Institute for Environmental Security

Eco-Insurance: Risk Management for the 21st Century

TOWARDS A POLICY FRAMEWORK FOR A SUSTAINABLE FUTURE




People – Ecosystems - Sustainability


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This publication is the result of cooperation between The Eco-Insurance Initiative (http://www.Eco-Insurance.net) and The Global Footprint Network (http://www.FootprintNetwork.org).

The Eco-Insurance Initiative is a public-private partnership promoting Eco-Insurance – *a proposed home insurance plan for the planet*. Eco-Insurance is meant to enable a permanent funding mechanism for long term investment in the maintenance of life-supporting ecosystems in order to improve environmental, economic and human security from the global to the local.

The Global Footprint Network envisions a world where all people can lead rewarding lives within the means of one planet. It seeks to achieve this by supporting the *Ecological Footprint*, a resource accounting method that compares human demand on nature with available biocapacity, making sustainability requirements and limits both clear and measurable.

The Eco-Insurance Initiative was started in 2002/2003 by the Institute for Environmental Security and TransGlobal Ventures, Inc.

The Institute for Environmental Security is a foundation based in The Hague, The Netherlands with liaison offices in Brussels and Washington DC. Its mission is to advance global environmental security by means of Horizon 21 a multidisciplinary work program integrating the fields of science, diplomacy, law, finance and education.

TransGlobal Ventures, Inc. is a Washington DC-based finance and venture development company dedicated to creating synergies between information technology, earth sciences, education and sustainable development. The author of *Eco-Insurance for a Sustainable Future* is the company's founder and president; he also co-founded the Institute for Environmental Security.

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Preface

Humankind's inability to reinvest a portion of the monetary riches provided by nature back into the globe's life-supporting ecosystems has produced a mounting deficit on the world's ecological balance of payments. This deficit has now grown to be 20 percent of the Earth's capacity - we are consuming resources 20 percent faster than they regenerate. At the same time, the accumulated ecological deficit over the last 20 years has now grown to be the equivalent of 2.7 planet years of ecological production. Such large and still rising ecological cumulative deficits are not sustainable and feeds growing systemic risk to humankind's financial, environmental or human security[1]. The impact of environmentally induced risks on society such as forest fires, storms, floods, landslides, oil spills or industrial contaminants or accidents is already large and growing.

Potential solutions to insure humankind against future impacts have been slow in coming because ecological goods and services are public goods – free resources of nature which belong to no one and exist for the common good. When damaged, individual property rights are not affected, civil liabilities do not apply and markets fail. An added problem is that we have thus far been unable to adequately quantify the probability or size of future losses, a prerequisite for the insurance industry to become truly engaged. Fresh approaches are urgently needed to address the types of risks that will preoccupy humankind in the decades to come.

People and organizations generally pay insurance premiums to ease financial hardship or loss when specific events defined in the insurance contract occur and trigger compensation. Many forms of (collective) insurance are mandated by government (e.g. social security, disability, unemployment, Medicare, car insurance, etc.) or have become an integral part of business transactions (e.g. home, mortgage, business and environmental liability insurance) as a result of a changing legal, technical, social or political environment. Others forms of insurance, such as health and life-insurance are mostly voluntary and consequently prone to leave people and their families without cover due to an inability (the poor) or unwillingness (the ill-informed) to pay the premium, perceived height of the premium, and/or prevailing perceptions of the level of risk associated with insurable events.

A good insurance policy pays out compensation to those who were able to afford the premium to reduce financial hardship when an accident, injury or disaster strikes. An even better insurance policy is one which invests in the prevention of accidents, injury and disasters from happening at all. Investments in nature parks, renewable energy sources, environmental technologies, eco-enterprise development, and listed companies internalizing triple bottom line performance objectives are but a few examples of insurance policies that can be taken out against future damage to the resilience and health of life-supporting ecosystems.

April 2004, Washington DC

J. Steven Lovink

[1] Systemic risk may be defined as the probability that broader financial difficulties will occur from an event that ignites a series of successive losses along a chain of institutions or markets comprising a system.

Acknowledgements

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TOWARDS A POLICY FRAMEWORK FOR A SUSTAINABLE FUTURE

Summary

Eco-Insurance* has recently been proposed as a home insurance plan for the planet. A publication entitled: *Eco-Insurance for a Sustainable Future -- A Contribution to the Johannesburg Plan of Implementation* appeared during the Fall of 2003, following a process of initial consultations. It described a permanent funding mechanism for long term investment in the maintenance of life-supporting ecosystems, assessed its feasibility, and provided the contours of an implementation plan.

In this paper, we elaborate aspects of the scheme by focusing on Eco-Insurance as a potential tool for strategic management of environmentally induced risks facing humanity in the 21st Century. Starting from the premise that the best insurance policies prevent accidents and disasters from happening at all, we first review what environmental risks and damage are and whether they are insurable. We find that the insurability of ecological damages is fraught with challenges and mainly addresses compensation of damages once they occur. This leads to a discussion of Eco-Insurance as a potential precautionary risk management mechanism enabling a large scale Global Community Investment Program in economic, environmental and human security for the benefit of humankind followed by an explanation of how premiums can be calculated and mobilized within a voluntary framework to be facilitated by government incentives. It is shown how individuals benefit financially from participation in the scheme. Next, the Ecological Footprint concept is reviewed as a practical tool for showing, tracking and managing the planet's growing ecological deficits. Ecological Footprint metrics form an excellent foundation for building Shrink and Share (S&S) Scenarios which can provide important risk management metrics based on humankind's decisions about the amount of biocapacity to be preserved for humankind to sustain itself and by when such a target should be reached. S&S scenarios build on Contraction & Convergence (C&C), internalize the principles of precaution, equity, efficiency and choice, but apply to humankind's total footprint. Three sample scenarios of the future (the 'Brundtland', '2050' and 'EO Wilson' scenarios) are graphed and discussed to demonstrate the flexibility and practicality of the tool for target based risk management approaches. We show that S&S scenarios enable the calculation of cumulative ecological debt (in planet years) -- a proxy for ecological risk. Proxies of ecological risk (or indices) can be monetized by linking them to Eco-Insurance premium levels. This results in a feedback loop which ensures that to the extent agreed upon targets are not met (and ecological risks increase), aggregate premium income available for preventive investment in the Global Community Investment Program would automatically rise to offset heightened risks – a build-in fuse to manage 21st Century risks. Monetization of ecological risk might be made increasingly efficient through cap and trade approaches and futures markets; both are potential market-based mechanisms which could one day help to price what is priceless: the premium to be charged for a sustainable future.

A suggested policy framework for governments, the private sector, NGOs, multilateral organizations and academia, including an outline of the way forward, completes the paper.

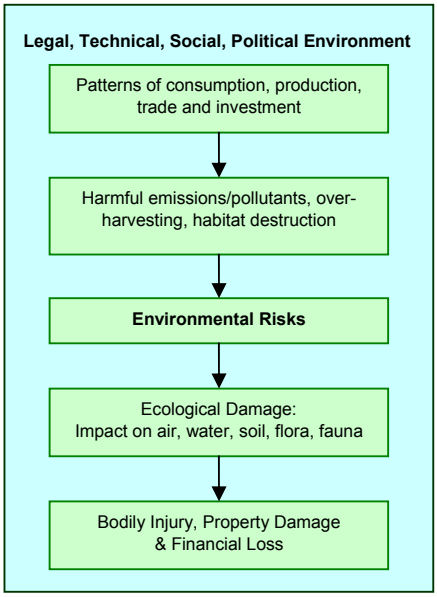
* [from Gr. *Oikos*, house + *insurance*, the business of insuring against loss]

Ecological Damage and Insurability

What is Ecological Damage?

Ecological damage is *primary* environmental damage done directly to air, water, soil, flora and fauna. It always involves a 'free' resource of nature and is either irreversible or requires an extended period of time to recover. It results in *secondary* environmental damage when ecological damage becomes legally relevant and causes bodily injury, property damage and financial loss[1].

Figure 1: Ecological Damage



Within any given legal, technical, social and political environment, it holds true that consumption, production, trade and investment patterns reflect how societies deal with environmental risks and responsibilities for activities that are harmful to the environment. These activities include the emission of pollutants, over-harvesting of renewable resources and destruction of animal and plant habitat. The type and extent of these activities determines the impact (ecological damage) they ultimately have on the quality of air, water, soil, flora and fauna.

Efforts to firm up and extend the 'polluter pays principle" by assigning (legal) liabilities to all forms of ecological damage – a principle supported by the insurance industry[2], are frustrated by: (i) a lack of clear property rights (free resources of nature belong to no one and everyone), (ii) difficulties in determining the responsible party or parties (as in the case of diffuse, long-distance, historic and chronic), and (iii) determining the monetary value of the ecological damage.

Worldwide losses due to natural disasters appear to be doubling every ten years and have reached almost $1 trillion over the past 15 years[3]. Based on current trends, annual loss amounts within the next decade may approach $150 billion[4], not counting the effects of climate change. The financial impact of such a trend exceeds what insurance companies can afford[5].

Are Life-supporting Ecosystems Insurable?

Insurance is the business of insuring against loss. Insurance companies take two types of risk: investment risk and underwriting risk. Well balanced investments of their assets in combination with sufficiently high premiums for the risks being underwritten typically generate the necessary income to compensate for underwriting losses when they occur. Insurance companies can get into difficulties when invested assets perform poorly, premiums are not high enough, and/or systemic risks undermine investment performance and increase underwriting losses. To the extent the insurance industry does not insulate itself against such risks, its financial performance will suffer, and, in the event of the industry's imminent collapse, governments will ultimately have to step in to underwrite excessive losses at the expense of the tax payer. With environmentally induced loss amounts expected to reach $ 100 billion plus per annum, as noted above, this may become a real world scenario. The insurance industry can insulate itself against excessive losses by for example not underwriting certain risks altogether, underwriting primarily short-term (property-and-casualty) versus long term (life) insurance contracts, raising overall premiums, investing assets in solidly performing companies, and/or providing clients with new insurance products.

In technical terms, the underwriting criteria for insurability on commercial terms are[6]:

- *Accessibility*: it should be possible to (i) calculate the probability and scale of damage in order to arrive at an appropriate premium and (ii) allocate damage to a particular insurance period;

- *Randomness*: insured events must be unpredictable in terms of time of occurrence and independent of the will of the insured;
- *Mutuality*: many endangered parties must joint together to carry exposure to risk jointly;
- *Efficiency*: private insurers need to be able to charge a premium that allows them to write insurance profitably in the long term.

The emergence of commercially viable insurance products covering damages to life-supporting ecosystems has been tentative because the accessibility and efficiency criteria for insurability are not met. Legal questions that arise are: who can sue for compensation when a free resource of nature belonging to no one is damaged, who is responsible and what is the monetary value of the damage? If the private sector can only provide coverage that meets all four criteria – to the exclusion of life-supporting ecosystems, what new approaches need to be developed that transfer risks associated with ecological damage? Possible solutions might include: (i) a clear regulatory regime on environmental damage liabilities derived from civil and public law in order to create growing demand for environmental risk liability protection (ii) a focus on restorative measures, (iii) limiting coverage to tangible ecological damages, (iv) placing limits on the liability of insurers, and/or (v) the use of guarantees and innovative reinsurance mechanisms to improve the supply of new insurance products within the emerging liability regime[7]. Importantly, development and implementation of these type solutions will take an estimated 10-20 years, may only be affordable for some, concentrate on manageable micro events, and will not address potentially large 'intangibles', i.e. ecological damages with unknown probabilities or difficult to quantify losses. This strongly suggests that uninsurability of life-supporting ecosystems or portions thereof at the macro level will worsen environmentally induced risks and their associated impacts in the decades to come, unless alternative insurance approaches focusing on prevention are implemented.

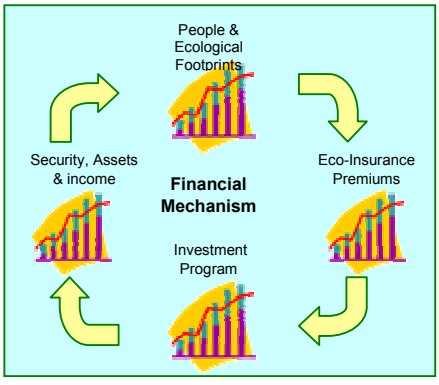
Eco-Insurance, as will be elaborated below, starts from the premise that it is imprudent for society to be lulled into inaction and that even intangibles should be underwritten. The approach is complimentary to, and can act as a catalyst for, emerging insurance solutions for ecological damage and its secondary environmental damages. At the same time it is distinct in its focus on prevention and the objective to provide coverage based on the principles of precaution, equity, efficiency and choice.

Eco-Insurance for a Sustainable Future

What is Eco-Insurance?

Eco-Insurance*-- *a proposed home-insurance plan for our planet,* is an innovative risk management strategy for the 21st Century. It seeks to mobilize a modest Eco-Insurance premium from people and organizations for investment in the restoration and maintenance of the globe's life-supporting ecosystems in order to promote environmental, economic, and human security from the global to the local. The Global Community Investment Program is the equivalent of a preventive insurance policy against loss of valuable ecological goods and services for the collective and individual benefit of humankind.

Figure 2: Financial Mechanism



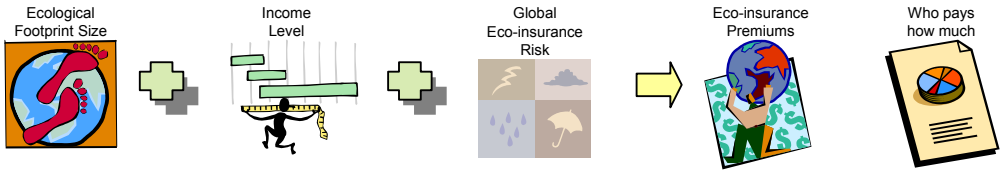
Even though the globe's life-supporting ecosystems provide us with water, food, shelter, medicines, clean air, fertile soils and climate stability[8], the quality and available amount of these goods is rapidly declining[9]. The globe's ecological goods and services are valuable[10] and their proper maintenance is necessary to avoid economic decline, rapid or unexpected environmental changes, and natural resource conflicts[11]. This maintenance requires sustained and sizeable investments.

Ecological Footprint data, income levels, and a global Eco-Insurance risk factor, taken together, determine the level of the Eco-Insurance premium. Eco-Insurance is proposed to be used to capitalize a new Financial Mechanism – a World Conservation Bank, Fund or Trust -- to be governed for, on behalf of, and with participation of, the world's community who is its beneficiary. The Financial Mechanism will be responsible for the

implementation of a multibillion dollar Global Community Investment Program implemented through strategic financial partners following transparent and measurable performance criteria.

Eco-Insurance *internalizes* the principles of precaution, equity, efficiency and choice, *encourages* smaller ecological footprints of people, organizations and nations on the earth, *promotes* sustainable consumption, production, trade and investment, *stimulates* private sector companies to embrace triple bottom line performance goals, and *encourages* governments to support a new and innovative financing mechanism to help insure society against institutional, policy and market failures, and effectively *reduces* the anticipated tax burdens of current and future generations..

Eco-Insurance for a Sustainable Future is currently in the exploratory stages of being realized through public-private initiative and international cooperation between governments, the private sector, multilateral institutions, academia, and NGOs. An important success factor is to demonstrate that people, organizations as well as nations are better off financially when they participate in the Eco-Insurance scheme. The basic proposition is that Eco-Insurance is about paying a modest sum today for what is more than likely to cost a fortune tomorrow; it provides insurance coverage in the form of intangible returns for all (increased environmental, economic and human security) as well as tangible returns (income, ecological asset appreciation and a lower future tax burden) for those who participate.



Why We Need It

Eco-Insurance is necessary because of the world's structural underinvestment in the restoration and maintenance of the globe's life-supporting ecosystems. This 'Eco-investment Gap' currently amounts to $50-300 billion per annum[12] and has resulted in serious ecological deficits that already severely jeopardize global economic, environmental and human security.

Eco-Insurance proposes the implementation of a Global Community Investment Program in companies, technologies, projects and activities that support life-supporting ecosystems as a preventive insurance policy promoting economic, environmental and human security by reducing the risks of ecological damage, bodily injury, property damage and financial loss.

Global Economic Security

When ecosystems lose their capacity to provide the inputs that keep economies running, the world economic system will be subjected to increasingly severe shocks, followed by long-term decline[13]. While strong economies will be more resilient, such shocks will eventually hurt the more powerful economies as well. To the extent humankind lives beyond the regenerative capacity of the globe's life-supporting ecosystems, global economic security will spiral downward. In the past, civilizations have collapsed because fragile or degraded ecosystems were no longer capable of sustaining them[14]. This time however, the threat of collapse involves the fate of humanity as a whole.

One important example of environmentally induced insecurity is that during the coming two decades the world economy's capacity to grow will be increasingly limited by the double edged sword of a finite supply of increasingly expensive fossil fuels and the substantial risks of warming the globe by discharging even more CO_2 into the atmosphere[15]. While one can debate specifics of when fossil fuels run out and the severity of global warming or its consequences, one thing appears certain: inaction will split the world economy at the seams. Current investment levels in an alternative energy future are insufficient by a long shot[16] and indicate humankind should prepare for a rough ride marked by rising energy prices, pockets of growth, bouts of inflation and deflation, financial hardship, environmental pressures, economic instability, and conflict about access to resources and growth based on a world economy that revolves around its dependency on fossil fuels.[17] As governments become frantic to intervene with massive remedies to keep their economies afloat, voters in most parts of the world will be asked to foot the bill for mistakes of the past through higher taxes. This ominous and insecure future will make some people, businesses, and nations rich, and others poor.

Eco-Insurance premiums seeks to fund a Global Community Investment Program that will make long term investments in portfolios of companies, technologies and indices that seek to profit from the inevitable transition from a fossil fuel economy to a sustainable energy economy as one of its key objectives. The expected returns of this energy insurance policy are: increased economic, environmental and human security, a portfolio of sustainable energy investments with solid capital appreciation potential, and current income from dividends and realized capital gains.

Environmental Security – Seven Major Challenges

Seven leading environmental changes of major concern are: (i) depletion and pollution of fresh water supplies; (ii) depletion of fisheries; (iii) degradation and loss of biodiversity, including forests; (iv) degradation of agricultural lands; (v) food and health safety; (vi) stratospheric ozone depletion; and (vii) global climate change[18].

Environmental scarcity and the wish to control remaining resource stocks can cause conflict, including violent conflict from the local to the global level as well as environmentally induced mass migrations[19]. Environmental resources are becoming scarce due to (i) the environmental impact of growing populations with their associated patterns of consumption, production, investment and trade; (ii) uneven access to resources; and (iii) unexpected environmental changes[20]. The cumulative effect is decreased global environmental security.

The world's population now exceeds six billion people and may reach nine billion people by the year 2050[21]. Access to resources is unevenly distributed amongst geographic regions and people[22]. The planet's atmosphere, water resources, habitats, soil fertility and biodiversity are resources that form part of the global commons[23]. They represent global public goods that belong to everyone and no one. Unclear ownership and property rights makes them particularly susceptible to what is often referred to as the 'Tragedy of the Commons' – the tendency for unmanaged public resources to be consumed until they become exceedingly scarce, or worse, cease to exist[24]. Experts agree that global public goods are undersupplied[25] and international collective action is required to maintain or increase the supply of these goods[26].

Eco-Insurance premiums will fund a Global Community Investment Program that will make long term investments in companies, projects and sectors that increase economic, environmental and human security by means of large scale conservation and sustainable development activities, including enhancement and expansion of the world's protected area system, water projects, agricultural biodiversity, protection of biodiversity hotspots, the acquisition of conservation and sustainable enterprise development areas, eco-enterprise capacity building and finance, and environmental education and awareness building. The expected returns of this ecosystem insurance policy are: (i) healthier and more resilient ecosystems, (ii) a portfolio of appreciating ecological assets and eco-enterprises, (iii) sustainable livelihoods for local communities as ecosystem managers, and (iv) increased economic, environmental and human security.

Calculating the Premium

Eco-Insurance proposes to collect a modest premium from people and organizations, based on Ecological Footprint data, levels of income, and global Eco-Insurance risk. The underlying rationale for this formula is that:

- *Ecological Footprints* measure a nation's, an organization's, or individual's consumption of food, materials, and energy in terms of the area of biologically productive land or sea required to produce those resources and absorb the corresponding waste, using prevailing technology[27]. The resulting ecological deficit or surplus (remainder)[28] can be used to set targets for a 'balanced ecological budget' from the global to the local level;
- *Income levels* reflect the extent to which nations, organizations and individuals benefit from the world economic system, including their ability to pay for the often free or discounted costs of using the globe's life-supporting ecosystems;
- *Global Eco-Insurance risk* expresses the aggregate level of Eco-Insurance to be mobilized on an annual basis to ensure that sufficient funds are available for sustained investment in the restoration and maintenance of the globe's life-supporting ecosystems. Global Eco-Insurance risk would be assessed by an independent organization representing all regions of the world and supported by a competent science community[29].

Eco-Insurance is designed to be a flexible financial mechanism that stimulates nations, organizations and individuals to think more directly about the sustainability of their consumption, production, investment, and trade patterns. Ecological deficits would be discouraged through progressively higher Eco-Insurance premiums, while nations, organizations and individuals that have or move towards a more balanced ecological budget would be rewarded by means of reduced Eco-Insurance premiums. The mechanism works at both the individual level or for society as a whole. Interventions ranging from fiscal stimuli to economic and other incentives stimulate voluntary adoption of Eco-Insurance at an early stage[30]. *Unlike taxes, Eco-Insurance is neither mandated nor collected by governments. Governments are however encouraged to provide a supportive incentive framework for Eco-Insurance to work on a voluntary basis.*

Large global challenges become far easier to finance if more people contribute to their proposed solution. If the global Eco-Insurance risk is estimated at $50 billion per annum – the lower range of what should be invested in life-supporting ecosystems on an annual basis[31] – the average annual Eco-Insurance premium payable by an OECD citizen would amount to less than $50 per capita, the equivalent of approximately $1.00 per week. According to our proposed scheme, Non-OECD citizens would have to initially pay an average annual Eco-Insurance premium of $1.80, or the equivalent of less then 4 cents per week. Actual Eco-Insurance premiums would vary amongst nations, organizations and individuals based on (i) applicable ecological footprint and income data and (ii) whether ecological footprint benchmarks, targets or norms would be compared at the national, organizational or individual level.

Importantly, Eco-Insurance seeks to ensure that modest per capita Eco-Insurance premiums mobilize significant financial resources for contemplated investments in maintaining the globe's life-supporting ecosystems in proportion to prevailing ecological risks. Several innovative programs are proposed to mobilize eco-insurance premiums from people and organizations:

- *MyEcoFoot™ for People and Organizations*[32] is an internet-based resource mobilization mechanism designed to: *show* people and organizations the impact they and others have on the world's ecosystems, *offer* e-learning resources on how to reduce one's "ecological footprint", and *provide* people and organizations the opportunity to offset the inherent risk profile of their footprint size by paying a relatively modest annual eco-insurance premium to be invested in a sustainable future.
- *One Percent in a Sustainable Future™* is a promotional program modeled on successful community-based investment approaches.[33] It is designed to dramatically increase assets to be invested in its Global Community Investment Program by encouraging people and organizations to shift at least an eco-insurance premium equal to one percent of their investment dollars into the Bank's investment program.
- An *EcoSmartCard™*, an affinity credit card, can be offered to people and organizations to automate their eco-insurance payments and obtain discounts on selected environmentally friendly goods and services; *Eco-insurance Bonds* may be issued to investors to promote pre-payment of eco-insurance for periods of five to ten years[34].

How Individuals Benefit

While Eco-Insurance may be a laudable concept, convincing people, organizations and nations to disburse money (even modest amounts) for the common good has been proven difficult unless there are clear incentives to do so – selfless altruism is known to drive but a small minority of human endeavors.

- A command and control solution to this conundrum would advocate that governments should reach an international agreement which would make Eco-Insurance mandatory. While in theory this could lead to effective compliance with the Eco-Insurance mechanism's goals and objectives, such agreements typically take ten or more years to negotiate and are generally costly to implement and monitor once agreed. Moreover, it will be environmentally imprudent and fiscally irresponsible to wait ten years or more before taking action.
- Voluntary approaches, on the other hand, suffer from the free rider problems commonly associated with public goods --- why should one pay Eco-Insurance when it cannot be ensured that everyone else contributes as well? Voluntary systems then, need to be able to rely on smart (market-based) incentives that motivate people, organizations and nations to modify

current behavior because it is deemed in their best (economic) interest. A form of public private collaboration towards this end takes shape when governments establish a framework of economic and fiscal incentives that enables the private sector to better and more efficiently internalize societal goals, such as triple bottom line performance goals (people, planet and profits).

In consideration of the above considerations, Eco-Insurance proposes its home insurance plan for the planet be launched as a voluntary mechanism within a public-private collaborative framework to be initiated by a group of supportive sustainability leaders (from government, the private sector, NGOs, multilateral development institutions and academia). Within this framework several leading governments would provide tangible incentives to people and organizations that contribute Eco-Insurance on a voluntary basis, in addition to a range of tangible incentives and benefits provided by the Financial Mechanism itself. Once a credible tipping point is reached by voluntary means, Eco-Insurance could one day become compulsory by international agreement.

Smart incentives promoting voluntary participation in Eco-Insurance include:

Table 1: Smart Incentives

Government Incentives	
• Credits	Investment Tax Credit for Eco-Insurance contributions
• Exemptions	Income from Eco-Insurance Securities exempt
• Co-financing	Government to match Eco-Insurance contributions
Eco-Insurance Incentives	
• Eco-Insurance Bonds	A security with attractive rate of return issued to early adopters of Eco-Insurance pursuant to 5, 10 and 20 year commitments
• EcoSmartCard™ Savings	Eco-friendly products and services offered by network of qualified vendors and purchased with the EcoSmartCard™ earn back annual eco-insurance premium
• Eco-Points	Eco-Insurance premiums may be lowered in future years by means of qualified purchases
• Eco-Insurance Sweepstakes	Participation in Eco-Insurance secures automatic enrollment in sweepstakes for ecotourism vacations and other prizes
• Empowerment, Transparency & Accountability	Eco-Insurance contributors co-manage the Eco-Insurance Financial Mechanism online, including by means of investments strategies and policies and have access to reports on investment activities
• Transferability	Participants may transfer their Eco-Insurance Investment Portfolio to their children

The Ecological Footprint

What the Ecological Footprint Measures

The human economy is embedded in the biosphere and is entirely dependent on its natural resources and ecological services. Once human demand exceeds the regenerative capacity of the biosphere, further expansion impoverishes us. Such “development” beyond the planet’s ecological limits is not achieved by using the regenerative “interest” of nature, but by liquidating the “principal” (what ecological economists call “natural capital.”) This is why systematic resource accounting—documenting humanity’s overall demand on the planet’s natural capital for both resource provision and waste absorption—is core to achieving sustainability. As long as governments and business leaders do not know how much nature we use compared to how much nature we have, it is difficult for policy makers to manage and protect society’s natural assets.

Ecological Footprint accounts provide a way of documenting the extent to which human economies stay within or exceed the regenerative capacity of the planet. Such biophysical resource accounting is

possible because resources and waste flows can be tracked. The Ecological Footprint measures how much productive land and sea area a population (an individual, a city, a country, or all of humanity) requires for the resources it consumes and for the absorption of its waste, given prevailing technology. Measured in "global hectares"-- bio-productive hectares with world average capacity to produce biomass-- it is calculated based on official government data and reflects annual changes in resource efficiency and technology.

Figure 3: Humanity's Total Ecological Footprint: *This graph shows how human demand has grown from using 70% of the biosphere's capacity to using 120% of its capacity – or 1.2 planet Earths.*

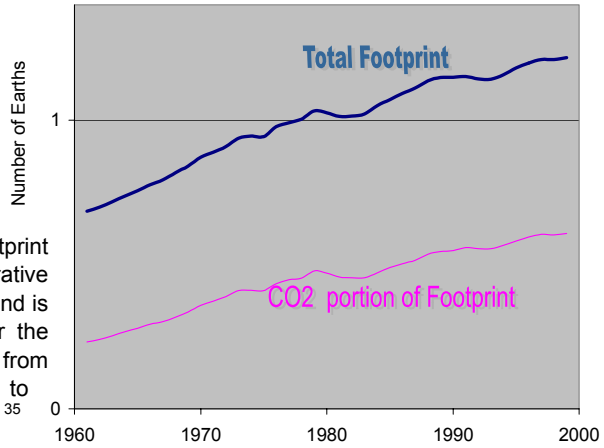


Figure 3 shows how the Ecological Footprint compares human demand with the regenerative capacity of the biosphere. Ecological demand is exceeding the biosphere's capacity. Over the last 40 years, human demand has grown from using 70% of the biosphere's capacity to using 120% of its capacity – or 1.2 planets. [35]

Our Growing Ecological Deficit

Human consumption and waste production have been exceeding the earth's capacity to create new resources and absorb waste since the 1980s. The world average Ecological Footprint is currently 2.3 global hectares per person, but there is only an average of 1.9 hectares of biologically productive land and sea area available for each person. Note that these 1.9 global hectares need to provide not only for humans but also for the millions of other species with which people share this planet.

This growing global ecological deficit or "overshoot" now exceeds by 20% the Earth's regenerative capacity and, by requiring the depletion of natural capital, reduces the Earth's ability to support future life. This means it now takes more than 14.5 months to regenerate the resources humanity consumes in one year. Humanity is therefore liquidating natural capital in order to support the current level of resource use.

Figure 4: World Ecological Footprint versus World Biocapacity: *Historical data and scenario based on moderate projections from FAO, UN Population Fund, and IPCC*

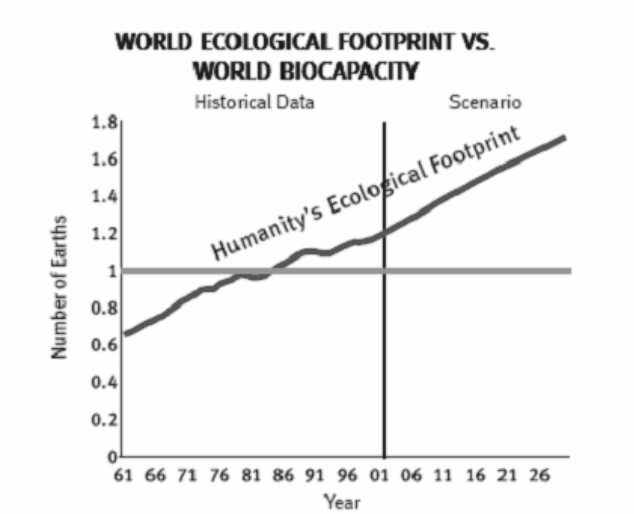


Figure 4 shows that according to UN and FAO scenarios based on moderate efficiency improvements and moderate population growth, humanity's path will lead to significantly larger ecological overshoot.

Using UN estimates of world population, natural resource consumption and CO_2 emissions over the next 30 years, we have translated this scenario into global Ecological Footprint equivalents through 2030. [36] Even though these UN estimates assume slowed population growth and more resource-efficient technologies, this scenario still results in a world Footprint that would grow from today's level of 20 percent above the Earth's biological capacity to a level 70 percent above it. This means the world's population in 2030 would require 1.7-fold of the Earth's regenerative capacity to meet its consumption requirements.[16] This calculation assumes that the Earth *can* sustain this growth in resource use over the next 30 years. It does not account for the possibility that as the natural resource base is depleted, a decrease in biocapacity could further hamper the biosphere's ability to regenerate.

Ecological Footprint of Nations

A comparison of the average per capita Ecological Footprint in any given country with the average per capita Biological Capacity within that country's boundaries reveals whether that county is living within its biological means—it is maintaining an Ecological Reserve—or running an Ecological Deficit. Table 2 presents this information for a number of selected countries.

Table 2: Ecological Footprints, Biological Capacity and Ecological Deficit/Reserve of Selected Countries

	Population	**Ecological Footprint**	**Biological Capacity**	**Ecological Deficit (-) or Reserve (+)**
	[millions]	[global ha/cap]	[global ha/cap]	[global ha/cap]
WORLD	**5,978.7**	**2.3**	**1.9**	**- 0.4**
Argentina	36.6	3.0	6.7	3.6
Australia	18.9	7.6	14.6	7.0
Brazil	168.2	2.4	6.0	3.6
Canada	30.5	8.8	14.2	5.4
China	1,272.0	1.5	1.0	- 0.5
Egypt	66.7	1.5	0.8	- 0.7
France	59.0	5.3	2.9	- 2.4
Germany	82.0	4.7	1.7	- 3.0
India	992.7	0.8	0.7	- 0.1
Indonesia	209.3	1.1	1.8	0.7
Italy	57.5	3.8	1.2	- 2.7
Japan	126.8	4.8	0.7	- 4.1
Korea, Rep.	46.4	3.3	0.7	- 2.6
Mexico	97.4	2.5	1.7	- 0.8
Netherlands	15.8	4.8	0.8	- 4.0
Pakistan	137.6	0.6	0.4	- 0.2
Philippines	74.2	1.2	0.6	- 0.6
Russian Federation	146.2	4.5	4.8	0.4
Sweden	8.9	6.7	7.3	0.6
Thailand	62.0	1.5	1.4	- 0.2
United Kingdom	59.5	5.3	1.6	- 3.7
United States of America	280.4	9.7	5.3	- 4.4
Combined	*4,048.6*	*2.5*	*1.9*	*-0.6*

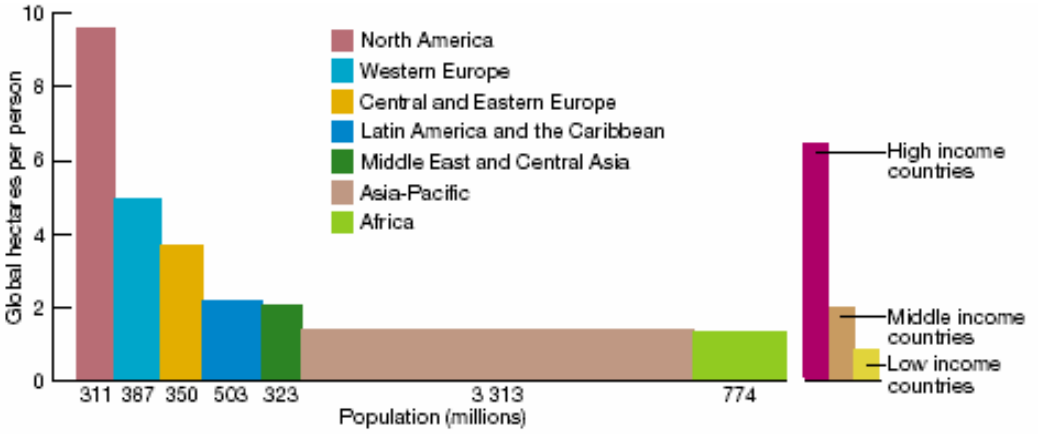
Source: WWF International, Redefining Progress, and UNEP WCMC, 2002, Living Planet Report 2002, Gland Switzerland. In the last column, negative numbers indicate an ecological deficit, positive numbers an ecological reserve. Note that numbers may not always add up due to rounding. These Ecological Footprint results are based on 1999 data.

Ecological Footprints by Region

The Ecological Footprints of seven regions of the world in 1996 are shown in Figure 5. The Footprint per person of high income countries was on average over six times that of low income countries, and over

three times greater than the Earth's biological capacity. (area units are now called, and equal to, global hectares).

Figure 5: Ecological Footprint by Region and Income[37] *The ecological footprint of seven regions in the world in 1999. The footprint of high income countries was on average six times that of low income countries, and over three times the Earth's biological capacity.*



A Conservative Metric

The Ecological Footprint is a conservative measure of human demand on the biosphere. It builds on publicly available statistics from United Nations agencies and does not depend on extrapolation or an understanding of causal relations. The measure provides estimates that avoid exaggerating the ecological deficit of humanity. It underestimates human demand when data is inconclusive and exaggerates biocapacity by assuming current practice is not reducing future biocapacity. For instance, aspects of human demand that are not conclusively documented or not yet easily translated into global hectares are left out of the Footprint. These include the use of freshwater with very locally specific impacts, and the emission of most pollutants other than carbon dioxide. When there is uncertainty about the yields of a given bioproductive space the higher yield figure is used, favoring overestimation of available global biocapacity. Because of the Ecological Footprint's conservative nature, human demand on the planetary biosphere is likely larger than this measure indicates, and the need for appropriate action even more urgent.

Ecological Footprint analyses and accounts provide key advantages to policymakers as they consider the issues raised by sustainability questions. The Ecological Footprint answers a significant question in a specific way: how much of the biosphere's regenerative capacity is occupied by any given activity?

Key Advantages

Key Advantages of Ecological Footprint Accounts
• **Comprehensive:** Ecological Footprint accounts are based on comprehensive and well-established natural resource data sets. They analyze the compound effect of resource consumption pressures related to climate, ocean habitats, forests, farmland, and urban areas. They also compare consumption to the Earth's biological capacity.
• **Credible**: Ecological Footprint Accounts are computed annually using the best scientific data from official government sources and reflect advancements in resource efficiency. The accounts are transparent and can be tested.
• **Conservative**: Speculative data, even if well grounded, is eliminated from the Ecological Footprint accounts. Fossil fuel's contribution to the Footprint is calculated using Intergovernmental Panel on Climate Change (IPCC) sequestration data. The alternative fossil fuel footprint based on replacement with biomass would lead to even larger Ecological Footprints.

- **Concise while Detailed**: Despite the comprehensive data inputs, the Ecological Footprint can be expressed in a single, readily understood number — the area required to support an individual, region or other entity. This single number is easily disaggregated into detailed supporting data.

- **Flexible and Scalable**: This analysis can be applied to products, households, cities, nations and the world. Results can guide physical design; policy development; sectoral and trade analysis; and investment screening.

Shrink & Share Scenarios

Retooling for a Sustainable Future

At the core of the quest for sustainability is the need to be able to live within ecological limits. In spite of ample recognition, exemplified by the Rio Declaration of 1992, that the global economy is unsustainable, the amount of resources allocated to expand human activities continues to exceed by far the limits that would make development sustainable. While much discussion of global resources over the last few decades has focused on the depletion of non-renewable resources such as minerals, ores and petroleum, it is increasingly evident that renewable resources, and the ecological services they provide, are at even greater risk.[38] Examples include collapsing fisheries, carbon-induced climate change, deforestation, and the loss of cropland to erosion and salinization.

Sustainability, or rewarding lives for all within the means of nature, requires that people do not use more ecological services than nature can regenerate. As human pressure is already exceeding the globe's ecological capacity, the sustainability challenge hinges on reducing overall human pressure. Certainly, we cannot succeed in this challenge if we do not do this in a way that is fair to all. Proposed solutions will only be viable if they internalize the principles of precaution, equity, efficiency and choice.

Contraction & Convergence

The conditions for transforming the human economy in a direction that allows all people to live well within the means of nature are straightforward at the conceptual level. Contraction and Convergence (C&C), an approach developed to address climate change, boils this down to two simple principles: [39]

- *Contraction:* the need to shrink humanity's demand on nature to a level the biosphere's capacity can regenerate; and
- *Convergence:* the need to renegotiate who is getting what portion of the 'global pie.'

C&C recognizes that "any conceivable long-term solution to the climate problem will embody, at least in crude form, a high degree of contraction and convergence. Atmospheric concentrations of greenhouse gases cannot stabilize unless total emissions contract; and emissions cannot contract unless per capita emissions converge."[40]

C&C focuses exclusively on CO_2 emissions, which are responsible for about fifty percent of humanity's Ecological Footprint.[21] As humanity takes serious steps to reduce its dependency on fossil fuels and implements C&C or a similar scheme, there is a danger that the switch to fossil fuel alternatives could add further pressure on the already strained biosphere. Hence, C&C needs to be considered within a larger ecological context: the biosphere's overall regenerative capacity.

From C&C to Shrink & Share

In order to address the risk to all planetary ecosystems, we must go beyond C&C to include all core ecological services the biosphere provides. To avoid confusion with the carbon policy C&C focuses on, we call this expanded set of principles "Shrink and Share" Essentially, Shrink & Share (S&S) takes humanity's entire Ecological Footprint into consideration. *Shrinkage* occurs when nations, organizations and individuals reduce their Ecological Footprints so that consumption, production, investment, and trade activities do not exceed the regenerative capacity of the globe's life-supporting ecosystems. *Sharing* means that these reductions are allocated in fair ways. This could apply to regions, nations, organizations and/or individuals. For example, the current Footprints of individual nations vary greatly. A fairer allocation might mean that consumption, production, investment and trade patterns change such

that the Ecological Footprints of nations deviate less and less from each other, that there is a more equitable distribution of the rights to use resources, or that that resource consumption rights are more closely tied to the resources a region or nation has available.

While the Ecological Footprint of the average African or Asian consumer was less than 1.4 global hectares per person in 1999, the average Western European's Footprint was about 5 global hectares, and the average US resident's was about 9.6 global hectares; the world's existing capacity is only 1.9 global hectares per person.[41] The Ecological Footprint in high income countries is about 6.5 global hectares per person, in middle income countries about 2.0, and in low income countries 0.8 global hectares. In comparison with the high income countries, the low and middle income countries combined run much less of an ecological deficit, since their collective Footprint only slightly exceeds their bioproductive capacity.

Setting Realistic Targets

Like C&C, Shrink & Share asks humanity to choose two targets: (i) the percentage of the biosphere's capacity to be used by humanity, and (ii) the year by when this is to be achieved. Balancing ecological budgets can take place within either a shorter or longer time span, with longer time spans increasing the risk of unpredictable costs or irreversible damages.

In setting limits on appropriation by humanity of the planet's biocapacity, there is a great range of opinion about how much bioproductive area should be kept relatively untouched for other species, even merely for the utilitarian reason of maintaining species that are necessary for basic life-support services. Some conservation biologists suggest setting aside at least one quarter of this area for biopreservation, and in some specific places of unusually high and locale-specific biodiversity up to 75 percent. The highest conservation targets in policy documents are smaller. For example, the authors of the Brundtland Report *Our Common Future*[42] invited the world community to protect 12 percent of all the biologically productive space, which is politically courageous, but still may be ecologically insufficient.[43] In contrast, leading Harvard biologist E.O. Wilson proposes setting aside 50 percent of the Earth's biocapacity for other species.[44] Using the conservation goal put forward in the Brundtland report, the bioproductive space available per person today would be 1.7 global hectares rather than 1.9; the Wilson goal would allow 1.45 global hectares per person worldwide.

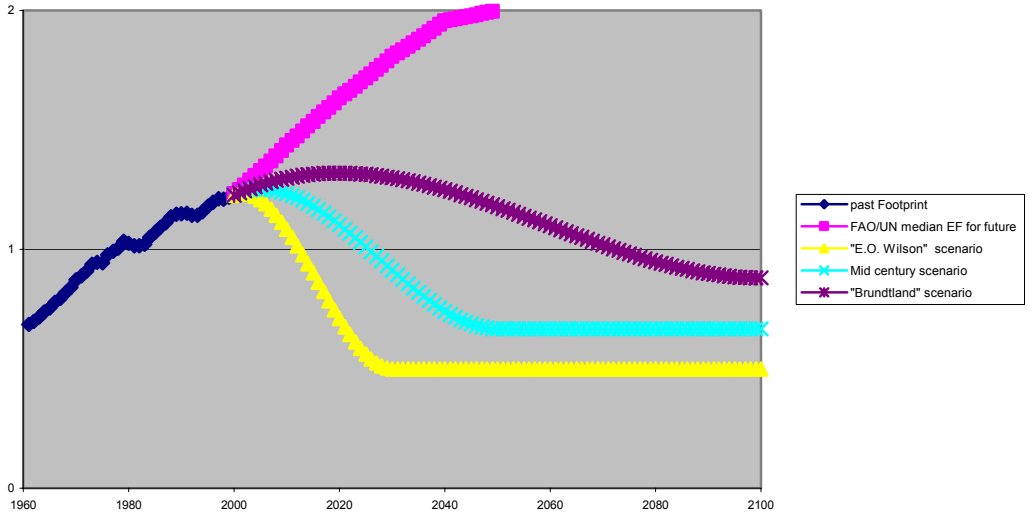
Note that saving a percentage of available biocapacity for other species may not in itself be sufficient for maintaining biodiversity; specific bioproductive areas may need to be protected. Biodiversity protection is highly dependent on the availability of habitats and life support systems. A recent analysis of "hotspots" by Myers et al. (2000) demonstrated that 25 localities, covering a mere 1.4 percent of the Earth's land surface, contain the last remaining habitats of 44 percent of the Earth's vascular plant species and 35 percent of species in four out of five vertebrate groups.[45] Were these hotspots to be preserved, the mass extinction of species currently underway might be reduced by at least one third.

Three Future Scenarios

The E.O. Wilson, 2050, and Brundtland Scenarios

Figure 6 below explores three future scenarios in which humanity's Ecological Footprint shrinks to different degrees and over different time periods; for comparison, it also shows the official UN/FAO or "business-as-usual" scenario based on moderate efficiency improvements and moderate population growth. Human demand at the level of 1.0 planets indicates that the amount of resources being consumed with in a year corresponds to the entire regenerative capacity of the planet in that year. If no capacity is allocated to other species, one could call this the maximum level of consumption at which humanity can live off the global natural capital's "interest" without consuming the "principal." As shown in the figure, humanity's current demand requires the productive capacity of over 1.2 planets, meaning it takes 1.2 years to regenerate what is being used within one year. Fossil fuel use alone accounts for about half of this demand.

Figure 6: Business-as-usual versus Three S&S Scenarios: *These curves show four possible tracks for the future. The pink line is an extension of the past, based on moderate projections from UN agencies. The yellow, blue and purple lines offer three Shrink and Share alternatives: they range from a faster and more aggressive reduction to a slower and smaller reduction over a 100 year period.*



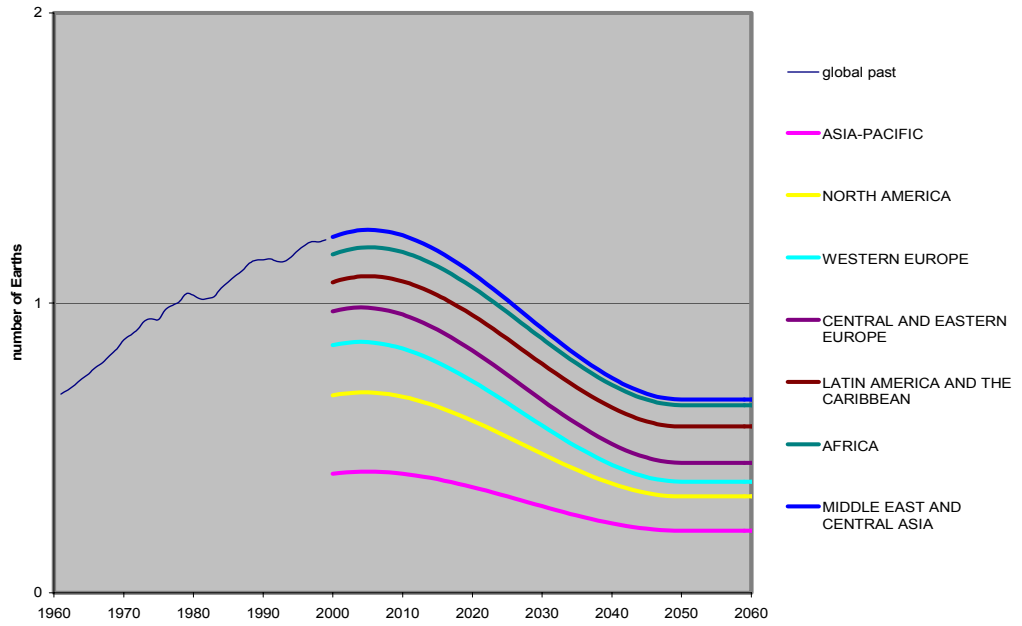
The scenarios explore how humanity's Ecological Footprint changes if we deviate from this business-as-usual projection. The "E.O. Wilson" scenario is the most aggressive, following the eminent biologist's suggestion to use not more than 50% of the planet's biocapacity, leaving the remainder available to all other species. [46] For this scenario, we selected a 30 year target date for achieving this reduction. A less aggressive "2050" scenario is also shown, with a target Footprint of 0.67 planets reached 50 years from now. The third, even more lenient scenario follows the suggestions of the Brundtland Commission, setting a target in which humanity is allocated 88% of the planet's biocapacity; we have allowed 100 years for reaching this target.

Regional Shrink & Share Targets

Figure 7 explores the shrinkage in Ecological Footprint by region that will be required in accordance with the intermediate "2050" scenario. Because nations have dominion over their own biocapacity, each region's share of biocapacity has been assigned in proportion to the percentage of the Earth's total biocapacity falling within the boundaries of the nations comprising that region. In this allocation, the population of a region does not influence its global share, but the more people in a region the fewer resources available to each person in that region.

The Latin American and Caribbean segment of the overall Footprint (shown in Figure 6 between the purple and brown lines) is the only regional Footprint that will grow in absolute terms. The reason is that their present Biological Capacity is still significantly larger than their Ecological Footprint. In fact, since the Biological Capacity of this region is 90 percent larger than their current Ecological Footprint, even a drop to 2/3 of their total Biological Capacity corresponds to the potential of increasing their Ecological Footprint by 25% (Here is the calculation 190% [percentage by which Biological Capacity exceeds Footprint] * 66.6% [proposed reduction for "2050" scenario] ≈ 125 %).

Figure 7: Ecological Footprint Reductions by Region. *This example shows the regional distribution for the "2050" scenario. The upper line for the global is identical with the blue "2050" line in Figure 5. In addition to Figure 5, this graph shows each major region's portion of the overall global Footprint. Note that the Latin American and Caribbean segment (between the purple and the brown line) is the only regional Footprint growing in absolute terms.*

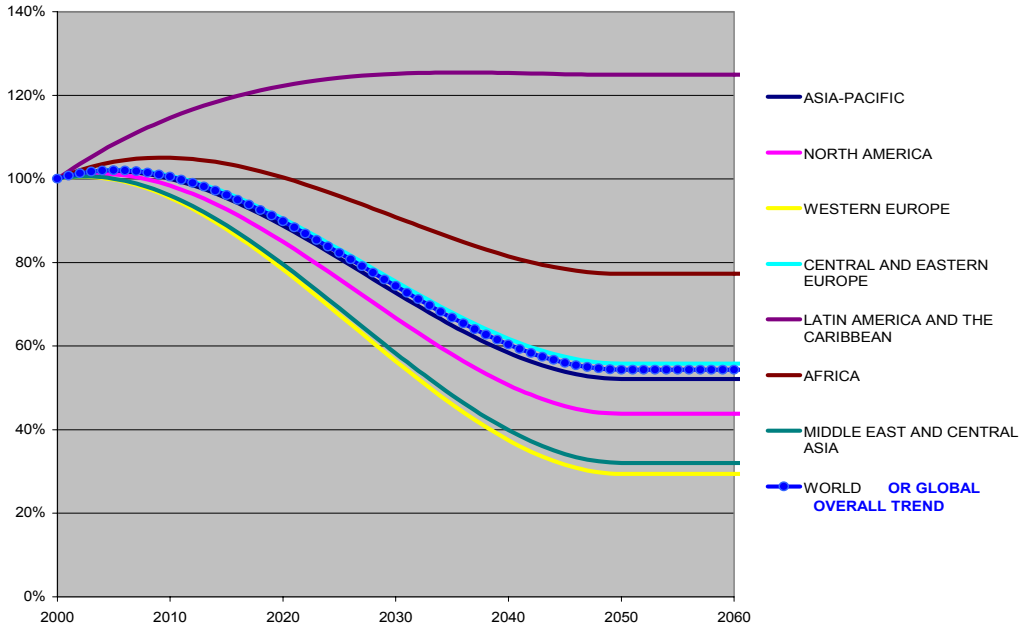


This regional allocation of shares in the Shrink & Share model differs from that proposed by Contraction & Convergence, which allocates the right to emit CO_2 on a global per capita basis. The latter offers a reasonable approach for carbon emissions since all consumers use the global commons of the atmosphere. However, because nations are unlikely to give up sovereignty over their territory, it is most probable that nations will claim access to the biosphere's overall capacity in proportion to the Biological Capacity that exists within their own territories.[47]

Allocation of shares based on regional biocapacity is only one of many possible strategies. Still, we believe it is one of the more practical and defensible approaches. Some other issues that might be considered in terms of what constitutes fair allocation include the problem of differential growth of regional populations, and how to address historical inequities in appropriation of global biocapacity. Discussion of these issues is beyond the scope of this paper.

Still looking at the "2050" scenario, Figure 8 shows the percent to which each region's share of the global Ecological Footprint will change over time. Note that the Latin America and Caribbean region will be entitled to a increased overall Footprint, as current demand in this region is less than its proportionate share of global biocapacity. These numbers reflect the allocation for each region as a whole, not per capita. Depending on the demographic development, per capita curves could follow significantly different paths. For instance, if the population in Latin America expanded by more than 25 percent over the next 50 years, the per capita allocation in Latin America would actually decline.

***Figure 8: Percent Change in Regional Allocations ("2050" Scenario**). In order to show the consequences for each region more clearly this graph compares the region's total Footprint to its current level (today = 100%). In contrast, Figure 7 depicts the absolute shares in the context of the global Footprint. As Figure 7 shows, all regions but Latin America and the Caribbean would need to shrink their overall Footprint in order to comply with a reduction target of the "2050" Scenario. This graph shows by which percent and how fast. For instance, humanity's Footprint, being at 120 percent of the planetary capacity would need to be reduced by 45 percent in order to shrink to 66 percent of the planetary capacity.*



Towards 21st Century Risk Management

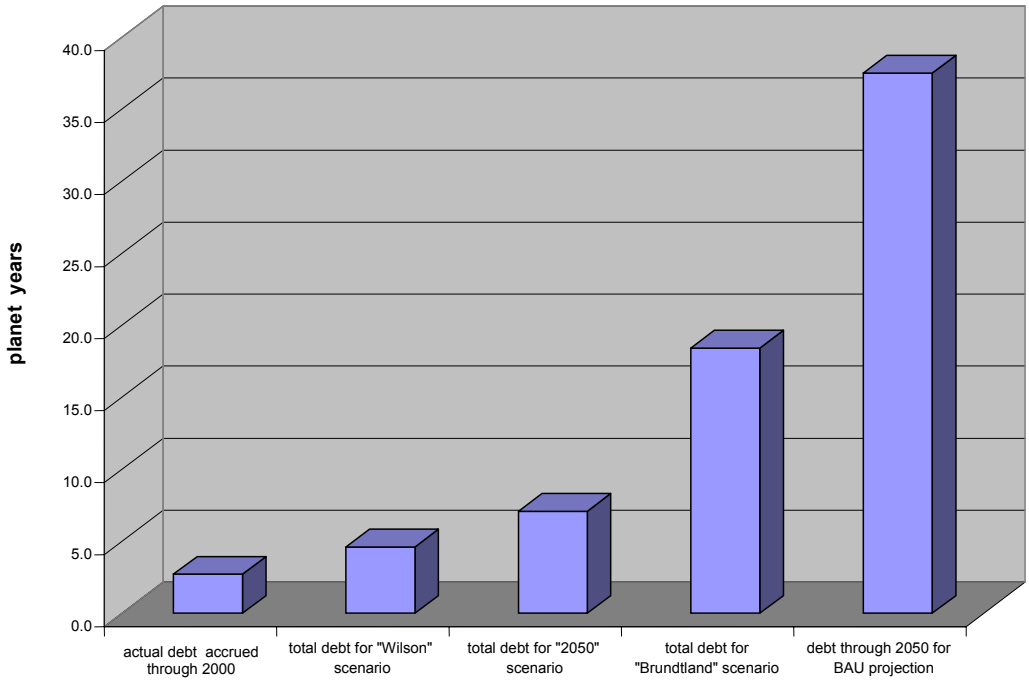
Ecological Debt as a Measure of Risk

Whenever the curves for the scenarios in Figure 3 extend above 1.0 planet, the Earth's natural resource base is being consumed, not just its annual yield—humanity is in overshoot, drawing down natural resource principal in addition to consuming all the interest. Overshoot can be calculated for each scenario in Figure 6 as the area under each curve that lies above the 1.0 planets horizontal line; this area is the total ecological debt that will accumulate until humanity can reduce its demand below what the planet can produce. Ecological debt to date is 2.7 planet-years, meaning that it would take the Earth 2.7 years—if all human demand on the biosphere were suspended during this interval--to replace the natural resource base that has already been depleted.

Figure 9 shows the ecological debt that will accumulate under each of the various scenarios until the global Ecological Footprint again drops below the biosphere's maximum regeneration rate. It also shows the debt through the year 2050 if the United Nations "business-as-usual" projection comes to pass. Totals under the E.O. Wilson, "2050," and Brundtland scenarios will be 4.5, 7, and 18 planet-years respectively over the entire 21st century, and under the U.N./FAO projection, 38 planet-years by 2050. For comparison, the debt of 2.7 planet years that has accumulated over the past 20 years (1980-2000) is also shown.

***Figure 9: Actual and Projected Levels of Ecological Debt:** We define the ecological debt as the accumulated deficits. In graphic terms, it is the surface under the curve between the one planet line and the Footprint line that is in excess of one planet, as depicted in Figure 6. For instance, the Wilson scenario would lead to a debt of 4.5 planet years, or 4.5 years worth of production of the Earth's*

ecosystems as shown below. This is the segment above the one-planet line that lies below the blue historical line (1980-2000) and yellow Wilson scenario line (2000-2013).



Because the greater the accumulated ecological debt the less likely the planet is to return to its former level of productivity, ecological debt can serve as an additional measure of risk in considering the various scenarios. The smaller the natural resource base becomes, the smaller the Earth's annual sustainable yield; and it is not at all clear when or even if the resource base will recover when demand again drops below 1.0 planet. Thus the same amount of consumption may have a larger Footprint in the future.

This measure of ecological debt from global overshoot is an approximation rather than an exact value. It is useful in estimating time horizons and potential risks associated with various possible paths into the future. For instance, what risk does 38 planet-years represent? Let's assume the following: the ecologically most robust situation would be if the entire bioproductive portion of the planet was covered by forests. Since forests can harbor a stock 50 times larger than their yearly maximum sustainable production, such a world may tolerate an ecological debt of 50 planet-years. This would mean starting with mature forests and ending up with the liquidation of the accumulated biomass and beginning again with seedlings. The productivity might still be about the same if well-managed, but the accumulated natural capital would be gone.

However, in the real world, much of the Earth's bioproductive area is not forest, but pasture and cropland, which have little stock to take advantage of. In response to overshoot, pasture and farmland expand into forest, displacing it. This places more pressure on the remaining forest area, concentrating overshoot in forest ecosystems. In a bioproductive world which is not entirely forest, 50 planet-years therefore exceeds the debt threshold that can actually be reached; global forest stocks would be depleted before then, with less robust ecosystems—those with less stock, like fisheries—being depleted at considerably lower levels of ecological debt.

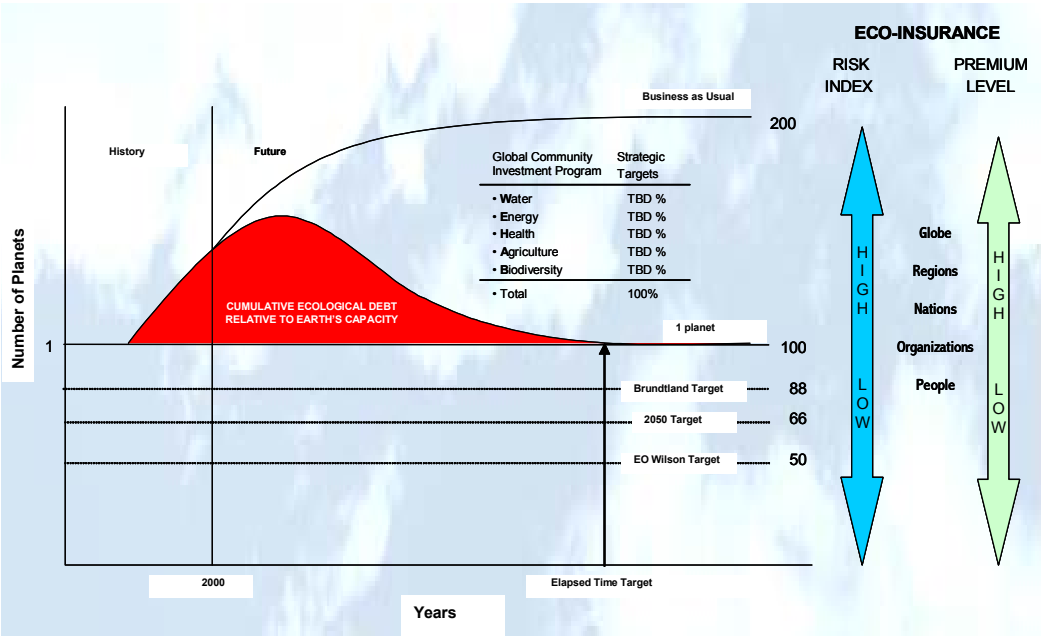
If society moves from fossil fuels to renewable resources for generating energy, additional pressures may be put on biocapacity. While wind and solar may require little extra space, the use of biomass as a more cost-effective and versatile energy source could lead to quite significant space requirements. The rate at which debt accumulates is also important, as ecosystems may be able to tolerate a given level of stress for only a limited time before yields drop significantly, and thresholds may be passed which introduce unanticipated non-linearities into the yield curve—that is, a small increase in demand may result in an unexpectedly large drop in biocapacity. These are all critical considerations when setting

goals for Shrink & Share. Politically, what may appear to be the most lenient scenario—in the above examples, the 'Brundtland Scenario' calls for the smallest reduction in Ecological Footprint and allows the longest time in which to achieve it—may in fact be, from a human welfare perspective, the riskiest.

Ecological Risk and Premium Levels

Eco-Insurance, when combined with Ecological Footprint metrics and Shrink & Share Scenarios can become an important tool for managing ecological risk and its impacts on economic and human security. One way to capture these risks is by looking at and comparing the cumulative Ecological Footprint of different S&S Scenarios which represent the ecological debt that builds up through the continuous overspending of ecological resources.

Figure 10: Towards Managing Environmental Risks in the 21st Century. *Eco-Insurance premium levels go up when the Eco-Insurance Risk Index -- a proxy of cumulative ecological debt -- increases.*



For every set of decisions on (i) the percentage of the biosphere's capacity that is to be used by humanity (Brundtland versus 2050 versus EO Wilson) and (ii) the time by when such target is to be achieved (the elapsed time target), we can calculate an Eco-Insurance Risk Index (a S&S Scenario Risk Profile or S&S Ecological Footprint) on the basis of the surface area between a baseline representing the percentage target of the biosphere's capacity usage (set at one planet in figure 6) and the S&S curve expressing by when the target is to be reached. Such calculations can in principle be made at the global, regional, national, organizational and individual level and can even be assessed separately for the various components of biocapacity (e.g., cropland, pasture, forests, fisheries) and then used to develop differential Eco-Insurance Premiums Levels based on the category of natural resources being utilized.

Eco-Insurance Risk Indices are proxies of S&S Risk Profiles or S&S Ecological Footprints and can become a valuable risk management tool permitting governments, businesses and civil society to monitor, improve and report on sustainability of their targeted consumption, production, trade and investment patterns in the context of how they affect cumulative ecological debt and inherent environmental, economic and human security. Eco-Insurance premium levels would increase or decrease from the global to the local depending on a corresponding increase or decrease in Eco-Insurance Risk Indices. Actual Eco-Insurance Premium Levels can be calculated on the basis of Global Eco-Insurance Risk, i.e. the aggregate level of Eco-Insurance to be mobilized on an annual basis, to ensure that sufficient funds are available for sustained investment in the restoration and maintenance of the globe's life-supporting ecosystems.

Using Markets for the Common Good

While markets mostly fail to properly function when free resources of nature are concerned, governments can be instrumental in shaping a policy framework for market mechanisms to work for the common good. A Cap and Trade system and Futures Markets based on indices of ecological risk may one day accomplish this goal by monetizing risk.

Cap and Trade

It is generally agreed that Cap and Trade systems are an efficient way of achieving stated objectives at less cost then command and control type approaches. They also leave market participants with the freedom of choosing how to achieve stated objectives. If governments are so inclined they can facilitate management of ecological debts and associated risks by means of a Cap and Trade system based on Eco-Insurance Risk Indices. Such a system could be implemented following international agreement on how much biocapacity is to be preserved and by when. Next, a corresponding S&S curve would be constructed which automatically provides the annual targets or caps from the global to the local, using Eco-Insurance Risk Indices as the yardstick. Having established acceptable levels of risk by means of these cap targets, people, organizations and nations would have the choice to reach them by investing in the necessary technologies and business processes that lead to a reduction of their Eco-Insurance Risk Index or rating, or alternatively and to the extent they are not able to do so, they could either trade with others that have Eco-Insurance Risk Index ratings below the norm or purchase Eco-Insurance.

With the adoption of an Eco-Insurance Risk Index-based Cap and Trade system, people, organizations, and nations are obligated to pay Eco-Insurance to the extent their Eco-Insurance Risk Index exceeds the cap. As such, Eco-Insurance is an indispensable risk reinsurance mechanism – a built in fuse -- for persistent market and policy failures.

Pricing what is Priceless – Futures Markets

Futures exchanges can be useful in forecasting because markets are often highly efficient in aggregating information from many different participants and transforming this information into a collective consciousness or wisdom about future events (which is then reflected in current prices). Commodity futures markets are better than individuals at forecasting the price of wheat and corn. Similarly, orange juice futures have been shown to be better at predicting Florida weather than conventional meteorological forecasts[48]. Information markets can also be used to improve the way governments, businesses, people and organizations make forecasts and decisions.

Applied to the challenges of promoting better governance of the global commons, Eco-Insurance Risk Indices could be used to develop EcoScenarios Futures Markets. Such futures markets would formalize humanity's present day-to-day speculation on the risks associated with ecological deficits at the global, regional or national level by enabling people to buy and sell futures contracts based on their perceptions or assessments of risk associated with different EcoScenarios of the future. Broad-based participation in the EcoScenarios Futures Markets can provide governments with valuable policy signals that would stimulate those responsible to negotiate international agreements which closely correspond to what market participants actually perceive to be realistic targets for managing the risks that are measured by global, regional or national Eco-Insurance Risk Indices.

Eco-Insurance Risk Indices may one day enable the development of futures markets which have the potential for pricing what is priceless: a sustainable future for present and future generations on this planet.

Policy Framework

Guiding Principles

The combination of Eco-Insurance, Ecological Footprint metrics and S&S Scenarios provides a mutually reinforcing toolbox for setting humanity onto the path of building a sustainable future considering that:

- Healthy ecosystems sustain an intricate yet fragile web of life that provides us with food, shelter, clean water, medicines, clean air, fertile soils and a stable climate;

- Humankind is dependent on the globe's life-supporting ecosystems for its economic, environmental and human security, but fails to invest sufficiently in their proper maintenance and restoration; experts estimate this 'eco-investment gap' amounts to $ 50-100 billion per annum or more; perverse subsidies of $ 700 billion per annum widen this gap even further;
- Humanity's global ecological deficit has now grown to be 20 percent of the Earth's capacity; this means humanity is consuming resources 20 percent faster than the Earth is able to generate;
- People, organizations and nations stand to benefit greatly – financially and otherwise -- from reducing the increasingly costly environmental, economic and human risks associated with an accumulated ecological debt now exceeding 2.7 years of ecological production;
- Eco-Insurance proposes the establishment of a permanent financial mechanism for managing environmentally induced risks facing humanity in the 21st Century; its operational design internalizes the principles of precaution, equity, efficiency and choice.
- Participation in Eco-Insurance should be voluntary, yet stimulated by a series of fiscal and economic incentives which reward early adoption of the scheme and diminish free rider issues.

Incentive Measures

Eco-insurance will be more readily paid by people, organizations and nations on a voluntarily basis if there are very clear incentives that motivate them to do so and markets are allowed to function. To achieve this, governments in cooperation with the private sector, NGOs, multilateral organizations, academia and global citizens -- as joint stakeholders in a common future – will need to cooperate on the creation of an enabling environment.

Strong Scenario

The strong (and better) scenario of such an enabling environment would call for making policy decisions with respect to three key targets:

1. **Biocapacity:** a percentage target for humanity's annual usage of the biosphere's capacity;
2. **Timeframe:** the number of years to reach the biocapacity target; and,
3. **Financial risk**: total investments needed to achieve the biocapacity and timeframe targets.

Once these policy decisions are made and targets have been established it will be possible to construct the corresponding S&S Scenario in order to:

- *calculate* applicable Eco-Insurance Premium Levels as a function of Ecological Footprint metrics, income levels, and Global Eco-Insurance Risk (in proportion to accumulated ecological debt per the Eco-Insurance Risk Index);
- *implement* an S&S-based Cap and Trade system which allows society to reach its targets faster and at reduced cost to governments, the private sector and civil society at large;
- *develop* and *test* environmental futures markets to provide price signals to governments relative to established targets.

Experience with the climate negotiation process and similar international processes have shown that reaching consensus on mandatory targets is time consuming. Serious consideration should therefore be given to:

- adoption of voluntary targets by for instance a coalition of willing governments as part of a longer term effort to move towards mandatory targets over time;
- rewarding early adopters of the targets with tangible financial returns for meeting their obligations before others (by issuing Eco-Insurance Bonds for example).

Second-best Scenario

The second-best scenario of an enabling environment (which could pave the way for adoption of the strong scenario) would focus on stimulating voluntary participation by means of a series of smart incentives such as listed in Table 1, page 7 above.

Requirements would be that:

- a critical mass of governments adopt policies leading to modifications in their tax codes and/or budgets to create the necessary fiscal and economic incentives;
- a recommended Eco-Insurance premium schedule for voluntary payment is prepared on the basis of appropriate targets for biocapacity, timeframe and financial risk.

What are reasonable targets?

The following benchmarks may be appropriate targets to start incentive framework discussions*:

1. **Biocapacity:** 88% of planet
2. **Timeframe** by 2050
3. **Financial Risk** 0.2 – 0.5 % of World GDP per year

* to be adjusted up or down as new information becomes available about the environmental, economic and human risks associated with prevailing levels of ecological deficits and debt.

Everyone Benefits

Given an appropriate incentive framework, individuals, the private sector, governments, NGOs, multilateral development institutions and academia would be compelled, motivated by self-interest rather than altruism, to participate in the Eco-Insurance scheme for the following reasons:

- *Individuals* would like the proposed scheme because Eco-Insurance:
  - pays for itself or returns money through smart financial incentives; it also lowers future tax liabilities -- a dividend resulting from better governance of natural resources;
  - offers a participative, transparent, accountable and online interface (the EcoSmartCard™) for tracking, reporting and co-managing people's investments in a sustainable future;
  - promotes fiscally prudent governance and ensures more reliable and equitable access to ecological goods and services for the benefit of both current and future generations; and,
  - enhances economic, social and environmental security on the basis of precaution, equity and an inclusive community-based solution to a global problem affecting everyone.
- The *private sector* would speak out in favor of Eco-Insurance because participation:
  - helps to lower uninsurable (systemic) financial risks to their businesses -- increasing performance, and facilitates long term access to the capital markets;
  - demonstrates a tangible commitment to, and engages the workforce in, the transition to sustainability; it exemplifies good forward-thinking corporate citizenship; and,
  - strengthens the private sector's license to operate within a world economic context increasingly impacted by the consequences of poor environmental governance.
- *Governments* would welcome the approach because Eco-Insurance:
  - promises to mobilize new and additional financial resources for meeting the rapidly mounting environmental challenges, risk and uncertainties of the 21st Century;
  - strengthens global environmental governance which is complementary to and in line with all major international (environmental) agreements and conventions;

- leverages the capabilities of multi–and bilateral institutions or initiatives, the private sector, NGOs and knowledge institutions within a common strategic framework and purpose;
- promotes the delivery of increasingly scarce environmental goods and services through international public-private cooperation and active engagement of civil society;
- stimulates more sustainable consumption, production, trade and investment patterns; and,
- builds a better foundation for timely realization of the Millennium Development Goals.

☐ *NGOs, Multilateral Development Institutions and experts* support Eco-Insurance because it:

- strengthens and leverages their own efforts to mainstream environmental concerns in society pursuant to a compelling international cooperative strategic framework;
- offers the opportunity to manage portions of the catalytic Global Community Investment Program as implementation agencies pursuant to transparent, efficient online procurement procedures;
- provides an opportunity to achieve the necessary scale to address the major environmental challenges facing humankind in the coming decades;
- is a preventive solution based on sound scientific methodology and a concern for equity, efficiency and choice for all living things.

The Way Forward

It is recommended multi-stakeholder support be mobilized to finance a development strategy for the Eco-Insurance Initiative along the following lines:

☐ The Eco-insurance scheme could be elaborated and implementation challenges could be overcome in close cooperation with a growing network of 'Launch Partners' drawn from government, the private sector, NGOs, multilateral development institutions and academia;

☐ Some 15-20 *initial* Launch Partners could take the lead in preparing a phased implementation plan that would feature demonstrations projects in selected regions of the world;

☐ Stakeholder consultations, workshops, technical papers, publications, and web-based communications and outreach programs should engage people, governments, companies and organizations from around the globe towards a tipping point of international support; and,

☐ Tax deductible donations from people and organizations supplemented by financial support from governments could enable the Eco-Insurance Financial Mechanism to finance development and start-up expenses of the Initiative until such time that premium payments enable the Eco-Insurance Financial Mechanism as a going concern.

End Notes

[1] *The Insurability of Ecological Damage*, Swiss Reinsurance Company, Zurich, 2003, p 5.

[2] Ibid 1

[3] See: *Climate Change and the Financial Services Industry*, Executive Briefing, UNEP Finance Initiatives, 2002.

[4] IPCC , Third Assessment Report - Climate Change 2001. Working Group I: The Scientific Basis. Summary for Policy Makers. Geneva, World Meteorological Organization and United Nations Environment Programme, 2001

[5] *Climate Related Perils Could Bankrupt Insurers*, ENS News, October 7, 2002.

[6] Ibid 1, pp 27-29.

[7] For a more detailed discussion see: Ibid 1, pp 27-42.

[8] See: Ibid 1, page 9 for overview of goods and services provided by life-supporting ecosystems. [correct]

[9] See for example: (i) *Living Planet Report 2002*, WWF with UNEP's WCMC and Redefining Progress, (ii) Global Environmental Outlook 3: Past Present and Future Perspectives UNEP, 2002; (iii) ibid 1, page 19, and (iii) Wackernagel, M. et al., *Tracking the ecological overshoot of the human economy.* Proceedings of the National Academy of Sciences, June 24, 2002.

[10] For an approximation of the value of what may be priceless and returns on conservation as an investment, see: *Economic Reasons for Conserving Wild Nature* Andrew Balmford, Aaron Bruner, Philip Cooper, Robert Costanza, Stephen Farber, Rhys E. Green, Martin Jenkins, Paul Jefferiss, Valma Jessamy, Joah Madden, Kat Munro, Norman Myers, Shahid Naeem, Jouni Paavola, Matthew Rayment, Sergio Rosendo, Joan Roughgarden, Kate Trumper, and R. Kerry Turner, Science 2002 August 9; 297: 950-953.

[11] See for example: (i) *Conserving the Peace: Resources, Livelihoods and Security*, Edited by Matthew, R., Halle, M. and Switzer, J. International Institute for Sustainable Development, 2002; (ii) Homer-Dixon, T., *Environment, Scarcity, and Violence*, Princeton University Press, June 2001.

[12] Ibid 23

[13] For discussion on ecological deficits and its consequences, see for example: Brown, Lester, R.*, Eco-Economy: Building an Economy for the Earth,* Earth Policy Institute, W.W. Norton & Company, New York and London.

[14] For example: the civilizations of Mesopotamia and Easter Island.

[15] The International Energy Agency (IEA) predicts demand for oil will rise from 77 to 120 million barrels per day by 2023 while supply can only increase to from a current 77 to 80 million barrels per day.

[16] [IEA reference, complete]

[17] {Leeb reference, complete]

[18] See the UN's Framework Papers on Water, Energy, Health, Agriculture and Biodiversity for summaries on these interrelated environmental changes related to sustainability: http://www.johannesburgsummit.org/html/documents/wehab_papers.html

[19] Myers, N. *Environmental refugees: a growing phenomenon of the 21st Century*, Philosophical Transactions of the Royal Society, London, May 2001, 356.

[20] Ibid 8 (ii)

[21] World Population 1950-2050, US Census Bureau, http://www.census.gov/ipc/www/img/worldpop.gif International Database 5-10-00

[22] See: Diamond, Jared, *Guns, Steel and Germs: The Fate of Human Societies* Norton, W. W. & Company, Inc, 1999.

[23] A global commons may be loosely defined as a domain that is beyond the exclusive jurisdiction of any one nation but one that all nations may use for their own purposes (such as extracting resources or discharging pollutants). Without effective controls, the use of a commons may increase to the point that it becomes severely depleted, contaminated, or degraded, a tendency Garrett Hardin refers to as the "tragedy of the commons."

[24] Hardin, G. The Tragedy of the Commons, Science 162, 1968, 1243

[25] See for example: (i) Kaul, I., Le Goulven, K., Schnupf, M., *Financing Global Public Goods: Policy Experience and Future Challenges*, in Global Public Goods Financing: New Tools for New Challenges, A policy dialogue, edited by Inge Kaul, Katell Le Goulven and Mirjam Schnupf, 2002 and (ii) Gardiner, R., Le Goulven, K. *Sustainaing our Global Public Goods,* UNED Economic Briefing No 3.

[26] See: Stiglitz, Joseph, E., Knowledge as a Global Public Good, *www.worldbank.org/knowledge/chiefecon/articles* and also: *Sustaining our Global Public Goods*, Towards Earth Summit 2002, Economic Briefing No.3, UNED Forum

[27] The following resources on ecological footprint analysis are helpful: Wackernagel, M and Rees, W., *Our Ecological Footprint: Reducing Human Impact on the Earth*, New Society Publishers, Gabriola Island, BC, Canada, 1996; Chambers, N., Simmons, C., Wackernagel, M., *Sharing Nature's Interest: Ecological Footprints as an indicator of sustainability,* Earthscan Publications Ltd., London and Sterling VA, 2000.

[28] "Remainder" is a more appropriate term than surplus because on a global level a surplus does not exist; humankind has been running an ecological deficit with the earth since the 1980s.

[29] The suggestion here is that UNEP may be an appropriate agency for providing such an assessment based on its current work program, expertise and increased attention to scenarios, such as included in the Global Environmental Outlook.

[30] Appropriate examples of fiscal and economic interventions include, but are not limited to: Eco-Insurance deductibility from VAT or income tax purposes, credits of Eco-Insurance payments against qualified environmental or carbon taxes, Eco-Insurance investment credits, the shifting of perverse subsidies, Eco-Insurance exempt goods and services, etc.

[31] The cost of achieving sustainable development has been estimated at $ 600 billion of which $ 125 billion was to be provided as foreign assistance to developing countries; the estimated demand for financing the globe's life-supporting ecosystems is estimated to be in excess of $ 100 billion (see for example: *What the World Wants* at www.osearth.com); the estimated supply for financing Global Public Goods is approximately $ 5 billion of which $ 1-2 billion reaches the globe's life-supporting ecosystems via the GEF (see: *Effective Use of Development Finance for International Public Goods*, in Global Development Finance 2001, The World Bank, Washington DC).

[32] MyEcoFoot is a development stage public-private initiative of the Institute for Environmental Security and TransGlobal Ventures, Inc., see: www.myecofoot.org

[33] See: 1% community campaign at Social Investment Forum at http://www.communityinvest.org/campaign.htm

[34] Eco-insurance Bonds are proposed to be issued upon pre-payment of eco-insurance premiums and would have the following basic features: (i) a face value equivalent to the premium amount; (ii) cumulative interest on the face value at a specified rate; and (iii) maturity of accumulated interest in five or ten years Early adopters would be protected against future increases of eco-insurance premiums pursuant to increased global risk up and until the effective maturity date of five, ten, fifteen or twenty years. One or a combination of the following tax incentives may support eco-insurance: (i) a tax deduction from current or future income equal to face value; (ii) a cumulative interest exemption for income tax purposes at maturity ; (iii) ability to offset face value against future environmental or carbon taxes

[35] Wackernagel, M., Schulz, N. B., Deumling, D., Linares, A. C., Jenkins, M., Kapos, V., Monfreda, C., Loh, J., Myers, N., Norgaard, R., Randers, J., 2002. Tracking the ecological overshoot of the human economy. *Proceedings of the National Academy of Sciences* 99(14), 9266-9271. Most recent data is for 1999.

[36] A 70 percent increase in the Ecological Footprint by 2030 is a conservative forecast based on optimistic projections of key variables. Increases in agricultural yields are assumed to continue at the rate experienced over the past forty years. A number of critical factors, including salinization, limitations on irrigation potential, and expansion into marginal cropland threaten to stall additional efficiency gains. The IPCC emissions scenarios used in this forecast assume rapid development of energy efficient technologies and an equal share of fossil and non-fossil energy sources by the year 2050. Failure to achieve these conditions would markedly increase the Ecological Footprint. The forecast is also based on moderate population growth to 8.1 billion by 2030. A continuation of current population growth rates would result in a significantly higher figure. See Food and Agriculture Organization. 2000. *Agriculture: Towards 2015/2030, Technical Interim Report* (Rome, Italy) and Intergovernmental Panel on Climate Change (IPCC). 2000. *Special Report on Emissions Scenarios* (Cambridge, UK: Cambridge University Press).

[37] Living Planet Report 2002

[38] World Resources Institute (WRI), United Nations Development Programme (UNDP), UNEP, World Bank, 2000, *World Resources 2000-2001, People and Ecosystems: The Fraying Web of Life,* Oxford University Press, New York. United Nations Environment Programme (UNEP), Stockholm Environment Institute, 1999, *Global Environment Outlook 2000,* Oxford University Press, New York.

[39] Aubrey Meyer, 2001, *Contraction & Convergence: The Global Solution to Climate Change*, Schumacher Briefings #5 and Global Commons Institute. Green Books; ISBN: 1870098943

[40] Ashton, J. & Wang, X. Equity and climate: In principle and practice. In *Beyond Kyoto: Advancing the International Effort Against Climate Change*, Pew Center on Global Climate Change, 2003.

[41] World-Wide Fund for Nature International (WWF), UNEP World Conservation Monitoring Centre, Redefining Progress, with the Center for Sustainability Studies, 2002, *Living Planet Report 2002*, WWF, Gland, Switzerland.

[42] World Commission on Environment and Development (WCED), 1987, *Our Common Future* (aka: The Brundtland Report), Oxford University Press, Oxford.

[43] Today, about 3 percent of biologically productive space is set aside as protected reserves, worldwide. However, conservation biologists believe that, independent of interspecies fairness, it may require far more merely for the utilitarian goal of biodiversity preservation. Wildlife ecologist and scientific director of the Wildlands Project, Reed Noss, along with Allen Cooperrider, conclude that most regions will need protection of some 25 to 75 percent of their total land area in core reserves and inner buffer zones. These projections all assume that this acreage is distributed optimally with regard to representation of biodiversity and viability of species, and is well-connected within the region and to other reserve networks in neighboring regions (Reed F. Noss and Allen Y. Cooperrider, 1994*, Saving Nature's Legacy—Protecting and Restoring Biodiversity*, Island Press, Washington, DC).

[44] E.O. Wilson, *The Future of Life.* Alfred A. Knopf, New York, 2002.

[45] Myers, N., Mittermeier, R. A., Mittermeier, C. G., Da Fonseca, G. A.B. & Kent, J. Biodiversity hotspots for conservation priorities. *Nature*,. **403**, 853 (2000)

[46] E.O. Wilson, *The Future of Life.* A. Knopf, New York, 2002.

[47] How does Shrink and Share link to the Contraction and Convergence scenarios? First, note that carbon emissions within the sustainable limits will not add to the overall Footprint. Absorption of the amount the biosphere can tolerate is a secondary ecological function on areas that can be used simultaneously for other purposes. Hence, the absorption of these emissions within sustainable limits are not demanding additional exclusive space – or are not adding to the Footprint. As a result, rights to carbon emissions (within the sustainable limits, and hence no longer burdened with a Footprint) may still be allocated independently of the Biocapacity, for example, on a per capital basis as suggested by the Contraction and Convergence approach.

[48] Insert reference