Creating a Sustainable and Desirable Future

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Full World Anthroposphere
A “no analog” world.
Practical Problem Solving Requires the *Integration* of:

- **Vision**
  - a. How the world works
  - b. How we would like the world to be

- **Tools and Analysis**
  - appropriate to the vision

- **Implementation**
  - appropriate to the vision
“What if the crisis of 2008 represents something much more fundamental than a deep recession? What if it’s telling us that the whole growth model we created over the last 50 years is simply unsustainable economically and ecologically and that 2008 was when we hit the wall — when Mother Nature and the market both said: “No more.”

The Inflection Is Near?
By THOMAS L. FRIEDMAN
New York Times
Published: March 7, 2009
Atmosphere
Temperature, past and future

![Graph of temperature anomalies over time, showing past trends and projected future increases.](image-url)
<table>
<thead>
<tr>
<th>Global temperature change (relative to pre-industrial)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0°C</td>
</tr>
<tr>
<td>Food</td>
</tr>
<tr>
<td>Falling crop yields in many areas, particularly developing regions</td>
</tr>
<tr>
<td>Falling yields in many developed regions</td>
</tr>
<tr>
<td>Possible rising yields in some high latitude regions</td>
</tr>
<tr>
<td>Water</td>
</tr>
<tr>
<td>Small mountain glaciers disappear – water supplies threatened in several areas</td>
</tr>
<tr>
<td>Significant decreases in water availability in many areas, including Mediterranean and Southern Africa</td>
</tr>
<tr>
<td>Sea level rise threatens major cities</td>
</tr>
<tr>
<td>Ecosystems</td>
</tr>
<tr>
<td>Extensive Damage to Coral Reefs</td>
</tr>
<tr>
<td>Rising number of species face extinction</td>
</tr>
<tr>
<td>Extreme Weather Events</td>
</tr>
<tr>
<td>Rising intensity of storms, forest fires, droughts, flooding and heat waves</td>
</tr>
<tr>
<td>Risk of Abrupt and Major Irreversible Changes</td>
</tr>
<tr>
<td>Increasing risk of dangerous feedbacks and abrupt, large-scale shifts in the climate system</td>
</tr>
</tbody>
</table>

Source: Stern review on the economics of climate change, 2006
It has been said that if one fails to understand the past, one is doomed to repeat it.

If we can really understand the past, (by creating a science of the past) we can create a better, more sustainable and desirable future.
Integrated History and future Of People on Earth

Jared Diamond identified what he considered to be the 12 most serious environmental problems facing past (and future) societies, problems that often have led to the collapse of historical societies:

1) Loss of habitat and ecosystem services,
2) Overfishing,
3) Loss of biodiversity,
4) Soil erosion and degradation,
5) Energy limits,
6) Freshwater limits,
7) Photosynthetic capacity limits,
8) Toxic chemicals,
9) Alien species introductions,
10) Climate change,
11) Population growth, and
12) Human consumption levels.

More importantly, Diamond, and several other authors before him emphasized that the interplay of multiple factors is almost always more critical than any single factor. Systems that lose resilience are vulnerable to shocks from several sources.
Increasing Frequency and Intensity of Storms
Increasing number of flood events

Source: Millennium Ecosystem Assessment
Potential “tipping elements” in the climate system.
(from Lenton et al. 2008)

**Figure 1** | **Beyond the boundary.** The inner green shading represents the proposed safe operating space for nine planetary systems. The red wedges represent an estimate of the current position for each variable. The boundaries in three systems (rate of biodiversity loss, climate change and human interference with the nitrogen cycle), have already been exceeded.
In a full world context, what is “the economy” and what is it for?
"Empty World" Model of the Economy

Basic premises:
More is always better
The economy can grow forever (scale is not an issue)
Poverty can best be solved with more growth
Nature is a side show
Private property is always best
Empty World Energy Planning?

Alabama Power’s motto: “Always on”

“With Electricity prices at least 15% below the national average, why not?”
What will you wear to the apocalypse?
The Global Recession presents an opportunity and a necessity to change:

Worldviews
Institutions and Technology in an integrated way

## Differences between the current, empty world model and the full world model


<table>
<thead>
<tr>
<th>Primary policy goal</th>
<th><strong>Current Development Model:</strong> the “Washington Consensus”</th>
<th><strong>Sustainable and Desirable Development Model:</strong> an emerging “Green Consensus”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary measure of progress</td>
<td>GDP</td>
<td>Better: Focus must shift from merely growth to “development” in the real sense of improvement in quality of life GPI (or similar)</td>
</tr>
<tr>
<td>Scale/carrying capacity</td>
<td>Not an issue since markets are assumed to be able to overcome any resource limits via new technology</td>
<td>A primary concern as a determinant of ecological sustainability. Real limits exist</td>
</tr>
<tr>
<td>Distribution/poverty</td>
<td>Lip service, but relegated to “politics” and a “trickle down” policy: a rising tide lifts all boats</td>
<td>A primary concern since it directly affects quality of life and social capital and is often exacerbated by growth</td>
</tr>
<tr>
<td>Economic efficiency/allocation</td>
<td>The primary concern, but generally including only marketed goods and services (GDP) and market institutions</td>
<td>A primary concern, but including both market and non-market goods and services – natural and social capital.</td>
</tr>
<tr>
<td>Property rights</td>
<td>Emphasis on private property and conventional markets</td>
<td>Emphasis on a balance of private, state, and common property rights regimes appropriate to the nature and scale of the system, and a linking of rights with responsibilities</td>
</tr>
<tr>
<td>Role of Government</td>
<td>To be minimized and replaced with private and market institutions</td>
<td>A central role, including new functions as referee, facilitator and broker in a new suite of common asset institutions</td>
</tr>
<tr>
<td>Principles of Governance</td>
<td><em>Laissez faire</em> market capitalism</td>
<td>Lisbon principles of sustainable governance</td>
</tr>
</tbody>
</table>
Quality of Life (QOL) as the interaction of human needs and the subjective perception of their fulfillment, as mediated by the opportunities available to meet the needs.

Well-being vs. GDP

Figure 2. Subjective well-being by level of economic development.
R = .70 N = 65 p < .0001
### A range of goals for national accounting and their corresponding frameworks, measures, and valuation methods

<table>
<thead>
<tr>
<th>Goal</th>
<th>Marketed</th>
<th>Economic Income</th>
<th>Economic Welfare</th>
<th>Human Welfare</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Weak Sustainability</td>
<td>Strong Sustainability</td>
<td></td>
</tr>
<tr>
<td>Basic Framework</td>
<td>value of marketed goods and services produced and consumed in an economy</td>
<td>1 + non-marketed goods and services consumption</td>
<td>2 + preserve essential natural capital</td>
<td>value of the welfare effects of income and other factors (including distribution, household work, loss of natural capital etc.)</td>
</tr>
<tr>
<td>Non-environmentally adjusted measures</td>
<td>GNP (Gross National Product)</td>
<td>GDP (Gross Domestic Product)</td>
<td>NNP (Net National Product)</td>
<td>MEW (Measure of Economic Welfare)</td>
</tr>
<tr>
<td>Environmentally adjusted measures</td>
<td>NNP (Net National Product including non-produced assets)</td>
<td>ENNP (Environmental Net National Product)</td>
<td>SNI (Sustainable National Income)</td>
<td>ISEW (Index of Sustainable Economic Welfare)</td>
</tr>
<tr>
<td>Appropriate Valuation Methods</td>
<td>Market values</td>
<td>1 + Willingness to Pay Based Values (see Table 2)</td>
<td>2 + Replacement Costs, Production Values</td>
<td>3 + Constructed Preferences</td>
</tr>
</tbody>
</table>

Genuine Progress Indicator (or ISEW) by Column

**Additions**
- Column A: Personal Consumption Expenditures
- Column B: Income Distribution
- Column C: Personal Consumption Adjusted for Income Inequality
- Column D: Value of Household Labor
- Column E: Value of Volunteer Work
- Column F: Services of Household Capital
- Column G: Services Highways and Street
- Column H: Cost of Crime
- Column I: Cost of Family Breakdown
- Column J: Loss of Leisure Time
- Column K: Cost of Underemployment
- Column L: Cost of Consumer Durables
- Column M: Cost of Commuting
- Column N: Cost of Household Pollution Abatement
- Column O: Cost of Automobile Accidents

**Subtractions**
- Column P: Cost of Water Pollution
- Column Q: Cost of Air Pollution
- Column R: Cost of Noise Pollution
- Column S: Loss of Wetlands
- Column T: Loss of Farmland
- Column U: Depletion of Nonrenewable Resources
- Column V: Long-Term Environmental Damage
- Column W: Cost of Ozone Depletion
- Column X: Loss of Forest Cover
- Column Y: Net Capital Investment
- Column Z: Net Foreign Lending and Borrowing
Indices of ISEW—
(Index of Sustainable Economic Welfare)
and GDP —
(1970 = 100)
Gross Production vs. Genuine Progress for the US, 1950 to 2002
(source: Redefining Progress - http://www.rprogress.org)
Genuine Progress Indicator (GPI) per capita

Bottom Line: Growth in material consumption (GDP) is not sustainable AND it does not necessarily bring happiness
The key is developing a better understanding of the opportunities to create a sustainable future with a high quality of life.
The Commons

“refers to all the gifts we inherit or create together. This notion of the commons designates a set of assets that have two characteristics:

they’re all gifts, and
they’re all shared.

A gift is something we receive, as opposed to something we earn.
A shared gift is one we receive as members of a community, as opposed to individually.
Examples of such gifts include air, water, ecosystems, languages, music, holidays, money, law, mathematics, parks, the Internet, and much more”.

Peter Barnes, Capitalism 3.0: a guide to reclaiming the commons
Figure 5.1
APPROXIMATE VALUE OF COMMON, PRIVATE, AND STATE ASSETS, 2001 ($ TRILLIONS)

Reflects only quantifiable assets.
Source: Friends of the Commons, State of the Commons 2003–04.
Ecosystem services are the benefits humans derive from ecosystem functioning.

<table>
<thead>
<tr>
<th>ECOSYSTEM SERVICES</th>
<th>ECOSYSTEM FUNCTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas regulation</td>
<td>Regulation of atmospheric chemical composition.</td>
</tr>
<tr>
<td>Climate regulation</td>
<td>Regulation of global temperature, precipitation, and other biologically mediated climatic processes at global, regional, or local levels.</td>
</tr>
<tr>
<td>Disturbance regulation</td>
<td>Capacitance, damping and integrity of ecosystem response to environmental fluctuations.</td>
</tr>
<tr>
<td>Water regulation</td>
<td>Regulation of hydrological flows.</td>
</tr>
<tr>
<td>Water supply</td>
<td>Storage and retention of water.</td>
</tr>
<tr>
<td>Erosion control and sediment retention</td>
<td>Retention of soil within an ecosystem.</td>
</tr>
<tr>
<td>Soil formation</td>
<td>Soil formation processes.</td>
</tr>
<tr>
<td>Nutrient cycling</td>
<td>Storage, internal cycling, processing, and acquisition of nutrients.</td>
</tr>
<tr>
<td>Waste treatment</td>
<td>Recovery of mobile nutrients and removal or breakdown of excess or xenic nutrients and compounds.</td>
</tr>
<tr>
<td>Pollination</td>
<td>Movement of floral gametes.</td>
</tr>
<tr>
<td>Biological control</td>
<td>Trophic-dynamic regulations of populations.</td>
</tr>
<tr>
<td>Refugia</td>
<td>Habitat for resident and transient populations.</td>
</tr>
<tr>
<td>Food production</td>
<td>That portion of gross primary production extractable as food.</td>
</tr>
<tr>
<td>Raw materials</td>
<td>That portion of gross primary production extractable as raw materials.</td>
</tr>
<tr>
<td>Genetic resources</td>
<td>Sources of unique biological materials and products.</td>
</tr>
<tr>
<td>Recreation</td>
<td>Providing opportunities for recreational activities.</td>
</tr>
<tr>
<td>Cultural</td>
<td>Providing opportunities for non-commercial uses.</td>
</tr>
</tbody>
</table>

Ecosystem Services: the benefits humans derive from ecosystems

ECOSYSTEM SERVICES

Supporting
- NUTRIENT CYCLING
- SOIL FORMATION
- PRIMARY PRODUCTION
- ...

Provisioning
- FOOD
- FRESH WATER
- WOOD AND FIBER
- FUEL
- ...

Regulating
- CLIMATE REGULATION
- FLOOD REGULATION
- DISEASE REGULATION
- WATER PURIFICATION
- ...

Cultural
- AESTHETIC
- SPIRITUAL
- EDUCATIONAL
- RECREATIONAL
- ...

CONSTITUENTS OF WELL-BEING

Security
- PERSONAL SAFETY
- SECURE RESOURCE ACCESS
- SECURITY FROM DISASTERS

Basic material for good life
- ADEQUATE LIVELIHOODS
- SUFFICIENT NUTRITIOUS FOOD
- SHELTER
- ACCESS TO GOODS

Freedom of choice and action
- OPPORTUNITY TO BE ABLE TO ACHIEVE WHAT AN INDIVIDUAL VALUES DOING AND BEING

Health
- STRENGTH
- FEELING WELL
- ACCESS TO CLEAN AIR AND WATER

Good social relations
- SOCIAL COHESION
- MUTUAL RESPECT
- ABILITY TO HELP OTHERS

LIFE ON EARTH - BIODIVERSITY

Source: Millennium Ecosystem Assessment
Ecosystem Services: Those ecological characteristics, functions or processes that directly or indirectly contribute to the well-being of human populations or have the potential to do so in the future.

Values: This term is used broadly to include contributions to human well-being and goals or ends, such as social and civil norms (including rights) and moral, religious, and spiritual beliefs and commitments.

Benefits: The value of the contribution to human well-being.

Valuation: The process of measuring the value or the change in value in terms of the contribution to a specified goal (e.g., human well-being, biodiversity conservation).

Valuation Method: A methodology, based on theory and data, for measuring the value of or the value of a change in terms of the contribution to a specified goal.
Picture taken by an automatic camera located at an electrical generating facility on the Gulf Intracoastal Waterway (GIWW) where the Route I-510 bridge crosses the GIWW. This is close to where the Mississippi River Gulf Outlet (MRGO) enters the GIWW. The shot clearly shows the storm surge, estimated to be 18-20 ft. in height.
History of coastal Louisiana wetland gain and loss over the last 6000 years, showing historical net rates of gain of approximately 3 km²/year over the period from 6000 years ago until about 100 years ago, followed by a net loss of approximately 65 km²/yr since then.
Global Storm Tracks 1980 - 2006
Figure 1. Typical hurricane swath showing GDP and wetland area used in the analysis.
The value of coastal wetlands for hurricane protection

\[ \ln \left( \frac{T_{Di}}{G_{Di}} \right) = \beta_1 \ln(g_i) + \beta_2 \ln(w_i) + u_i \]  

(1)

Where:

- \( T_{Di} \) = total damages from storm \( i \) (in constant 2004 $US);
- \( G_{Di} \) = Gross Domestic Product in the swath of storm \( i \) (in constant 2004 $US). The swath was considered to be 100 km wide by 100 km inland.
- \( g_i \) = maximum wind speed of storm \( i \) (in m/sec)
- \( w_i \) = area of herbaceous wetlands in the storm swath (in ha).
- \( u_i \) = error

Predicted total damages from storm \( i \)

\[ T_{Di} = e^{\beta_1 g_i + \beta_2 w_i} G_{Di} \]

Avoided cost from a change of 1 ha of coastal wetlands for storm \( i \)

\[ T_{Di} = e^{\beta_1 g_i + 2\beta_2 (w_i - 1) + \beta_2 w_i} G_{Di} \]
Figure 2. Observed vs. predicted relative damages (TD/GDP) for each of the hurricanes used in the analysis.
A loss of 1 ha of wetland in the model corresponded to an average $33,000 (median = $5,000) increase in storm damage from specific storms.

Taking into account the annual probability of hits by hurricanes of varying intensities, the annual value of coastal wetlands ranged from $250 to $51,000/ha/yr, with a mean of $8,240/ha/yr (median = $3,230/ha/yr)

Coastal wetlands in the US were estimated to currently provide $23.2 Billion/yr in storm protection services.

The value of the world’s ecosystem services and natural capital

Robert Costanza, Ralph d’Arge, Rudolf de Groot, Stephen Farber, Monica Grasso, Bruce Hannon, Karin Limburg, Shahid Naeem, Robert V. O’Neill, Jose Paruelo, Robert G. Raskin, Paul Sutton & Marjan van den Belt

The services of ecological systems and the natural capital stocks that produce them are critical to the functioning of the Earth’s life-support system. They contribute to human welfare, both directly and indirectly, and therefore represent part of the total economic value of the planet. We have estimated the current economic value of 17 ecosystem services for 16 biomes, based on published studies and a few original calculations. For the entire biosphere, the value (most of which is outside the market) is estimated to be in the range of US$16–54 trillion (10^{12}) per year, with an average of US$33 trillion per year. Because of the nature of the uncertainties, this must be considered a minimum estimate. Global gross national product total is around US$18 trillion per year.
### Summary of global values of annual ecosystem services (From: Costanza et al. 1997)

<table>
<thead>
<tr>
<th>Biome</th>
<th>Area (e6 ha)</th>
<th>Value per ha ($/ha/yr)</th>
<th>Global Flow Value (e12 $/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open Ocean</td>
<td>36,302</td>
<td>577</td>
<td>20.9</td>
</tr>
<tr>
<td>Coastal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Estuaries</td>
<td>3,102</td>
<td>252</td>
<td>8.4</td>
</tr>
<tr>
<td>Seagrass/Algae Beds</td>
<td>180</td>
<td>4052</td>
<td>12.6</td>
</tr>
<tr>
<td>Coral Reefs</td>
<td>200</td>
<td>19004</td>
<td>4.1</td>
</tr>
<tr>
<td>Shelf</td>
<td>180</td>
<td>6075</td>
<td>0.3</td>
</tr>
<tr>
<td>Tidal Marsh/Mangroves</td>
<td>62</td>
<td>1610</td>
<td>4.3</td>
</tr>
<tr>
<td>Swamps/Floodplains</td>
<td>2,660</td>
<td>4.3</td>
<td>4.3</td>
</tr>
<tr>
<td>Terrestrial</td>
<td>15,323</td>
<td>804</td>
<td>12.3</td>
</tr>
<tr>
<td>Forest</td>
<td>4,855</td>
<td>969</td>
<td>4.7</td>
</tr>
<tr>
<td>Tropical</td>
<td>1,900</td>
<td>2007</td>
<td>3.8</td>
</tr>
<tr>
<td>Temperate/Boreal</td>
<td>2,955</td>
<td>302</td>
<td>0.9</td>
</tr>
<tr>
<td>Grass/Rangelands</td>
<td>3,898</td>
<td>232</td>
<td>0.9</td>
</tr>
<tr>
<td>Wetlands</td>
<td>330</td>
<td>14785</td>
<td>4.9</td>
</tr>
<tr>
<td>Tidal Marsh/Mangroves</td>
<td>165</td>
<td>9990</td>
<td>1.6</td>
</tr>
<tr>
<td>Swamps/Floodplains</td>
<td>165</td>
<td>19580</td>
<td>3.2</td>
</tr>
<tr>
<td>Lakes/Rivers</td>
<td>200</td>
<td>8498</td>
<td>1.7</td>
</tr>
<tr>
<td>Desert</td>
<td>1,925</td>
<td>82</td>
<td>0.1</td>
</tr>
<tr>
<td>Tundra</td>
<td>743</td>
<td>232</td>
<td>0.1</td>
</tr>
<tr>
<td>Ice/Rock</td>
<td>1,640</td>
<td>92</td>
<td>0.1</td>
</tr>
<tr>
<td>Cropland</td>
<td>1,400</td>
<td>92</td>
<td>0.1</td>
</tr>
<tr>
<td>Urban</td>
<td>332</td>
<td>92</td>
<td>0.1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>51,625</strong></td>
<td><strong>33.3</strong></td>
<td></td>
</tr>
</tbody>
</table>
Problems with the *Nature* paper (as listed in the paper itself)

1. Incomplete (not all biomes studied well - some not at all)
2. Distortions in current prices are carried through the analysis
3. Many estimates based on current willingness-to-pay or proxies
4. Probably underestimates changes in supply and demand curves as ecoservices become more limiting
5. Assumes smooth responses (no thresholds or discontinuities)
6. Assumes spatial homogeneity of services within biomes
7. Partial equilibrium framework
8. Not necessarily based on sustainable use levels
9. Does not fully include “infrastructure” value of ecosystems
10. Difficulties and imprecision of making cross-country comparisons
11. Discounting (for the few cases where we needed to convert from stock to flow values)
12. Static snapshot; no dynamic interactions

Solving any of these problems (except perhaps 6 which could go either way) will most likely lead to larger values
Figure 3: Global Map of Non-Marketed Economic Activity (ESP) arising from Ecosystem Services and derived from Land Cover at 1 km²
(For National Totals See Table 1)
http://www.nj.gov/dep/dsr/naturalcap/

Valuing New Jersey’s Natural Capital:
An Assessment of the Economic Value of the State’s Natural Resources
April 2007

Average Ecosystem Service Value per Hectare for New Jersey
Ecosystem Service Value in 2001 Constant Dollars

The New Jersey Ecosystem Service Valuation Project Team at the University of Vermont:
Robert Costanza, Matthew Wilson, Austin Troy, Alexey Vannorsdall, Jin Li and John D'Agostino

Map Produced by Jarrin Tozy and John D'Agostino
Degradation of ecosystem services often causes significant harm to human well-being.

- The total economic value associated with managing ecosystems more sustainably is often higher than the value associated with conversion.
- Conversion may still occur because private economic benefits are often greater for the converted system.

Source: Millennium Ecosystem Assessment
Economic Reasons for Conserving Wild Nature

Costs of expanding and maintaining the current global reserve network to one covering 15% of the terrestrial biosphere and 30% of the marine biosphere

Benefits (Net value* of ecosystem services from the global reserve network)

*Net value is the difference between the value of services in a “wild” state and the value in the most likely human-dominated alternative

$\text{Benefit/Cost Ratio} = 100:1$

Managing Without Growth
Slower by Design, Not Disaster

Peter A. Victor

Prosperity without growth?
The transition to a sustainable economy
Making the market tell the truth

In general, privatization is NOT the answer, because most ecosystem services are public goods. But we do need to adjust market incentives to send the right signals to the market. These methods include:

• Full external cost and benefit accounting

• Ecological tax reform (tax bads not goods, remove perverse subsidies)

• Ecosystem service payments (a la Costa Rica)

• Impact fees for development tied to real impacts

• Environmental Assurance bonds to incorporate uncertainty about impacts (i.e. the Precautionary Polluter Pays Principle - 4P)

• Expand the “Commons Sector”

See:
Barnes, P, 2006. Capitalism 3.0: a guide to reclaiming the commons Berrett-Koehler
THE NEW COMMONS SECTOR

Global
• Earth Atmospheric Trust

National
• American Permanent Fund
• Children’s start-up trust
• Universal health insurance
• Copyright royalty fund
• Spectrum trust
• Commons tax credit…

Regional
• Regional watershed trusts
• Regional airshed trusts
• Mississippi basin trust
• Buffalo commons
• Vermont Common Asset Trust…

Local
• Land trusts
• Municipal wi-fi
• Community gardens
• Farmers’ markets
• Public spaces
• Car-free zones
• Time banks…
Emissions Paths to Stabilisation

Source: Stern review on the economics of climate change, 2006
An Earth Atmospheric Trust:
A system to stop global warming and reduce poverty

1) Set up a global cap/auction/dividend and trade system for greenhouse gas emissions – all greenhouse gas emissions from all sources.

2) Auction off all emission permits – and allow trading of permits

3) Gradually reduce the cap to follow the 350 ppm target. The price of permits will go up and total revenues will increase as the cap is reduced.

4) Deposit the revenues into a trust fund, managed by trustees appointed with long terms and a mandate to protect the asset (the climate and atmosphere)

5) Return a fraction of the revenues to everyone on earth on a per capita basis. This amount will be insignificant to the rich, and much smaller than their per capita contribution to the fund, but will be enough to lift all the world’s poor out of poverty.

6) Use the remainder of the revenues to enhance and restore the asset. They could be used to fund renewable energy projects (especially in the developing world), research and development on renewable energy, payments for ecosystem services such as carbon sequestration, etc.
The transition to a “sustainable quality of life” “lagom” economy requires:

• **The wide-scale conversion of built capital** to use sustainable, renewable energy with massive targeted investments in wind and solar, high efficiency smart power grids, effective mass transit, and high efficiency buildings and cars.

• **The full utilization of human capital** by focusing on fulfilling work, full employment, universal access to quality education through college and beyond, universal access to high quality preventive health care, and limiting population.

• **The rebuilding of social capital** by rewarding community involvement and participation, reducing the gap in income and wealth, and providing fewer work hours and more leisure time to allow connection to friends, family, and the community.

• **The restoration of natural capital** by focusing on protecting and enhancing the ecosystem services on which the quality of all human life depends. Aspects of this include limiting carbon emissions to keep the atmospheric concentration below 350 ppm (an atmospheric trust/cap, auction and dividend system would work well for this), greatly expanding marine protected areas, charging fees for the depletion of and investing in the restoration of natural capital.
Conclusion

The long term solution to the global recession is therefore to:

• break our addictions to the "growth at all costs" economic model, to fossil fuels, and to over-consumption
• create a more sustainable and desirable future that focuses on quality of life rather than merely quantity of consumption and recognizes the contributions of natural and social capital (the new commons sector)

It will require a new vision, new measures, new institutions and new technologies. It will require a redesign of our entire society. But it is not a sacrifice of quality of life to break this addiction. Quite the contrary, it is a sacrifice not to.
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Thank You

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Figure 9.8 Relative growth of the three subcultures (US, 1965-2000)