



In 1970 the Club of Rome identified the problem we are facing and named it “The World Problematique”.

The root problem is growth: growth in human numbers, growth in human activity, growth in human consumption.

The individual problems are global in scope, affect all of humanity, and most other species as well.

The problems are interlocked; trying to fix one may make others worse.

The Perfect Storm consists of three converging storm fronts:

1. Ecological Collapse, driven by the depletion of natural resources and Climate Change
2. Energy shortages, driven by Peak Oil and Natural Gas
3. Economic destabilization driven by American debt loads and a complex and unsustainable global financial system

This presentation examines the current status of these problems and discusses ways in which individuals and communities can respond to the converging crisis.



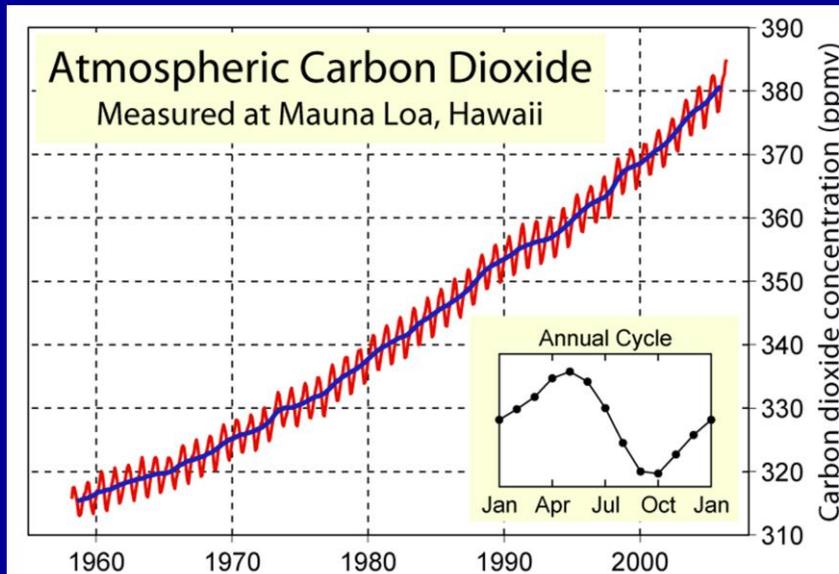
The ecological problem is caused by our prolonged unsustainable resource consumption and waste generation.

“Unsustainable” means that we conduct these activities faster than nature can cope with the consequences – faster than natural processes can replenish the resources we use or re-absorb the wastes we generate.

Of course, we also use non-renewable resources. That consumption is by definition unsustainable. Natural processes cannot replenish non-renewable resources, but they still have to deal with the waste products that result – the CO₂, the mine tailings, the landfill contents etc.

I deliberately use the term “Ecology” rather than “Environment” because I want you to think of humanity as part of an interdependent planetary web of life. Our actions have consequences far beyond our own species, and affect far more than just the quality of the air, water and soil that we use for our own purposes.

Climate Chaos



This is the major threat everyone is aware of.

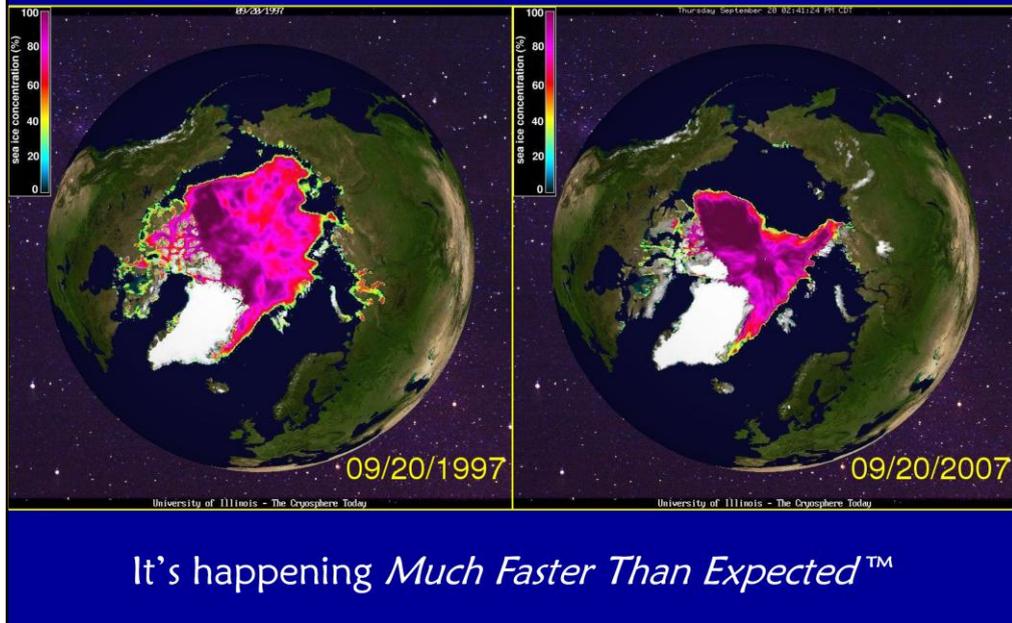
I thought it was mainly a medium- and long-term threat, but recent research into tipping points have indicated that global climate can change over a decade or two.

Atmospheric CO₂ is now at 394 ppm.

As Climate Change progresses, its effects will make all the other problems worse and harder to solve.

Al Gore recently told the World Economic Forum in Davos that the recent IPCC report from the UN was overly optimistic. The rate of change is much faster than their most pessimistic projections.

Climate Chaos



In the last two years the Arctic Ice Cap lost a an area twice the size of France.

The Arctic Ocean may be ice-free in the summer by 2015.

Scientists expected this in 2040 or 2050.

Antarctica is losing ice volume

Glacier flows are increasing dramatically due to water lubrication

High altitude glaciers e.g. Tibetan plateau and the Andes (water sources) are among the hardest hit

The Death of the Oceans



The numbers of large ocean fish have fallen by 90% since 1950, and 90% of **all** fish species could collapse before 2050.

Canada's Northern Cod stocks collapsed by 99% in the quarter century leading up to the moratorium in 1992 and show no signs of recovery 15 years later.

The biomass of prey fish in Lake Michigan declined 50% last year. It's down by 92% in the last 18 years.

The problem is overfishing. We are eating everything in the oceans.

It's not just the fish. The world-wide death of coral reefs is telling us we have utterly destroyed the oceans.

They will not recover so long as we continue using them as both a pantry and a garbage dump.

Mass Extinctions



We are living in the middle of a great extinction.

Mankind has been reducing biodiversity and causing outright extinctions for tens of millennia. The pace picked up after the development of agriculture, then accelerated again with the advent of fossil fuels.

Species are now going extinct faster than during the previous five Great Extinctions (except maybe for that asteroid...) - at a rate 1000 times faster than expected.

We are emitting carbon dioxide 10 times faster than one of the largest known volcanic eruptions – the Deccan traps – that was implicated in the Cretaceous-Tertiary extinction event 65 million years ago.

Biologists are calling this “The Anthropocene Extinction”.

Pervasive Pollution



This is how we all became aware of environmental problems: Rachel Carson's *Silent Spring* with its DDT, acid rain, the Exxon Valdez.

Canada has a growing pollution problem in Alberta due to the Tar Sands.

The world has a problem with chemical pollution of the land and the water, as well as plastic in the oceans (the Great Pacific Garbage Dump).

Loss of Arable Land



Every year the world loses 150,000 sq. km. of cropland to urbanization, deforestation and desertification. That's an area the size of Nova Scotia, New Brunswick and Prince Edward Island combined.

Over a billion people in 110 countries are now affected by desertification.

Loss of Soil Fertility and Fresh Water



About 35% of all agricultural land has been seriously damaged by intensive agriculture since WW II.

Soil fertility on the American Great Plains is half what it was a hundred years ago.

The Ogallala aquifer is being drained 100 times faster than it is being refilled.

Indian farmers have drilled 21 million water wells using oil-well technology. They take 200 cubic kilometers of water out of the earth each year for irrigation.

The biggest impact of Climate Change won't be rising sea levels, but changing weather patterns – droughts and floods. We are seeing the effects now, and they will get worse over the next 20 years.

Increased agrifuel production (either corn ethanol or cellulosic ethanol) will accelerate this depletion of both water and soil.

Declining Grain Supply



We have eaten more than we have grown in 7 of the last 8 years.

World grain stocks provided 130 days of consumption in 1986 – today, only 53 days.

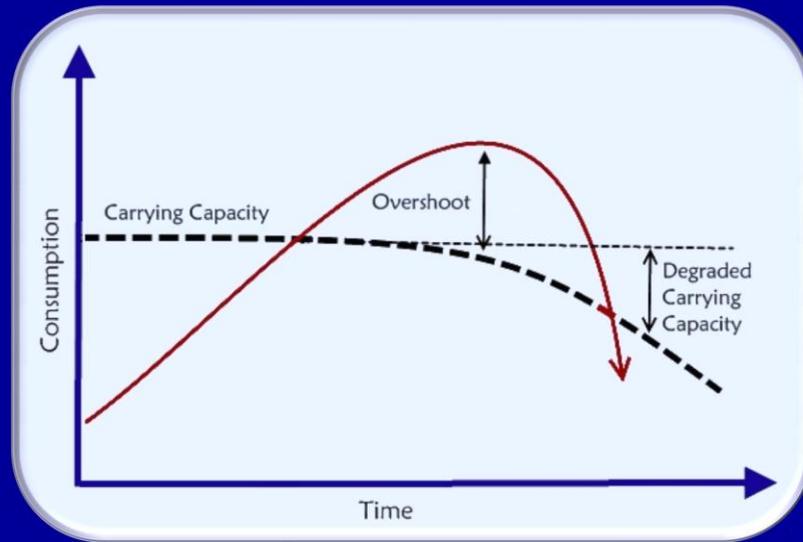
Global per capita grain supply has fallen from 340 kg in 1984 to 300 kg today.

We may have maximized the yield of grains, Climate Change is cutting yields, and there are strong indications that the use of corn for biofuels is reducing the grain available for food around the world.

The United Nations FAO is now warning of growing food shortages around the world, and potentially catastrophic shortages in Africa within 15 years.

Was Thomas Malthus right after all?

Carrying Capacity and Overshoot



Carrying capacity is the population level that an environment can support over the long term without degrading the environment.

Below the carrying capacity, populations tend to increase; above it, they will decrease.

In overshoot the population's consumption exceeds the carrying capacity of its environment, and degrades the environment.

Maintaining or increasing population or consumption during overshoot erodes the carrying capacity.

The consequence of prolonged overshoot is usually a population crash.

The fact that Climate Change is being caused by man-made CO₂ is one proof that we are in overshoot.

Humanity is at least 25% (perhaps up to 100%) into overshoot.

We did this by using our one-time gift of oil – a gift that is starting to run out.

Resilience



- Resilience is the ability to withstand shocks
- Resilience increases with diversity
- Making a system more uniform **reduces** its resilience

Resilience is a system's ability to absorb shocks

As systems grow, they increase their productivity first by expanding, then by becoming more complex, then by eliminating redundant elements (diversity)

However, resilience is a function of diversity, so as they shed diversity they lose resilience.

When a system loses resilience, shocks can cause breakdowns that ripple through the system.

Think of two cities linked by a road, a railway and a canal. In the interests of efficiency the railway and the canal are closed. A logging company then clear-cuts hills by the road. Erosion causes a landslide that cuts the road. With no alternate routes, just-in-time deliveries from city A stop. That stops manufacturing in City B, which causes layoffs, which increase the crime rate in City B.

Industrial civilization is the largest, most productive, most complex, most efficient system ever seen on Earth.

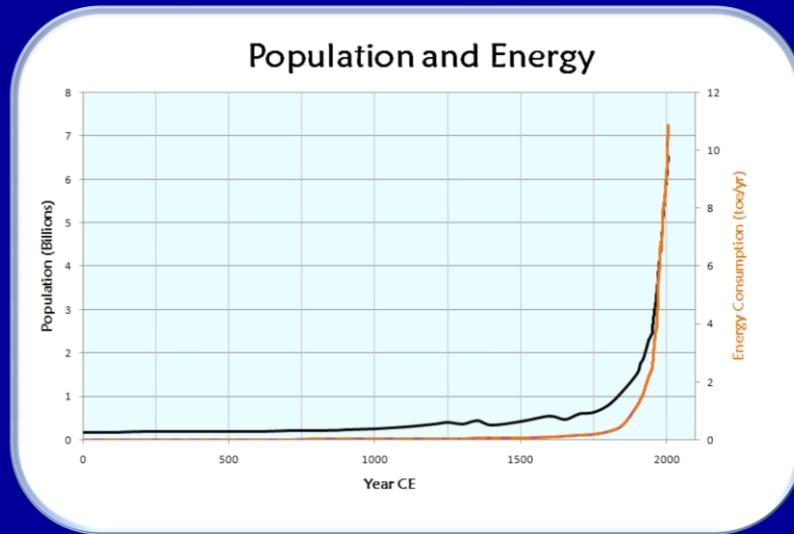
How Have We Reduced Resilience?

- Monoculture agriculture
- Just-In-Time delivery systems
- Offshore manufacturing
- The bees



The headline event is \$100 oil. What's behind that, and what does it imply for our future?

The Story of Civilization is The Story of Energy

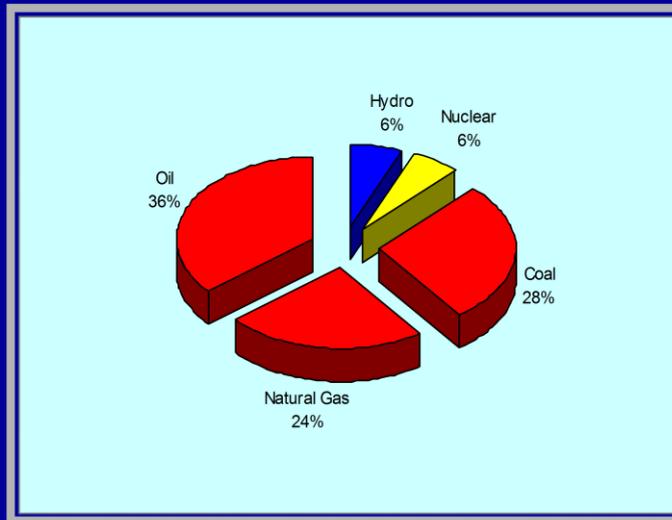


Energy is what lets our population and civilization grow.

We use food, mechanical, thermal and electrical energy.

The most important forms of energy for our civilization are oil, natural gas and electricity.

Where Do We Get Our Energy?



60% of our energy comes from oil and natural gas.

88% of our energy is from fossil fuels.

On a global scale, renewables supply only 1% of the total energy we use.

We Use 5 Cubic Kilometres of Oil Every Year



1000 barrels a second
85 million barrels a day
30 billion barrels a year

How Much Energy Is That?



It's the yearly output of:

- 300 Three Gorges dams, or
- 6,000 coal or nuclear power plants, or
- 6,000,000 wind turbines, or
- 100,000,000,000 solar panels

A barrel of oil contains the energy of 20,000 hours of human labour (ten years of 8-hour days).

85 million barrels of oil a day is the equivalent of the work of over 200 billion human beings

Oil Is Our Master Resource

- Transportation fuel (70%)
- Heating fuel
- Asphalt
- Plastic
- Artificial fibres
- Fertilizer
- Pesticides
- Paint
- Insulation
- Adhesives
- Detergents
- Pharmaceuticals
- Look around you...

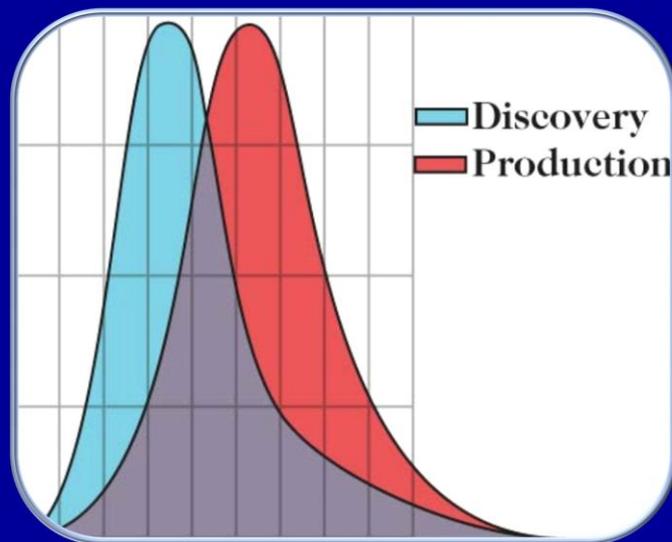


Electricity can't replace oil in all its roles.

Oil is the master resource of our civilization.

Everything we do depends directly or indirectly on cheap oil.

What is Peak Oil?



The production rate of an oil field follows a bell curve over time.

Production increases as the field is developed, but then slows down after **about half** the oil has been extracted.

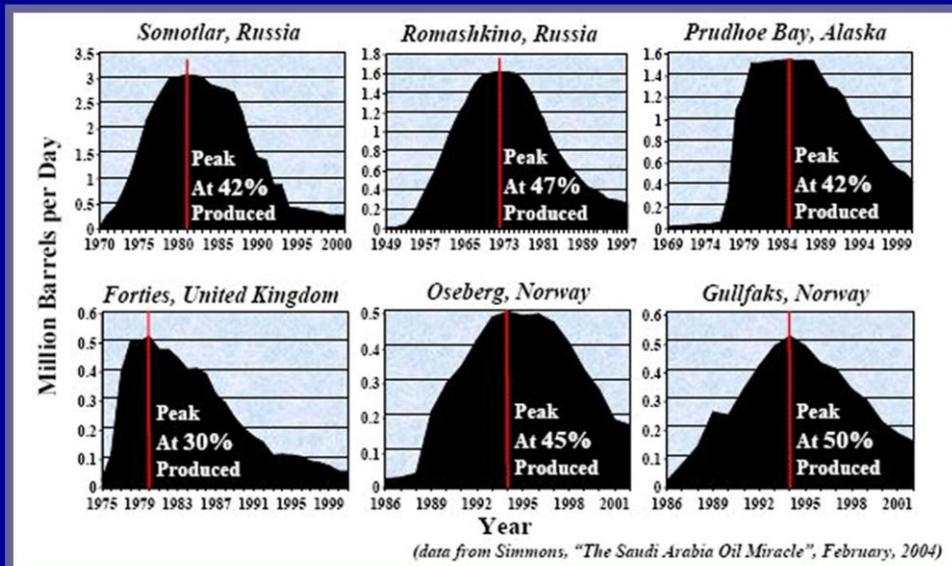
This applies to oil fields, countries and the world.

Peak Oil is a flow rate problem, not a reserves problem. We need a certain amount, every day, to keep civilization running.

It's not the size of the tank that matters, it's the size of the tap.

*We have used **about half** the world's oil.*

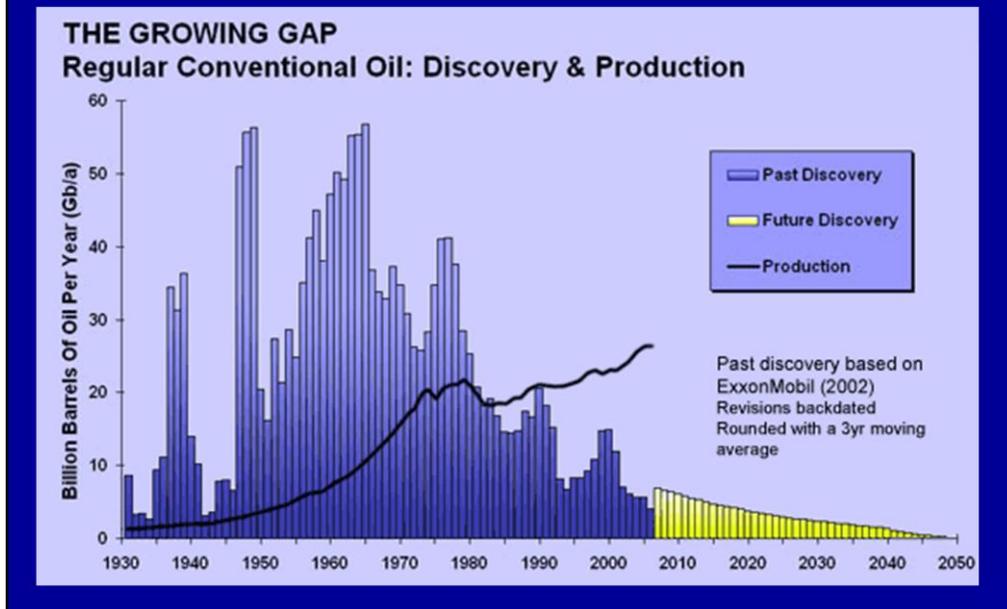
All Oil Fields Peak



Notice how their production rates all decline after they peak.

The underlying principle of Peak Oil is that the world will behave like one huge oil field – rising over time to peak production, then entering a permanent decline.

Consumption Outstrips Discovery



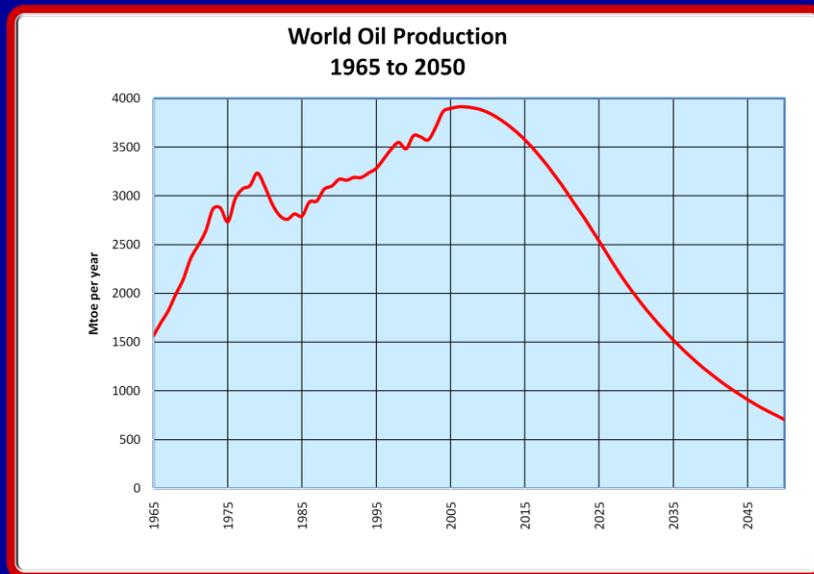
Discoveries peaked over 40 years ago.

The world has now been almost fully explored, so it's utterly unlikely that we will discover enough new oil to keep pace with our consumption.

We have been consuming more oil than we've discovered since 1985.

Today we consume 5 barrels for every one we find.

The Peak is Happening Now



Matthew Simmons, T. Boone Pickens, Samsam Bakhtiari, Ken Deffeyes have already said they believe the peak has happened already.

Production of crude oil has been on a plateau for two years.

Some major oil regions (USA, Mexico, North Sea) are in steep decline, and even Russia and Saudi Arabia may already be in decline.

It's hard to tell what the real situation is because no oil producing nation tells the truth, the whole truth and nothing but the truth.

We will know the peak has happened for sure a couple of years after the event.

The Net Oil Export Problem



This is the most likely early trigger for global difficulties.

As oil prices rise, the economies of exporting countries grow.

That growth increases their domestic oil consumption.

Governments tend to satisfy domestic demand first, and export what is left over.

As their production begins to decline, their exports will fall very rapidly.

While oil production will never fall to zero, oil exports can.

There are signs this is already affecting the world export markets – China is moving from market purchases to long term contracts with suppliers.

The world oil market could be effectively empty shortly after 2030.

The net oil export problem will affect major importers like Europe and the USA.

As an oil exporter Canada won't have that problem, but there is NAFTA 605.

The USA will be looking north for an increasing proportion of its energy needs as suppliers like Mexico falter.

That means more pressure to develop the tar sands.

What sorts of pressure? At first political, then economic, then possibly military.

Are There Substitutes For Oil?

- **Biofuels**
 - Put food in our gas tanks???
- **Liquids from Coal**
 - Too polluting
- **Hydrogen**
 - The fuel of the future, and always will be
- **Electricity**
 - Maybe. Electrified rail and urban mass transit

There are NO realistic substitutes for oil.

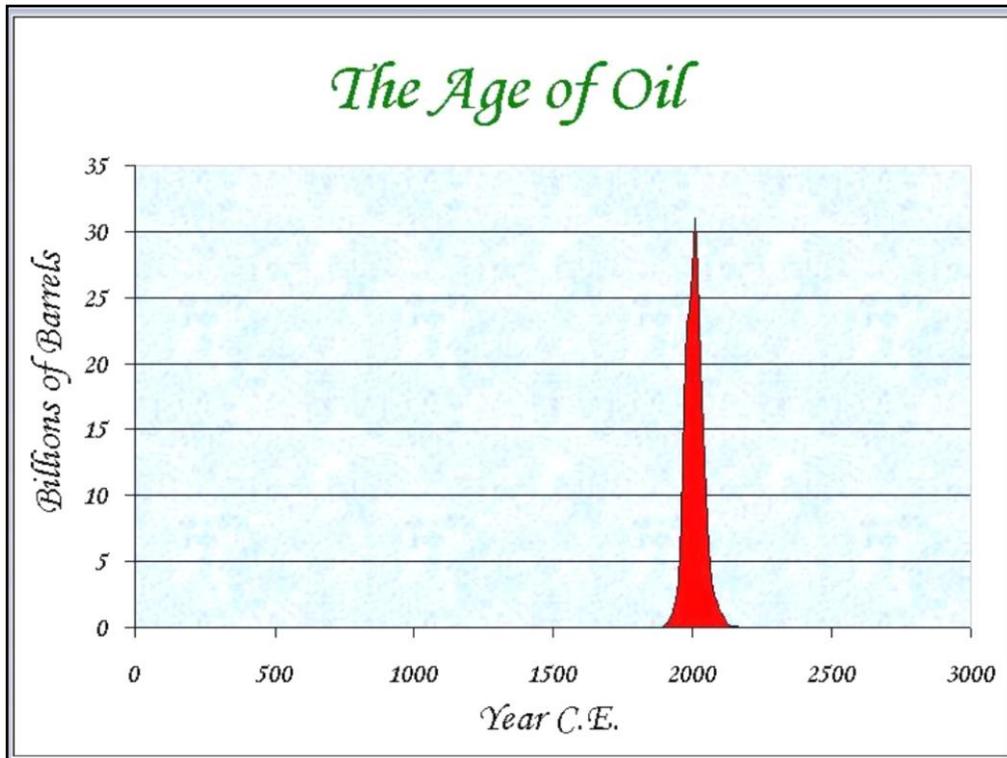
Biofuels: low net energy, competes with food

Coal To Liquids: pollution, scale

Hydrogen: most of it comes from natural gas, which is already in decline in North America.

Electricity: a 4% oil decline = 250,000 wind turbines?

All have **major** problems with scale, timeframe, infrastructure or environmental consequences.



Considered over the timescale of recorded history, the era of oil use is going to be extremely brief.

The Oil Age has lasted about 100 years so far, and it probably has less than 100 years to run.

We will never completely “run out of oil”. Long before we do, oil will get extremely scarce, and as a result extremely expensive.



The global economy incorporates an assumption of perpetual growth.
It was inevitable that it would run into some limits.

The World Economy is Unstable



To support our economic requirement for perpetual growth the financial world has created an increasingly complex system of perpetually growing credit and debt.

This situation is by definition unsustainable.

The US debt is at record levels.

Derivatives: financial instruments that derive their value from an underlying asset (e.g. a basket of sketchy mortgages). They are often heavily leveraged – valued at many multiples of the value underlying asset.

The global GDP is 65 trillion dollars, but the derivative market has a paper value of 750 trillion.

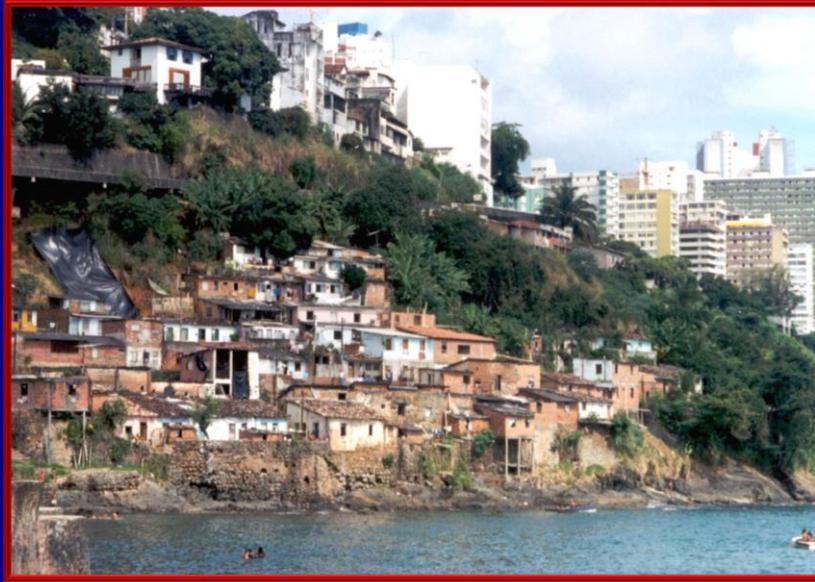
There is a problem with US bank reserves – as of Jan. 16, 2008 the 10% of the loan values they have to keep on hand is all borrowed from the Federal Reserve.

The stock market is at the beginning of a massive reorganization (meltdown).

As excessively leveraged positions unwind around the world, a global depression is becoming more and more likely.

The world's economy in 10 years is unlikely to resemble what we have today.

Economy Shapes Society



The gap between rich and poor is at record levels, and is still growing.

The per capita income gap between a rich and a poor nation is over 30:1.

The number of failing states is growing: Zimbabwe, North Korea, Haiti, Sudan, Nigeria, Chad, Iraq, Congo, Afghanistan, Somalia, Bangladesh, Uganda, Egypt, Burma, Pakistan, Uzbekistan...

Cultural and religious clashes are spreading and growing more violent.

Growing population in the failing states makes their economic problems worse, as do increasing world prices for food and energy.

There are already 33 million refugees under the protection of UNHCR. That number will increase dramatically over the next two decades.

All The Problems Interact

- Peak Oil → more coal → more Climate Chaos
- Climate Chaos → more droughts and floods → declining grain production
- Declining grain supplies → more land cleared for agriculture → desertification and biodiversity loss
- Declining economy → less capital for new energy technologies → more “old energy” like coal

The number, scope and interaction of these problems makes the whole set “hard to solve”.

“Hard to solve” is scientists’ code for “impossible”.

Can We Prevent the Converging Crisis?



- Can we roll back the tides of Climate Chaos?
- Can we find alternatives to oil?
- Can we restructure the world's economy?
- Can we do it in the time we have left?

Can We Change Our Ways?

- Our natural tendency to consume, reproduce and compete are reinforced by our institutions
- Individuals and small groups will react in advance; large groups won't
- Politicians need to be elected by large groups; don't count on them for leadership

Human behaviour is influenced by evolved genetic imperatives: the drives to reproduce, consume, compete and seek status, as well as drives to help our family and tribe members when they are in trouble, and cooperate with close allies to succeed in both nurturing and inter-group competition.

The social, economic, political, industrial and educational institutions we have created all support the hierarchical, competitive, growth-oriented aspects of our nature rather than cooperation, altruism and sustainability (nature-nurture interaction).

These institutions have tremendous influence over public attitudes world-wide, to the extent that a majority see the values of competition, growth and individualism as self-evident.

It is not in their interest for these institutions to relinquish their position. They will fight to the death to stay in control.

It's up to us to effect change, as it always has been.

There Isn't Much Time Left

- The problems are happening **now**
- They are happening **faster** than we expected
- They are **worse** than predicted
- We'll be in the heart of the crisis in 15 years
- We can't prevent it, but we can protect ourselves

It's time to prepare.



Democratically elected politicians will not be able to address the converging crisis.

Leaders that require the consent of the governed will be hamstrung by dissent, denial and resistance among their electorate. Due to the nature of democracy disruptors can't be excluded from the debate. As a result, their policy options will be quite limited, and even if leaders understand the severity of the situation they will be rendered impotent by the very nature of democracy

Non-political individuals like Al Gore or David Suzuki can influence the debate, but have limited ability to directly act on events because they are lone individuals outside the corridors of power.

As far as I can determine this means there are only two potential sources of effective action: autocrats who do not depend on consent, and consensual groups that self-select for altruism and awareness.

Individual awareness and action is the foundation of all change. However, most individuals have a limited effect on the world. To overcome this, individuals capable of reasoned thought, cooperative dialogue and some degree of wisdom can form communities of interest. These communities focus and amplify their members' actions, but more importantly they act to exclude people who oppose their methods or goals. As a result reasonable things can be accomplished, at least within the group's sphere of influence.

Small communities (under 150 people) have always been the building blocks of human society.

"I get by with a little help from my friends."

The Usual Suspects

- Change your light bulbs and insulate your house
- Drive less and reduce your air travel
- Buy local food, goods and services
- Join a green electricity supplier
- Start a vegetable garden
- Reduce/reuse/recycle/repair
- Avoid overpopulation
- Eat less meat
- Get out of debt
- Become active in politics or community groups
- Throw block parties (get to know your neighbours)

All action starts with the individual, so here are some ideas for things you can do to make your own life less expensive, more secure and more fulfilling.

There are many, many lists of actions and ideas like this on the Internet.

In addition to these, I want to present some less common ideas that might spark your thinking about individual and community responses.

A Place: Kerala

- 30 million people, average income \$500
- In 1957, a progressive Communist government focused on social reform rather than economic reform
- Today Kerala has:
 - A total fertility rate of 1.7 (not 2.9)
 - Infant mortality of 12 per 1000 (not 65)
 - Life expectancy of 73 years (not 64)
 - High levels of education
 - Excellent health care
 - Matrifocal social values
- Kerala is proof that high quality of life *can co-exist* with low consumption

People worry that the looming crisis may reduce their quality of life as well as their standard of living.

The Indian state of Kerala is evidence that this is not inevitable. With the right social policies and strong communities, quality of life can be maintained even if incomes drop substantially.

“Money doesn’t buy happiness.” Repeated studies have shown this. Family, community and getting enough sleep make you happier than money.

A Movement: All of Us

- There are one to two million independent, local citizens' groups devoted to environmental and social justice issues
- It has been called "*The largest social movement in the history of the world*"
- It's not an organized movement
- It is our natural response to increasing problems in society and the biosphere
- These groups are "*Gaia's antibodies*"

The movement already exists.

It has been described by Paul Hawken in his book "Blessed Unrest".

Each group works on local issues of its own choice.

These groups exist in every city in country on earth regardless of how tyrannical or democratic, rich or poor they are.

There is no global organization or leadership. There is no "white male vertebrate leader" setting the agenda.

Their independence makes them resilient, their wide distribution means that they will survive hard times.

They are perfectly positioned to be the seeds of a new sustainable civilization, if such a thing is possible.

Why is the Movement Important?

- The movement is tremendously resilient
- Its values are those of sustainability:
 - Cooperation, not competition
 - Nurturing, not exploiting
 - Consensus, not hierarchy
 - Recognition of interdependence
 - Respect for other life
 - Acceptance of limits
 - Universal justice
 - It is strongly matrifocal, which supports those values.

They help mitigate existing problems now.

They form the seed stock for the rebirth of a truly sustainable civilization later.

They are humanity's best long-term hope.

We can all participate.

A Network: “Transition Towns”

- Started in the UK as an integrated way for communities to prepare for the shifts that will accompany Peak Oil and Climate Change
- A cooperative, networked approach to sharing ideas and techniques for a transition to low-carbon living
- Still very formative, but the network includes 24 communities.
- Extensive resources at www.transitiontowns.org

A Philosophy: Permaculture

- An agro-ecological design theory
- Permanent and sustainable agricultural practices
- Expand biodiversity, reduce ecological damage
- Integrates human needs into the biosphere
- Holistic, system-oriented, respects limits
- Well developed set of principles and practices
- Example: edible landscaping
- Large movement with groups in North America and Europe (including Ottawa)

A Technology: Terra Preta



It's one of the most encouraging technologies I've discovered – better than solar panels, better than wind turbines, even better than genetically engineered soybeans.

Terra Preta is the intentional use of charcoal in soils.

Terra preta means “dark soil” in Portuguese. It refers to expanses of very dark, fertile patches of soil found in the Amazon Basin. It owes its name to the very high charcoal content of the soil.

Charcoal provides a home for huge numbers of microbes and fungi that improve soil fertility. It also acts as a soil amendment – it's alkaline and over time improves soil consistency.

Terra preta soils are typically 2-3x more fertile than raw soil, without the addition of chemical fertilizers.

The carbon in charcoal stays underground for thousands of years. This is the definition of “carbon sequestration”.

Charcoal can be made at any scale, from backyard to factory.

It can be made from most woody material, including fast growing plants like bamboo or coppice willow or poplar.

Growing such trees, making them into charcoal, using some of the charcoal in the soil the trees grew in, then replanting the trees would provide an effective way of reducing the carbon dioxide in the atmosphere over time.

A hectare of soil could sequester up to 10 tonnes of carbon in the form of charcoal every year. That would reduce fertilizer needs and improve crop yields.

Try it in your garden along with your compost.

An Economy: Barter and Local Currencies

- Local or community currency:
 - A community can establish its own medium of exchange
 - Allows varying goods to be traded more easily than by barter
- Barter:
 - Goods and services are traded directly with no medium of exchange
 - Barter is easier for informal transactions – only two people need to agree on value
- They are legal, but the tax man hates them both

Local currencies and barter economies give individuals and communities more control over their own economic activities.

They become extremely important in times of economic crisis.

Computers and the Internet make them easier to implement and manage.

Many local currencies already exist (e.g. the Toronto Dollar) but most are tied to the regular currency system.

If that system falters, local currencies can be easily uncoupled to function on their own.

A Social Structure: Co-Housing



- People thrive in small, close communities
- People need privacy and a sense of ownership
- Group effort makes alternative energy and food production easier
- “It takes a village to raise a child”

Co-housing has elements of cooperatives, condominiums and communes.

Members decide how they will be structured, what the important features are, what the ownership requirements are.

They are difficult to start, but can make excellent communities.

One excellent example (with a complete how-to web page) is Earthsong Eco-Village in New Zealand.

An Attitude: I HELP

Involve yourself: Become an antibody.

Humanize: Form closer ties with others.

Economize: Conserve wherever possible.

Localize: Reduce travel for food, work, leisure.

Produce: Some of your own food and energy.

A simple mnemonic provides a high-level reminder of the kinds of things we should think about and do in the years ahead.

Conclusions

- The converging crisis of ecology, energy and economics is already here
- We need to adapt to the coming changes and protect ourselves from their worst effects
- Politicians will not be able to do enough, fast enough
- Individual and community actions are the key

“I get by with a little help from my friends!”

The Beatles wrote the theme song for the coming changes.

Canada's Greatest Canadian, Tommy Douglas, reminded us, "Courage, my friends; 'tis not too late to build a better world."

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