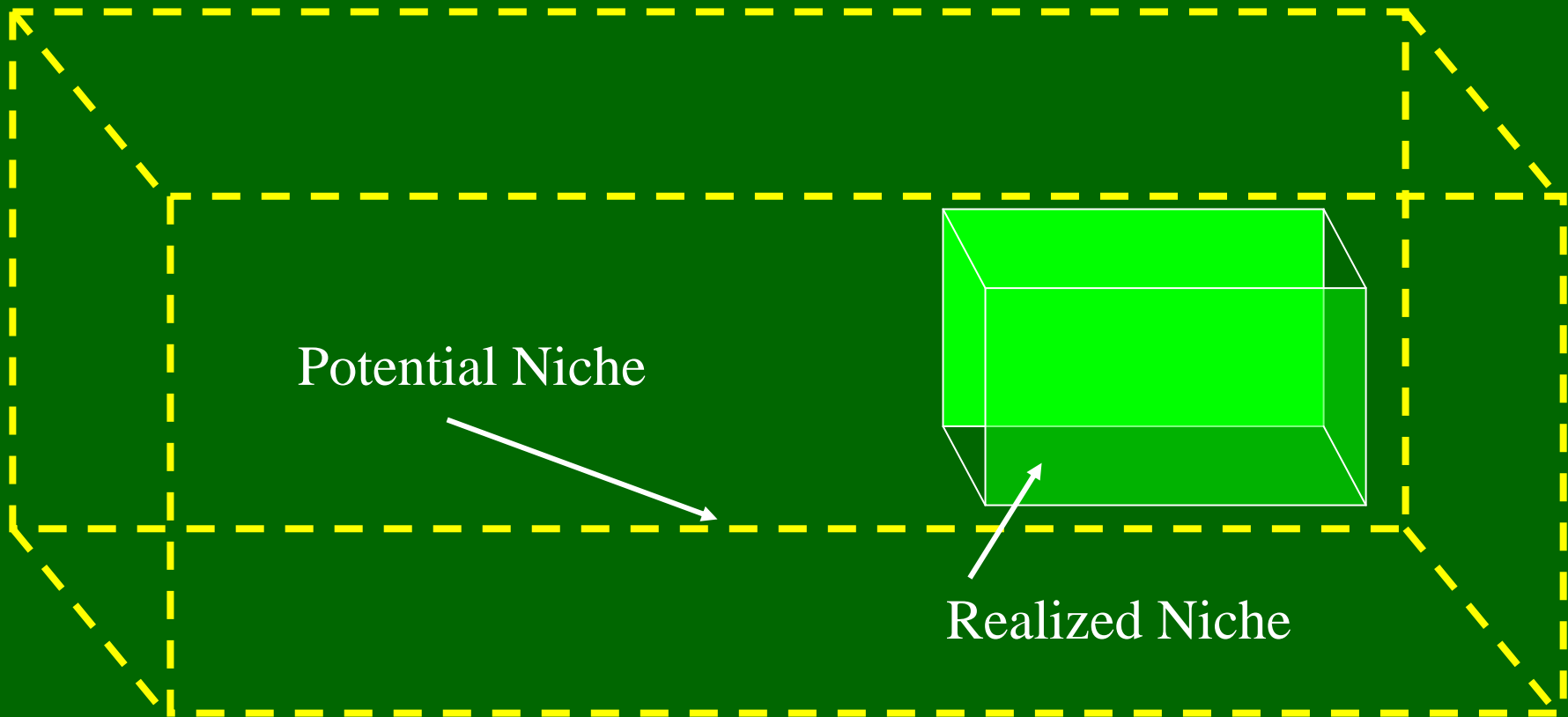


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A Niche is an “N-dimensional hypervolume”

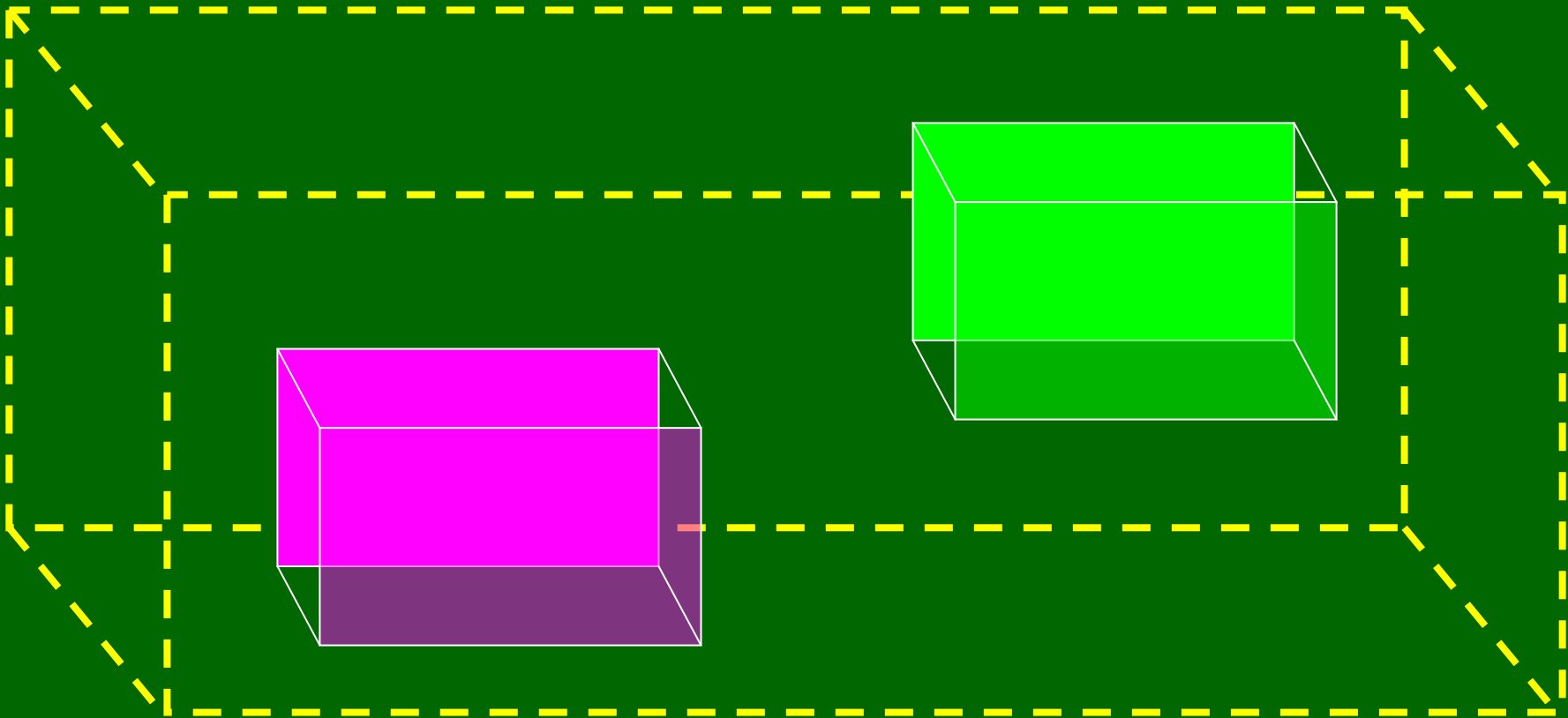


All species have a *potential* niche and *realized* niche

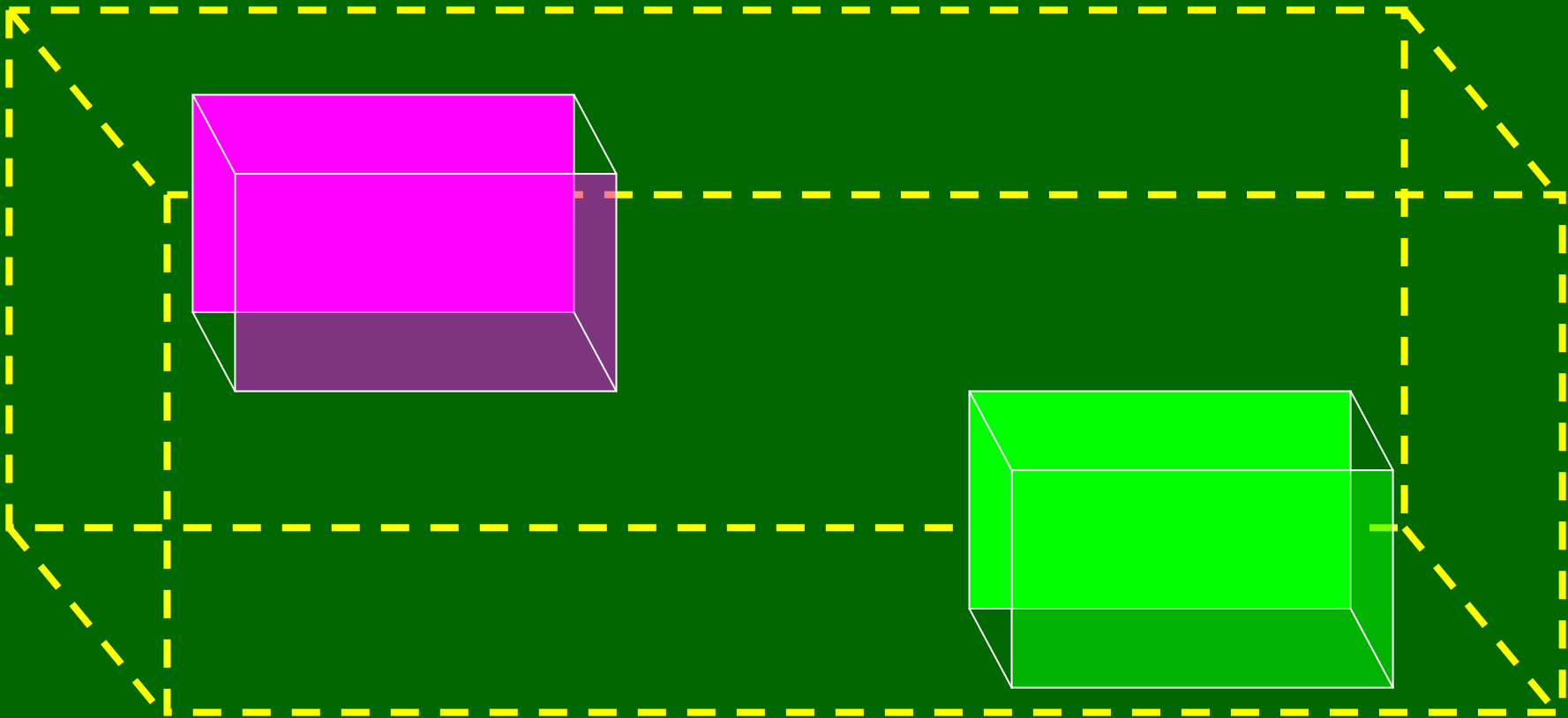


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Other species can find their realized niche in our  
“potential niche” but not share our “realized niche”

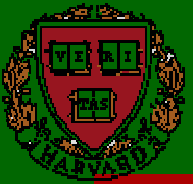
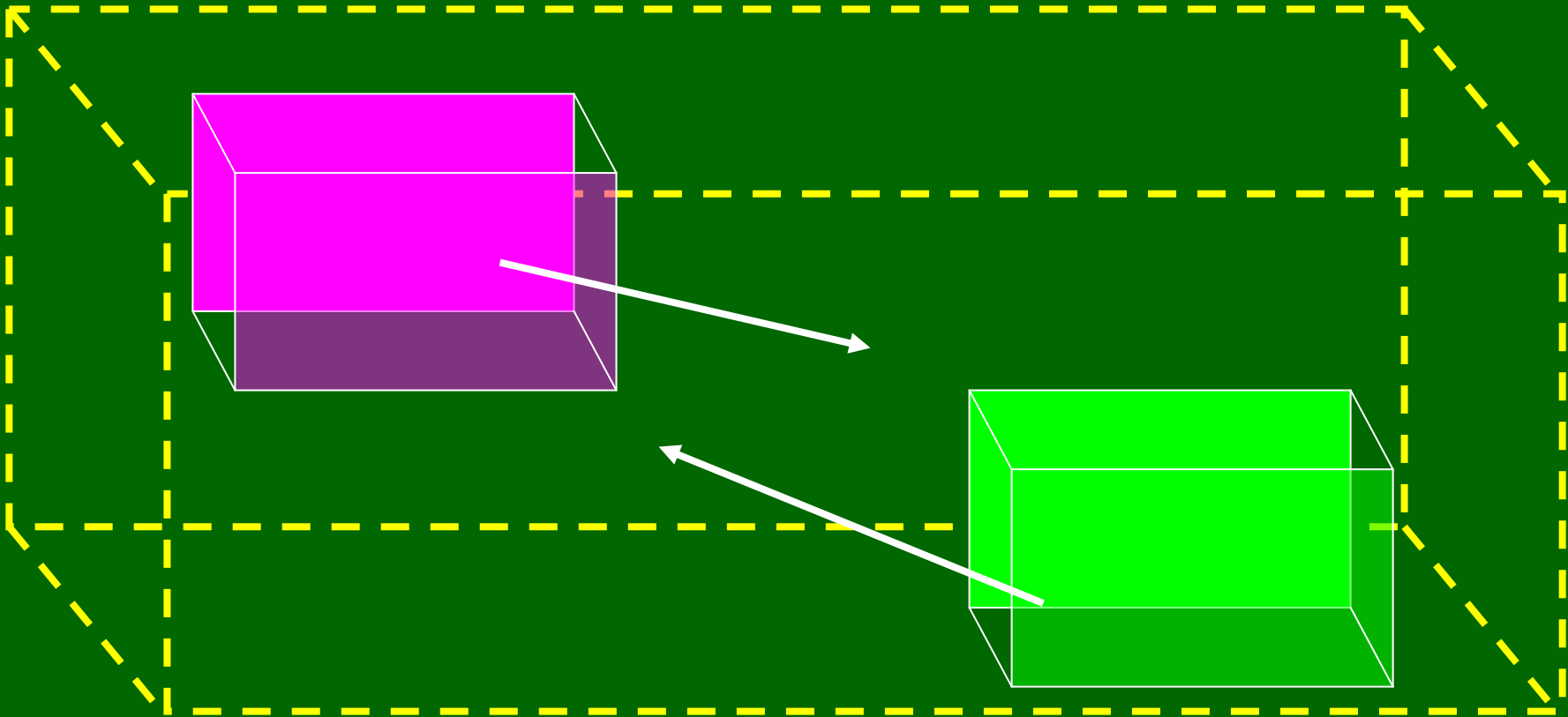


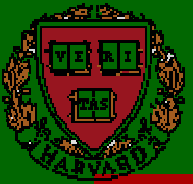
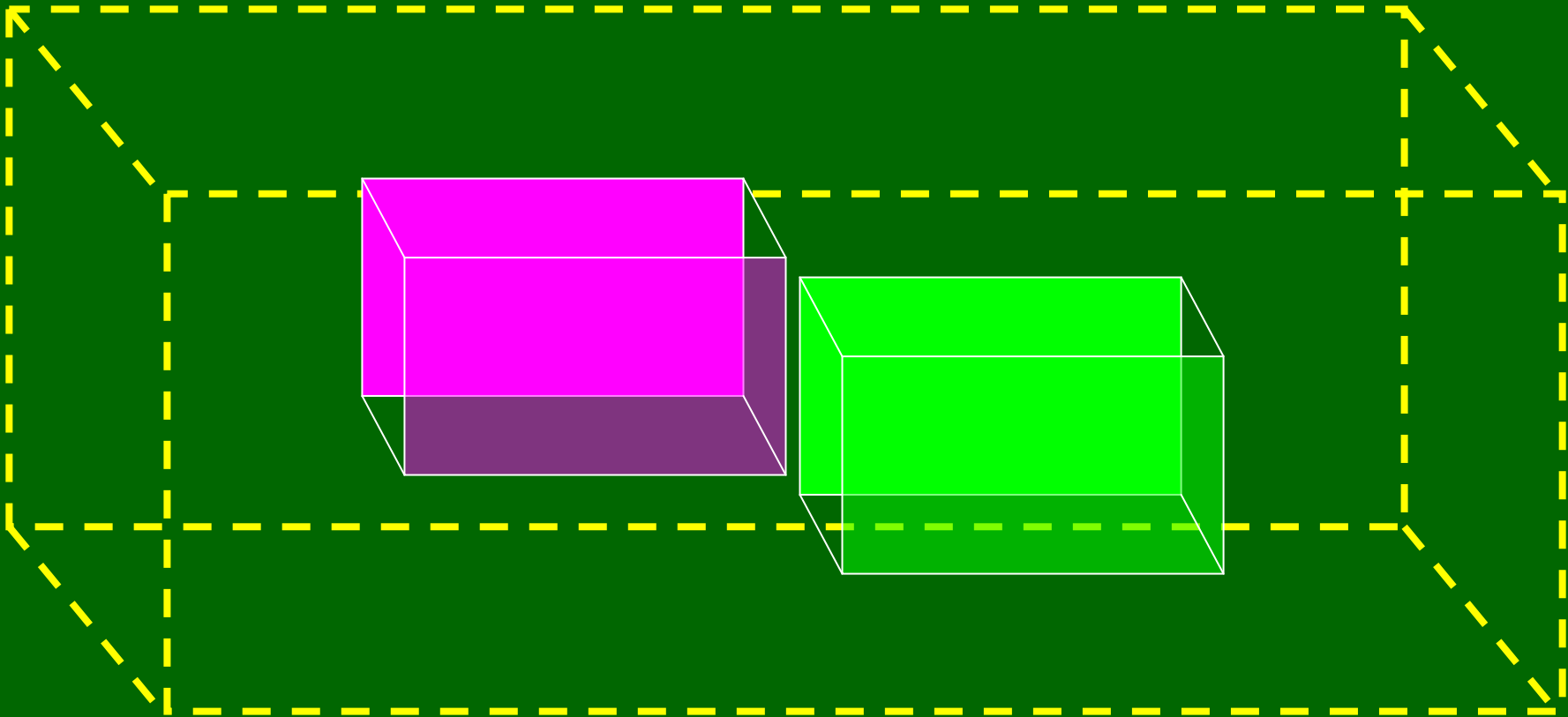
A species realized niche can change over time



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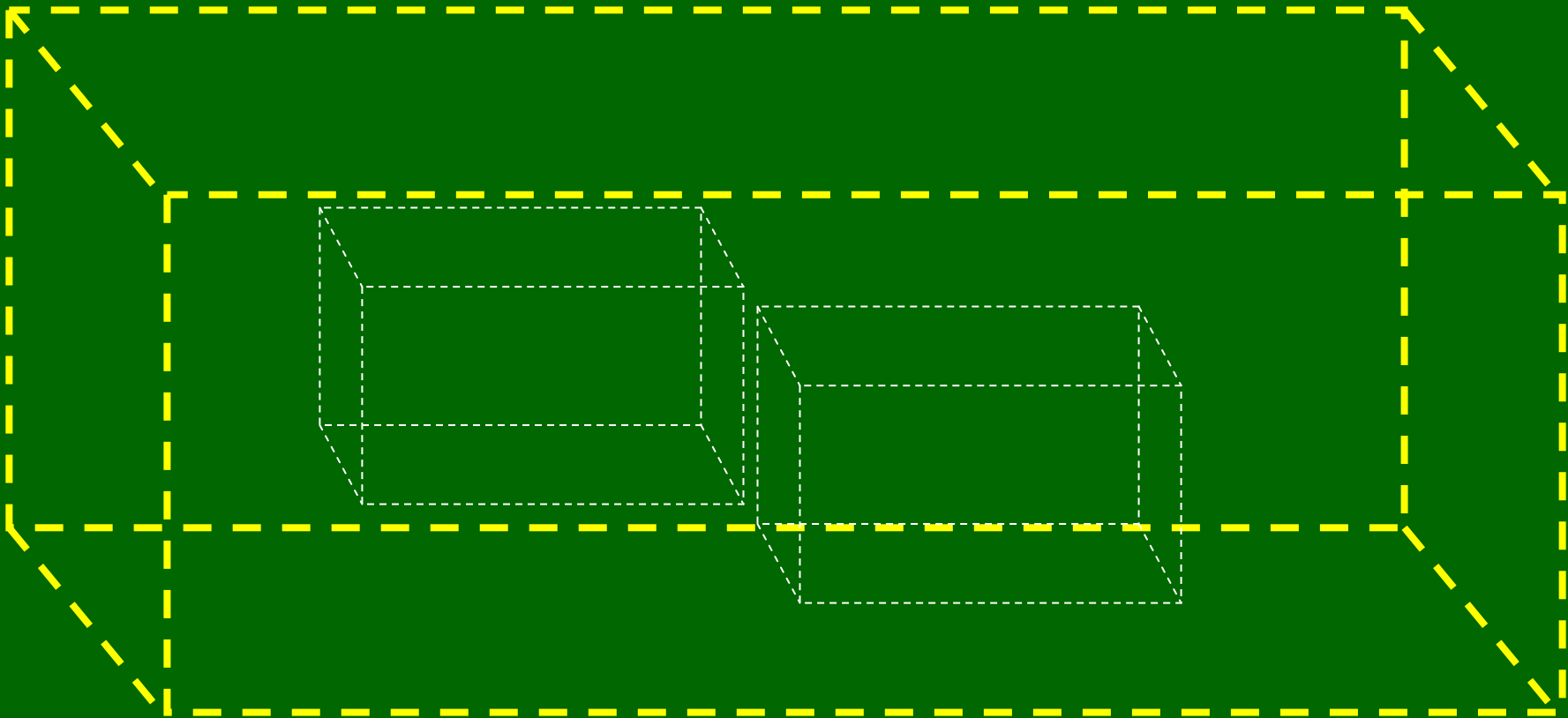
# What happens when realized niches converge?





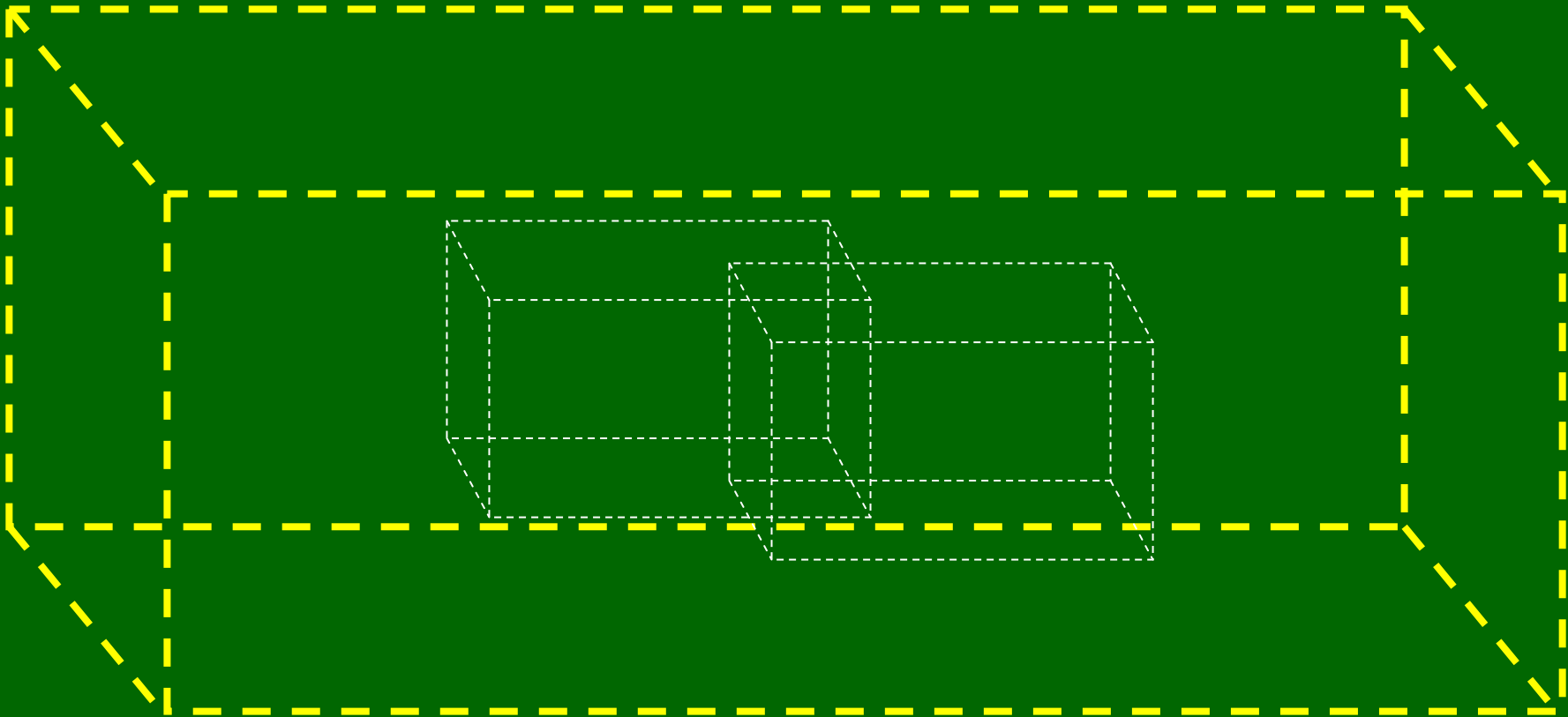


Remember, niches abstractions  
(reflecting real behavior)



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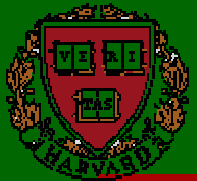
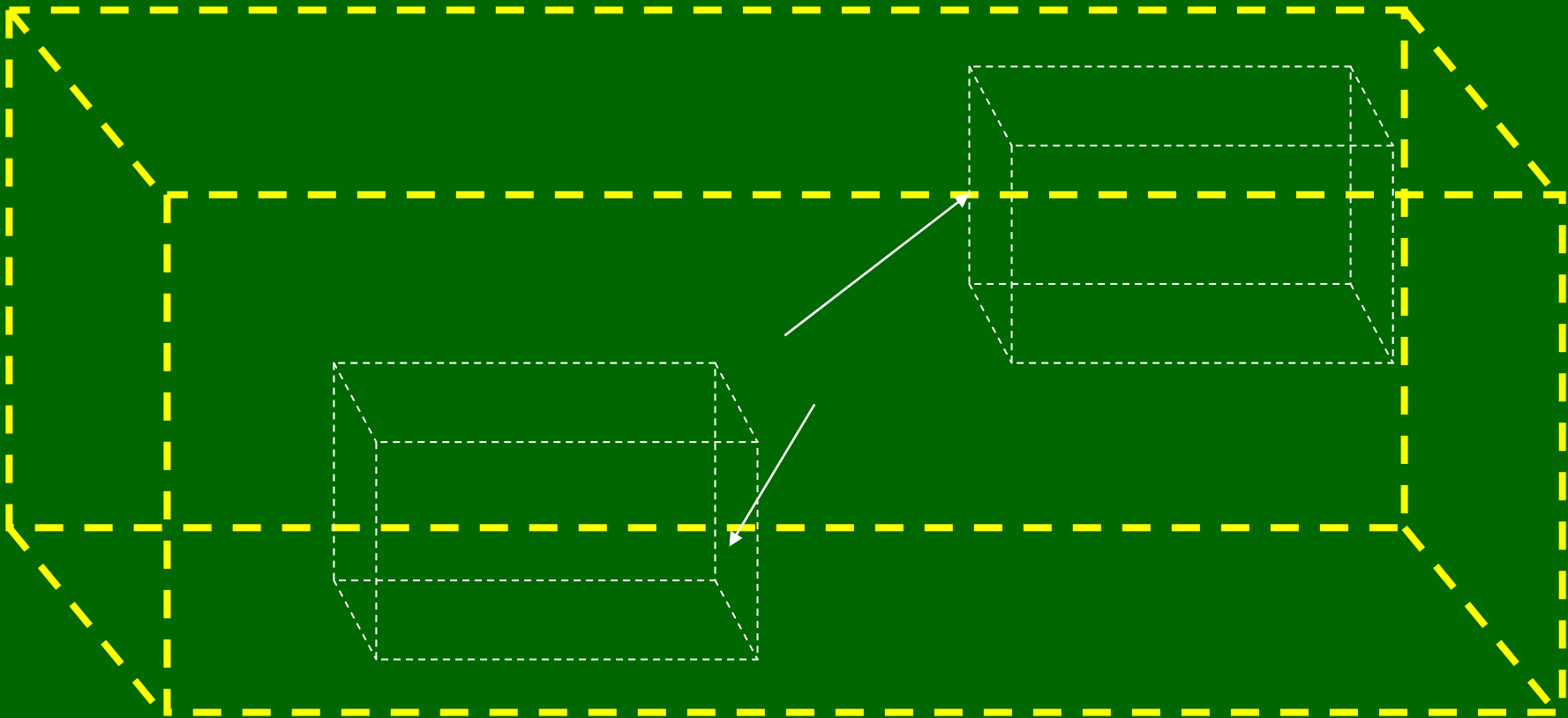
Niches can be “shared,” leading to commensualism or symbiosis.



Symbiosis, mutualism

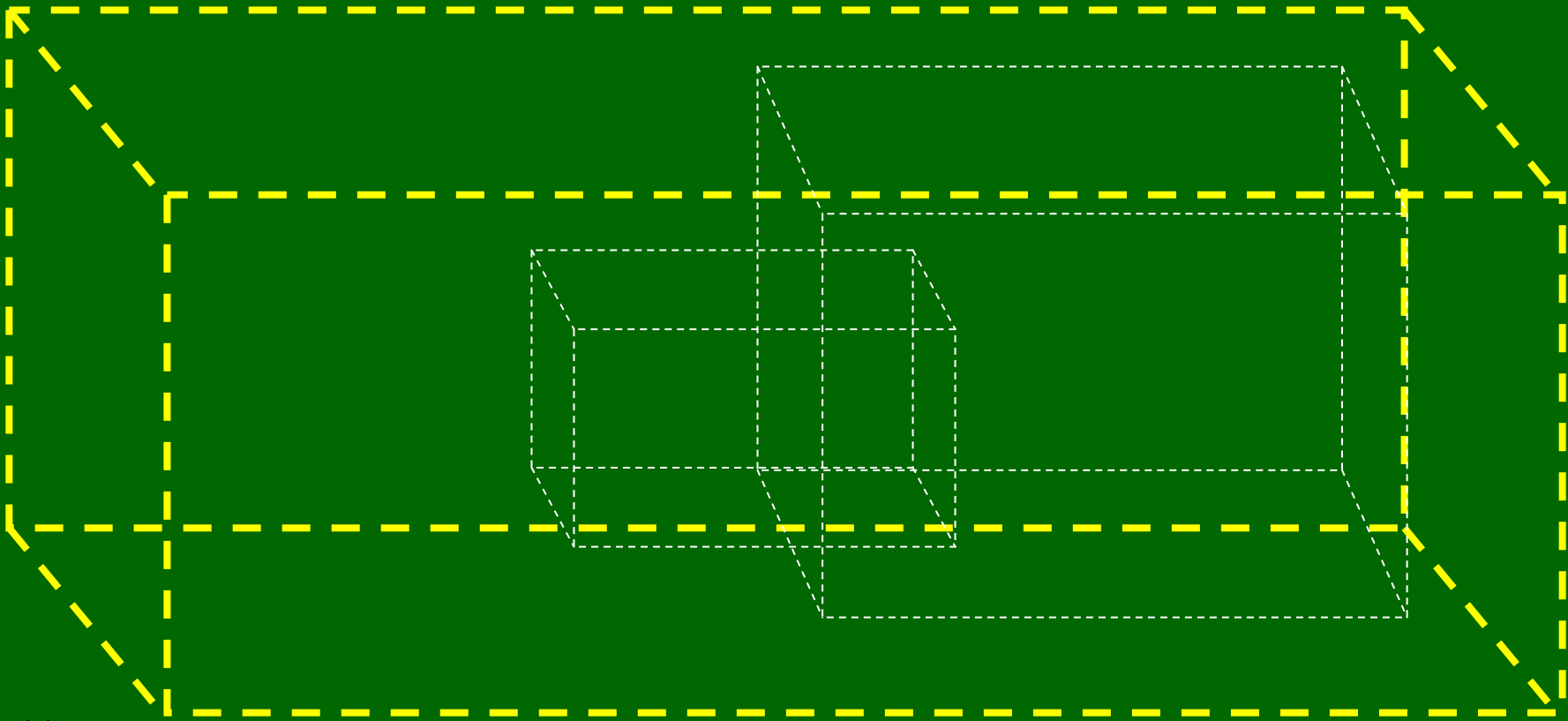
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But species can also “move” to a different portion of their potential niche.

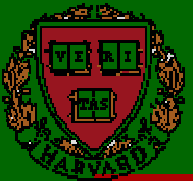


Antibiosis, avoidance, antipathy

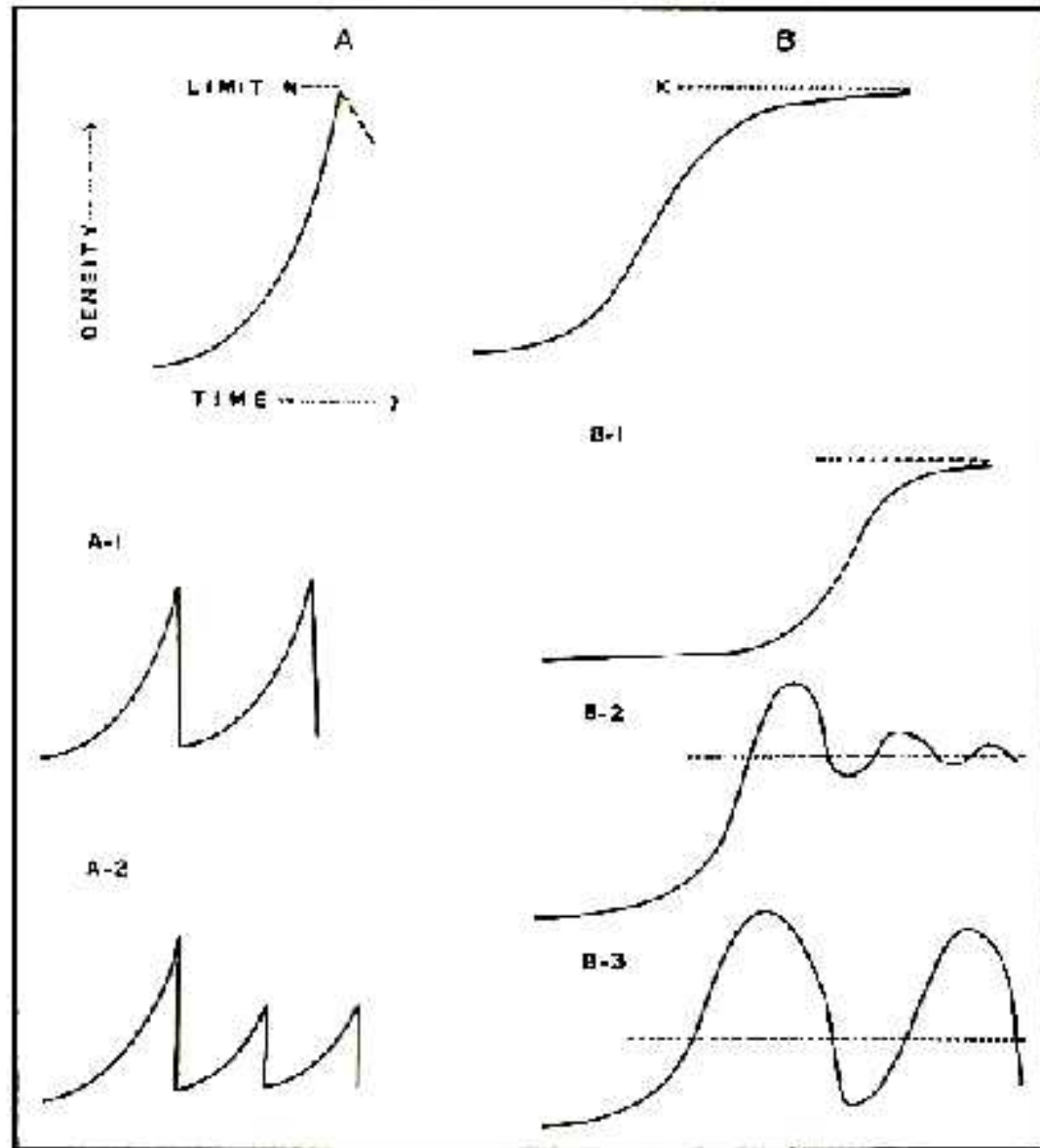
In addition, the “shape” of the realized niche can change because of the new relationship with another species.



parasitism  $\implies$  predation  $\implies$  annihilation



Patterns of population variation in biological species.



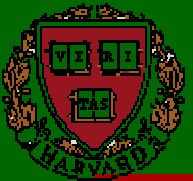
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## How have human beings grown over time?

What have been the patterns of human growth in  
evolutionary time?

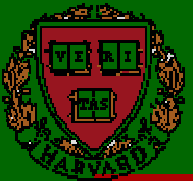
How do we find out?

We look for traces of human activity....starting with  
the non-random (or patterned) arrangements of  
enduring objects like stones....



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Anthropologists examine the regular patterns of life processes and the “improbable” traces they leave behind.





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Anthropologists examine the regular patterns of life processes and the “improbable” traces they leave behind.

If something appears improbable, we seek an explanation.





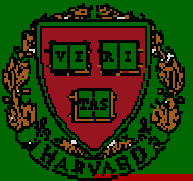
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Anthropologists  
examine the  
regular patterns  
of life processes  
and the  
“improbable”  
traces they leave  
behind.

If something  
appears  
improbable, we  
seek an  
explanation.



Some explanations do not involve  
humans...

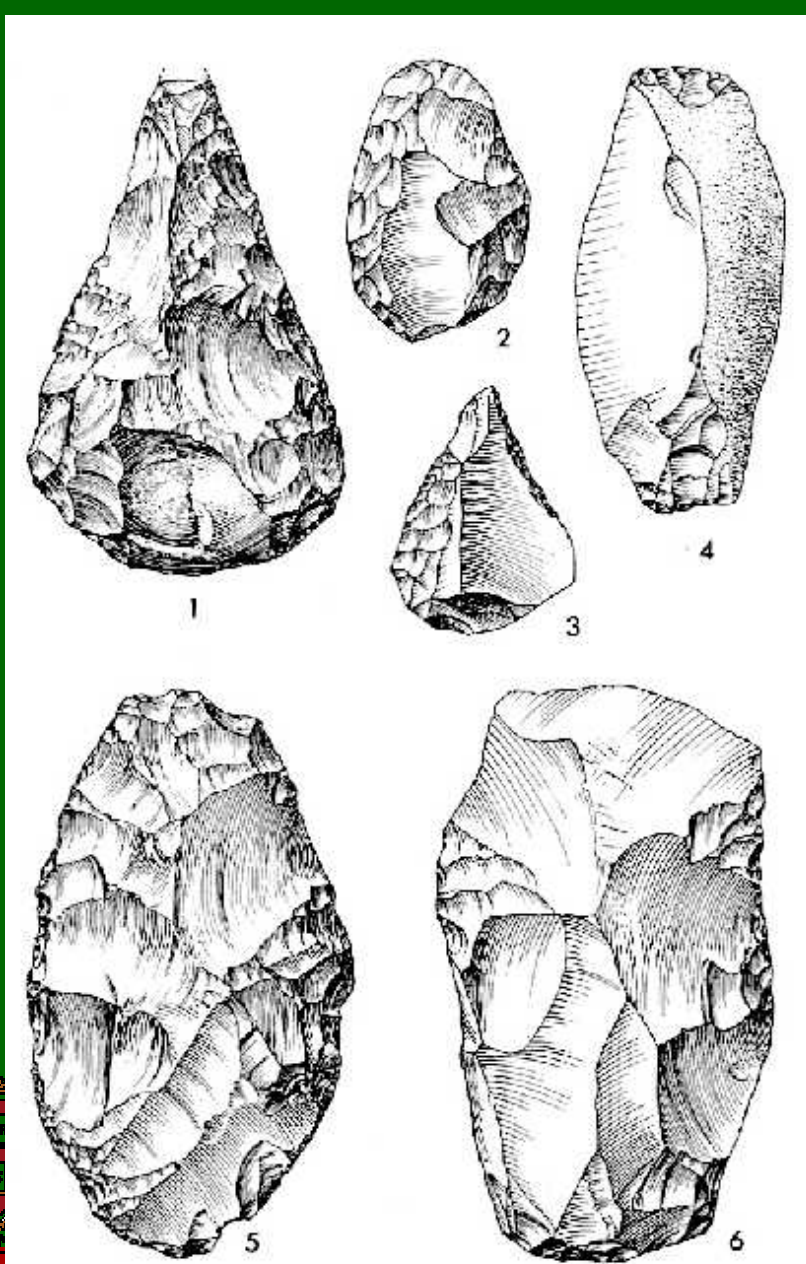




But on examination, other kinds of improbable  
“rocks” seem to involve humans.



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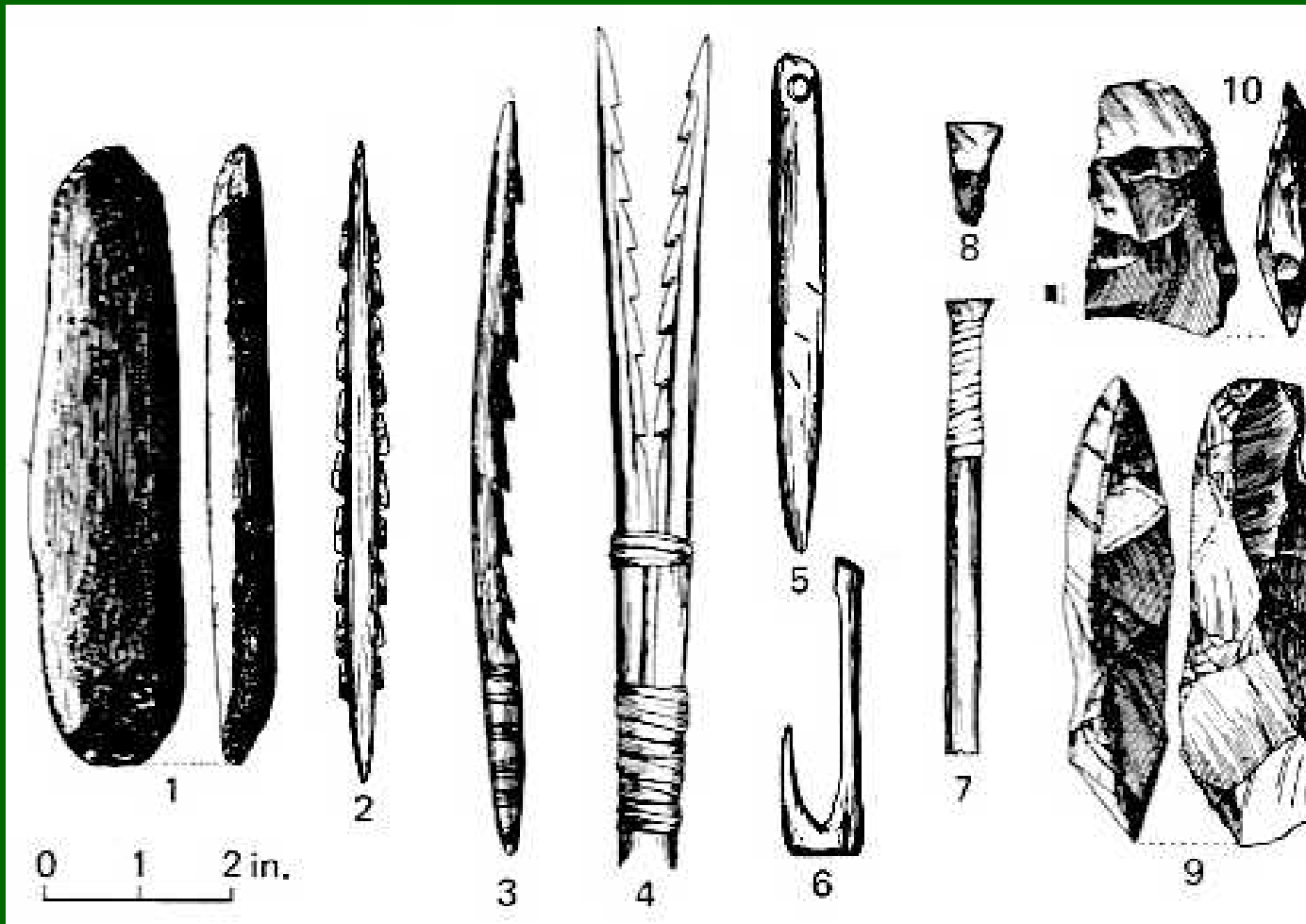
But other improbable patterns can only be explained by human agency.

If we look carefully at what seems to be piles of rocks in many parts of the world we will find non-random, patterned rocks, whose existence is improbable and therefore prompts us to seek an explanation.

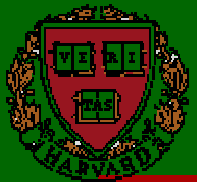


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Over time, there are marked changes in the types of “tool kits” that humans use, and these point to different forms of behavior and social organization.





Last Updated: Thursday, 5 October 2006, 12:05 GMT 13:05 UK

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## Early humans followed the coast

By Paul Rincon

Science reporter, BBC News

**Learning how to live off the sea may have played a key role in the expansion of early humans around the globe.**

After leaving Africa, human groups probably followed coastal routes to the Americas and South-East Asia.

Professor Jon Erlandson says the maritime capabilities of ancient humans have been greatly underestimated.

He has found evidence that early peoples in California pursued a sophisticated seafaring lifestyle 10,000 years ago.

Anthropologists have long regarded the exploitation of marine



Coastlines were rich in resources for early humans

### SEE ALSO

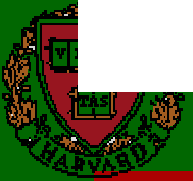
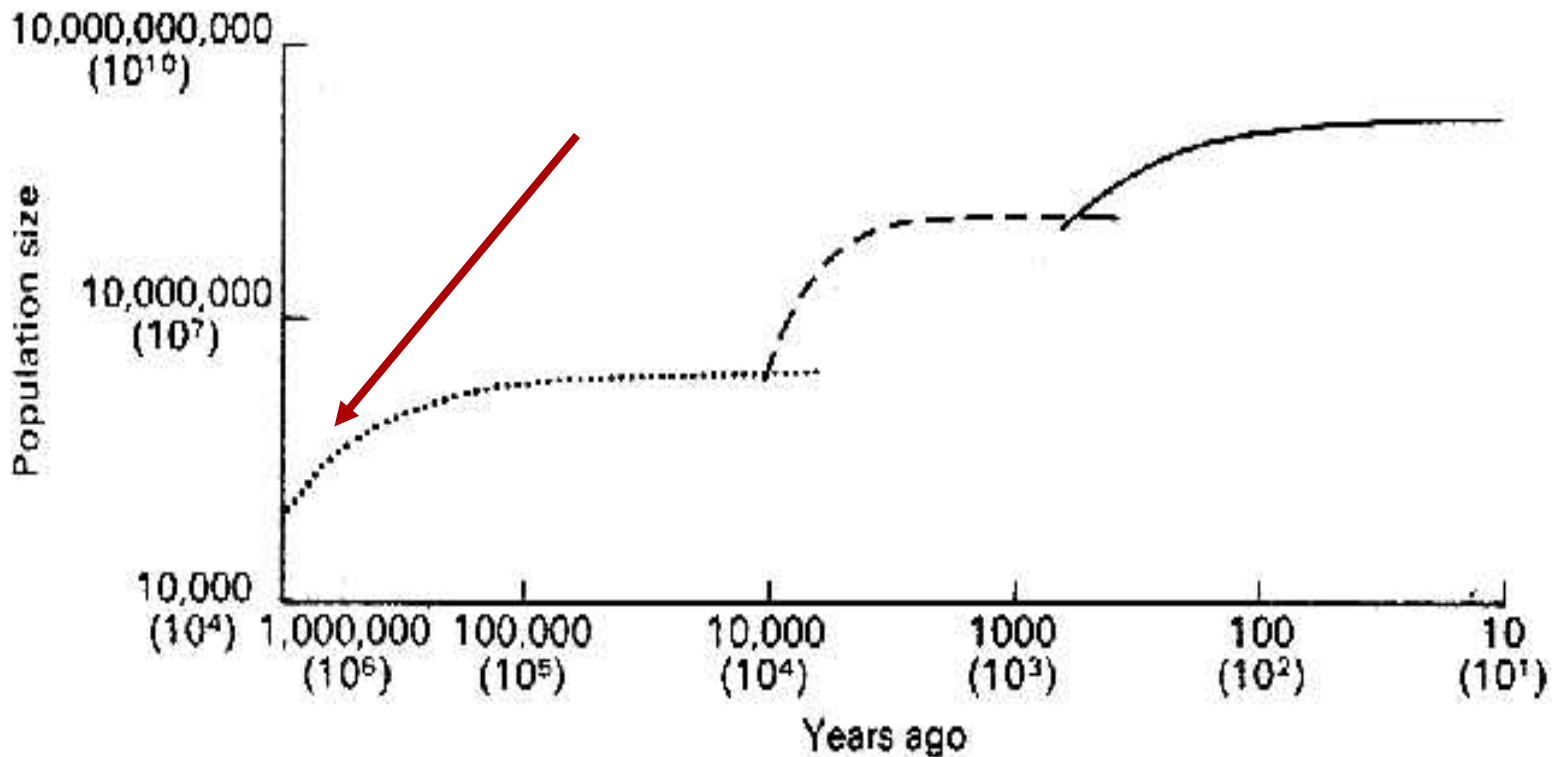
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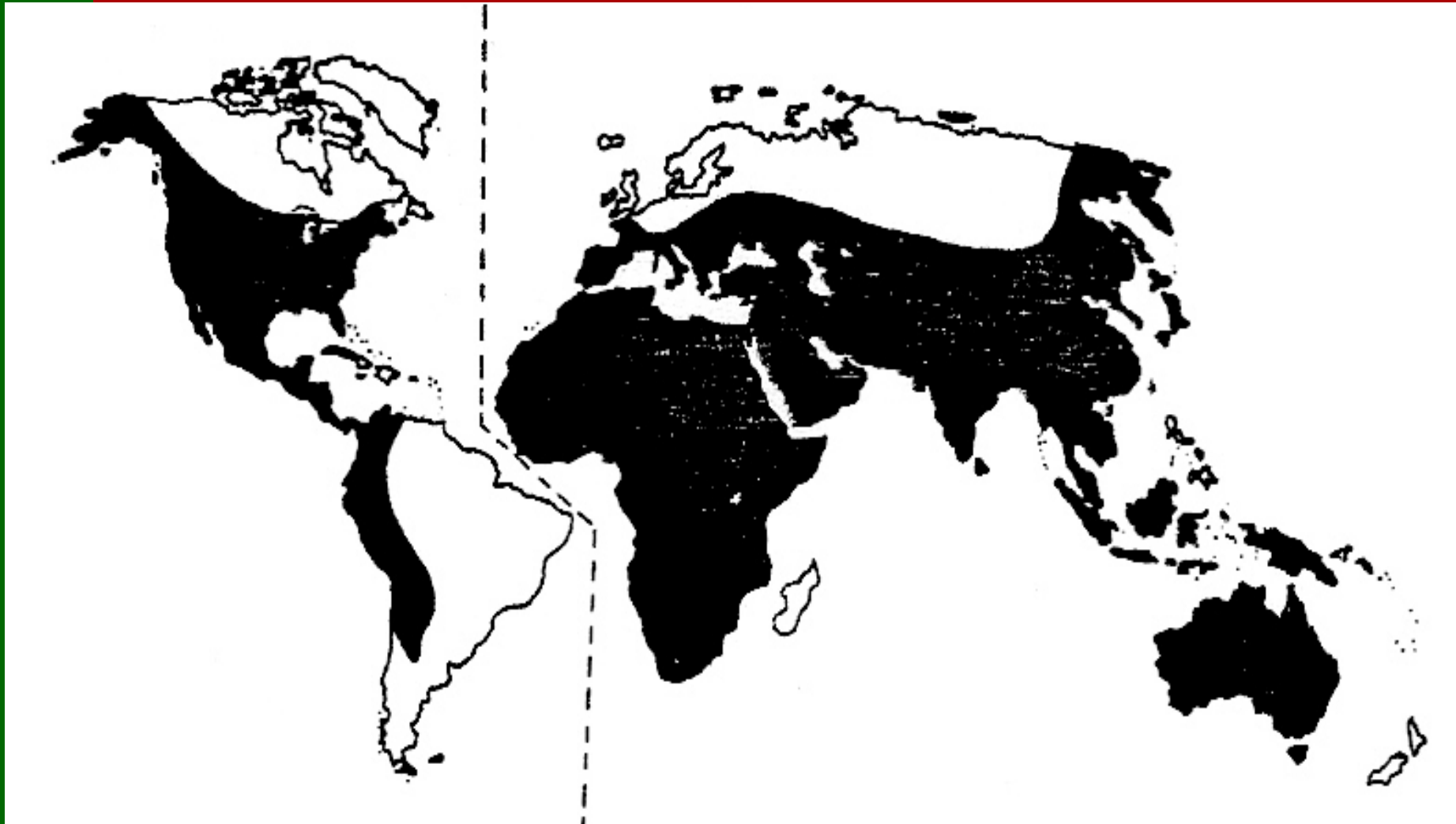
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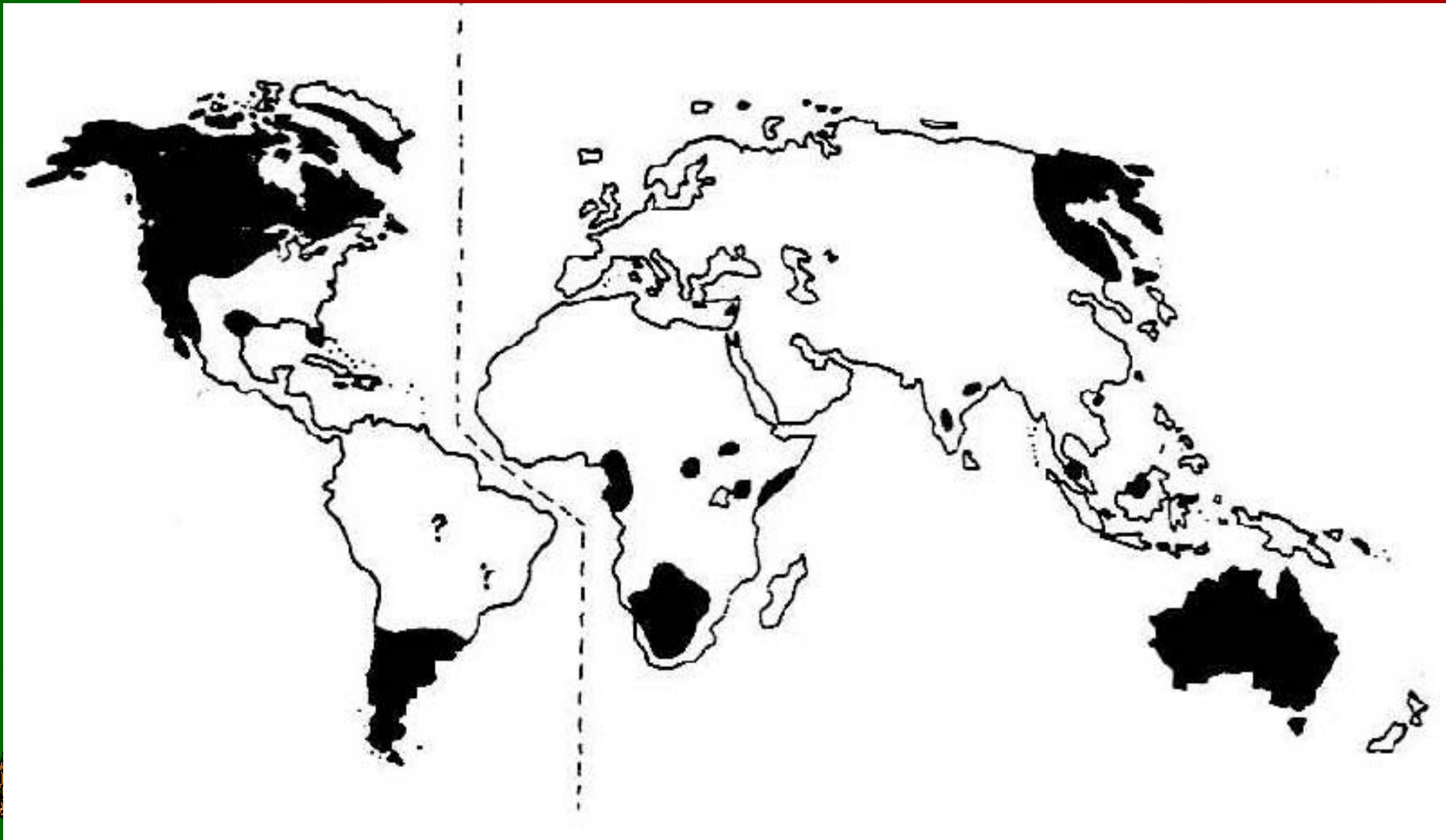
Some new “tool kits” are more efficient in assisting populations to capture new energy sources ~ population growth.



# Human as Foraging Species Distribution - 12,000 BP

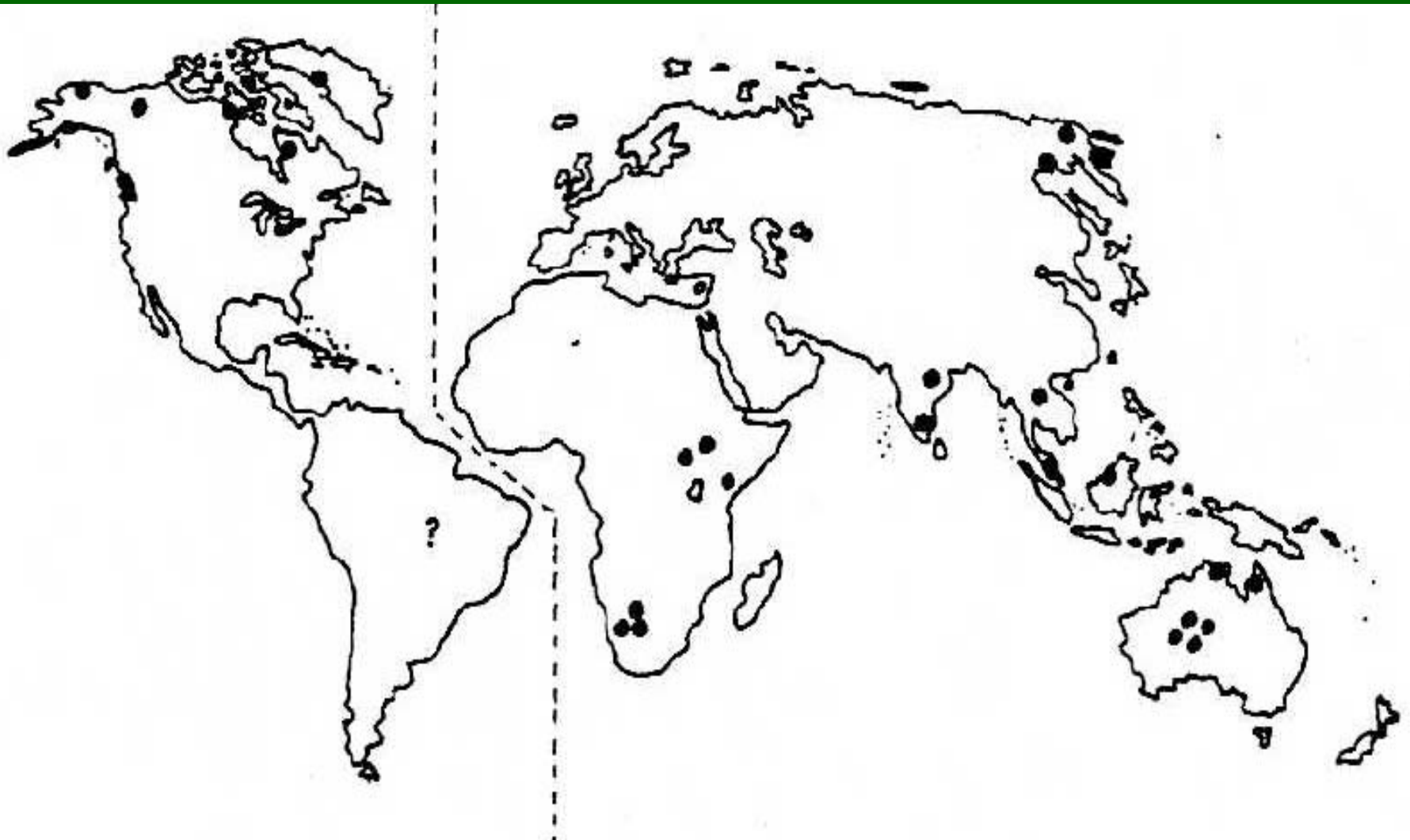


# Humans as Foraging Species Distribution - 2,000 BP



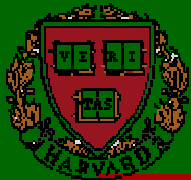
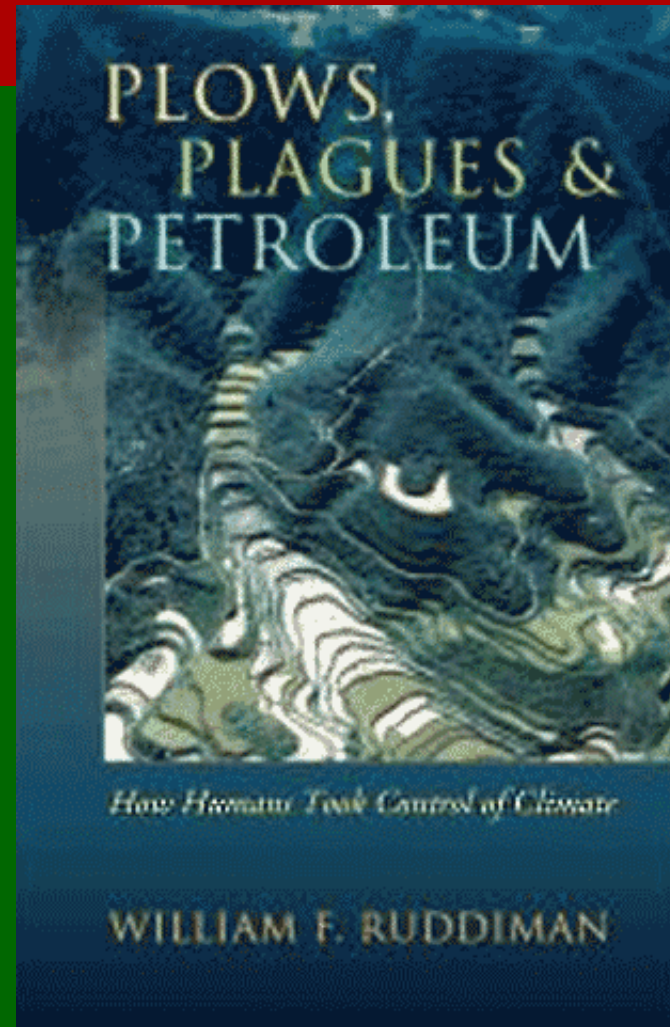


# Humans as Foraging Species Distribution - 75 BP

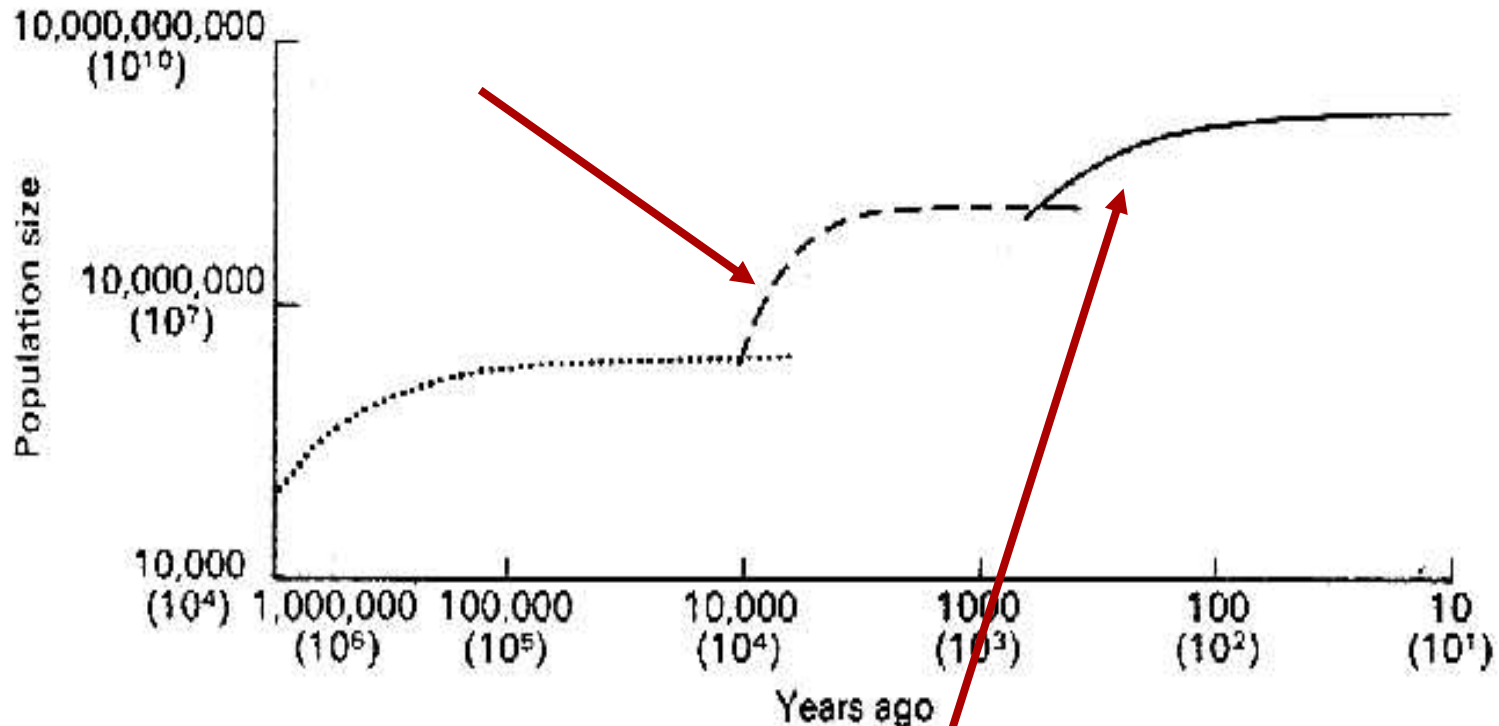


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Some scholars have begun to argue that the ecosystemic transformations engendered by the agricultural revolution marked a major and measurable shift in Earth's climate, suggesting, therefore, that anthropogenic climate alteration may have greater antiquity than we have become accustomed to think.



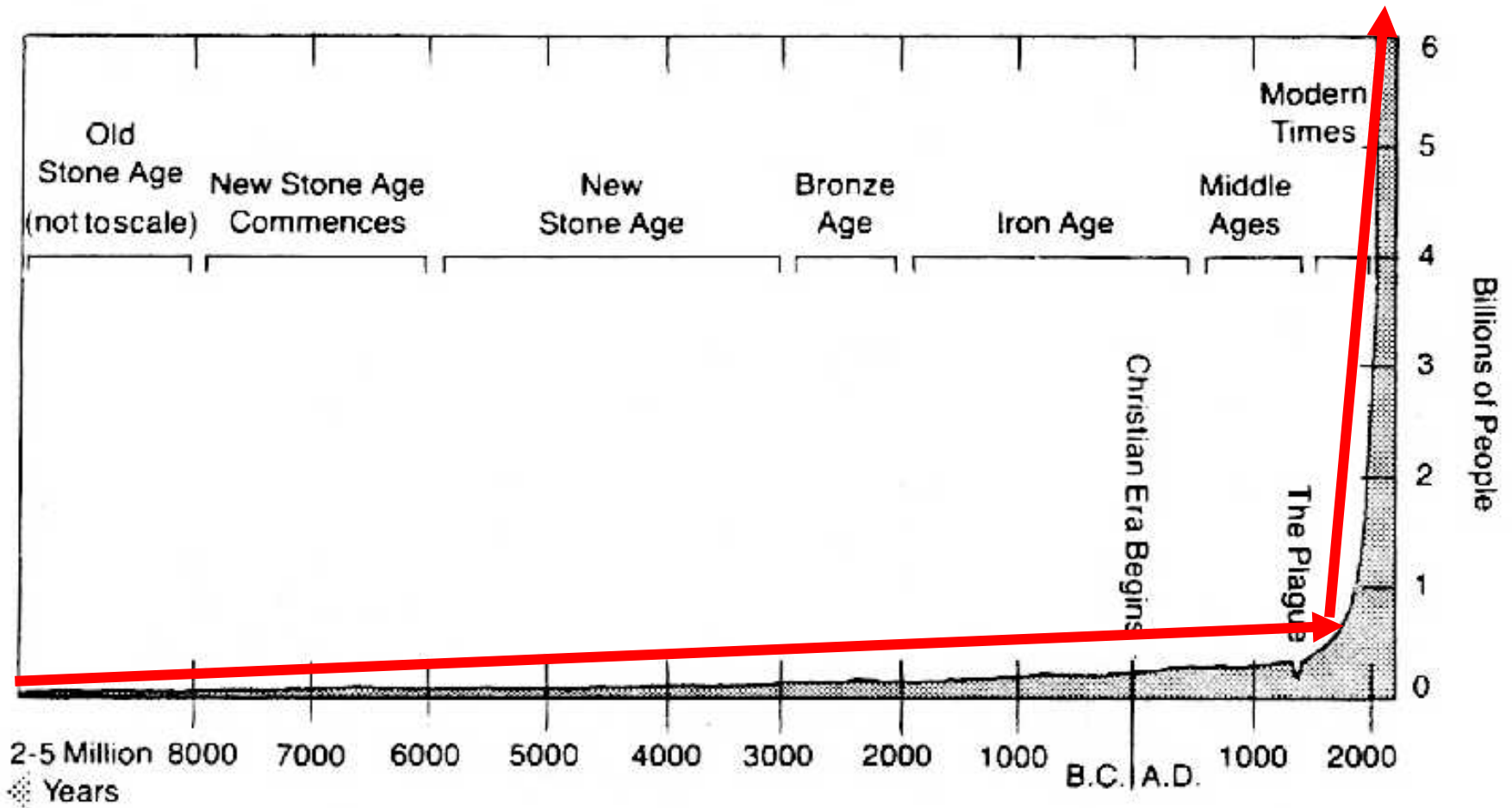
Agriculture represents a new means of capturing solar energy and this leads to  $\implies$  a population 'spurt' in growth.

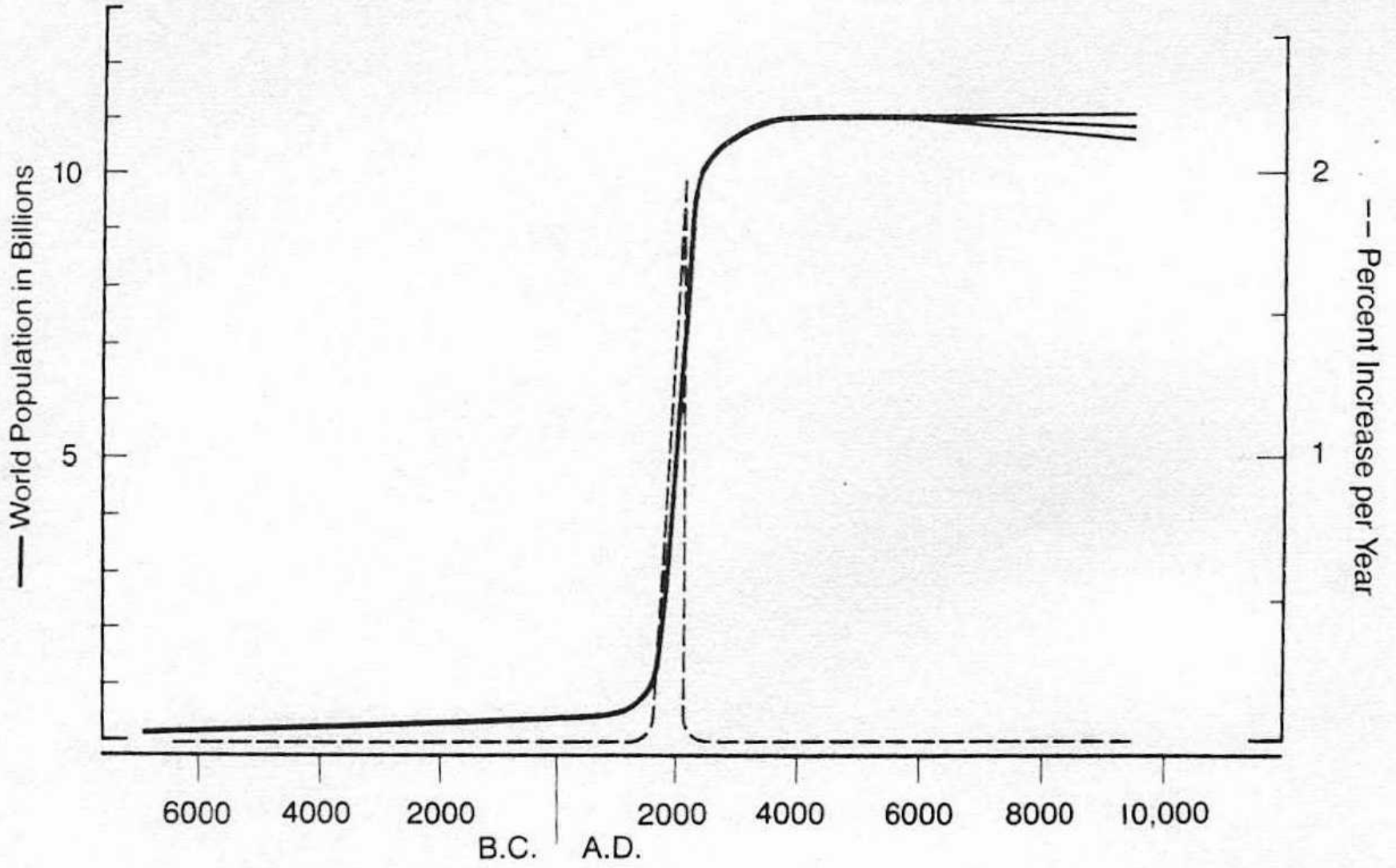


As does the 'energy spurt' provided by the industrial revolution & fossil fuels...



# World Population Growth Through History







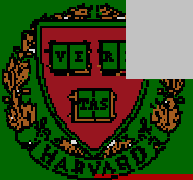


Along with a “new” set of stone tools that were more technically advanced and durable, the “neolithic” or “new stone age” is distinguished in the archaeological record by the appearance of several nearly simultaneous technologies that emerge along with sedentary agriculture – notably **pots**.





Sedentary life patterns combined with **storage technologies** and **record keeping technologies** (**writing**, in particular) allow for a rapid, largely simultaneous burst of social and cultural invention leading to....



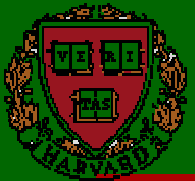
# The State

Town ==> City ==> City State ==>  
League of States == Empire



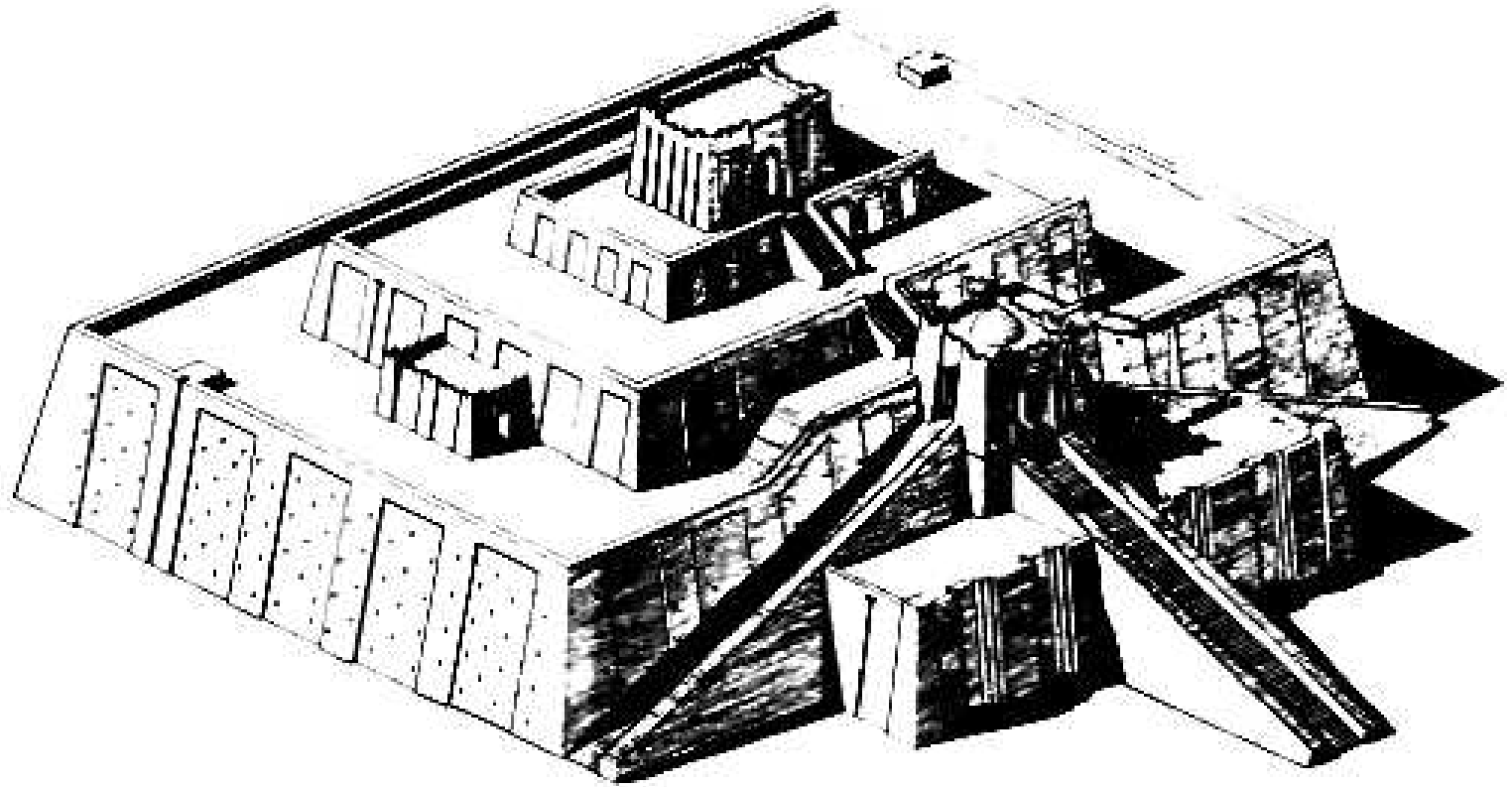
*Extraordinarily rapid social evolution...*

Tim Weiskel - 88



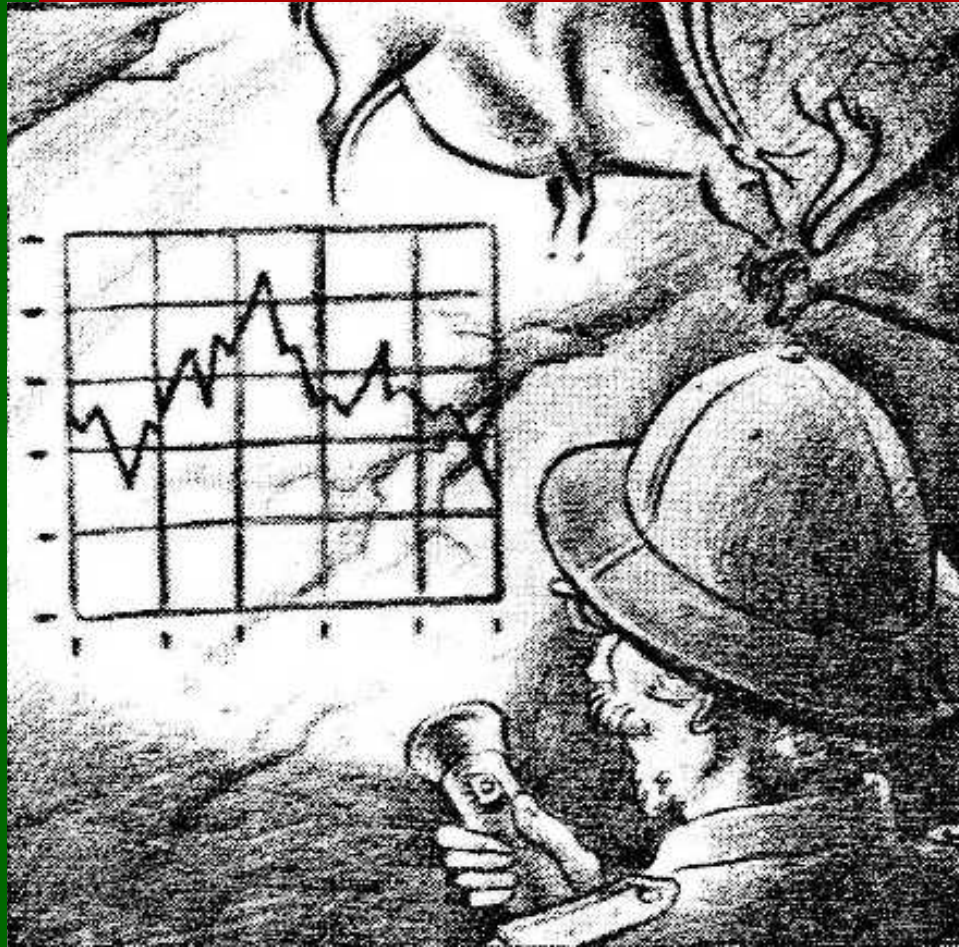


Strikingly similar forms appear around the world....

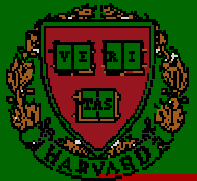


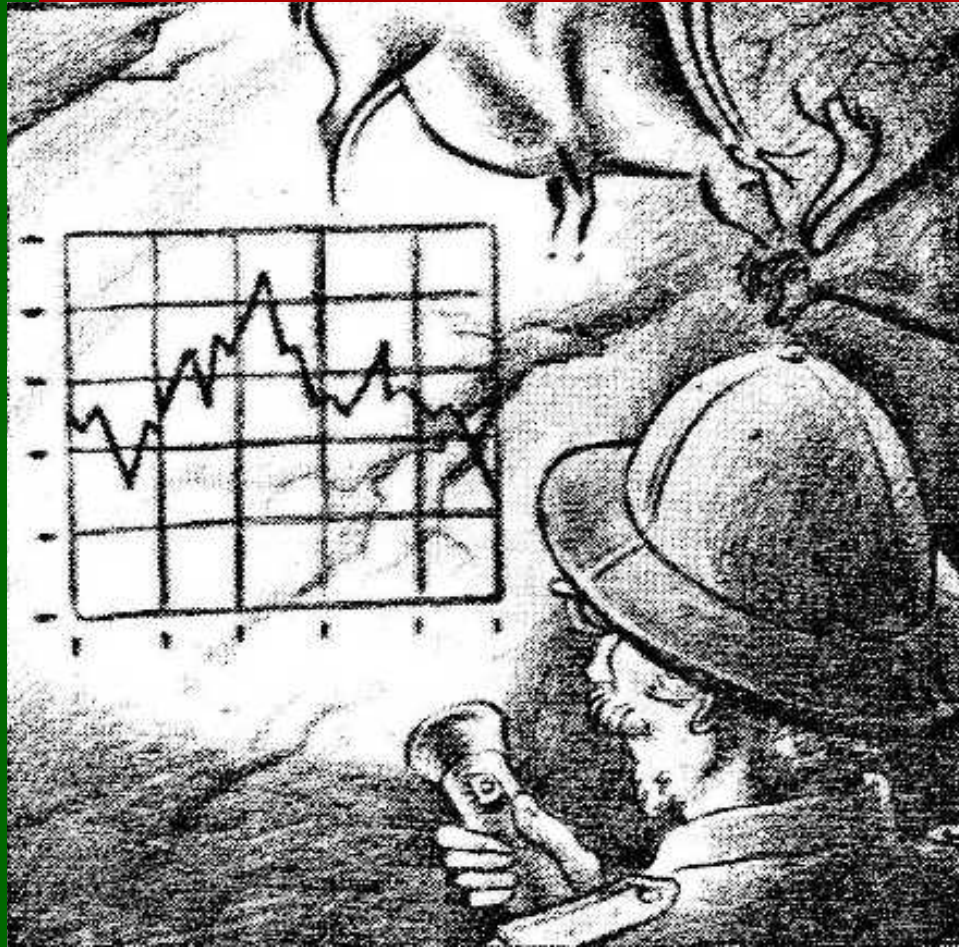
Is this Middle-Eastern or Mayan Architecture?





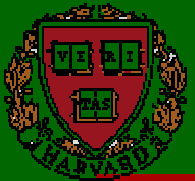
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This, in turn, kicks off an enormous “positive feedback loop” *in all subsequent human history.*



# Stone Age Economics

Marshall Sahlins

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Marshall Sahlins

Because of its mobile character, the calculus of the domestic sphere in foraging societies is based on the “limit of portability.”

Both production and *reproduction* are undertaken with regard to the overriding concern for the limit of portability.

*Don't produce or acquire more than you can carry.*



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# Logic Changes with Agriculture

The logic of production and reproduction changes dramatically with the emergence of sedentary agriculture.



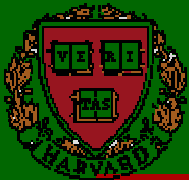


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Land becomes valued, needs to be worked with labor, the more labor the better, especially if it needs to be defended, the more defenses are needed, which require more agricultural surplus to support and therefore require people to acquire more land upon which to grow more food, etc. etc.



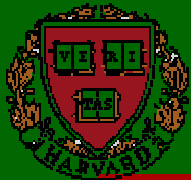
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This is an ever escalating “positive feedback” loop - an escalating “vicious circle.”



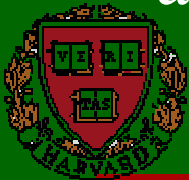
# More is better....

However much is produced, with new storage technology and desiccated grains, it is possible to accumulate ever more -- multi-annual surpluses.

Record keeping allows for inter-generational inheritance of both surpluses *and* debts.

The larger one's family is, the greater one's domestic labor force one can command.

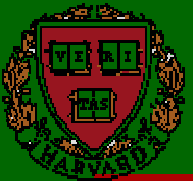
Unskilled, repetitive and boring work needs to be done and women and children can be pressed into service.



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# Growth is good....

The positive function of child labor as a tractable labor force in the newly organized system combined with the sedentary settlement pattern gives a whole new dynamic to the domestic domain.

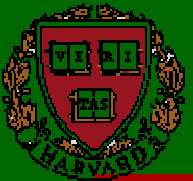


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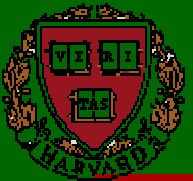
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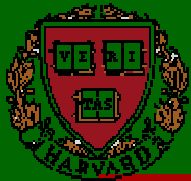
Growth becomes a “good thing” as opposed to something that ought to be avoided.



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# Neolithic Ethnocentrism

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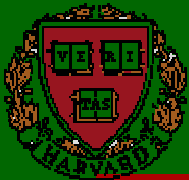
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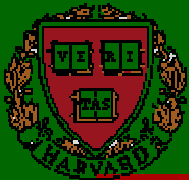
Moreover we must watch very carefully how the collective human econiche shifts with agriculture.

New forms of symbiosis have emerged.

We have co-evolved with our domesticates.

We have gained many things in the process

AND we have *lost* many things as well....



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We may need to overcome this neolithic bias in our outlook.



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## Our Neolithic Bias Contains Some Important Implicit Theories in our Ethical Discourse

A Theory of **Community**

A Theory of **System**

A Theory of **Authority**

A Theory of **Change**

A Theory of **Agency**

A Theory of **Time**





Let's try to imagine  
for a moment what a  
difference the  
neolithic makes...

Aldo Leopold gives us  
a clue.

How do we look at the  
“wild”? At the  
“sown”?



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• Environmental Ethics and Land Management  
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# Elements of Ethical Reasoning

Timothy C. Weiskel

Session 3 – Part 2  
5 October 2006

Harvard University Extension School  
Fall Semester 2006

