# *Sustainability: Beyond Green Building and Smart Growth*

Ballarat, Australia
September 17, 2008

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For the past dozen years I've been working towards an intention:
that if we are to deal responsibly with the risks associated with building and development, we need to be able to see those risks…fully, clearly, and in context…

# *A Starting Point*

"Safety is very important, but we need to think about the responsibilities for our collective safety; especially the welfare of future generations who, it's worth noting, are unable to represent their own interests."

*- Bob Fowler, FAIA, P.E., C.B.O., former Chairman of ICBO and founding Chairman of the International Code Council (ICC), former Vice President of the World Organization of Building Officials (WOBO)*

# *Finding the Trailhead…*

Almost exactly 11 years ago I got up in front of nearly one thousand building code officials in Phoenix, Arizona, knowing that I only had ten minutes to give the 20 minute presentation I had prepared…

# *Finding the Trailhead…*

What I learned that day:

I got my first glimpse into the possibility that I was actually working with a "caring community."

And I saw that I wanted everything that they wanted…and more…because I didn't want people building unsafe buildings…

But I was looking at a much larger risk profile for the built environment than they were and questioning many widely accepted assumptions…

# *Get Out of the Box*

We often hear that we need to think "outside the box" to deal with our problems today.

But it's a process -

expand your field of view, get out of the box you're in …into the next bigger box.

# *See the Details AND the Big Picture…*

To get out of boxes requires knowing if you're working in the details or the big picture, in the past, present or future, and constantly shifting your focus back and forth.

That helps keep things in perspective and proportion, enabling us to see the *things* as well as the *relationships* between them.

# *How Do You Know What You Know?*

# *A Focus Shifting Template - What's Missing*

Things you used to think about

Linkages to related realms

Linkages to unrelated realms

Unasked Questions

Unquestioned Answers


Unintended
Consequences

Delayed
Consequences

Internalized benefits

Externalized benefits

Important stuff you
don't yet know

Important stuff you
know that isn't true

Things you used to know but can't remember

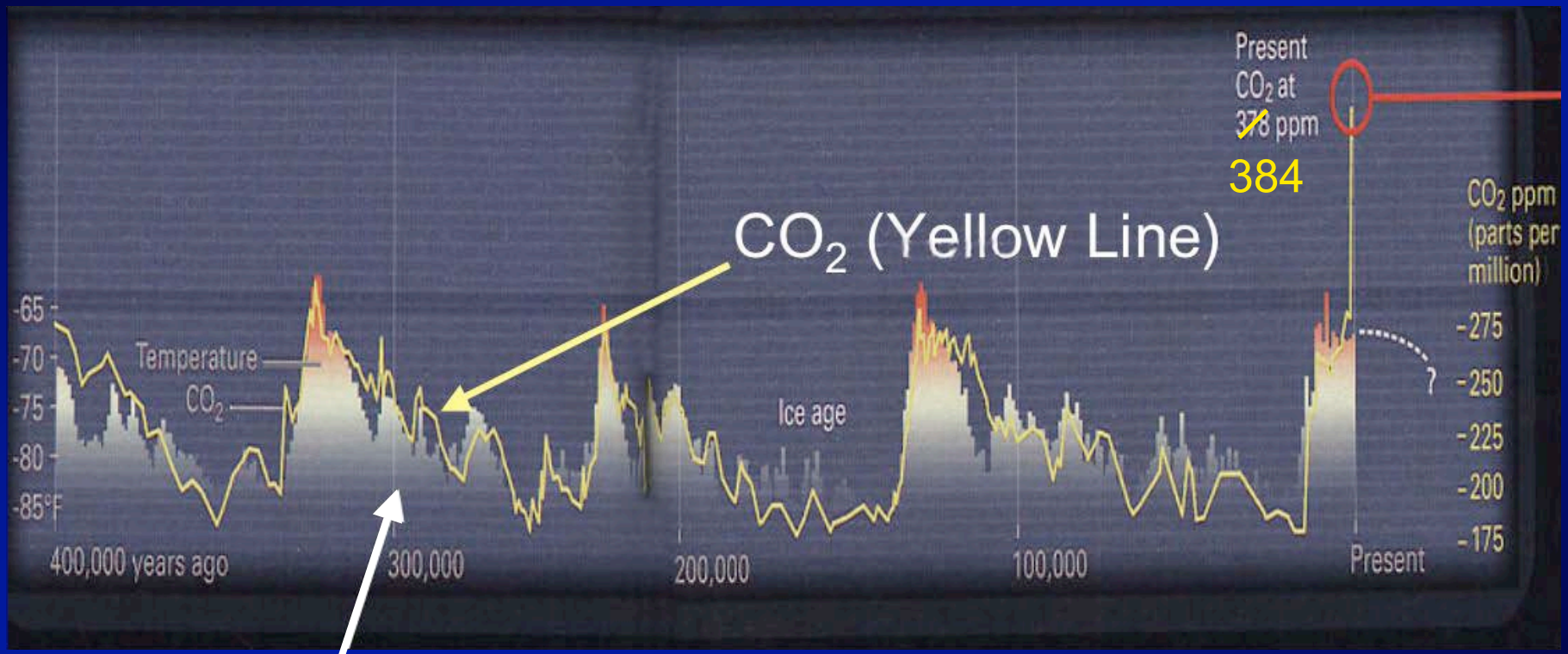
Things you never thought about but should

# *Critical Assumptions…*

- A stable and predictable climate.
- Adequate and affordable key resources including energy, water, food and other critical resources.
- The natural systems on Earth are robust enough to withstand whatever humans may choose to do.
- Our current economic system can provide what is needed for all people to have their needs met well.
- Our current social and political structures and our own interpersonal skills are adequate to deal effectively and peacefully with differences and coming changes.

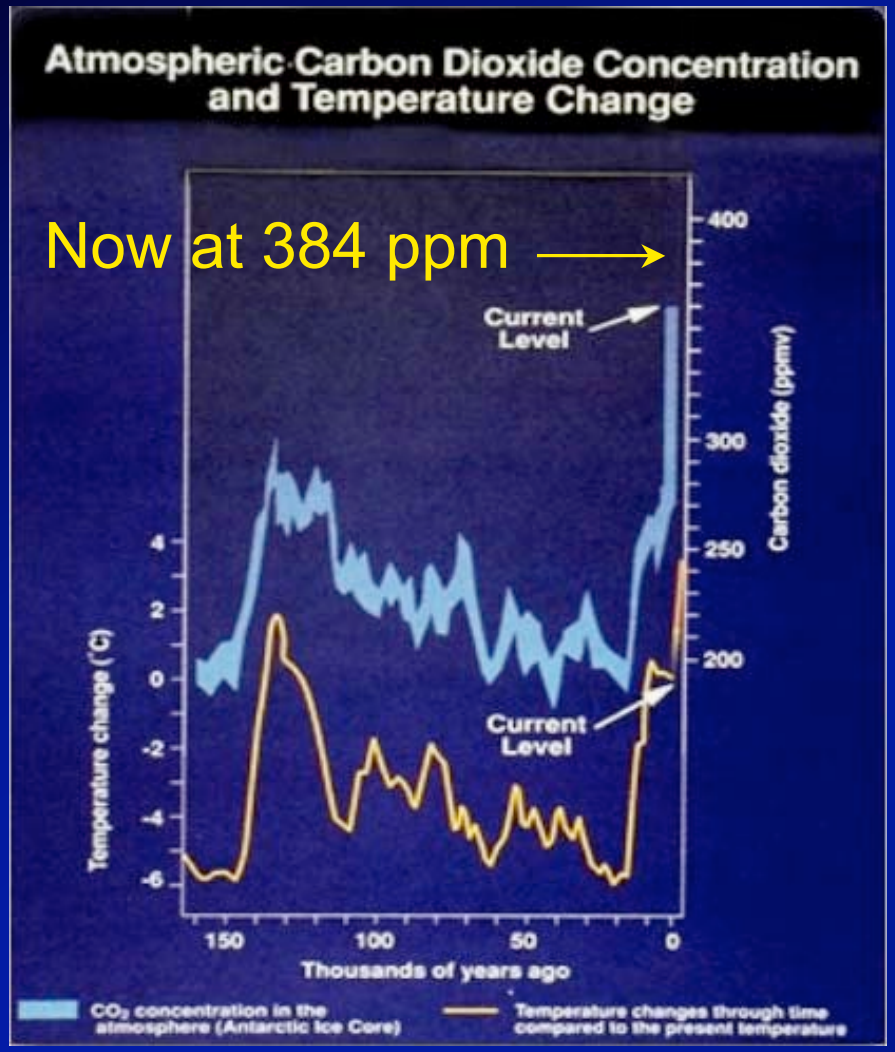
# Climate change

# *Global $CO_2$ & Temperature - 400,000 years*



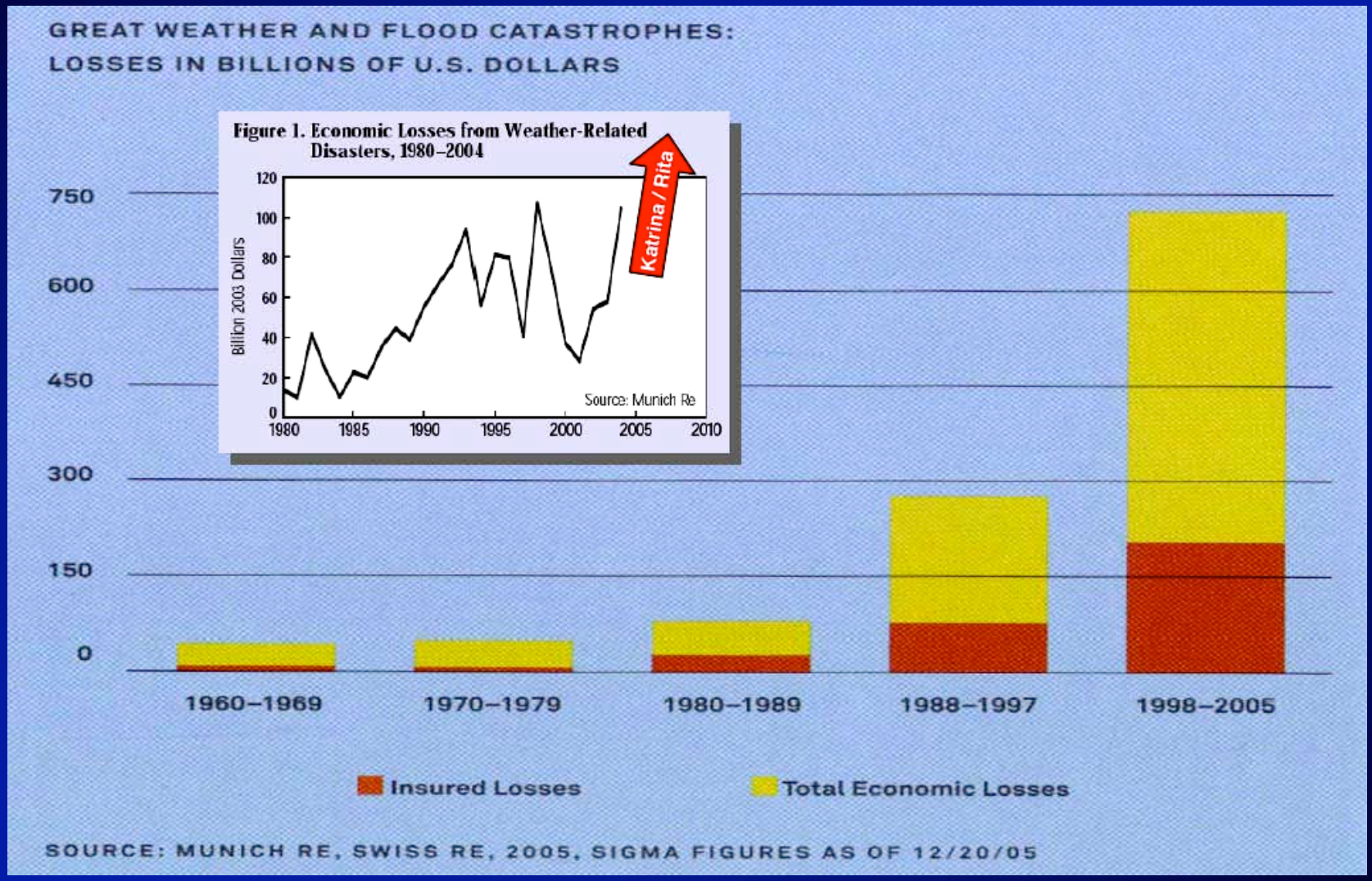

Temperature (Gray Shaded Area)

# *Will the Correlation Disappear?*

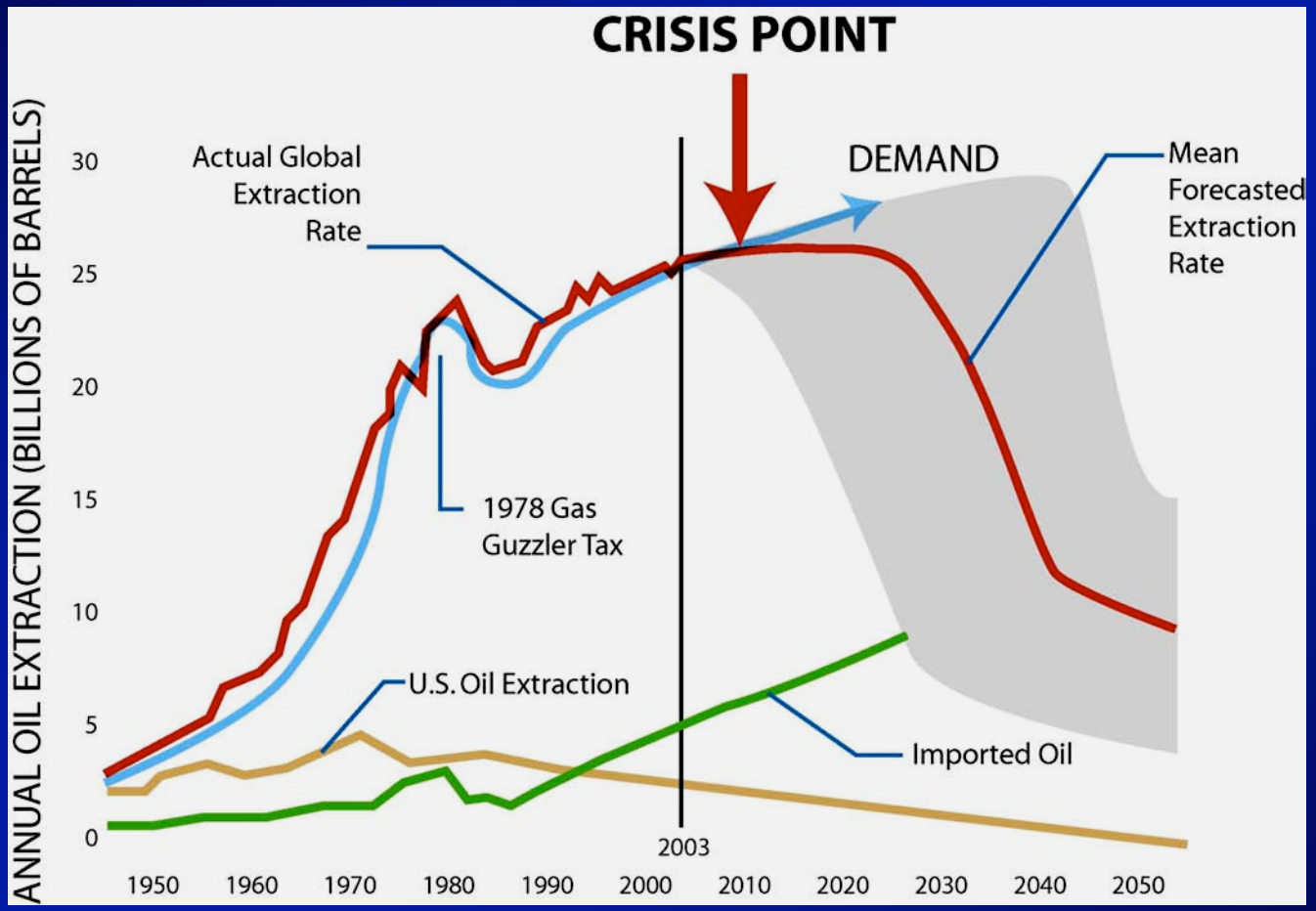



Given that current levels of atmospheric $CO_2$ exceed historic levels, and that few scientists conclude that the correlation between global temperature and $CO_2$ levels will magically disappear, the question is what will happen next.

# *Don't Trust Scientists?…How About Insurers?*



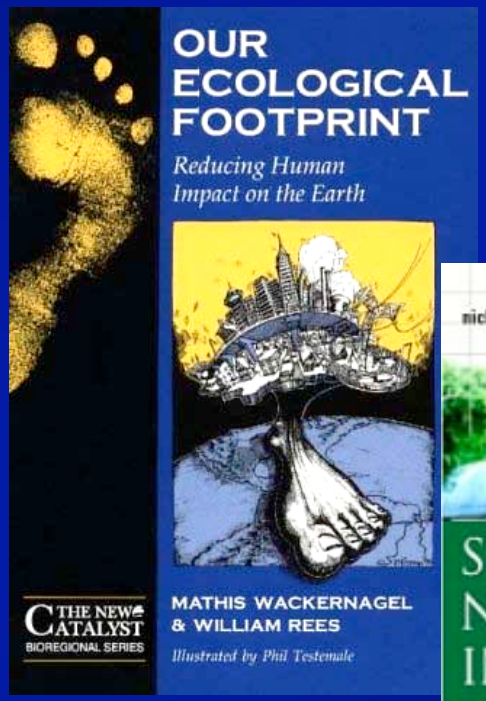
# *Where We Are - Peak Oil*

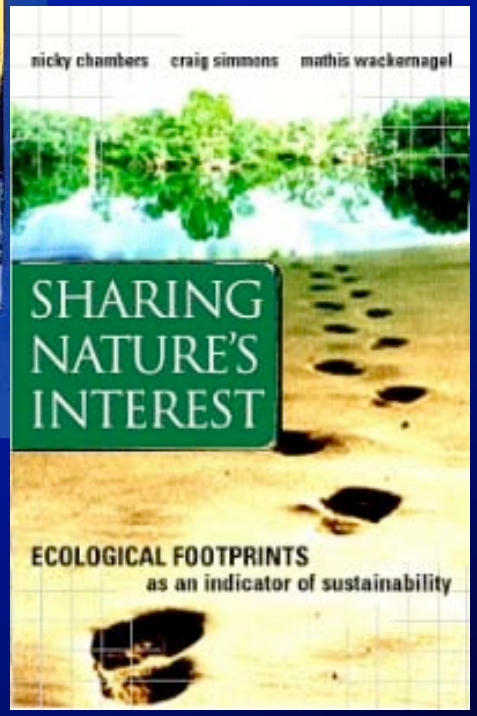



Source: Dr. Donald Aitken, ISES/ASES World Solar Congress 2005

# *Where We Are - Ecological Footprint*

Ecological footprint is a concept based on carrying capacity. It's a way to calculate the amount of productive land required to supply resources and absorb wastes from a given activity - of an individual, organization, community, nation or population, including the world population.



# *The Picture that is Emerging…*




There's credible evidence that if each person on Earth used resources & generated wastes at the rate of the average American, Canadian, or member of the EU we would need several more Earths to sustain that level of human activity. And that's for Earth's current population.

# *The Big Picture - Living Planet Report*

WWF *for a living planet®*

LIVING PLANET REPORT 2006

Download the Report:
http://www.footprintnetwork.org

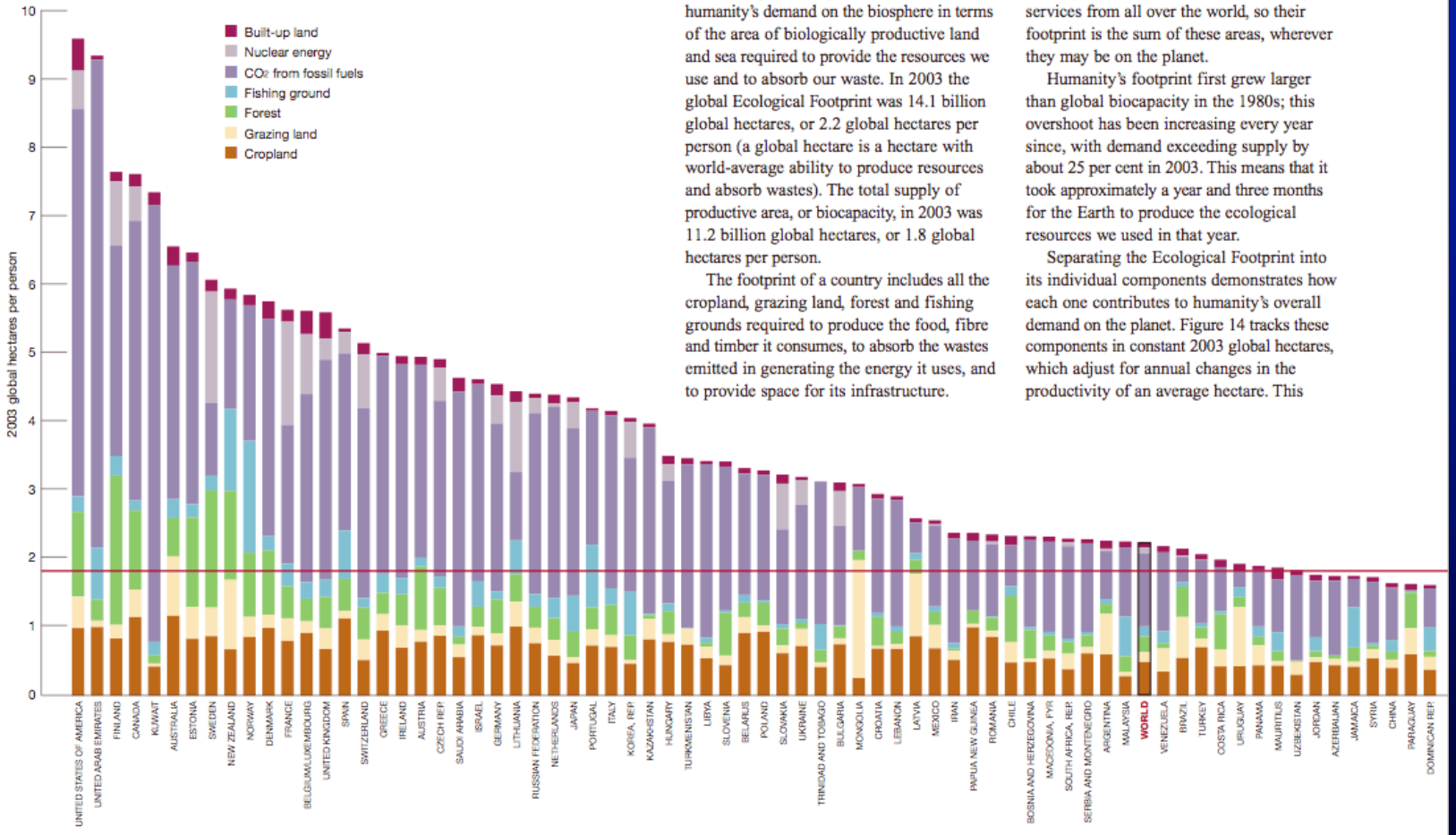
Global Footprint Network

ZSL LIVING CONSERVATION

# www.footprintnetwork.org

## ECOLOGICAL FOOTPRINT

Fig. 13: **ECOLOGICAL FOOTPRINT PER PERSON, BY COUNTRY,** 2003




The Ecological Footprint measures humanity's demand on the biosphere in terms of the area of biologically productive land and sea required to provide the resources we use and to absorb our waste. In 2003 the global Ecological Footprint was 14.1 billion global hectares, or 2.2 global hectares per person (a global hectare is a hectare with world-average ability to produce resources and absorb wastes). The total supply of productive area, or biocapacity, in 2003 was 11.2 billion global hectares, or 1.8 global hectares per person.

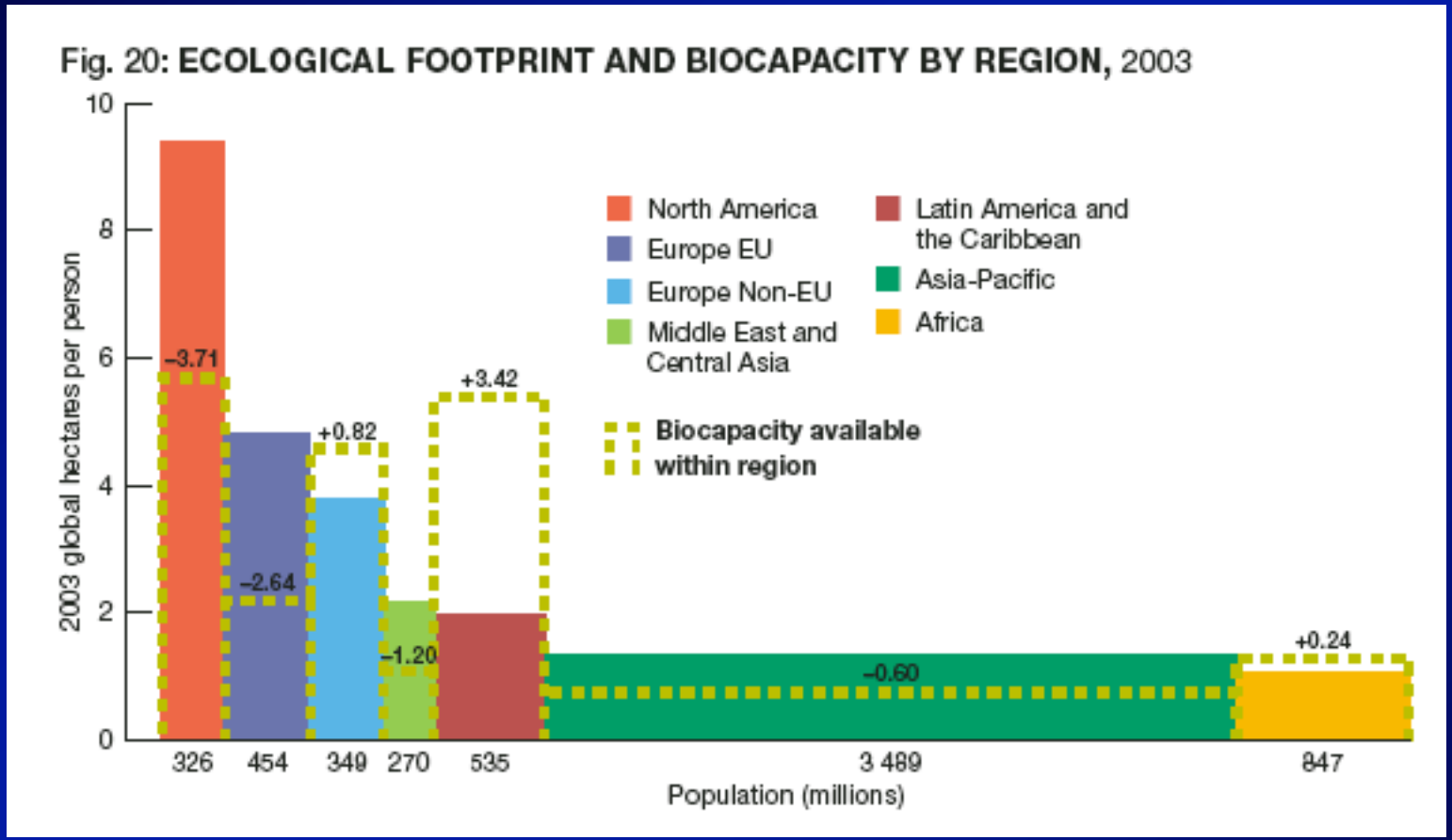
The footprint of a country includes all the cropland, grazing land, forest and fishing grounds required to produce the food, fibre and timber it consumes, to absorb the wastes emitted in generating the energy it uses, and to provide space for its infrastructure.

People consume resources and ecological services from all over the world, so their footprint is the sum of these areas, wherever they may be on the planet.

Humanity's footprint first grew larger than global biocapacity in the 1980s; this overshoot has been increasing every year since, with demand exceeding supply by about 25 per cent in 2003. This means that it took approximately a year and three months for the Earth to produce the ecological resources we used in that year.

Separating the Ecological Footprint into its individual components demonstrates how each one contributes to humanity's overall demand on the planet. Figure 14 tracks these components in constant 2003 global hectares, which adjust for annual changes in the productivity of an average hectare. This

# *www.footprintnetwork.org*




From the 2006 Living Planet Report

# *Where We Are…*

REALITY - We're maintaining our high standard of living by *importing* resources, cheap labor and ecological capacity from the developing world.

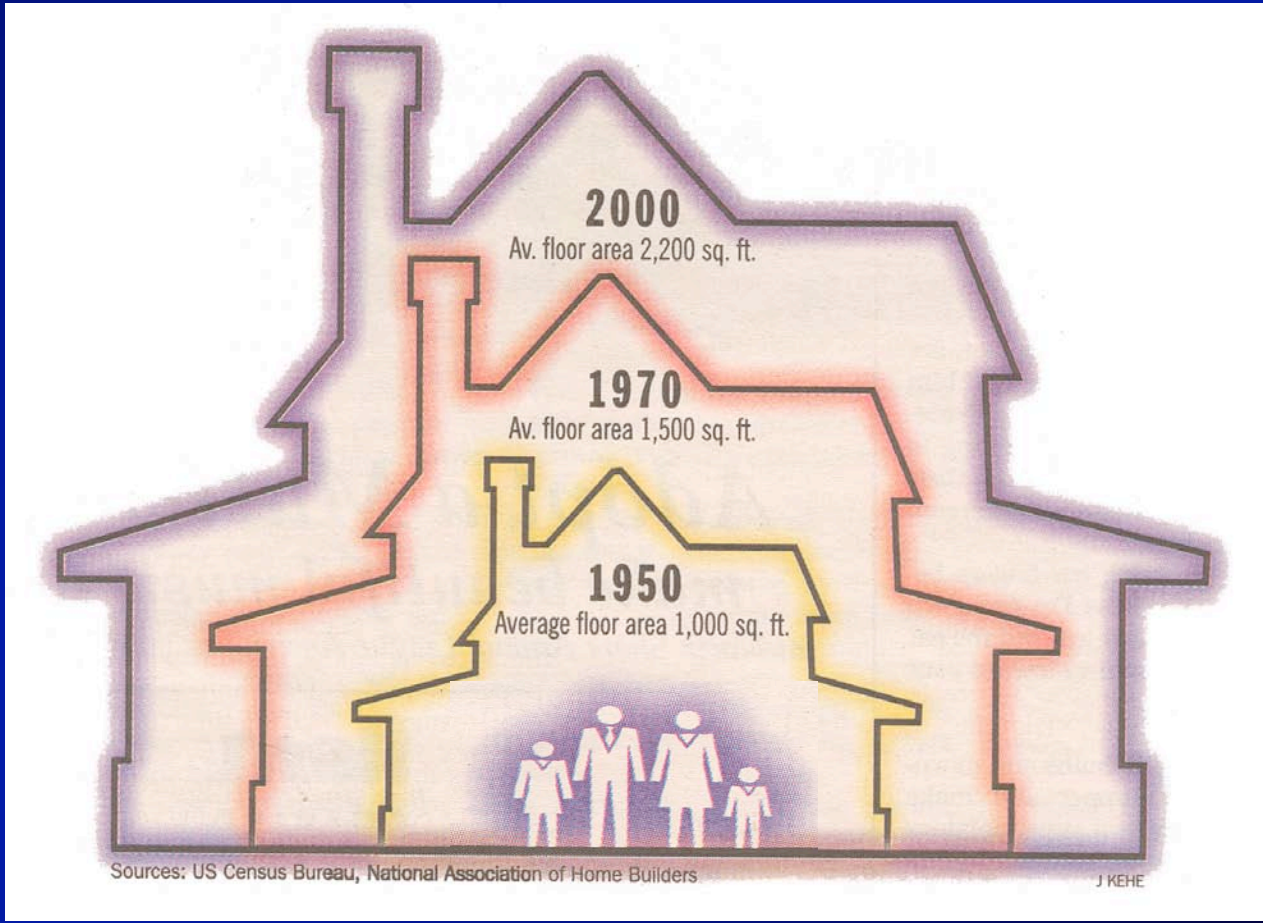
Surplus global ecological capacity no longer exists.

Ecological footprint is increasing in both the developed and developing world and world population is growing.

Buildings account for a majority of this footprint and energy accounts for much of that.

# *But Not Everything is Getting Smaller…*

1950 3.37 people per household - 297 s.f. per person
1970 3.14 people per household - 478 s.f. per person
2000 2.62 people per household - 840 s.f. per person



# *Where we are - at a Crossroads*

# *The Purpose of Building Codes*

International Building Code (USA) - 2000 edition

101.3 ***The purpose of this code is to*** establish the minimum requirements to ***safeguard the public health, safety and general welfare*** through structural strength, means of egress facilities, stability, sanitation, adequate light and ventilation, energy conservation, and safety to life and property ***from*** fire and other ***hazards attributed to the built environment.***

**Big Picture in White - Details in Blue**

# *What's Protected and What's at Risk?*

Modern building codes enable us to design and build structures that are safe for their occupants, making it seem that we've eliminated or greatly reduced the risks associated with buildings.

# *What's Protected and What's at Risk?*

We've just moved those risks in space and time:

- away from the building site, and
- into the future.

# *Big Problems Hidden in Plain View*

Looking at buildings through codes is like looking through a microscope. The individual, building-related risks fill the field of view.

But, it's like dealing with risk with tweezers, while creating many orders of magnitude greater, generalized risk for everyone, including all future generations.

# *Risk - Through the Microscope of Codes…*

# *Risk - The Bigger Picture…*

Risks to Future Generations

Climate Impact

Resource Depletion

Fire Safety
Structural Integrity
Means of Egress
Light
Ventilation
Heat
Water & Wastewater
Electrical & Gas
Energy Efficiency

Embodied Energy

Dependence on Non-Renewable Energy

Pollution

Loss of Habitat

Toxicity of Materials

Loss of Biodiversity

Nutrification of Water

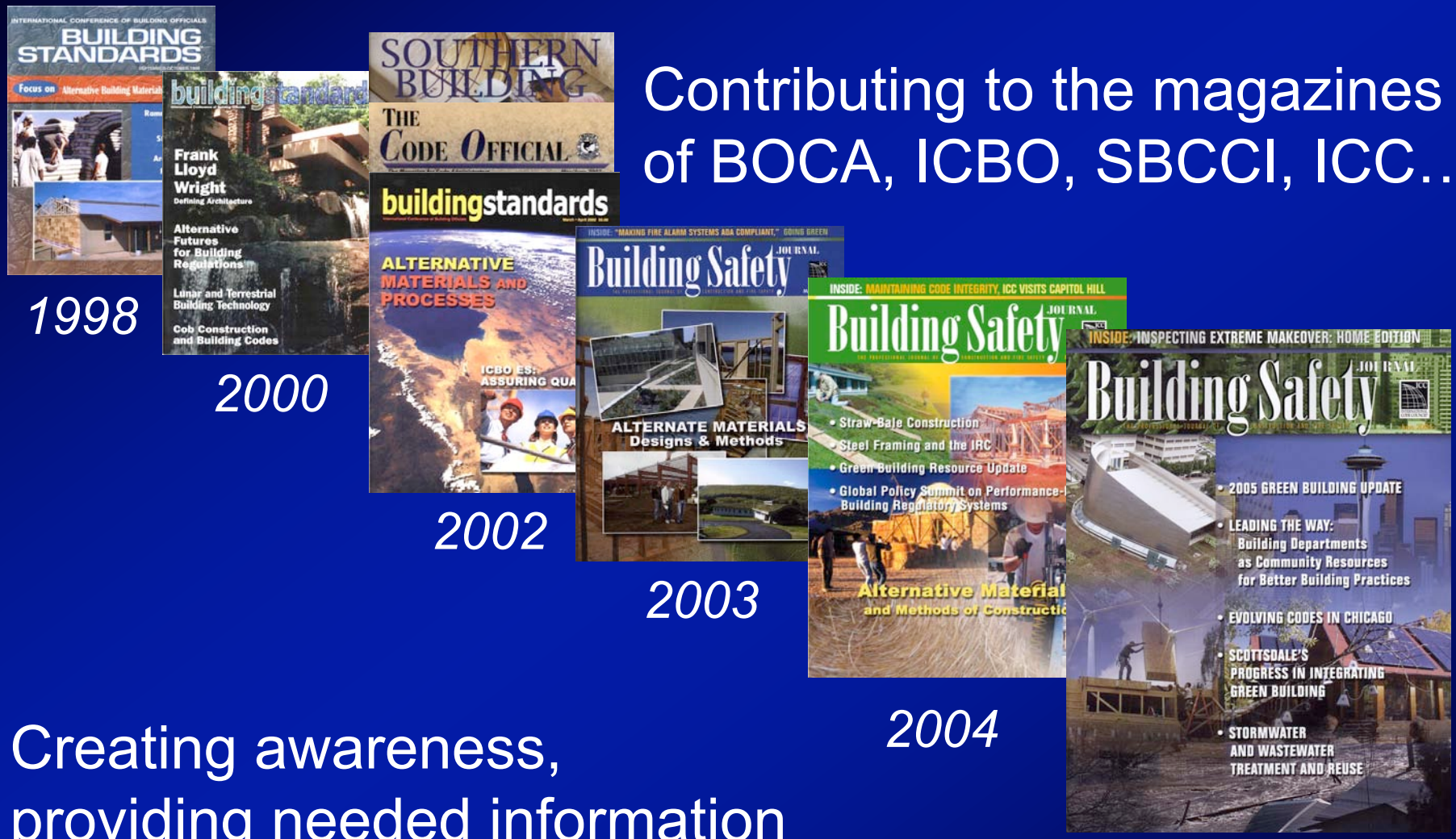
Loss of Agricultural Land

Heat Island Effect

Increased Transportation

Externalized Costs to Society

# *The Ongoing Work…*




Contributing to the magazines of BOCA, ICBO, SBCCI, ICC…

Creating awareness,
providing needed information
and access to technical resources…

# *The Ongoing Work…*


We produced a 50 minute video *Building Codes for a Small Planet* to tell this story more widely.

We upgraded the DCAT website www.dcat.net

# *And things are moving…*


ICC-USGBC MOU May 2007

## Green Codes Summit

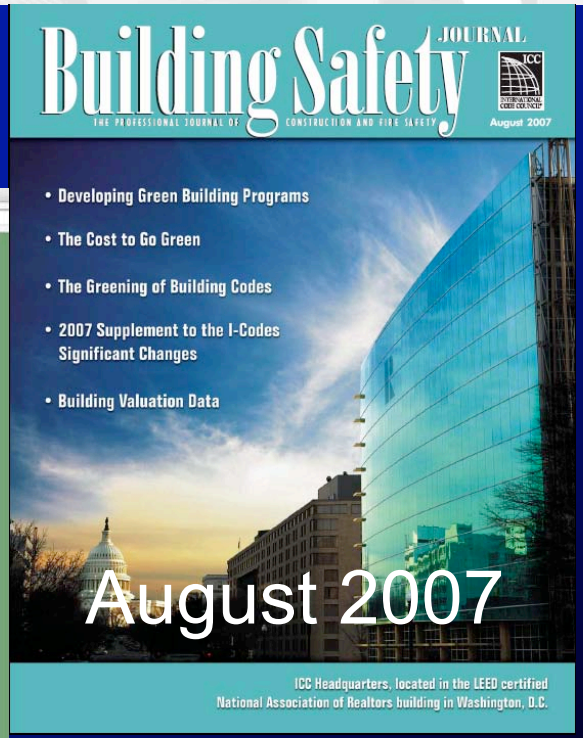
**July 11-12, 2007**
**The American Institute of Architects**
**1735 New York Avenue, NW**
**Washington, DC 20006**

Designed to afford participants the opportunity to gain a greater understanding of the options and issues associated with "green" regulations and to give them insight into methods to improve their efforts back home, the AIA hopes you will be a part of this exciting endeavor.

You are invited to be a principle participant in the summit and will be asked to bring to the summit the resource materials that your community has gathered and any draft legislation or other approach you have been working on. Our hope is that by sharing with others, you and the AIA can derive a better solution that we can all share.

The Green Codes Summit will begin with dinner on the evening of Wednesday, July 11, and continue on Thursday, July 12, from 8:30 a.m. to 3:30 p.m., in Washington, DC.

ICC
Green Building
Home Page

# 2007 - Some Acknowledgment


# *A Lot is Happening…*


**The Challenge of a Lifetime** by David Eisenberg

I am thrilled to be writing this first column for the new Green Building section of *Building Safety Journal*. In future issues, ICC Senior Staff Architect Allan Bilka and I will alternate using this space to present a broad spectrum of ideas, information and opinions about the world of green building and building codes. My aim in this inaugural entry is to convey the importance and uniqueness of this moment in time and the crucial role I believe the building codes community can play in addressing some of the more pressing challenges we are likely to face.

First, however, I wish to acknowledge the visionary leadership provided over the past year by ICC CEO Rick Weiland and Immediate Past Board President Wally Bailey, along with the commitment demonstrated by the Code Council's Board and staff to sustainability and green building. From the issuance of a Green Building Policy Statement in January 2007; to entering into an MOU with the U.S. Green Building Council; to the move into new green headquarters in Washington, D.C.; to the creation of a dedicated green building webpage (*www.iccsafe.org/news/green*); to cosponsoring the Green Codes Summit with the American Institute of Architects; to participating in the development of American Society of Heating, Refrigerating and Air-Conditioning Engineers Standard 189, *Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings*; to partnering with the National Association of Home Builders to develop the *National Green Building Standard* for residential construction; to the August *Building Safety Journal* sustainability feature issue; and more, ICC has demonstrated that it is serious about this endeavor. This is a great start and congratulations are in order.

## Defining the Challenges

Many of you will recall that among Wally Bailey's key goals during his term as President were raising the profile of building officials in the public eye and promoting sustainability and green building, and 2008 ICC Board President Steven Shapiro has made it clear that he intends to continue to pursue these efforts. What may not be so obvious is how closely related these two initiatives may prove to be.

There are few more crucial challenges than those we are beginning to comprehend related to climate change and the world's demand for, and supply of, energy and water. A recent meeting of the world's petroleum experts found them in basic agreement that we are rapidly approaching the moment when the demand for petroleum will outstrip the capacity of the planet to supply it, and the effects and rate of climate change documented around the world have greatly alarmed the scientific community, with projections about sea rise previously formulated in centuries now being discussed in terms of decades.

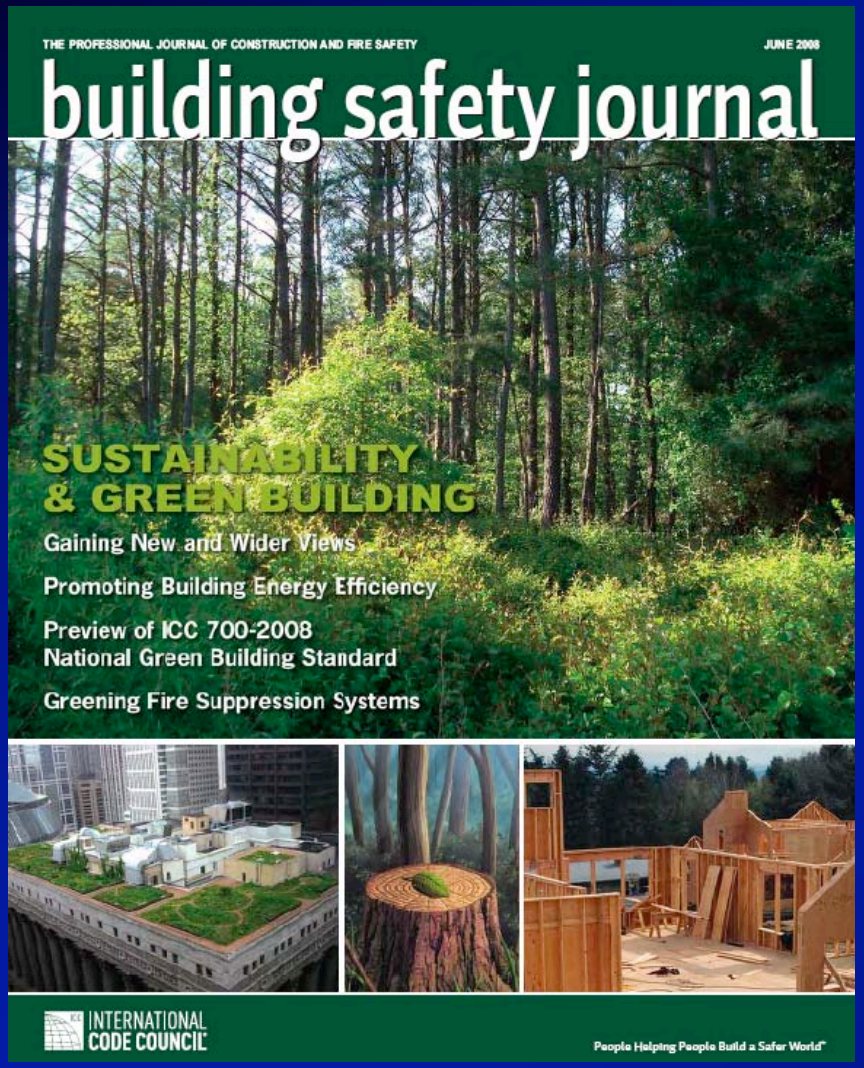
Now consider recent studies indicating that, taken together, building construction, operation and



What we have now in the US
A platform…
The audience…
A strong message:

We have a regular column in the ICC magazine, *Building Safety Journal*. My first column frames this shift as "The Challenge of a Lifetime" essentially calling them to do the most important work of their careers!

# *A Lot is Happening…*




## Gaining New and Wider Views

by David Eisenberg

*Creating a new theory is not like destroying an old barn and erecting a skyscraper in its place. It is rather like climbing a mountain, gaining new and wider views, discovering unexpected connections between our starting point and its rich environment. But the point from which we started out still exists and can be seen, although it appears smaller and forms a tiny part of our broad view gained by the mastery of the obstacles on our adventurous way up.*

*– Albert Einstein*

This quotation accurately describes the essential process of learning: how the experience of working something through enhances and expands our view of reality. We have been required to do much learning lately. Those who have heard about net-zero energy buildings and programs like the Living Building Challenge—which is also working toward net-zero water balance and very high environmental performance—and think these goals are decades away from implementation might want to get out their hiking boots and compasses, because there is a high probability that these kinds of projects will begin sprouting up across the country in the next few years.

The rapid changes we are seeing are driven by emerging realities that are forcing increasing numbers of people in responsible public policy and business leadership positions to rethink what is required of them to fulfill their duties with regard to the health and welfare of their communities and businesses. As a result, the dialogue is shifting from whether issues associated with global climate change are real or serious and if and when we should respond to them, to finding the most effective and beneficial path forward.

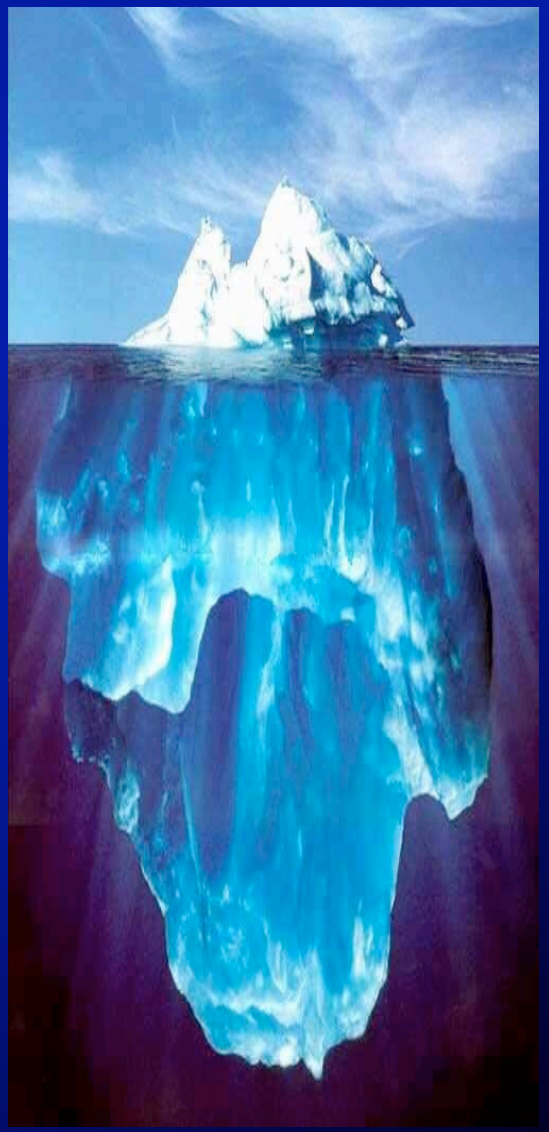
Designers, builders and developers ahead of the mainstream have been pushing hard in this direction and have discovered that high

# *Bigger Context: Just the tip of the Iceberg…*

Green building, Smart Growth, Energy Star, LEED, changes in codes, etc. are all steps in the right direction, but they're really only first steps…

The magnitude of what we're facing is daunting.

The good news is that we've finally overcome inertia and things are moving… But we need to keep seeing the big picture…



# *Time to Evolve…*



Most of the systems we have created are far beneath the dignity and magnificence of the human species.

These systems denature us.

They override our fundamental nature as a caring, creative, nurturing species.

# *Life After Cheap Energy & a Stable Climate*

We can't rely on our past assumptions about progress, technology, risk, standard of living, national security, global security, trade, or economics. It is all changing.

Today's energy and climate realities are stunning and stark. We have crucial choices to make and not much time to make them. We have what we need to find a safer path forward but to choose it, we have to ***change our minds*** and *then* ***change our behaviors***…

# THE FOOTPRINT AND HUMAN DEVELOPMENT



Sustainable development is a commitment to "improving the quality of human life while living within the carrying capacity of supporting ecosystems" (IUCN *et al.*, 1991).

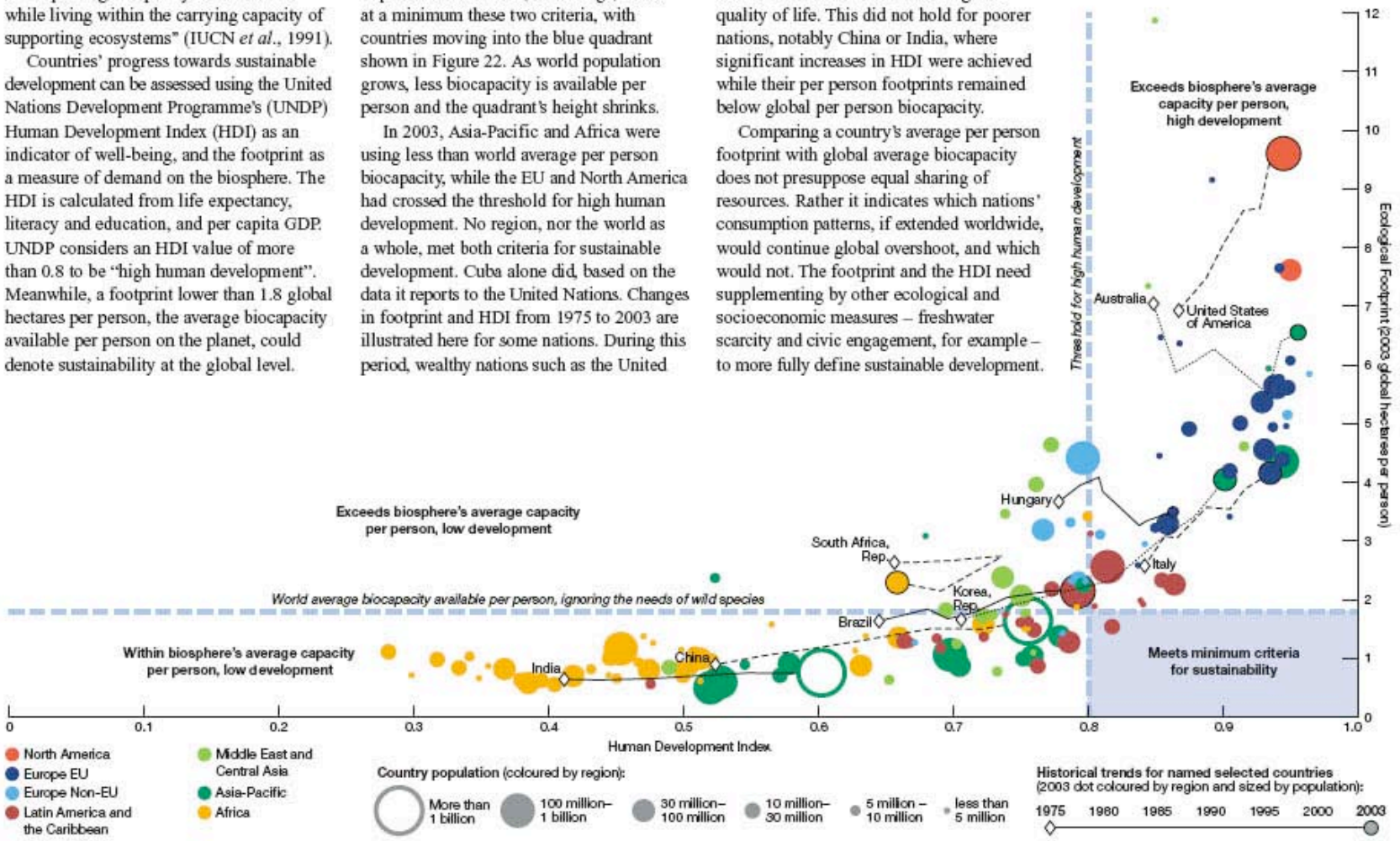
Countries' progress towards sustainable development can be assessed using the United Nations Development Programme's (UNDP) Human Development Index (HDI) as an indicator of well-being, and the footprint as a measure of demand on the biosphere. The HDI is calculated from life expectancy, literacy and education, and per capita GDP. UNDP considers an HDI value of more than 0.8 to be "high human development". Meanwhile, a footprint lower than 1.8 global hectares per person, the average biocapacity available per person on the planet, could denote sustainability at the global level.

Successful sustainable development requires that the world, on average, meets at a minimum these two criteria, with countries moving into the blue quadrant shown in Figure 22. As world population grows, less biocapacity is available per person and the quadrant's height shrinks.

In 2003, Asia-Pacific and Africa were using less than world average per person biocapacity, while the EU and North America had crossed the threshold for high human development. No region, nor the world as a whole, met both criteria for sustainable development. Cuba alone did, based on the data it reports to the United Nations. Changes in footprint and HDI from 1975 to 2003 are illustrated here for some nations. During this period, wealthy nations such as the United States of America significantly increased their resource use while increasing their quality of life. This did not hold for poorer nations, notably China or India, where significant increases in HDI were achieved while their per person footprints remained below global per person biocapacity.

Comparing a country's average per person footprint with global average biocapacity does not presuppose equal sharing of resources. Rather it indicates which nations' consumption patterns, if extended worldwide, would continue global overshoot, and which would not. The footprint and the HDI need supplementing by other ecological and socioeconomic measures – freshwater scarcity and civic engagement, for example – to more fully define sustainable development.

Fig. 22: **HUMAN DEVELOPMENT AND ECOLOGICAL FOOTPRINTS,** 2003



# *Enabling the Transformation…*

For changes in the built environment, codes are the gate and code officials are the gatekeepers.

The solutions are going to be more community- and place-based. They'll require more local knowledge and intelligence. Information technology can help more appropriately fit the regulations to the place-based needs.

# *This is OUR Current Situation…*

We're dealing with a maze of regulatory structures and systems with conflicting and disconnected sets of minimum standards to control what gets built…

We're designing and trying to build projects that surpass those minimums while taking on a set of huge risks not yet incorporated into regulations

# *Our Understanding of Risk is Bigger…*

That projects seeking to meet all the existing minimum standards while addressing these huge unregulated risks are *a problem for the regulatory system* is a clear indicator of *a problem with the regulatory system*…

# *Our Understanding of Risk is Bigger…*

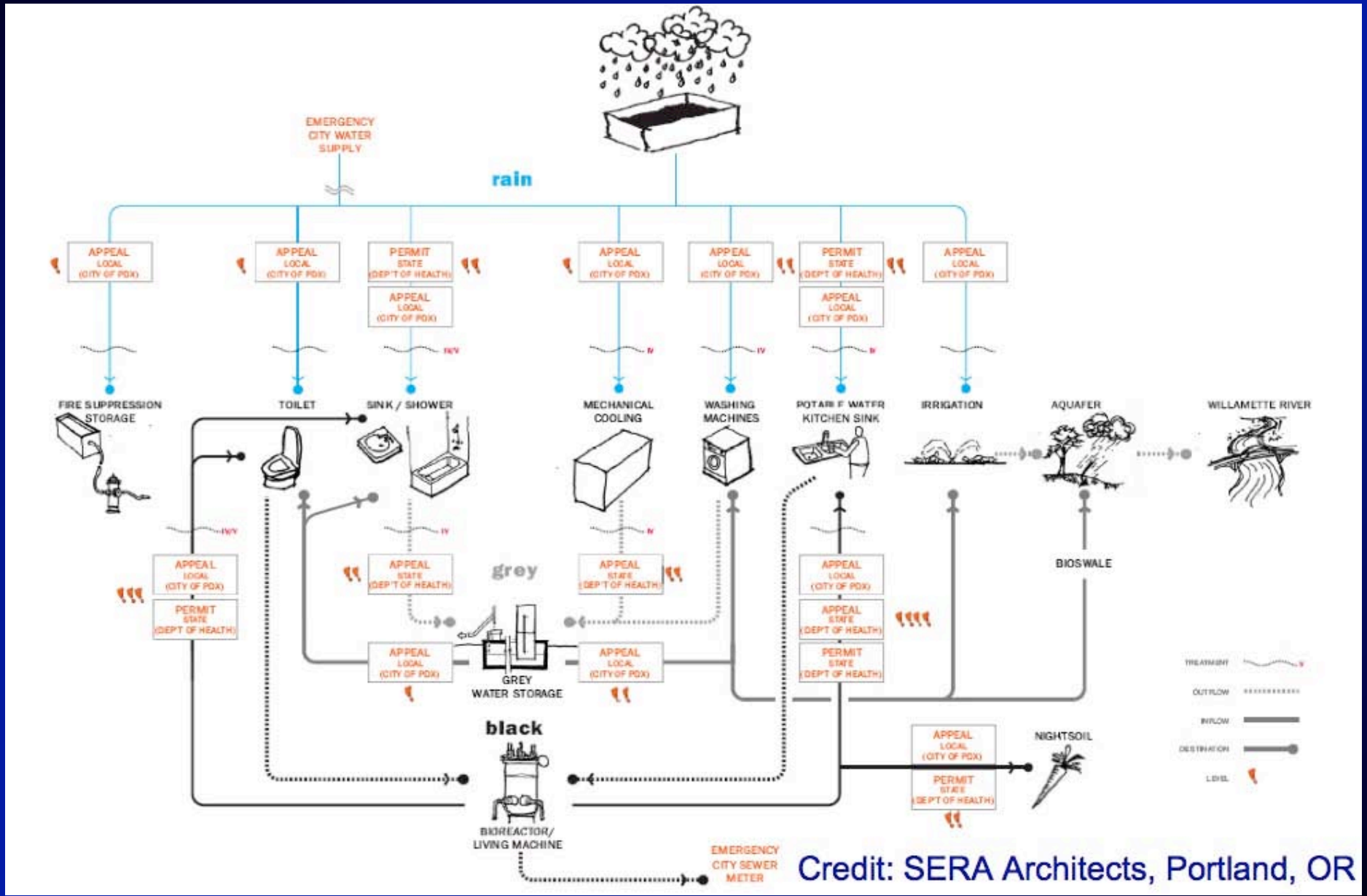
Our understanding of what is required to *safeguard public health, safety and welfare from hazards attributed to the built environment* - recognizing and attempting to balance the whole risk profile of a project - is larger and more comprehensive than the scope of concern or regulatory authority of any of the individual agencies or regulations that govern our projects.

# *This is OUR Current Situation…*


To achieve these higher goals, we use unfamiliar methods - so the regulators have a problem with our projects…

Big problem—it's not a "system." Regulatory responsibility/authority is broken into different jurisdictions, agencies, and departments, with rules, codes and standards varying from place to place–with approvals nested but not necessarily linked at each level.

# An Example: a Water Approvals Maze



# *A Couple More Problems…*

Codes and regulations are reactions to disasters, failures, or major past problems. They are about keeping bad things from recurring through the use of minimum standards.

It's *logical*, *important* and *insufficient*. A risk-averse mindset tends to view change (the unfamiliar) as at least as dangerous as known risks.

So the regulatory mindset tends to be nearly as effective at preventing the best things as the worst.

# *As Important, it Looks Back and Down…*

The focus stays on *the Known* and on *Minimums*.

There's no built-in forward-looking, problem-seeking capability to address larger-pattern, systemic risk or risks of a new kind.

When such risks do arise, the system is often slow (or worse) in recognizing and starting to deal with them.

The agencies are typically under-funded and under-staffed for their normal work load, let alone change.

# *What if the New Minimum is the Maximum?*

The large-scale risks we've allowed to grow  while looking through the microscope are now large enough that the minimum requirement to *"safeguard public health, safety and welfare from hazards attributed to the built environment"* is the most fundamental and rapid transformation to sustainable practices we can achieve.

# *Buildings are Complex Systems of Systems*

*English does not contain a suitable word for "system of problems." Therefore I have had to coin one. I choose to call such a system a "mess." The solution to a mess can seldom be obtained by independently solving each of the problems of which it is composed.* - Russell L. Ackoff

Or, more simply put…

*Optimizing components in isolation tends to pessimize the whole system.*

- Paul Hawken, Amory & L. Hunter Lovins

# *How to Not Pessimize the System?*

Building codes typically optimize components of a building in isolation, often pessimizing both the building and the systems to which it's connected.

To truly optimize buildings requires considering the whole system of systems. All technologies need to be viewed this way, to include their whole risk/benefit profile.

# *What Buildings Should and Shouldn't Do…*

Building codes could be a set of principles for what buildings should and shouldn't do…

A good first principle would be a corollary of the Hippocratic Oath; buildings should first do no harm.

To consider the harm a building might do requires looking at the impacts from its entire lifecycle…

# *Acquisition of Resources through Demolition & Beyond*


# *We Need to Ask New Questions about Risk*

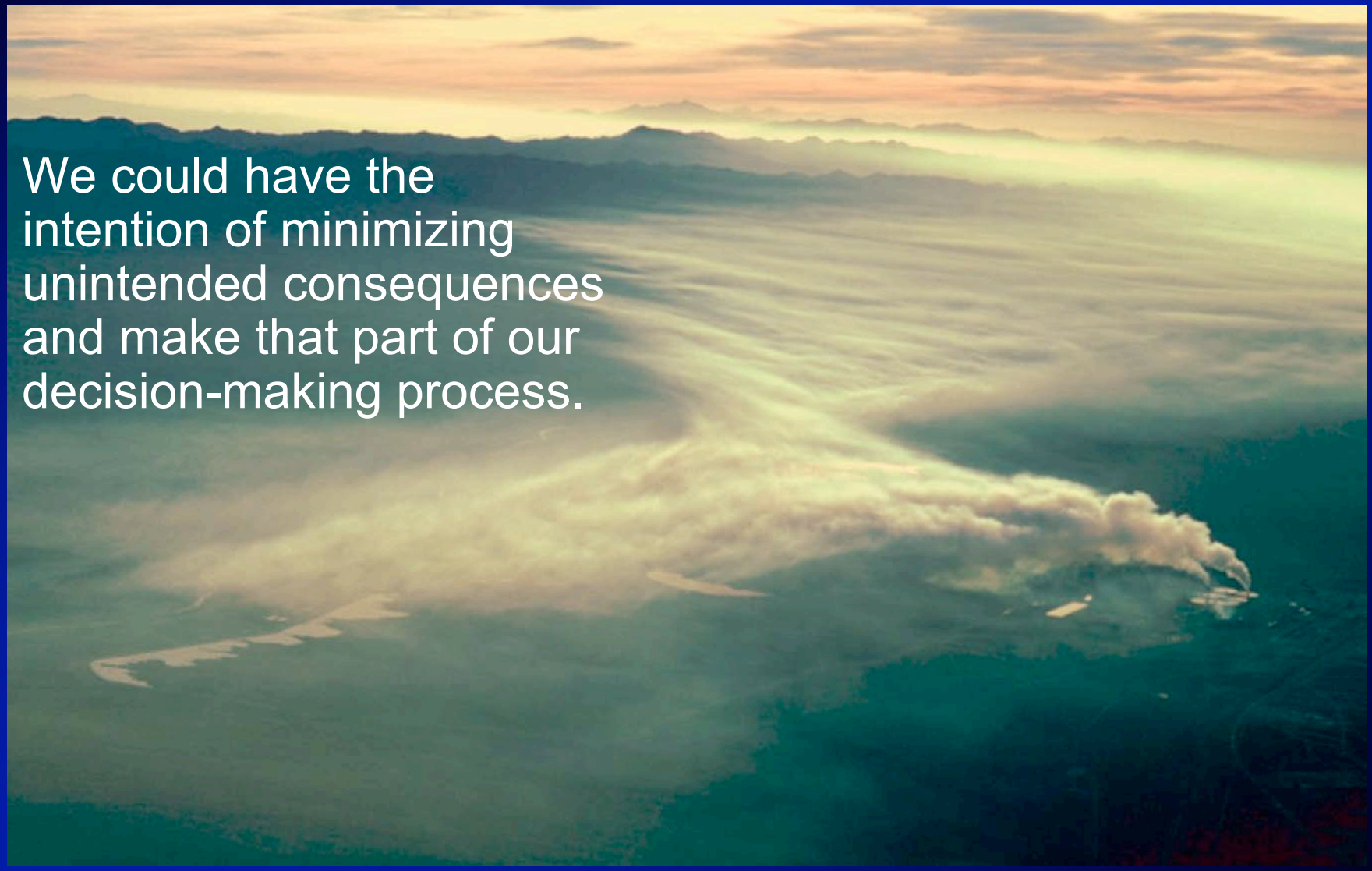
What?
Where?
To Whom?
When?
How?
How Long?
How Much?
Reversible?
Necessary?
At What Cost
and to Whom?

We can't get where we need to be by avoiding risk…

# *The Great Modern Myth*

We need to recognize and address the great modern myth - that we know what we're doing and are in control. We don't and we're not…

# *Addressing the Great Modern Myth*



# *Addressing the Great Modern Myth*

Thinking deeply about our choices of materials and systems might lead us to develop a preference for doing things as locally as possible, as simply as possible, and doing as little as possible of those things that we know are harmful or about which our knowledge and understanding is limited.

# *A Place to Start*

Appropriate technology - the lowest or simplest level of technology that can do the job well.

Appropriateness relates to where and for what purpose technology is used and the social, economic, and ecological context.

Truly appropriate technology doesn't make people or their communities dependent on systems over which they have no control. This means technologies that enhance the local capacity to meet local needs - in a lower energy world this is the foundation for security and sustainable communities.

# *Relocalization*

Doing things locally is important for many reasons, but first and foremost, the feedback loops are shorter and much higher quality. You're much more likely to run into the unintended consequences of your actions.

# *Relocalization*

If *security* is a goal, strengthening regional and local self-sufficiency is an essential strategy for us and for everyone else, everywhere else.

Enhancing the local capacity of people and their communities to meet their own needs, also:

- shortens vulnerable supply lines
- creates more robust & resilient supply systems
- supports vital, durable local economies, and
- supports healthy cultural, political, and social structures

# *Relocalization*

When we don't have inexpensive, abundant energy to drag materials around the world, process them as much as we imagine we need to, and then drag them around some more, it will become crucial that we learn, once again, how to use well those resources that are available to us where we live…

The rules and the way we think about risk and benefit will have to change - to become more nuanced, more inclusive, and more responsive.

# *Local Economic Development*

In most communities, between 70 and 80 cents of every dollar spent on energy immediately leaves the local economy…

Why do we allow the focus to remain on what energy-efficiency and renewable energy cost?

What does energy-deficiency and non-renewable energy cost? And who benefits and who pays?

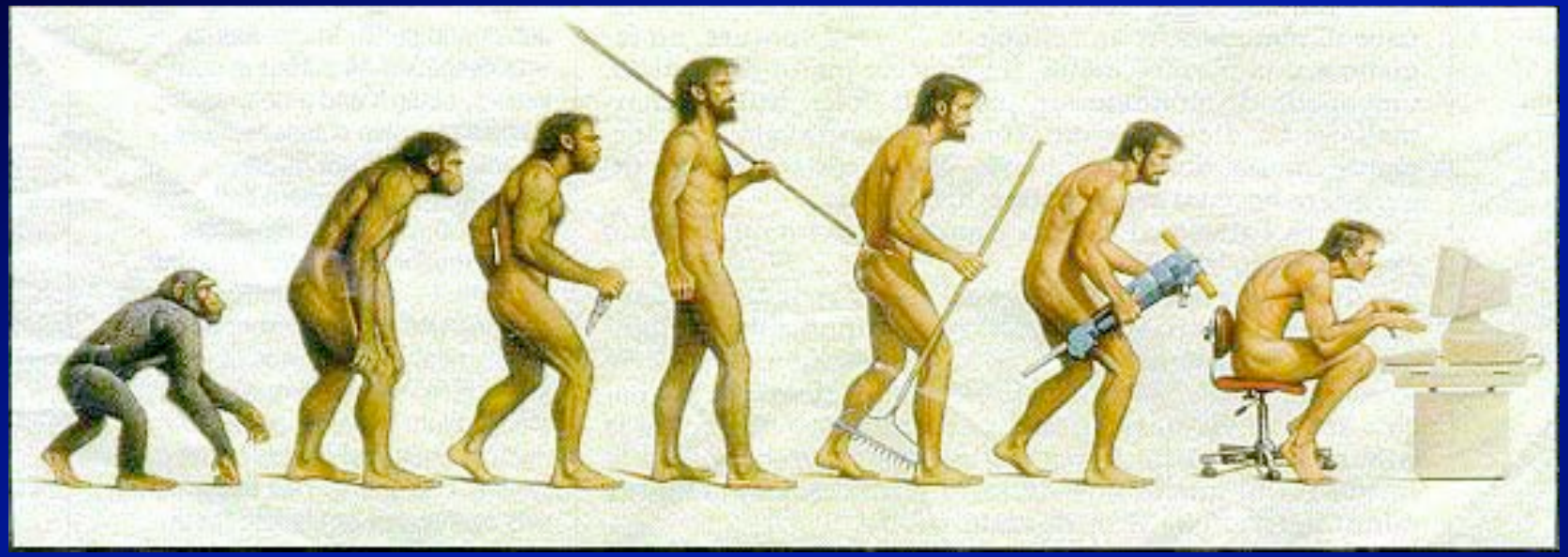
# *Some Tools and Resources*

The relocalization movement is a key part of the shift toward sustainable development and true security. This includes energy, materials, food, economic development and more. Check out these websites for more information:

www.relocalize.net

www.postcarbon.org/informed/relocalization

# *And We Keep Asking Questions…*



Why do all our systems appear to be designed to make the world safe for technology and capital?

# *Making the World Safe for Technology?*

What if we understood that our task as human beings on this planet is to make the world safe for all life forever…

## *Some Questions We Should Be Asking*

Does this choice or action:

enhance or undermine your capacity to meet your needs locally/regionally?

create benefit without making you dependent on systems over which you have little or no control?

transfer wealth out of the community?

embed you and others in your community or displace or compel people to become transient?

# *Some Questions We Should Be Asking*

Does this choice or action:

enhance or destroy equity - both the social and cultural equity related to fairness and justice, and the tangible physical/economic benefits of belonging to and being "invested in" a place-based community?

promote or undermine health - your health, the health of your family, your neighbors, your community, region, nation and the health of people and living systems anywhere in the world?

# *Some Questions We Should Be Asking*

Does this choice or action:

increase or decrease the level of unintended consequences flowing from what you are doing?

increase or decrease your awareness, comprehension and ability to mitigate the unintended consequences of what you are doing?

bring people together or drive them apart?

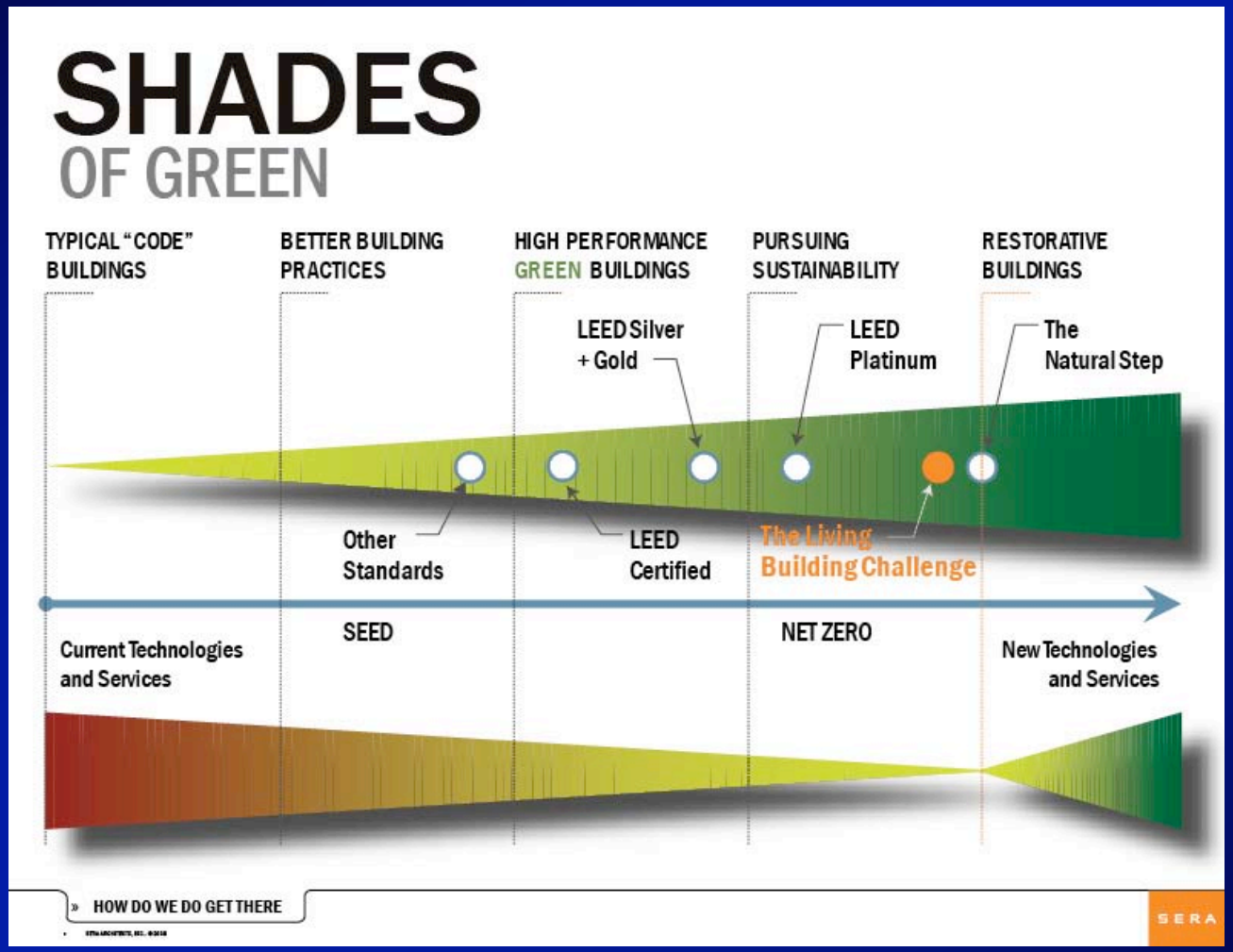
# *Some Questions We Should Be Asking*

Does this choice or action:

cause offense, concern, or harm?

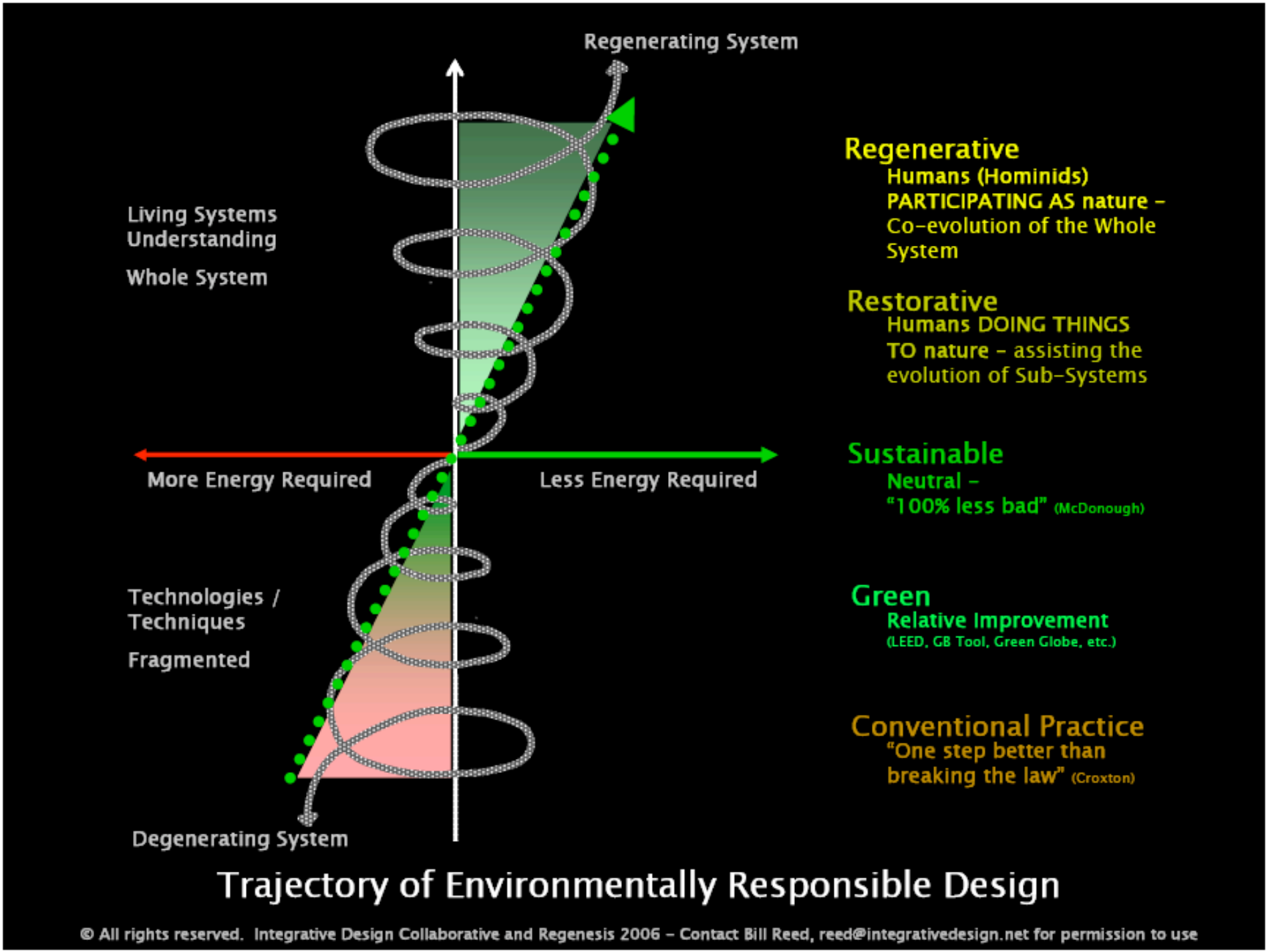
bring joy and/or satisfaction to you and to everyone effected by it?

# *The Larger Context*




Source: SERA Architects, Portland, OR - 2008

Truly restorative and regenerative projects demand a fundamentally different mindset; a commitment to honor the essence of each place we inhabit and to enhance the evolutionary capacity, vitality and health of both the natural and human systems.



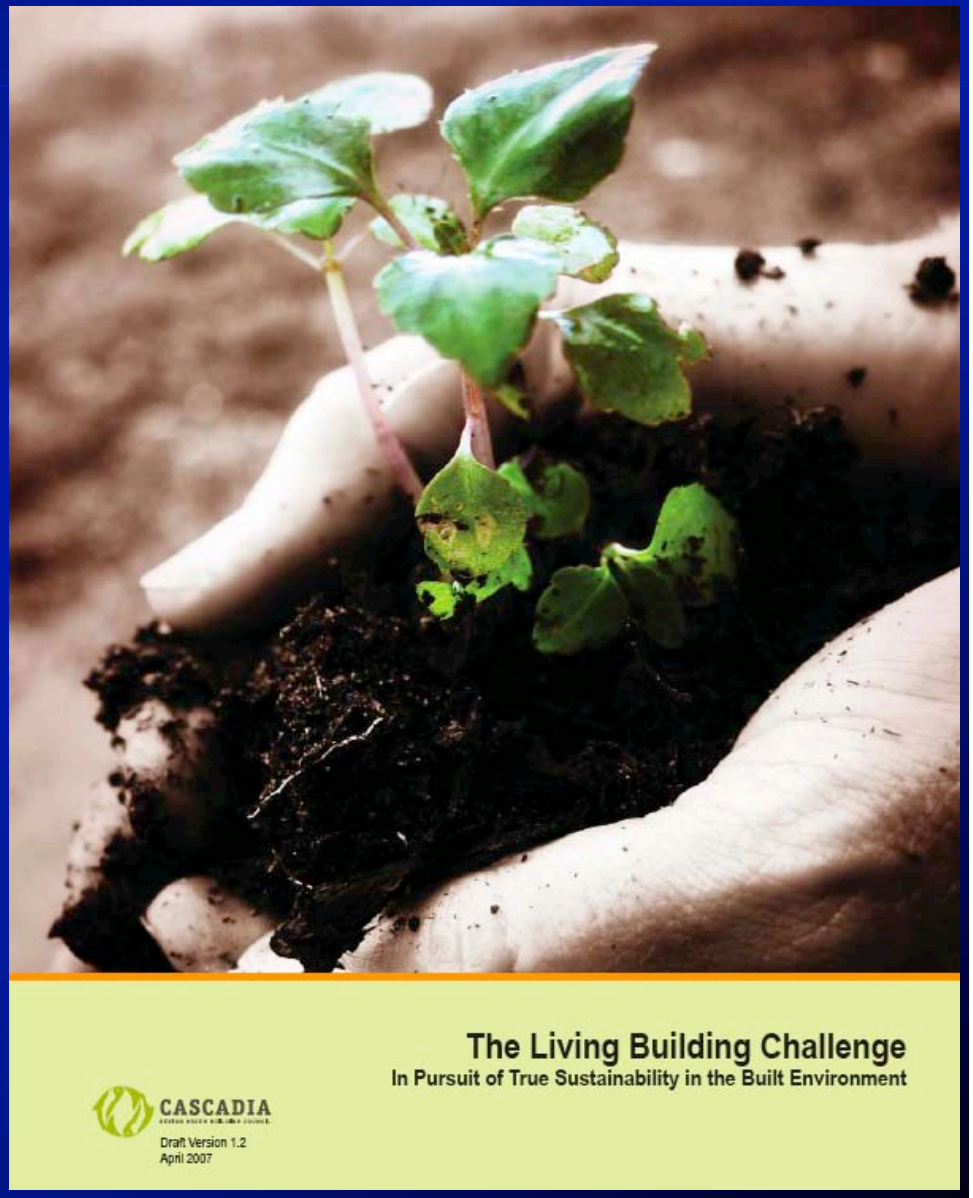

# Trajectory of Environmentally Responsible Design

# The Living Building

*The metaphor of the flower…*

- Harvests all its own energy and water
- Adapted to climate and site
- Operates pollution free
- Promotes health and well-being
- Comprised of Integrated Systems
- Is Beautiful

- www.cascadiagbc.org/lbc



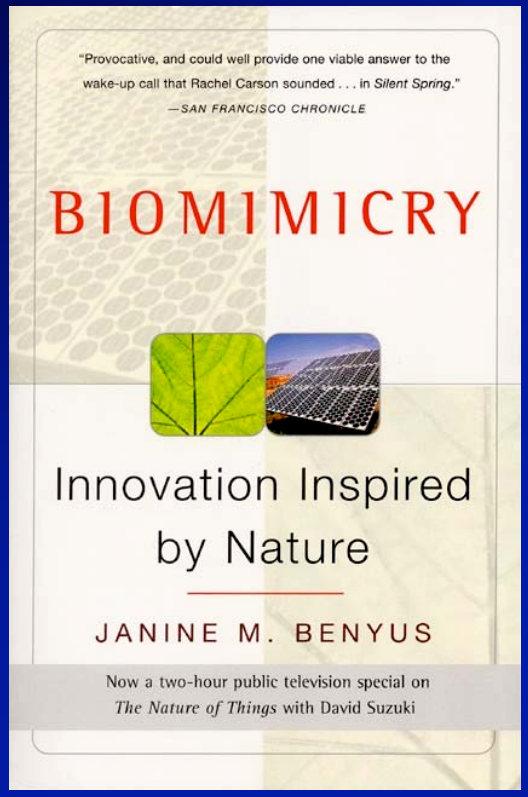
Living Building Challenge

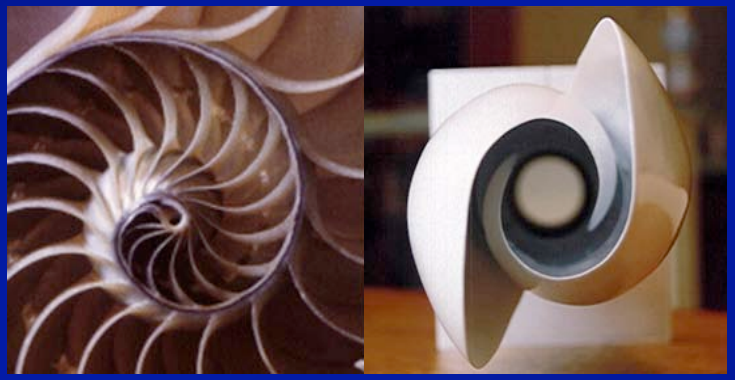
## Summary of Prerequisites

| Number | Category | Prerequisite |
|---|---|---|
| One | Site Design | Responsible Site Selection |
| Two | Site Design | Limits to Growth |
| Three | Site Design | Habitat Exchange |
| Four | Energy | Net Zero Energy |
| Five | Materials | Materials Red List |
| Six | Materials | Carbon Footprint |
| Seven | Materials | Responsible Industry |
| Eight | Materials | Appropriate Materials Radius |
| Nine | Materials | Construction Waste |
| Ten | Water | Net Zero Water |
| Eleven | Water | Sustainable Water Discharge |
| Twelve | Indoor Environmental Quality | Civilized Work |
| Thirteen | Indoor Environmental Quality | Source Control |
| Fourteen | Indoor Environmental Quality | Ventilation |
| Fifteen | Beauty & Inspiration | Design for Spirit |
| Sixteen | Beauty & Inspiration | Inspiration and Education |

# *Why Not Look at How We Got Here?*

www.biomimicry.net/



Janine Benyus, in her book *Biomimicry*, writes, “For too long we have judged our innovations by whether they are good for us, which has increasingly come to mean whether they are profitable. Now…we have to put what is good for life first, and trust that it will also be good for us. The new questions should be “Will it fit in?,” “Will it last?, and “Is there a precedent for this in nature?” If so, the answers to the following questions will be yes:

Does it run on sunlight?
Does it use only the energy it needs?
Does it fit form to function?
Does it recycle everything?
Does it reward cooperation?
Does it bank on diversity?
Does it utilize local expertise?
Does it curb excess from within?
Does it tap the power of limits?
Is it beautiful?”

# *These are Deeply Conservative Values*

Edmund Burke, the 18th-century British philosopher, statesman, and father of modern conservatism believed that conservatism is founded on social order based on a "societal contract" between "those who are living, those who are dead, and those who are to be born."

Burke saw this as a partnership promoting science, art, and virtue which could not be achieved by a single generation without deep regard for both the past and those to follow.

Burke believed that government or anyone "possessing any portion of power ought to be strongly and awfully impressed with the idea that they act in trust."

I think we have a small window of opportunity to save ourselves as a species.

I believe that window is the size and shape of the human heart…


Thank you!
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