Workshop at UNIP UNIVERSIDADE PAULISTA

August 26th, 2014

THE NEED OF SUSTAINABILITY

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UNIVERSITÀ DI SIENA 1240

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FIRST CHAPTER

INTRODUCTION

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What is sustainability?

Sustainability is an opportunity

… to talk about man

In particular, the study of sustainability is the study of the relations of man – both as individual and in its collective expressions – with his context.
The context(s) can be different: environmental, social, economic, political, urban, juridical, etc.

2 key concepts:

- Purpose(s)

  better life conditions

  living in harmony with Nature and other individuals

- Transdisciplinarity

We think that the disciplinary structure of knowledge is a problem of fragmentation, a difficulty to be overcome rather then a criterion to be met. Real problems do not respect academic boundaries. We certainly believe that thinking should be 'disciplined' in the sense of respecting logic and facts, but not 'disciplinary' in the sense of limiting itself to traditional methodologies and tools that have become enshrined in the academic departments of neoclassical economics.

Daly, H. & Farley, J., Ecological Economics - Principles and Applications, Island Press: Washington, DC, 2004.

COMMUNICATION

INFORMATION

AWARNESS

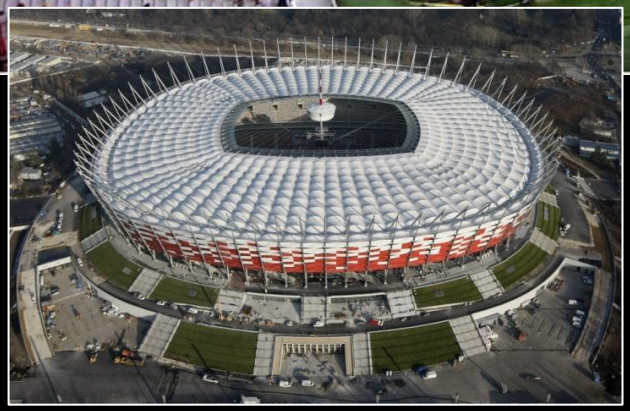
EDUCATION

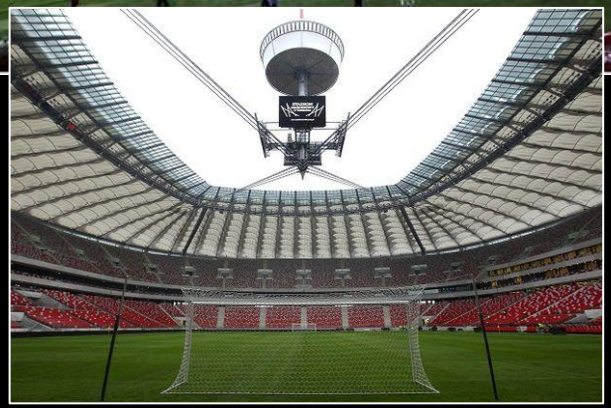
DISSEMINATION

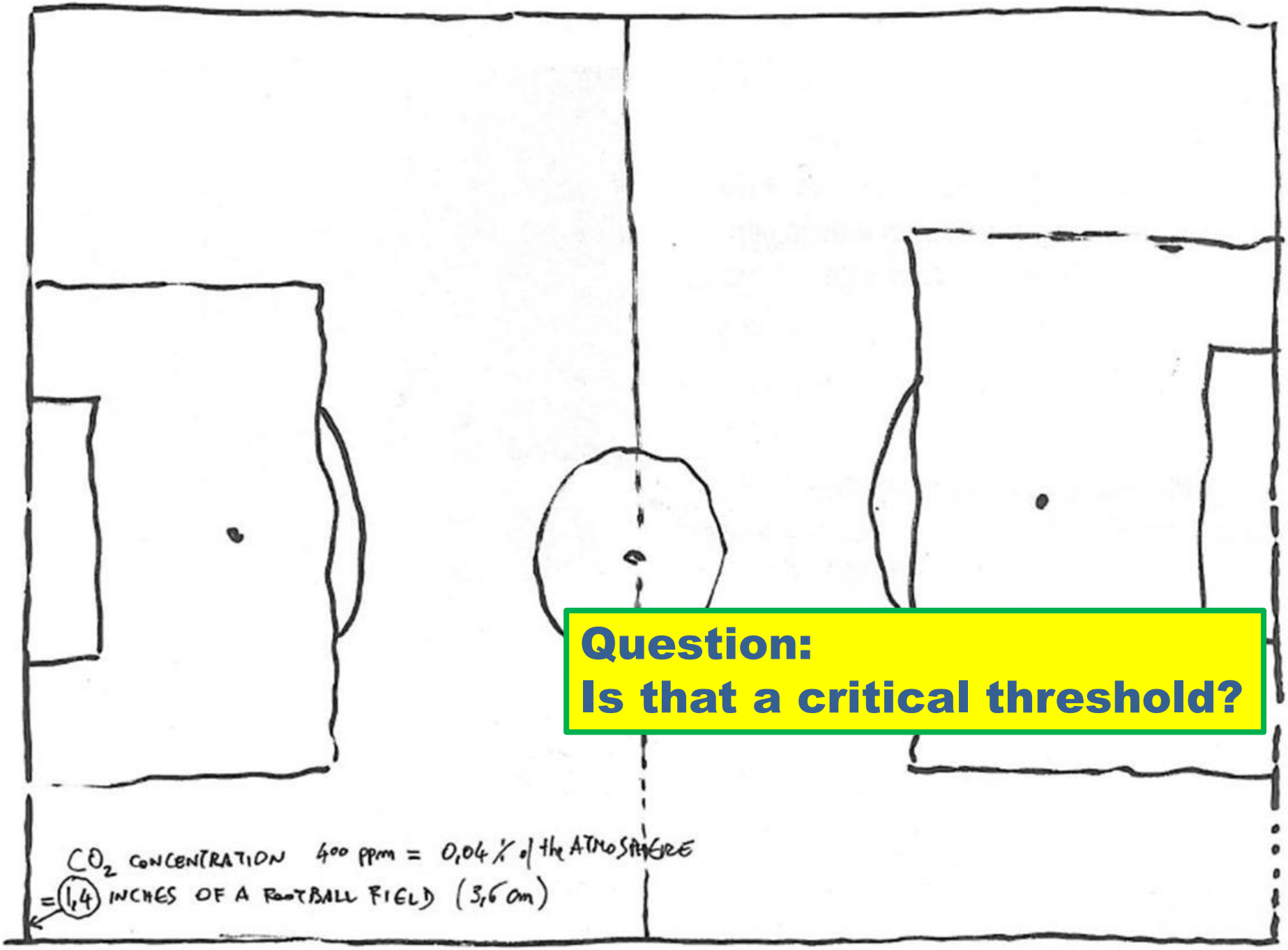
POPULARIZATION

TEACHING

COP 19 (2013)
WARSAW STADIUM







Question:
Is that a critical threshold?

EARTH OVERSHOOT DAY 2014

EARTH OVER SHOOT DAY 2014

The date our
Ecological Footprint
exceeds our **planet's budget**

Em menos de oito meses, Humanidade já usou todos os recursos naturais disponíveis para o ano

Dados mostram que consumo do brasileiro corresponde a 50% a mais da capacidade da Terra

POR O GLOBO
19/08/2014 6:00 / ATUALIZADO 19/08/2014 8:28

Esta terça-feira é mercada pelo dia da Sobrecarga da Terra (em inglês, Overshoot Day). Desde 2000, a data surge cada vez mais cedo: de 1º de outubro em 2000 a 19 de agosto em 2014

RIO - Em menos de oito meses, os habitantes da Terra já usaram todos os recursos naturais do planeta disponíveis para o ano. Segundo cálculo divulgado pela Global Footprint Network, uma organização internacional pela sustentabilidade em parceria com a Rede WWF, nesta terça-feira o Planeta Azul entra no vermelho. Até o final do ano, a população mundial seguirá em déficit ecológico, já que reduzirá as reservas e aumentará ainda mais a quantidade de CO^2 na atmosfera.

Segundo a entidade, 85% da população mundial vive em países que demandam mais da natureza do que os seus ecossistemas podem renovar. De acordo com os cálculos da GFN, seriam necessários 1,5 planeta para produzir os recursos ecológicos necessários para suportar a atual pegada ecológica mundial.
A organização também garante que projeções sobre a população, o uso de energia e a produção de alimentos sugerem que a humanidade vai precisar usufruir da biocapacidade de três planetas bem antes da metade do século. E isso pode ser fisicamente impossível.

BRASIL

No caso do Brasil, o consumo médio de recursos ecológicos equivale a 1,6 planeta – bem próximo à média mundial. Mesmo assim, o país está consumindo acima de 50% da capacidade anual do planeta.
Para reverter este quadro, a CEO do WWF-Brasil, Maria Cecilia Wey de Brito, defende que sociedade civil, poder público e empresas precisam se envolver no processo de redução dos impactos.
O cidadão pode fazer a sua parte adotando uma postura crítica e melhorando os seus hábitos de consumo. O poder público, por sua vez, é responsável por planejar e implementar políticas públicas de mitigação, como transporte público menos poluente, instalação de ciclovias e planejamento ambiental. Na outra ponta, as empresas têm o papel de melhorar suas cadeias produtivas e oferecer aos consumidores produtos mais sustentáveis - explica.

CHALLENGES and Questions:

On NOV 2013**:** find articles on this event in newspapers

Today:

Where will COP 20 be held???

Where will COP 21 be held???

For teachers**:** ask your students to find articles on events like this (e.g. Overshoot), and analyze the way in which these are presented

"How to teach/communicate sustainability" GAME:
Find communication tools to divulgate concepts like sustainability and crucial environmental themes.

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SECOND CHAPTER

FOUNDATIONS

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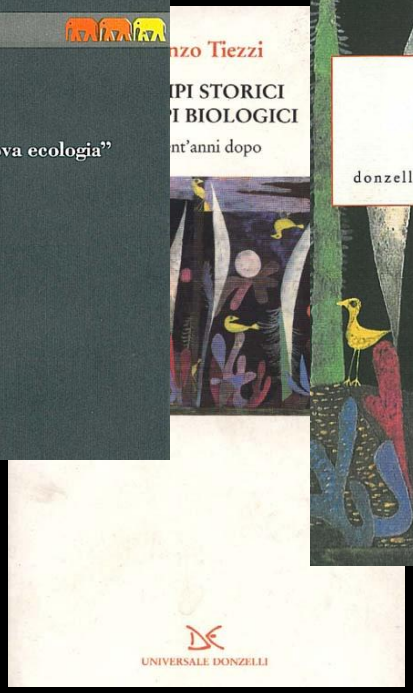
…Sustainable
is that development that meets the needs of the present without compromising the ability of future generations to meet their own needs...

WCED: "Our Common Future" Rapporto Bruntland, 1987

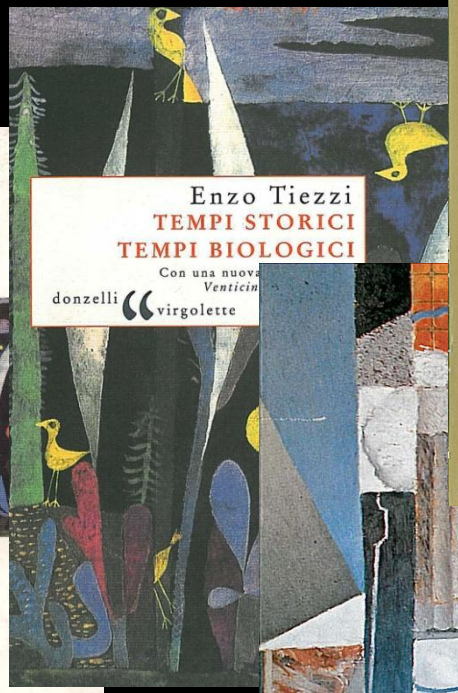

Pearl River
SUSTAIN
1
TIME

1984

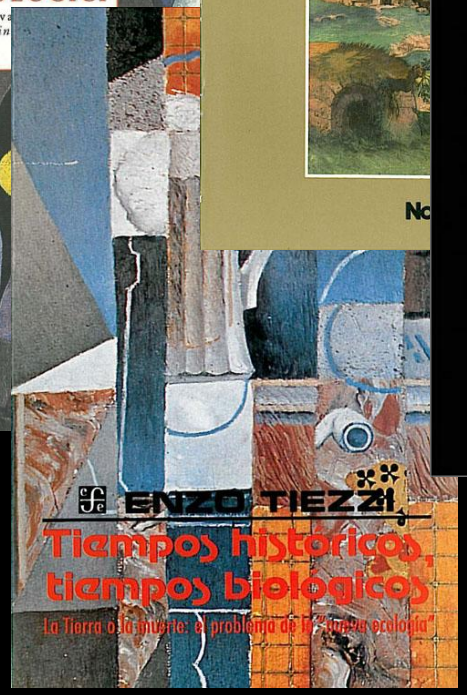
1992



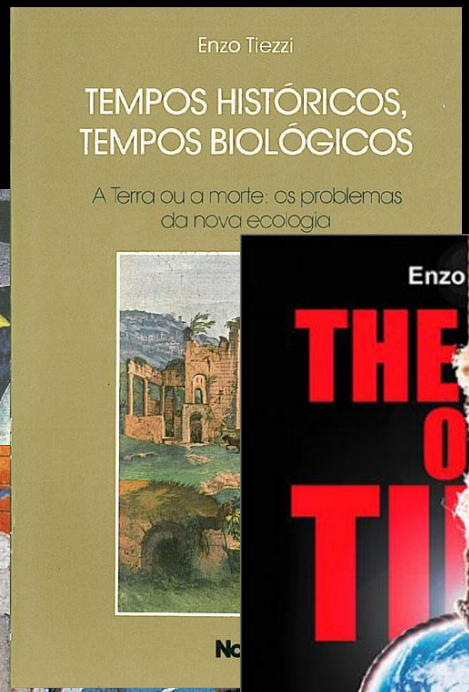
2001



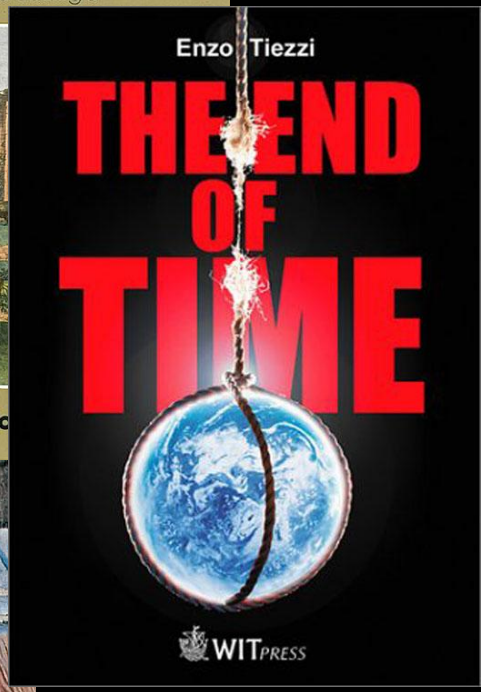
2005



1988



1990



2003

SUSTAINABILITY is an **ANTHROPOCENTRIC** CONCEPT

EARTH (4,5 bln years)

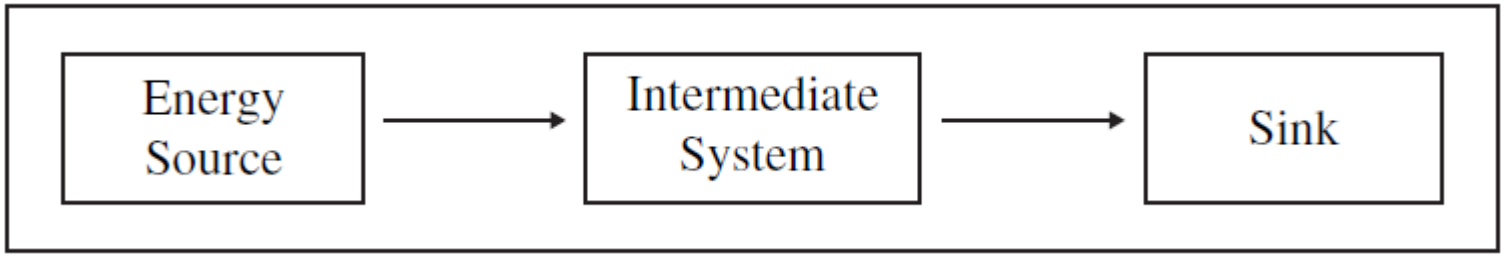
- Biodiversity
- Solar energy
- High entropy (discharge)

vs

HUMAN SPECIES

- Homologation
- Fossil energy
- Greenhouse effect

2 **BIOPHYSICAL LIMITS**



Isolated systems tend to the thermodynamic equilibrium (maximum entropy)

Biological systems (open systems) seem to violate the second principle: they have extremely ordered structures that evolve in the direction of greater order or lower entropy.

SUN – BIOSPHERE – UNIVERSE

SINK

$5{,}6 \times 10^{24}$ joule

Erwin Schrödinger

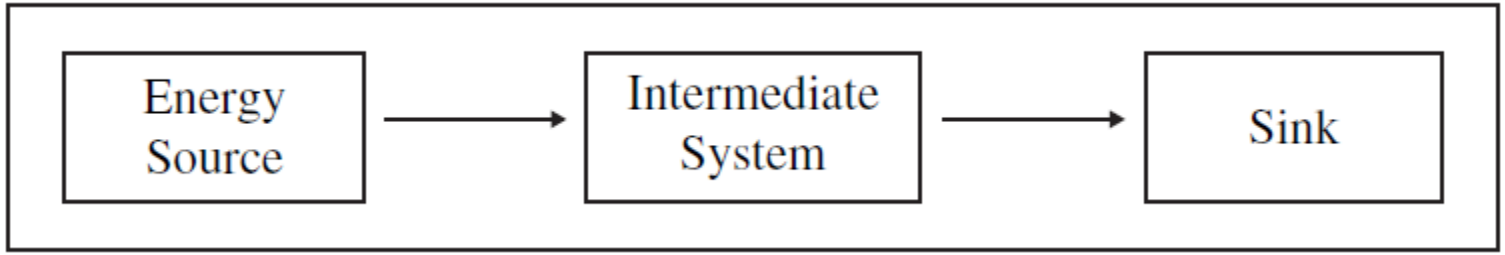
"a living organism feeds upon negative entropy, attracting a stream of negative entropy upon itself, to compensate the entropy increase it produces by living and thus to maintain itself on a stationary and fairly low entropy level".

[...] *"And that we give off heat [thermal entropy] is not accidental, but essential*"

EVERY SYSTEM DEPENDS ON THE CONTEXT IN WHICH IT LIVES

↓

ECONOMIC AND SOCIAL SYSTEMS



2 ESSENTIAL STATEMENTS

1) throughput, not just availability of resources, enables the system to survive, develop and increase in complexity

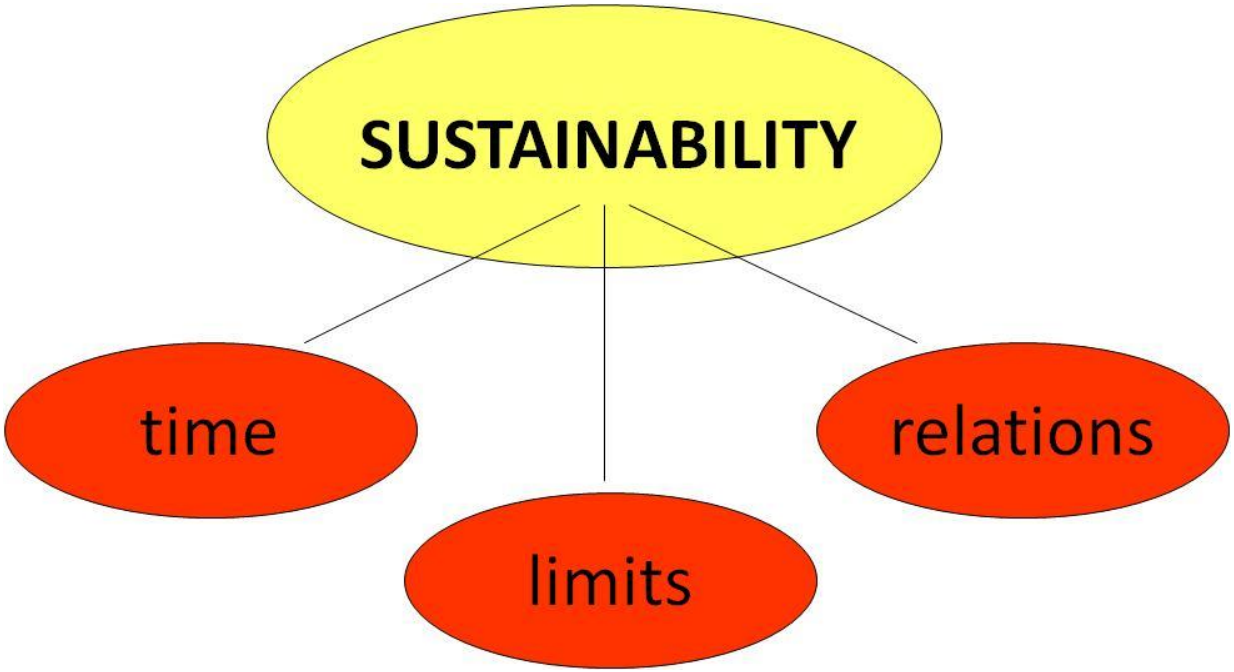
2) a low entropy source is just as necessary for the system as a cold sink for dissipating high entropy.

All this shows the importance of relationships for living systems and the dependence of all such systems on their contexts. **Prigogine** defined systems that decrease in entropy as they exploit flows of energy as "*dissipative structures*". The complexity of these structures manifests in the **relations** that these non-isolated systems entertain with their surroundings and in the way they self-organise.

Human behaviour and its manifestations resemble dissipative structures: economic systems, social systems, regional systems, urban systems all develop by exploiting flows of energy and matter, releasing entropy into their surroundings.

3 **RELATIONS**

The concept of sustainability therefore rests on three pillars: time, biophysical limits and relations.



A project cannot be called sustainable without these foundations: the use of the word sustainable would be inappropriate, misleading, or illusory. Human behaviour generally violates the laws of nature for ends that are often in contradiction with the ultimate aim of survival of the species.

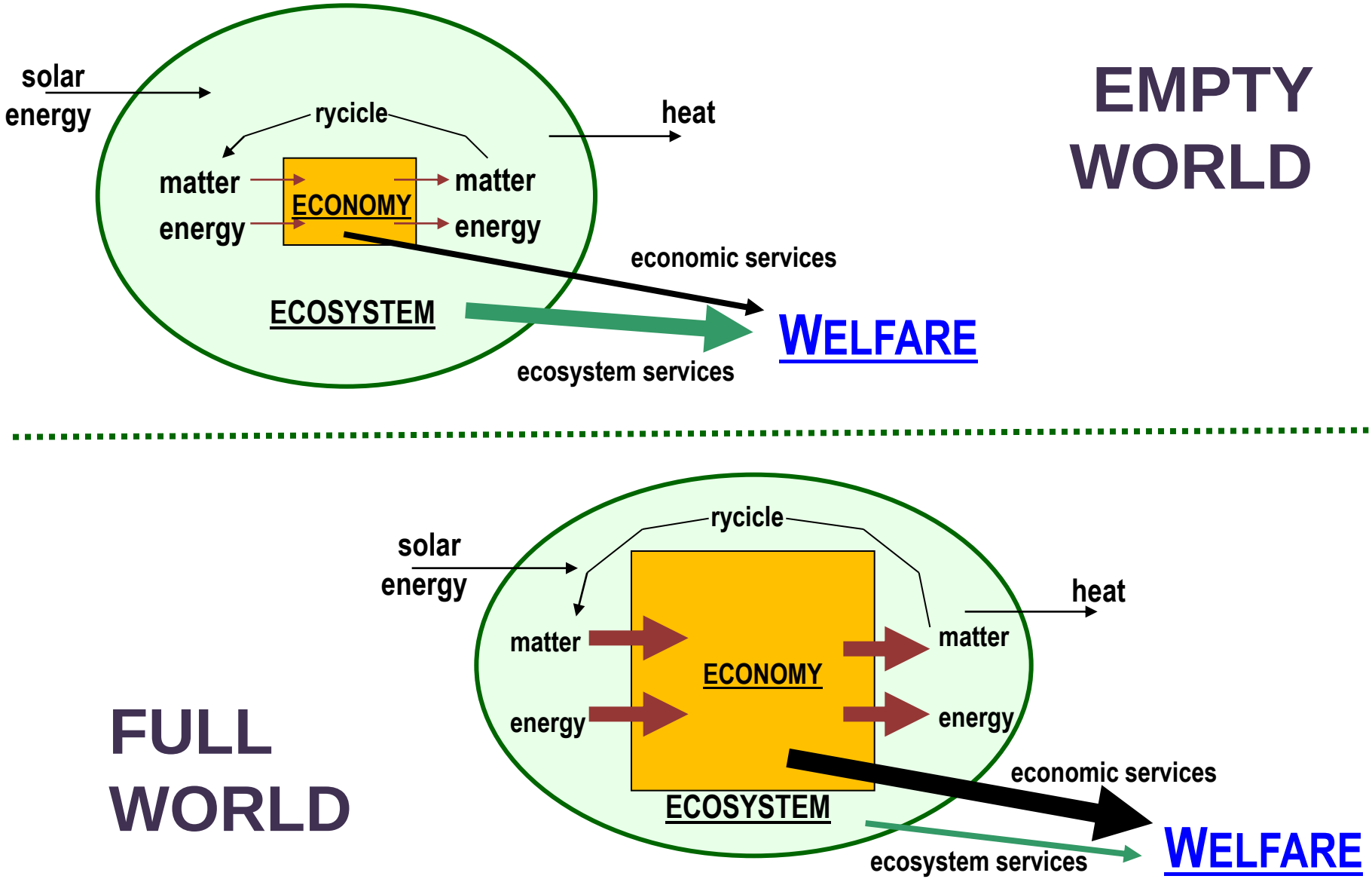
THE ESSENCE OF SUSTAINABILITY

- **TIME;**
- **BIOPHYSICAL LIMITS;**
- **RELATIONS.**

- **It is a transdisciplinar e complex concept;**
- **The chemico-physico-environmental component is a priority ("environmental sustainability" is a necessary condition);**
- **"Measuring" sustainability is difficult;**
- **"Communicating" sustainability is difficult;**
- **"Translating" sustainability into policies is difficult.**

This approach to the foundations of sustainability is extracted from "*The Road to Sustainability – GDP and Future Generations*" by FM. Pulselli, S. Bastianoni, N. Marchettini & E. Tiezzi; WIT Press, Southampton and Boston, 2008.

… THE CURRENT CONDITIONS



Daly, H. and Farley J. 2004. Ecological Economics: Principles and Applications. Island Press, Washington DC.

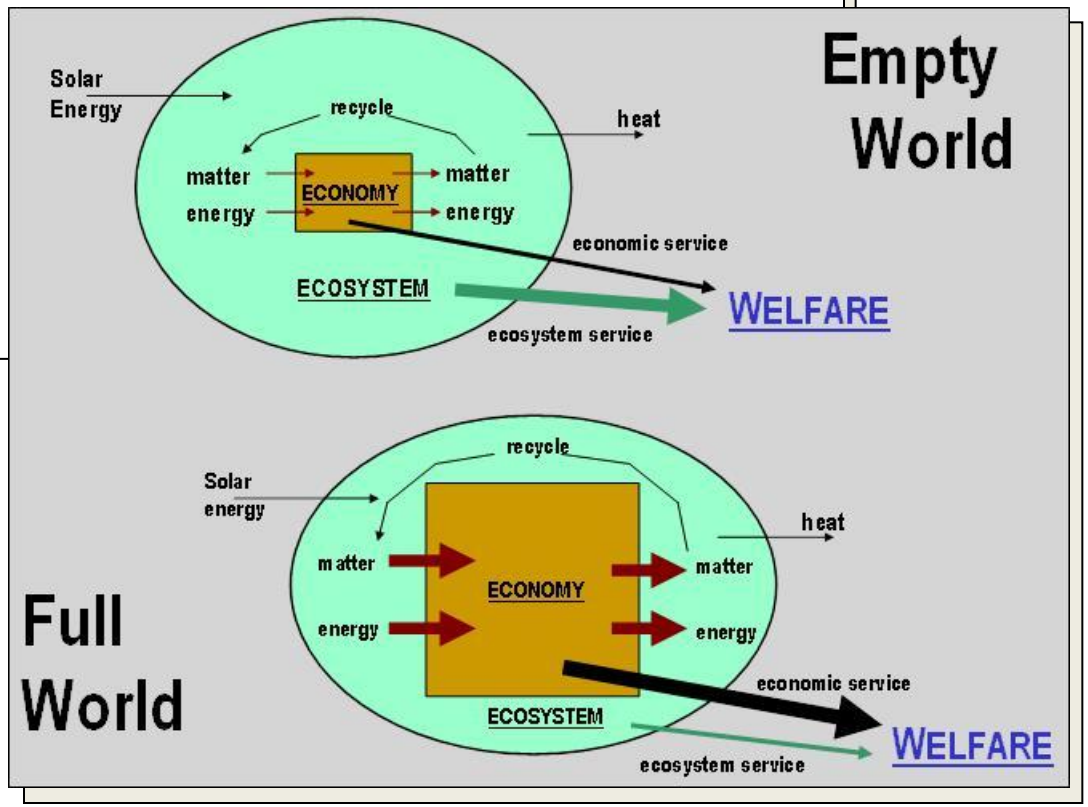
T H R E E MAIN ELEMENTS:

(to be determined)

Dimensions of the economy within the biosphere

Magnitude of energy and matter inflows and outflows

Role of Ecosystem Services and welfare



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THIRD CHAPTER

ADVANCEMENTS

FOCUS ON GDP, EMISSIONS AND RESOURCES

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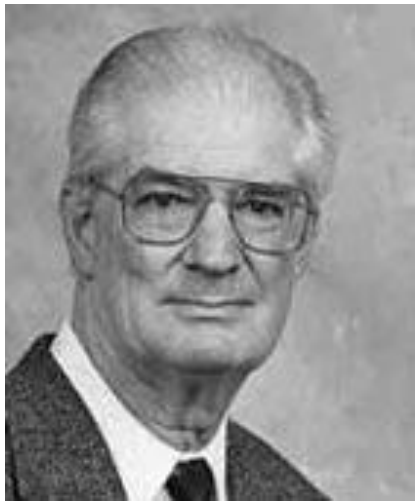
I

A focus on…

GDP

Herman E. Daly



When the economy's expansion encroaches too much on its surrounding ecosystem, we will begin to sacrifice natural capital (such as fish, minerals and fossil fuels) that is worth more than the man-made capital (such as roads, factories and appliances) added by the growth. We will then have what I call «uneconomic growth».

Daly, H. Preface to "The Road to Sustainability" by FM Pulselli, S Bastianoni, N Marchettini & E Tiezzi. WIT Press, Southampton, 2007.

ISEW

is an aggregate indicator of development that integrates information contained in GDP by correcting aspects such as inequable distribution of wealth, environmental damage and some social variables.

$$ISEW = C_w + G_{nd} + I_{ncg} + S - D_p - N$$

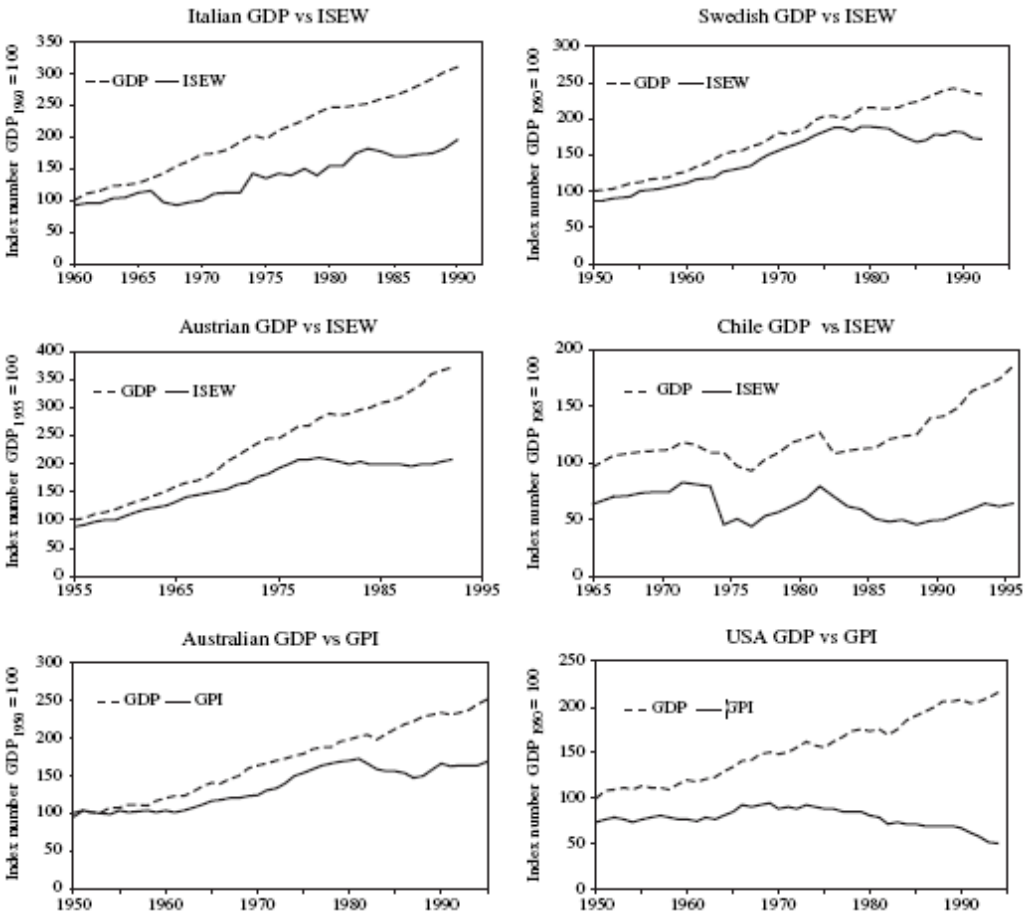
where:

C_w:	weighted consumption
G_{nd}:	non-defensive public expenditure
I_{ncg}:	net capital growth
S:	unpaid services contributing to welfare
D_p:	private defensive expenditure
N:	consumption/depletion of natural capital

Items composing the index

A		Year
B		Private consumption
C		Gini's index
D		Weighted private consumption
E	+	Services of domestic labour
F	+	Services of consumer durables
G	+	Road system services
H	+	Public non-defensive expenditure on education and health
I	-	Expenditure on durables
J	-	Private defensive expenditure on education and health
L	-	Commuting costs
N	-	Road accident costs
O	-	Costs of water pollution
P	-	Costs of air pollution
Q	-	Cost of noise pollution
R	-	Loss of wetlands
S	-	Loss of agricultural land
T	-	Depletion of non renewable resources
U	-	Long-term environmental damage
V	+	Net capital growth
W		ISEW
Y		GDP (inserted for comparison)

Examples at the national level



Example at the sub-national level

ECOLOGICAL ECONOMICS 60 (2006) 271–281

available at www.sciencedirect.com

ScienceDirect

www.elsevier.com/locate/ecolecon

ELSEVIER

Calculation for the Province of Siena, Italy.

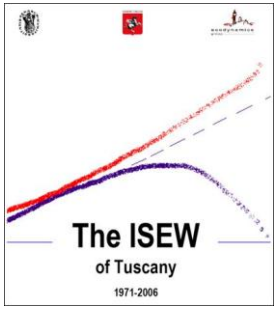
ANALYSIS

The index of sustainable economic welfare (ISEW) for a local authority: A case study in Italy

Federico Maria Pulselli [a,], Francesca Ciampalini [a], Enzo Tiezzi [a], Carlo Zappia [b]*

[a] *Department of Chemical and Biosystems Sciences and Technologies, University of Siena, Via della Diana 2/A, 53100 Siena, Italy*
[b] *Department of Economics, University of Siena, Piazza S. Francesco 7, 53100 Siena, Italy*

… it is possible and appropriate for local government to apply **different instruments** in order to obtain insights into its region and regional dynamics;
… it is possible to detect **particularities** and critical elements that do not emerge from indices applied at national scale;
… it is also possible to build local development of a kind that is not based exclusively on economic results, also considering the **living conditions** of the population, **environmental quality** and **availability of resources**.

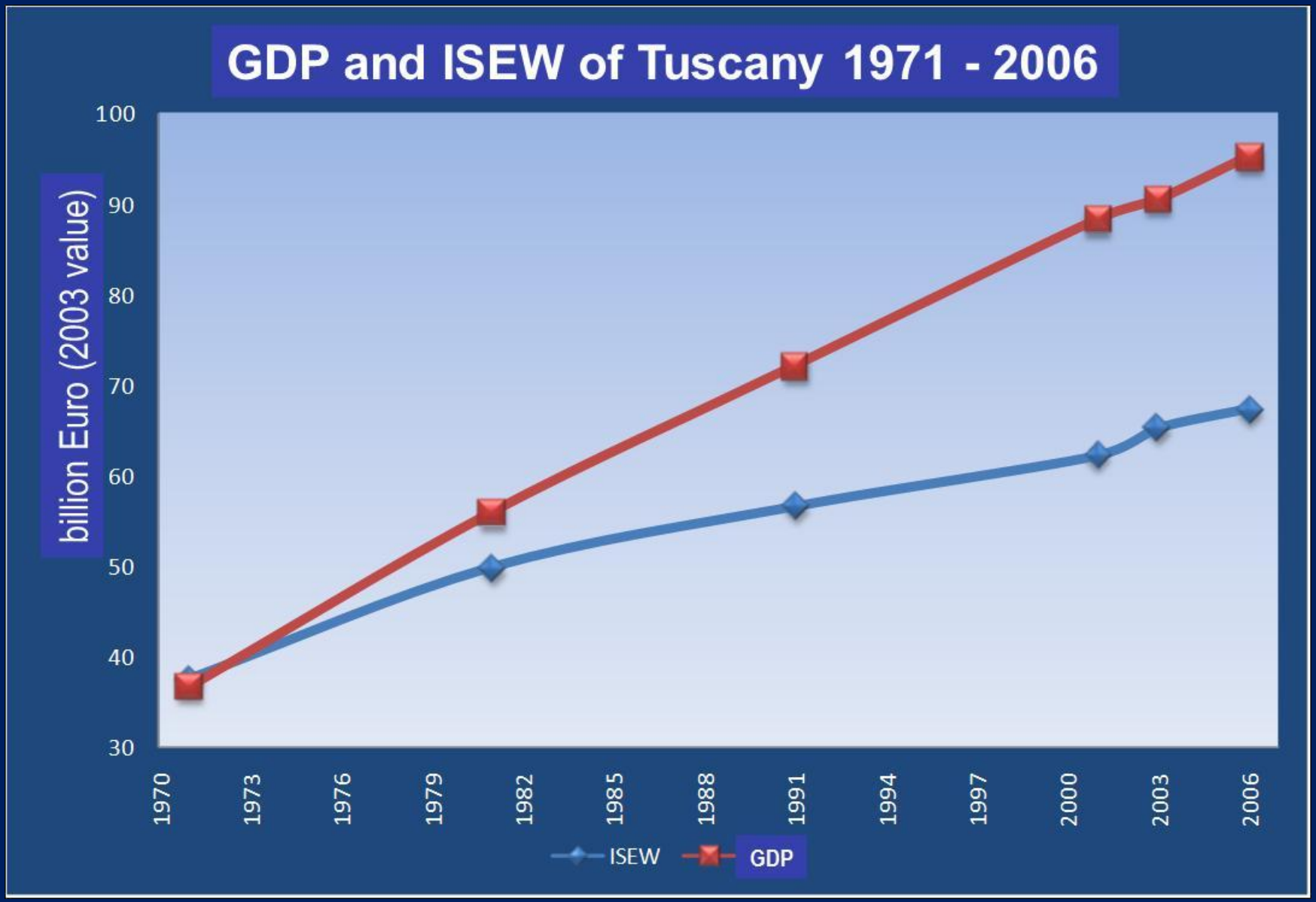


Results

Calculation for the Tuscany Region, Italy.

Table 25: Trend of ISEW 1971-2006 item by item

A		Year	**1971**	**1981**	**1991**	**2001**	**2003**	**2006**
B		Private consumption	24.724.659.489	31.703.914.500	42.413.202.090	53.179.025.590	54.206.850.000	55.333.625.514
C		Gini's index	0,400	0,330	0,360	0,360	0,307	0,279
D		Adjusted private consumption	12.963.984.856	21.241.622.715	27.144.449.338	34.034.576.378	37.565.347.050	39.895.543.996
E	+	Services from domestic labour	23.045.961.960	21.703.366.136	20.754.166.053	18.707.077.224	19.769.528.967	19.807.283.864
F	+	Services from durable goods	7.531.113.941	16.407.916.055	20.823.588.306	23.007.511.262	22.395.697.524	21.839.278.887
G	+	Services from infrastructure	145.904.683	103.529.676	225.959.746	232.504.961	244.271.500	241.707.395
H	+	Public health care and education costs	2.491.661.197	3.990.119.819	5.272.217.385	5.027.898.427	5.087.354.681	5.085.512.310
I	-	Expenditure in durable goods	2.295.543.247	3.079.299.302	4.399.843.473	5.814.266.481	6.087.369.775	6.569.085.235
J	-	Private health care and education costs	337.292.936	341.162.693	608.960.082	1.048.398.025	1.093.450.000	1.144.799.618
L	-	Cost of commuting	636.253.221	1.040.678.129	1.474.833.591	1.568.861.871	1.617.461.354	1.672.894.102
N	-	Cost of road accidents	39.533.033	29.475.044	31.523.326	72.269.892	79.542.222	78.347.293
O	-	Cost of water pollution	278.397.996	280.897.641	230.404.223	162.281.092	199.072.443	200.503.730
P	-	Cost of air pollution	1.282.714.969	1.888.078.870	1.799.434.360	1.272.929.953	903.488.110	863.694.357
Q	-	Cost of noise pollution	114.514.696	189.098.067	264.930.458	280.543.738	288.055.604	296.990.040
R	+	Variation of forest area	-677.455	-677.455	3.905.667	239.233	-165.930	0
S	-	Loss of agricultural land	2.668.182	-49.366.969	221.689.126	92.539.266	0	0
T	-	Depletion of non-renewable resources	5.987.418.580	9.302.406.209	8.051.733.715	7.631.301.136	8.421.417.068	7.460.364.901
U	-	Long term environmental damage	1.269.902.493	2.610.337.859	4.099.228.821	4.826.674.094	5.521.726.175	5.790.834.070
V	+	Net capital growth	3.543.462.002	5.070.132.172	3.576.102.415	4.029.568.306	4.380.552.919	4.467.060.703
W		ISEW	**37.477.171.831**	**49.803.942.271**	**56.617.807.734**	**62.269.310.243**	**65.231.003.959**	**67.258.873.810**
X		ISEW per capita	10.791	13.908	16.039	17.802	18.292	18.487
Y		GDP	**36.748.899.359**	**55.879.696.290**	**72.013.046.616**	**88.249.707.300**	**90.476.143.344**	**95.121.440.249**
Z		GDP per capita	10.581	15.604	20.401	25.230	25.371	26.145
		Population	3.473.097	3.581.051	3.529.946	3.497.806	3.566.071	3.638.211


GDP and ISEW of Tuscany 1971 - 2006
billion Euro (2003 value)
100
90
80
70
60
50
40
30
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997
2000
2003
2006
ISEW
GDP

Dealing with Un-sustainability, the role of thresholds is crucial

Example: economic and ecological indicators

ECOLOGICAL ECONOMICS 60 (2007) 667–672

available at www.sciencedirect.com

ScienceDirect

www.elsevier.com/locate/ecolecon

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Comparison of Ecol.Footpr., Biocapacity, GDP and ISEW for national economies

NEWS AND VIEWS

Strengthening the threshold hypothesis: Economic and biophysical limits to growth

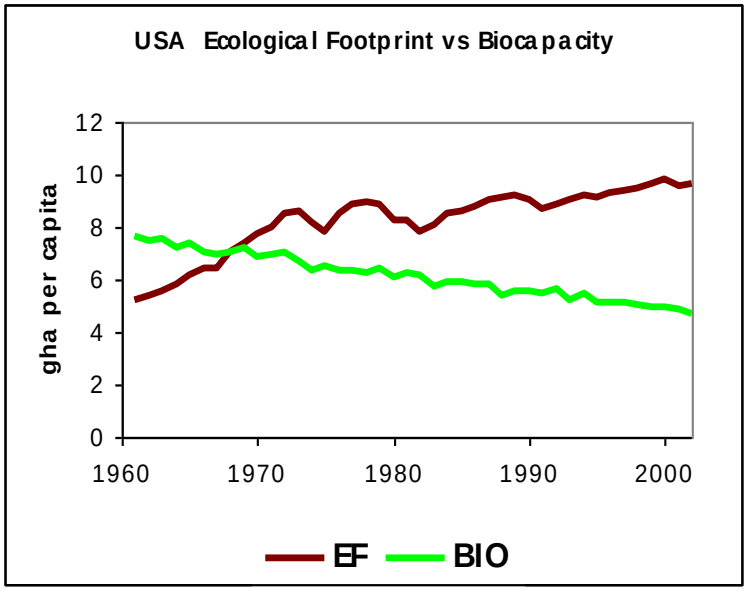
Valentina Niccolucci, Federico M. Pulselli, Enzo Tiezzi*

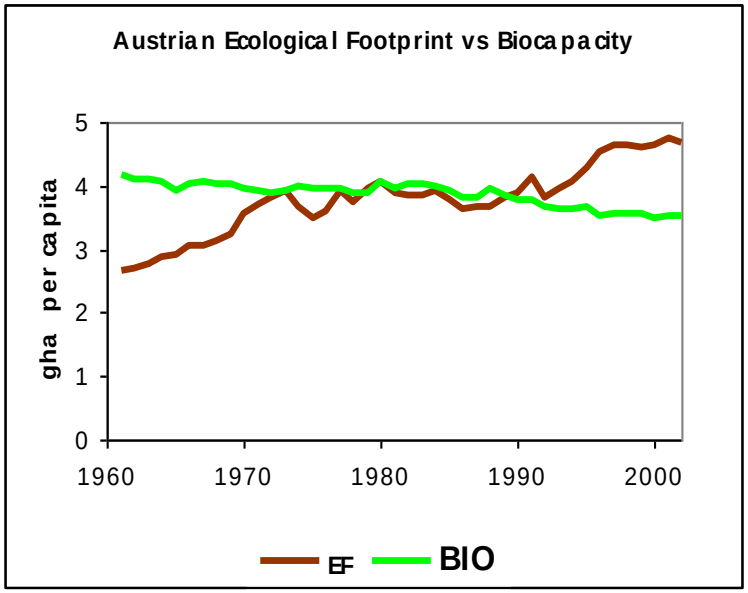
Department of Chemical and Biosystems Sciences and Technology - University of Siena, via della Diana 2A, 53100 Siena, Italy

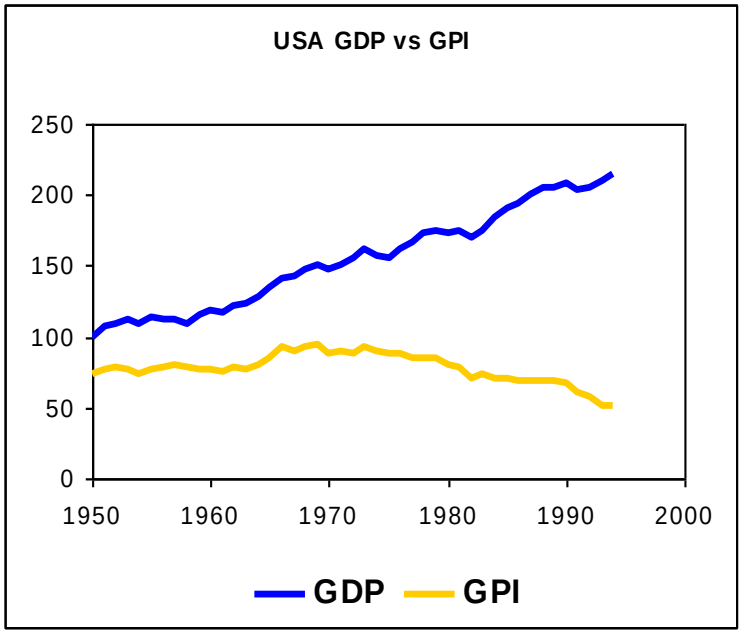
The joint use of different indicators is important:

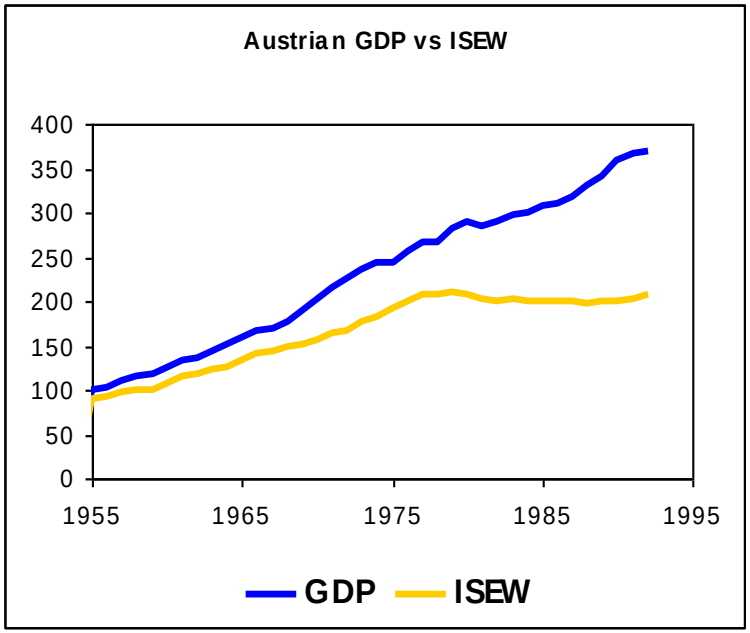
- it transcends the traditional short-sighted reductionist view of the economic system as a self-sufficient closed system in which households and firms are linked by flows of products and income;
- it promotes implementation of new economic scenarios and related legislative measures, inspired by the results of the kinds of analysis discussed, that in turn promote further scientific research in the environmental and social fields;
- it brings attention back to the biophysical foundation of all human systems.

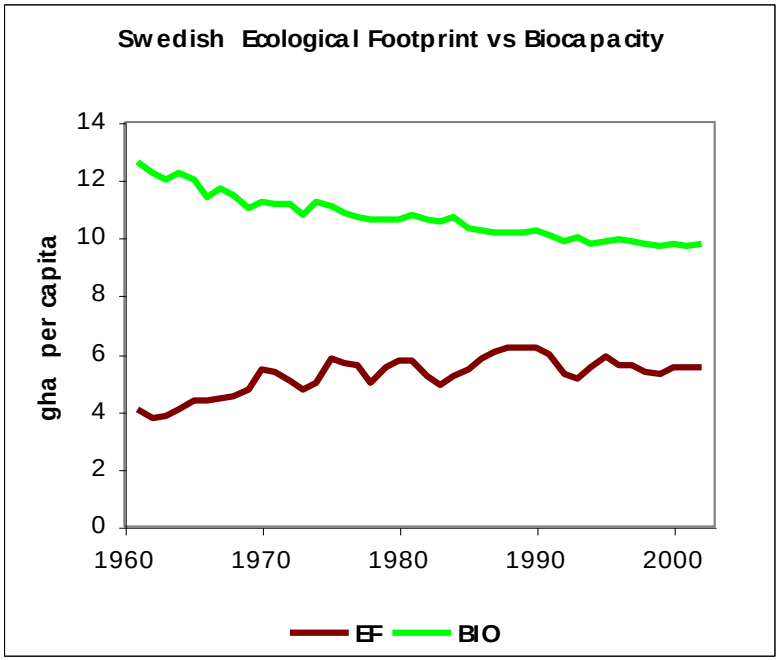
These economic and biophysical thresholds of growth should be understood as natural long term limits to human activity. For sustainable well being in the long run they are stronger than mere economic "break-even points", based on parameters such as feasibility, profits and prices.

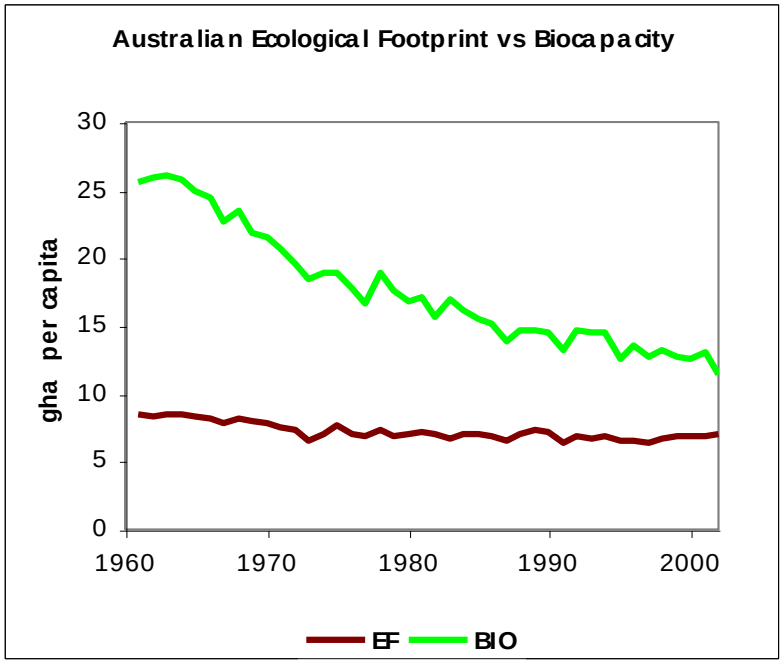

USA Ecological Footprint vs Biocapacity
gha per capita
12
10
8
6
4
2
0
1960
1970
1980
1990
2000
EF
BIO

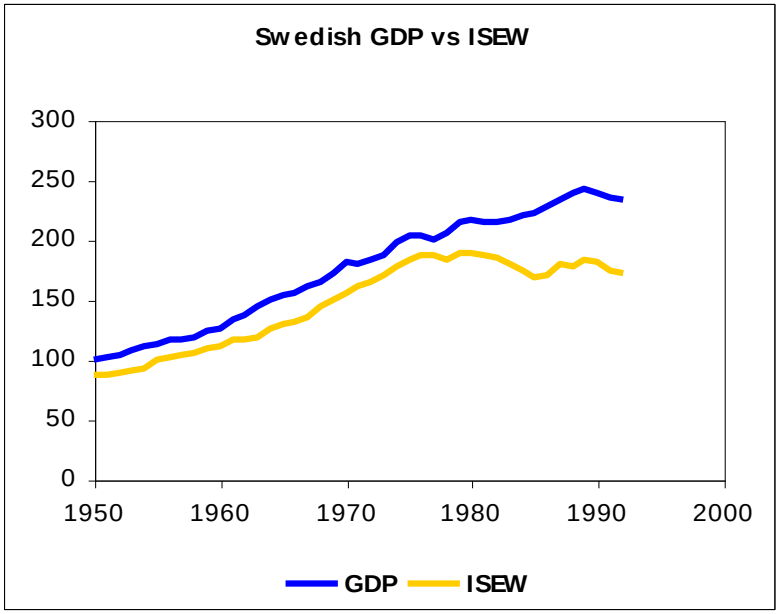

Austrian Ecological Footprint vs Biocapacity
gha per capita
5
4
3
2
1
0
1960
1970
1980
1990
2000
EF
BIO

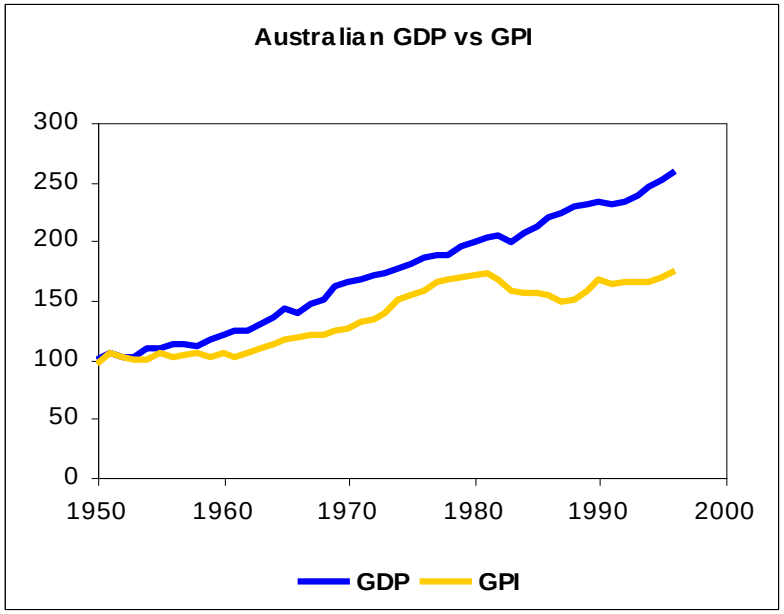

USA GDP vs GPI
250
200
150
100
50
0
1950
1960
1970
1980
1990
2000
GDP
GPI

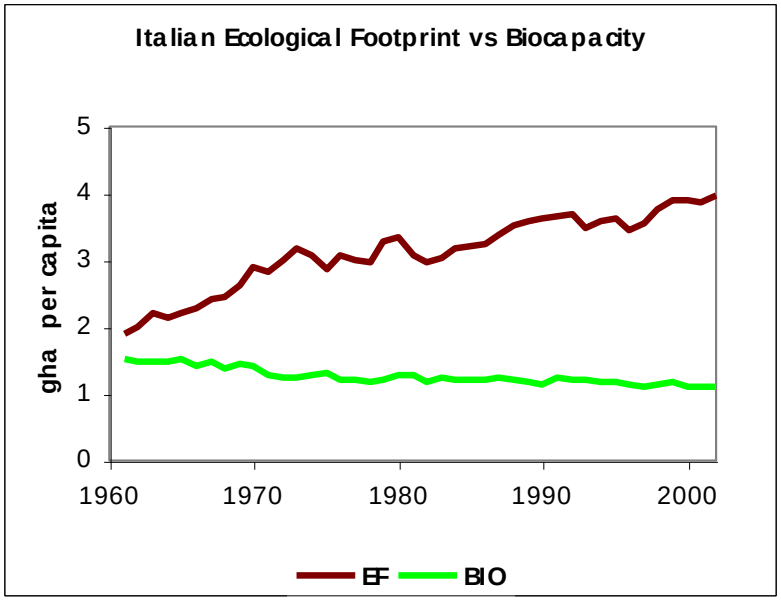

Austrian GDP vs ISEW
400
350
300
250
200
150
100
50
0
1955
1965
1975
1985
1995
GDP
ISEW

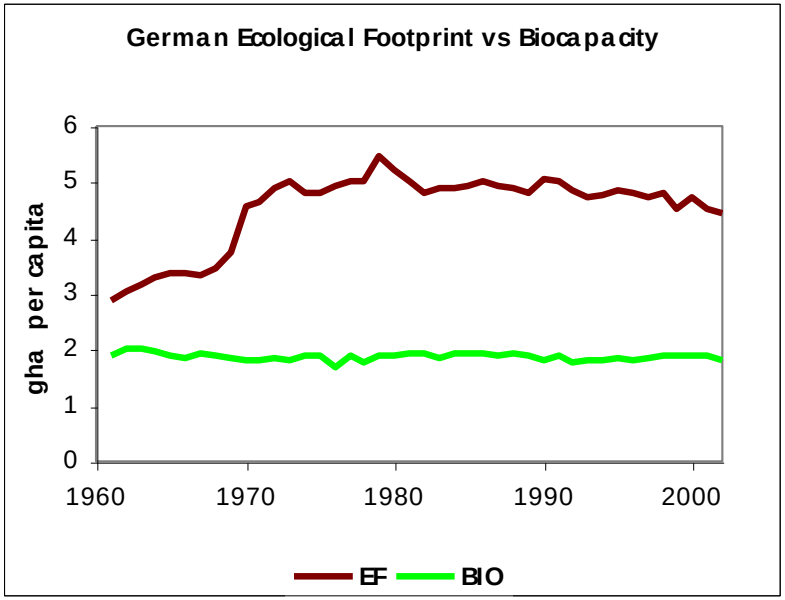

Swedish Ecological Footprint vs Biocapacity
gha per capita
14
12
10
8
6
4
2
0
1960
1970
1980
1990
2000
EF
BIO

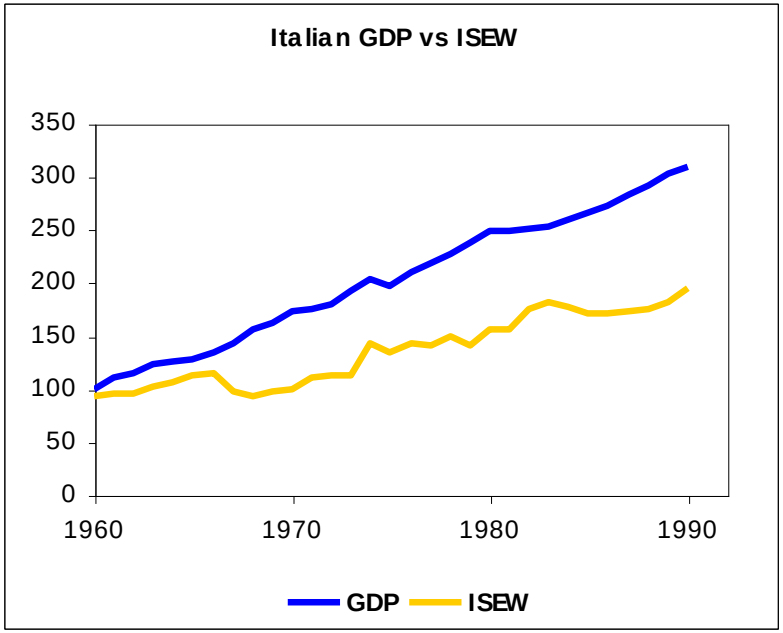

Australian Ecological Footprint vs Biocapacity
gha per capita
30
25
20
15
10
5
0
1960
1970
1980
1990
2000
EF
BIO

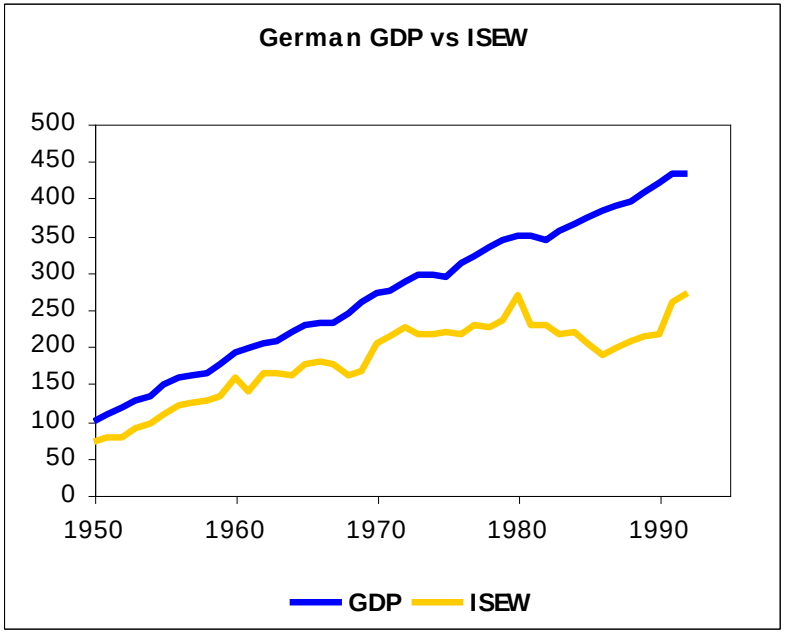

Swedish GDP vs ISEW
300
250
200
150
100
50
0
1950
1960
1970
1980
1990
2000
GDP
ISEW


Australian GDP vs GPI
300
250
200
150
100
50
0
1950
1960
1970
1980
1990
2000
GDP
GPI


Italian Ecological Footprint vs Biocapacity
gha per capita
0
1
2
3
4
5
1960
1970
1980
1990
2000
EF
BIO


German Ecological Footprint vs Biocapacity
gha per capita
0
1
2
3
4
5
6
1960
1970
1980
1990
2000
EF
BIO


Italian GDP vs ISEW
0
50
100
150
200
250
300
350
1960
1970
1980
1990
GDP
ISEW

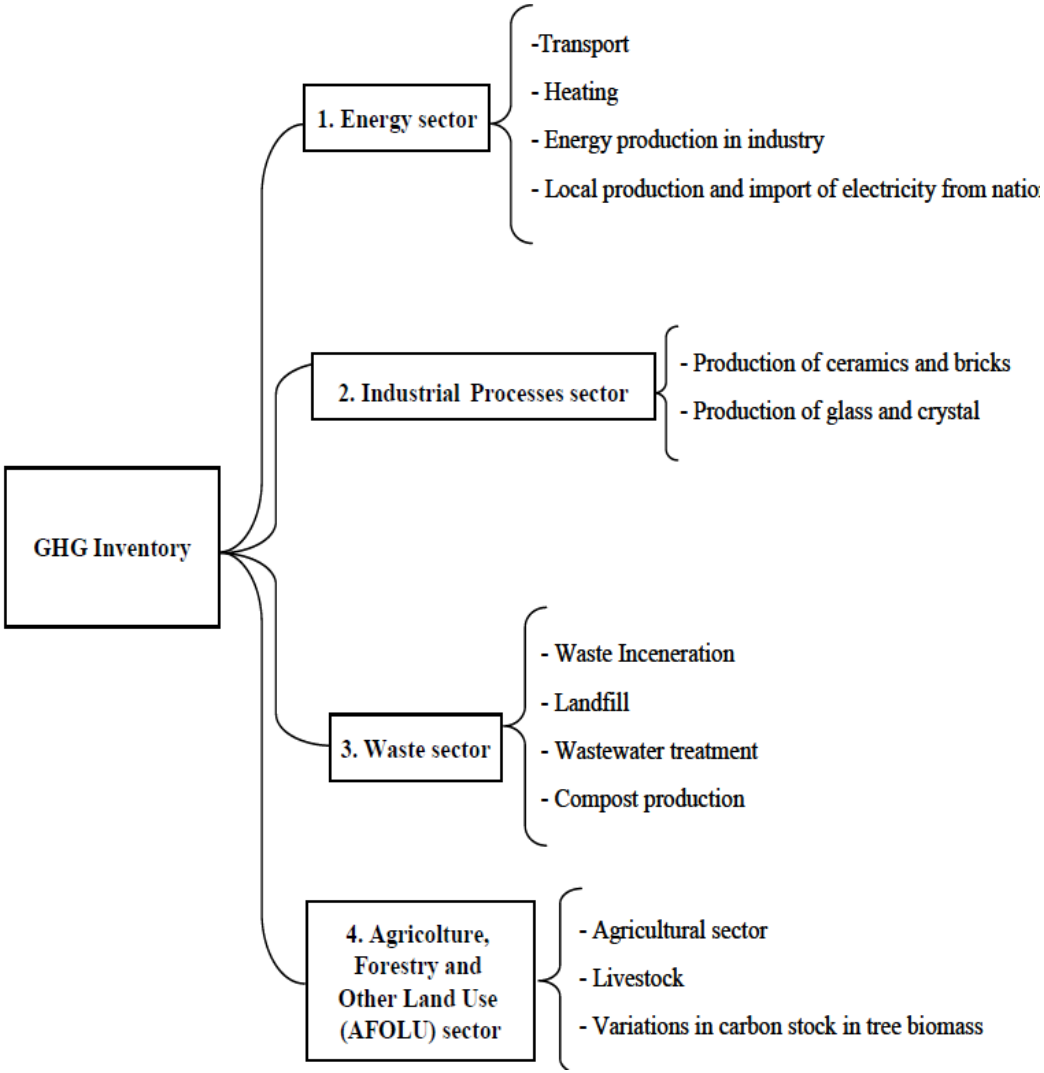

German GDP vs ISEW
0
50
100
150
200
250
300
350
400
450
500
1950
1960
1970
1980
1990
GDP
ISEW

II

A focus on…

EMISSIONS

THE IPCC GHG INVENTORY Production-based accounting

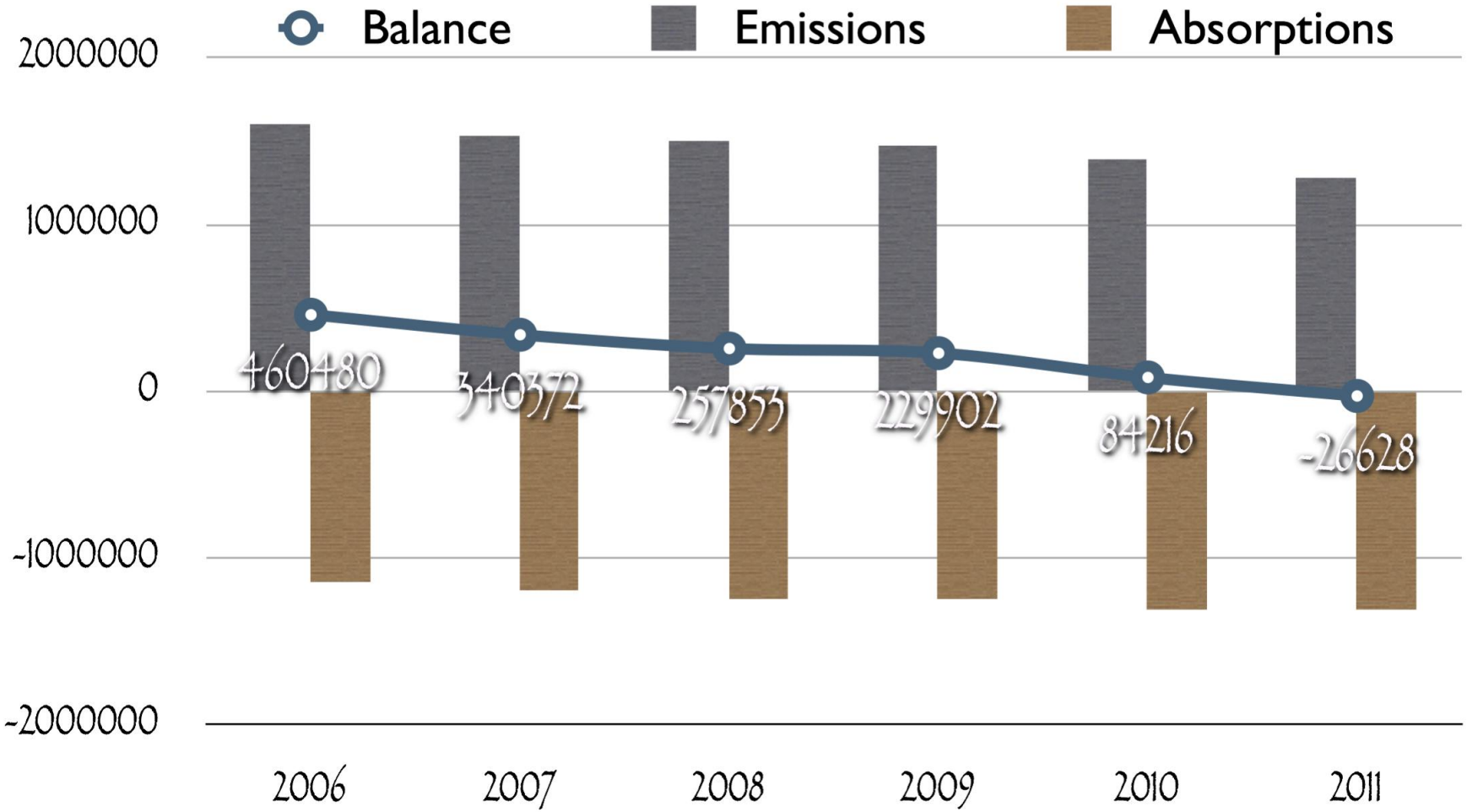


IPCC Guidelines

$$\text{Emissions} = AD \cdot EF$$

IPCC, 2006. In: Eggleston HS, Buendia L, Miwa K, Ngara T, Tanabe K (Eds.),2006 IPCC Guideline for National Greenhouse Gas Inventories. IGES, Japan.http://www.ipcc-nggip.iges.or.jp/public/2006gl/

Province of Siena
Balance 2006-2011



Main activities	Causes of the decrease in emission		Causes of the increase in emission	
	Global factors	Local environmental policies	Indirect factors due to the policies	Local environmental policies
Energy sector				
Transport	Economic crisis; oil price	Improvement of public transport using methane buses with CTR filters; bio-fuels	–[a]	–
Heating	Air temperature	Tests on boilers; increasing the number of energetic certifications and the efficiency of buildings	–	–
Energy production in industry	Economic crisis; oil price	–	–	–
Electricity				
Local production of electricity	–	Sustainable use of geothermal energy; Photovoltaic panels	–	Improvement of the incinerator
Imported electricity from national grid	–	The local production of electricity increases over the years, in proportion to the consumption	–	–
Industrial Processes sector	Economic crisis; European Emission Trading Scheme	–	–	–
Waste sector				
Landfill	–	–	Closure of the incinerator in 2007 and in 2008 (January–November)	–
Compost production	–	–	–	Increase of waste recycling
AFOLU sector				
Forest carbon loss	–	Reforestation; efficient wild-land fire prevention plan	–	–

[a] – represents no global or indirect factor and local environmental policy.

A successful prototype

- The Province of Siena constitutes a practical example of the effectiveness of local approach to reduce GHG emissions.
- In 2008, the Province of Siena was the first territorial system in Europe to achieve the ISO 14064 certification of its GHG inventories.

A successful prototype

- The Province of Siena has recently reached the status of “Carbon Free Province”.
- The strength of the project is that the Siena Province initiative is easily feasible and highly transferrable to any regional system.

A successful prototype

- The inventory and its certification are part of a 3 steps iterative plan, which includes:

1. monitoring the environmental performances by means of specific indicators;
2. ISO certification, to avoid the problem of merely self-referential processes;
3. policy actions, with a feedback to measure the effects of policy actions by using the monitoring system.

ENVIRONMENTAL SCIENCE & POLICY 44 (2014) 97–107

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journal homepage: www.elsevier.com/locate/envsci

The connection between 2006 IPCC GHG inventory methodology and ISO 14064-1 certification standard – A reference point for the environmental policies at sub-national scale

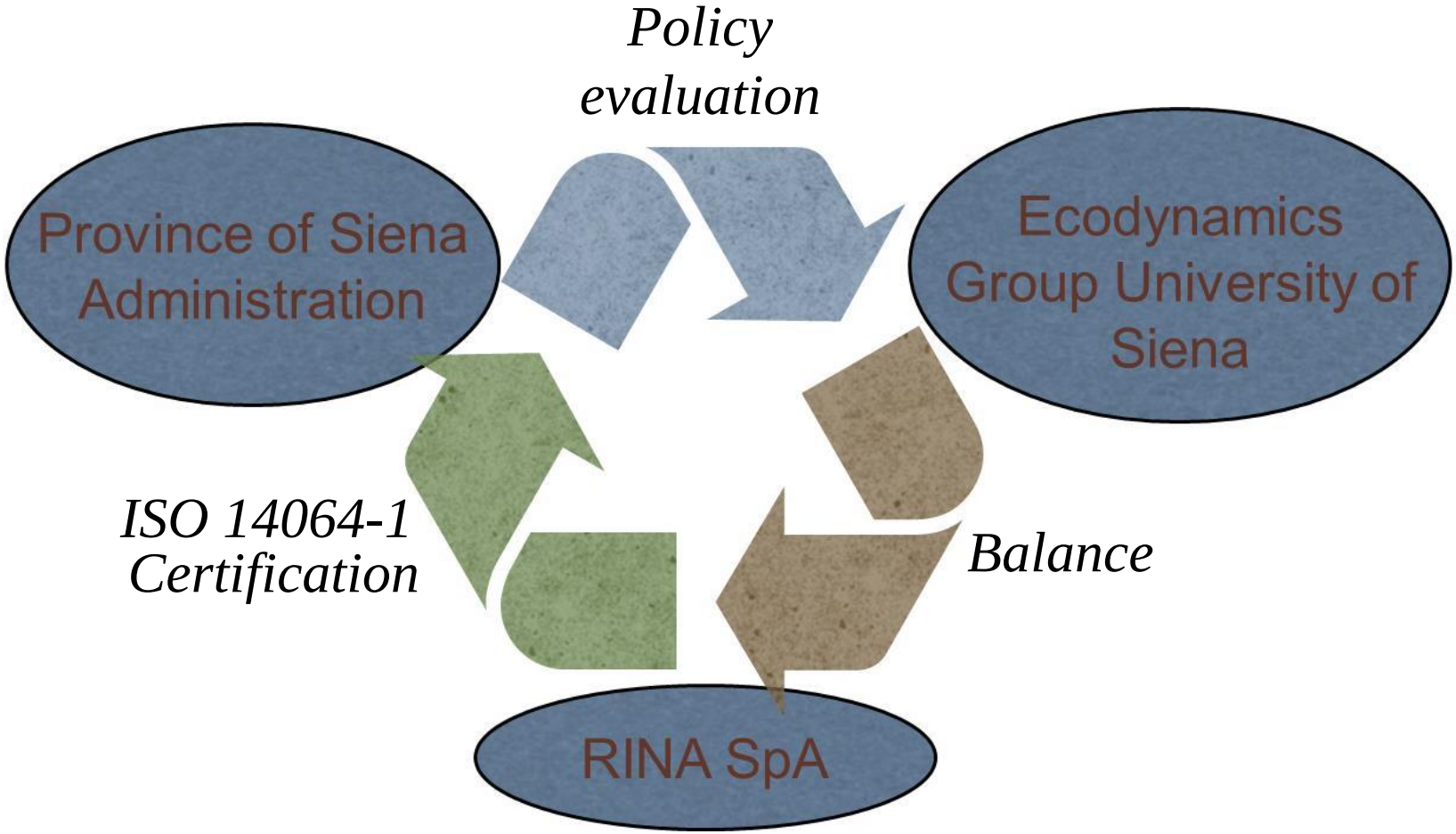
Simone Bastianoni[a], *Michela Marchi*[a], *Dario Caro*[a], *Paolo Casprini*[b], *Federico Maria Pulselli*[a,*]

[a] *Department of Earth, Environmental and Physical Sciences, Ecodynamics Group, University of Siena, Pian dei Mantellini 44, 53100 Siena, Italy*

[b] *Provincial Agency for Energy, Environment and Sustainable Development (APEA srl), Via Massetana Romana 106, 53100 Siena, Italy*

Scheme of the Siena Project

“Siena Carbon Free 2015”



What if the

<u>responsibility</u>

of the emissions

is taken into

account?

ELSEVIER

Ecological Economics 49 (2004) 253–257

www.elsevier.com/locate/ecolecon

News and Views

The problem of assigning responsibility for greenhouse gas emissions

Simone Bastianoni, Federico Maria Pulselli, Enzo Tiezzi*

Department of Chemical and Biosystem Sciences, University of Siena, Via della Diana, 2, 53100 Siena, Italy
A.R.C.A. Onlus, Associazione Ricerca e Consulenza Ambientale, Italy

In order to abate the proliferation of GHGs and thus stop global warming, it is necessary to investigate deeply the major sources of GHGs: it is important not only to identify fuel consumption as the main source of these emissions, but also to localize where these gases are emitted, why they are emitted and which economic sectors are involved in the emission. However, without attributing responsibility for GHG emissions, their reduction and abatement will remain an arduous task.

Take a look at the following papers:

Ecological Indicators 36 (2014) 640–643

Contents lists available at ScienceDirect

Ecological Indicators

journal homepage: www.elsevier.com/locate/ecolind

On the feasibility of a consumer-based allocation method in national GHG inventories

Dario Caro[a], Simone Bastianoni[a,*], Simone Borghesi[b], Federico Maria Pulselli[a]

[a] Department of Earth, Environmental and Physical Sciences, Ecodynamics Group, University of Siena, Pian dei Mantellini 44, 53100 Siena, Italy
[b] Department of Political and International Sciences, University of Siena, Via Mattioli 10, 53100 Siena, Italy

frontiers in ENERGY RESEARCH

ORIGINAL RESEARCH ARTICLE
published: 27 January 2014
doi: 10.3389/fenrg.2014.00004

The effect of a consumption-based accounting method in national GHG inventories: a trilateral trade system application

Simone Bastianoni[1], Dario Caro[1], Simone Borghesi[2] and Federico Maria Pulselli[1]*

[1] Ecodynamics Group, Department of Earth, Environmental and Physical Sciences, University of Siena, Siena, Italy
[2] Department of Political and International Sciences, University of Siena, Siena, Italy

Workshop at UNIP UNIVERSIDADE PAULISTA

August 26th, 2014

FOURTH CHAPTER

OPEN DISCUSSION

OBSERVATIONS, CRITICISM, SKEPTICISM, AND NOTES FROM THE BRAZILIAN NUMBERS

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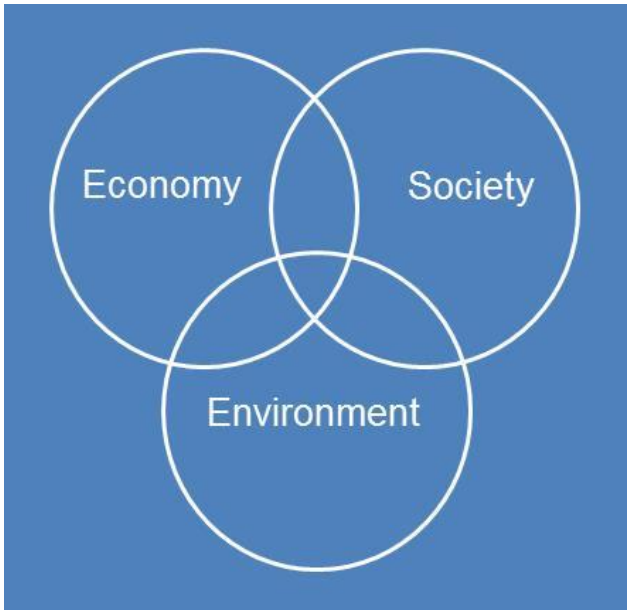
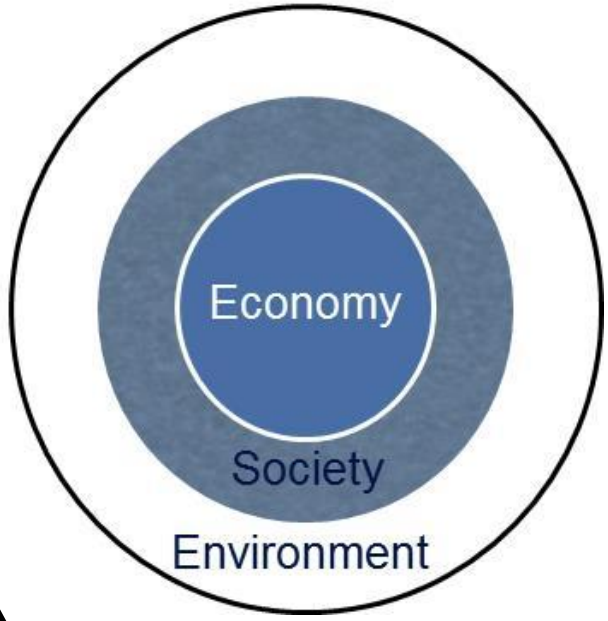
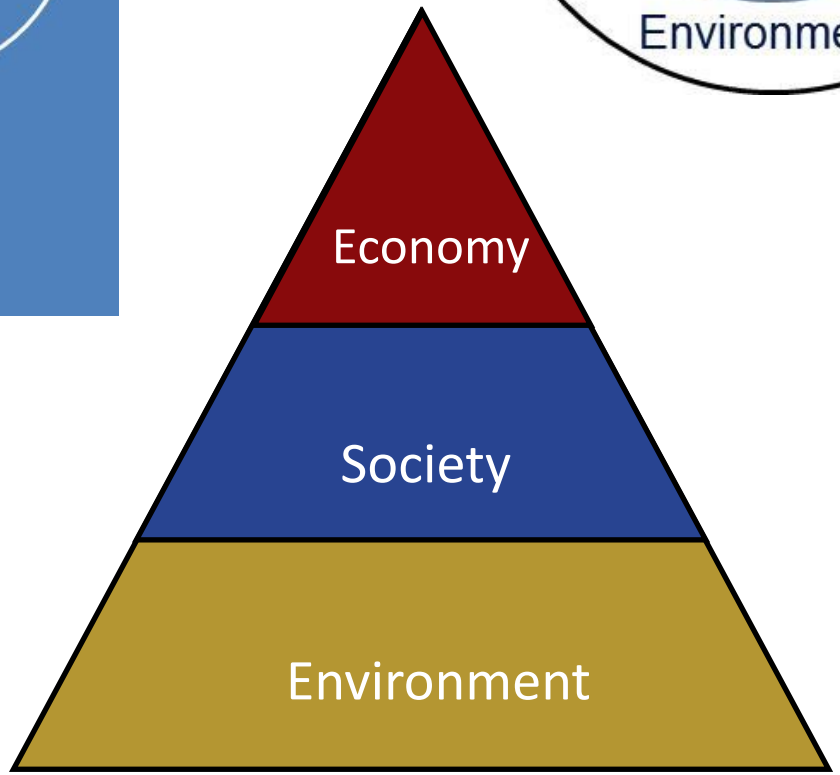
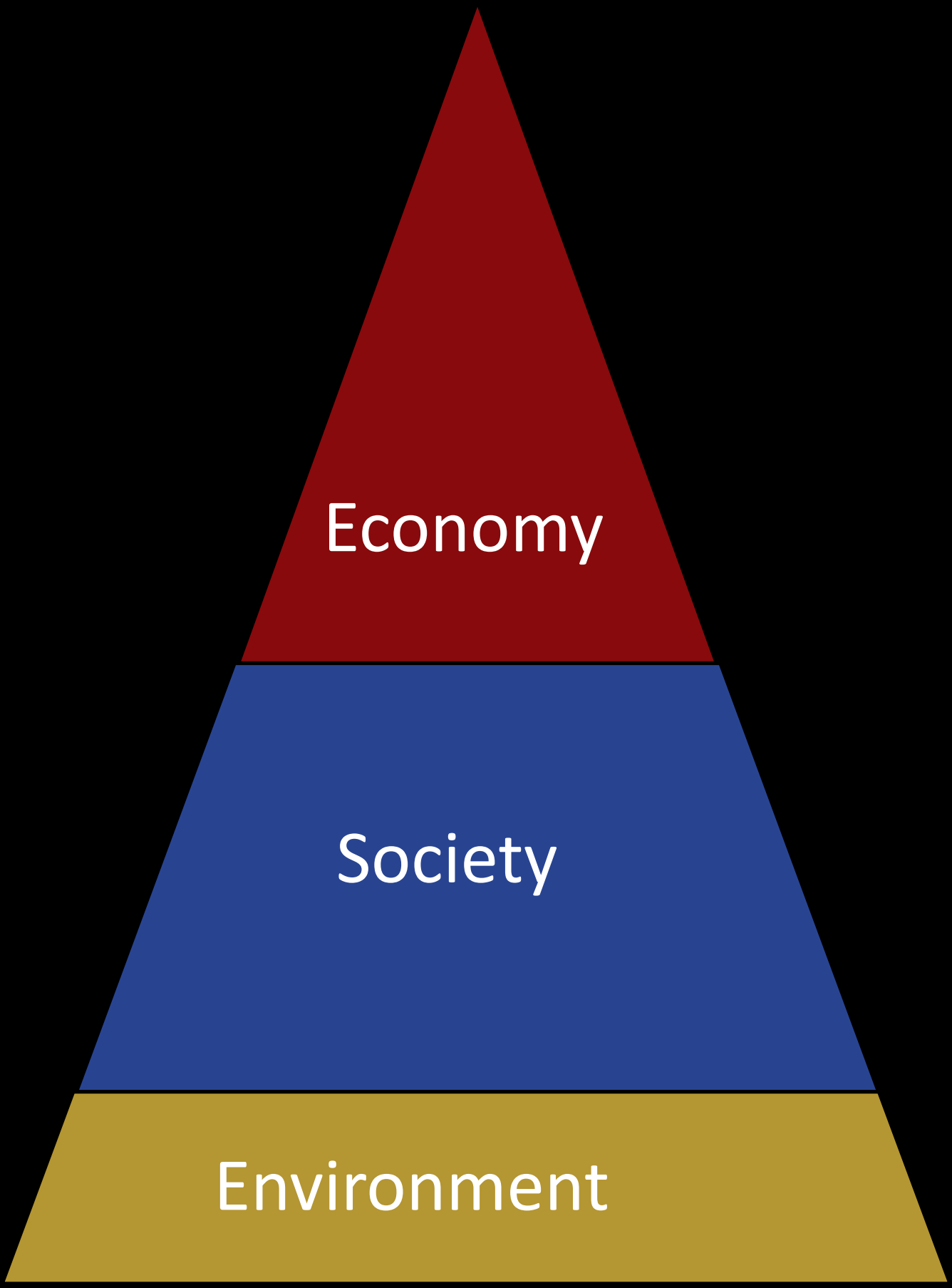
Usual and less usual representations of sustainability

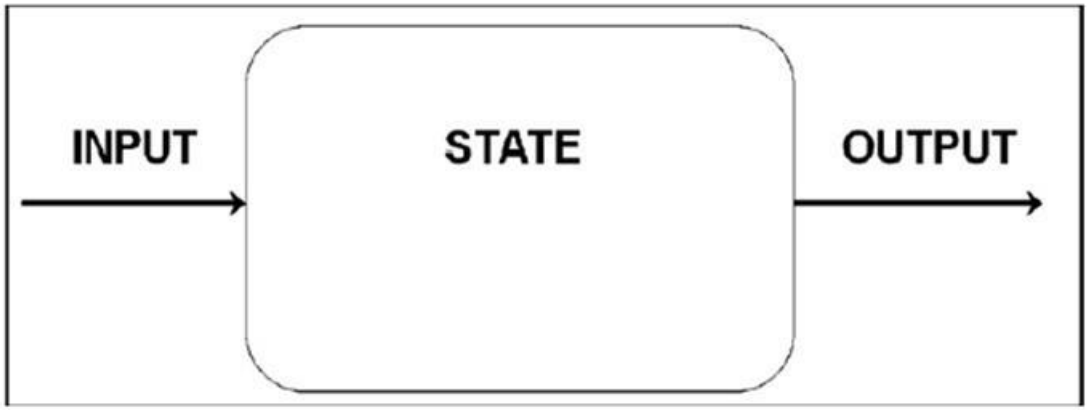







Economy
Society
Environment

THE FRAMEWORK

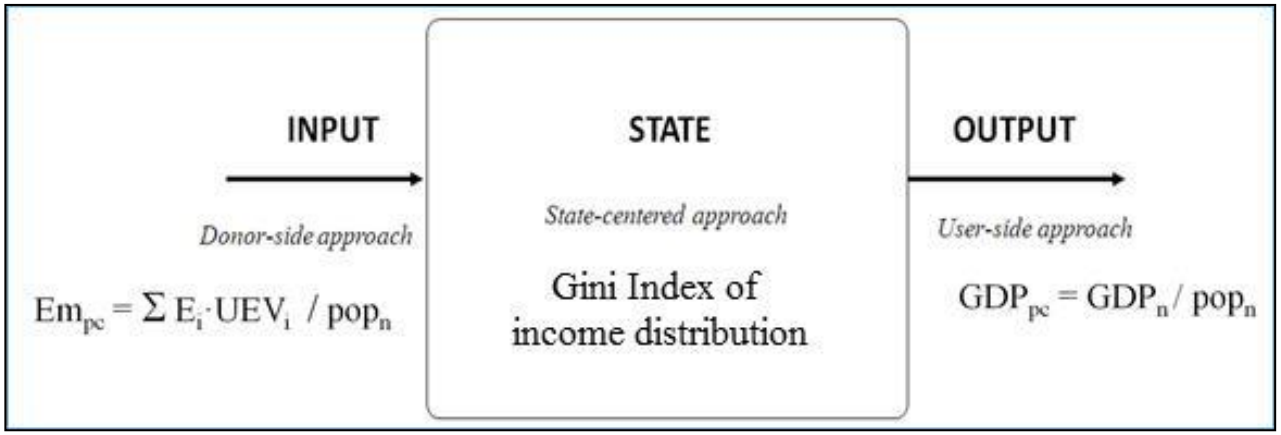


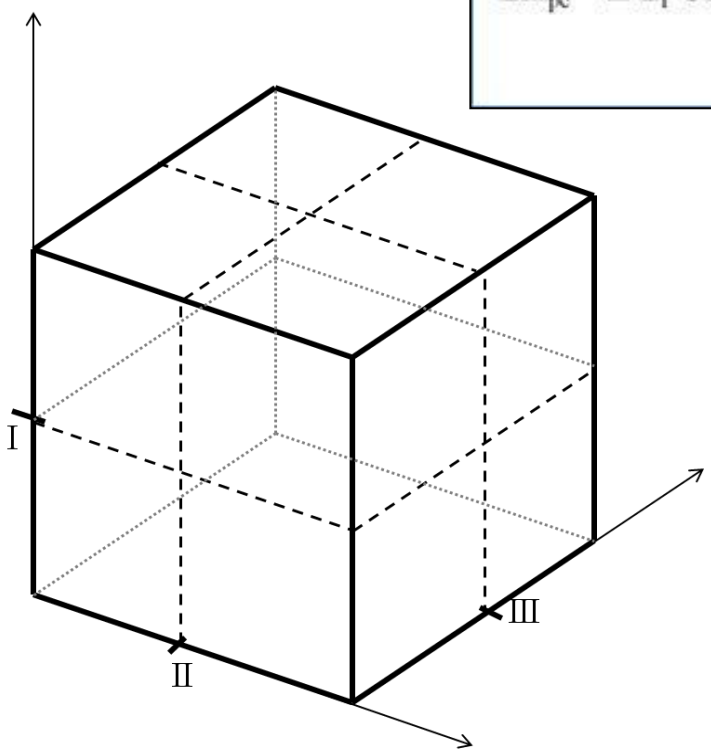
DEFINITIONS

The "**Inputs**" to a given system are all flows of energy and matter entering the system from the environment.

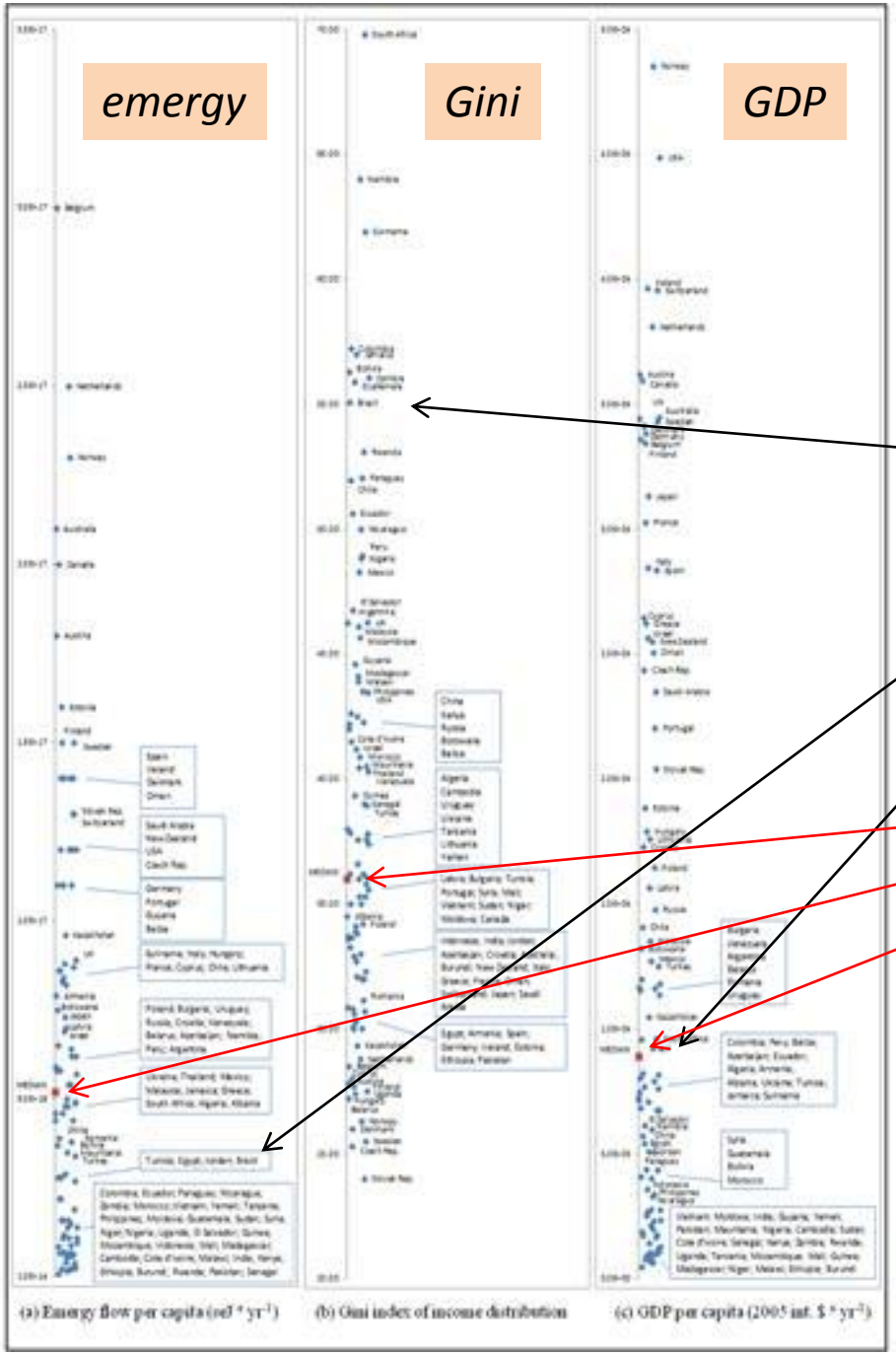
A "**State**" of a system is a particular configuration/organization of the abiotic–biotic system components. It is characterized by specific relationships between living and non-living entities.

The "**Outputs**" of an ecosystem are all flows of energy and matter, resources, goods and services moving from the system to the environment.



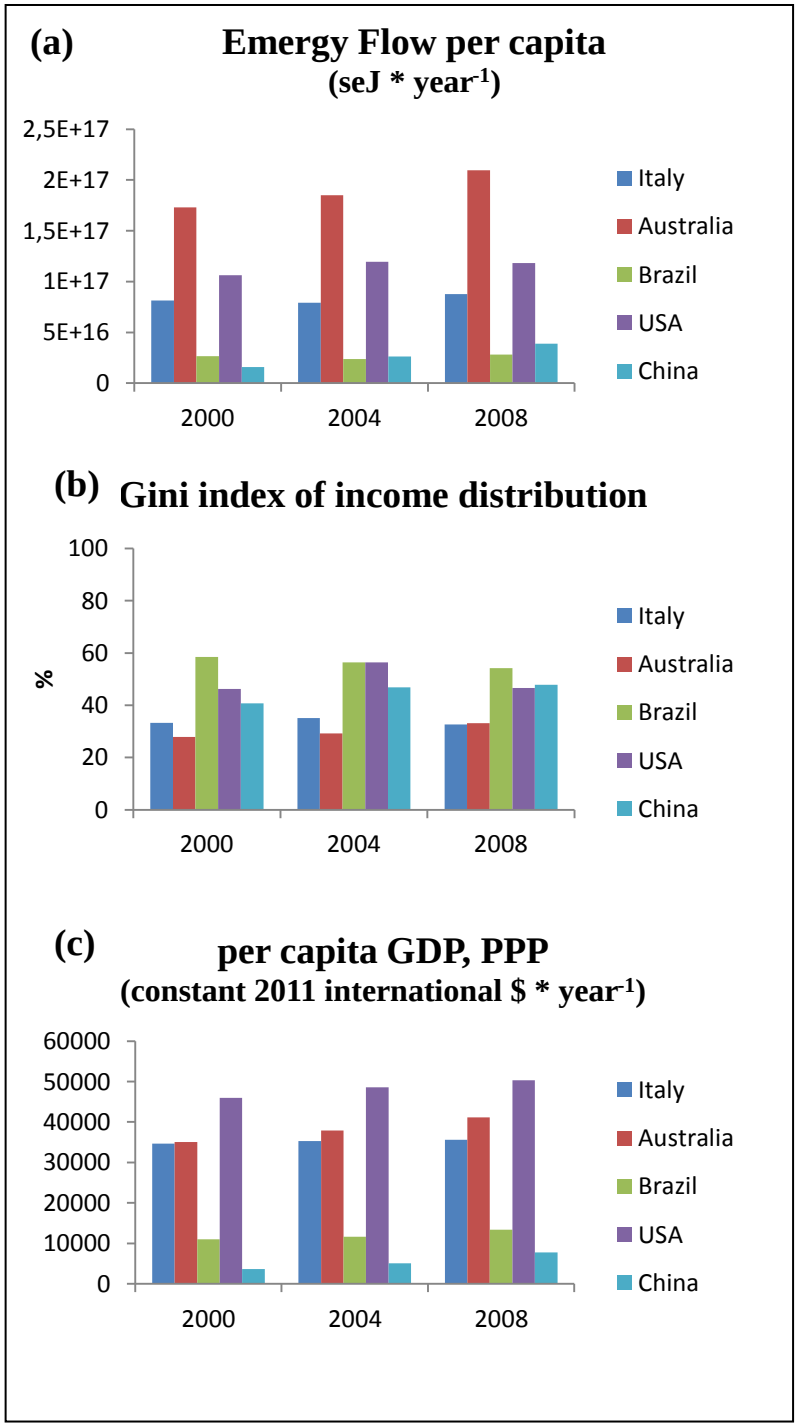


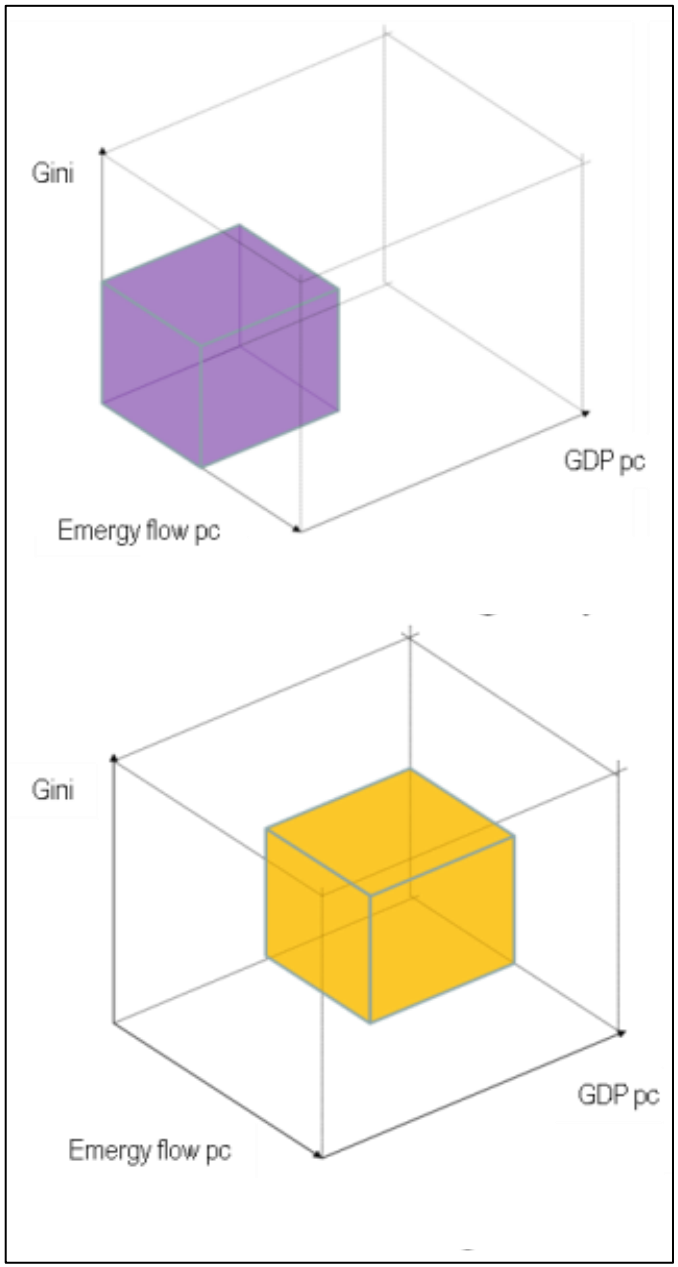
The cube derives from a three-axis diagram. Median values are forced in the middle of the segments; 8 sub-cubes characterize different combinations of the indicator values.



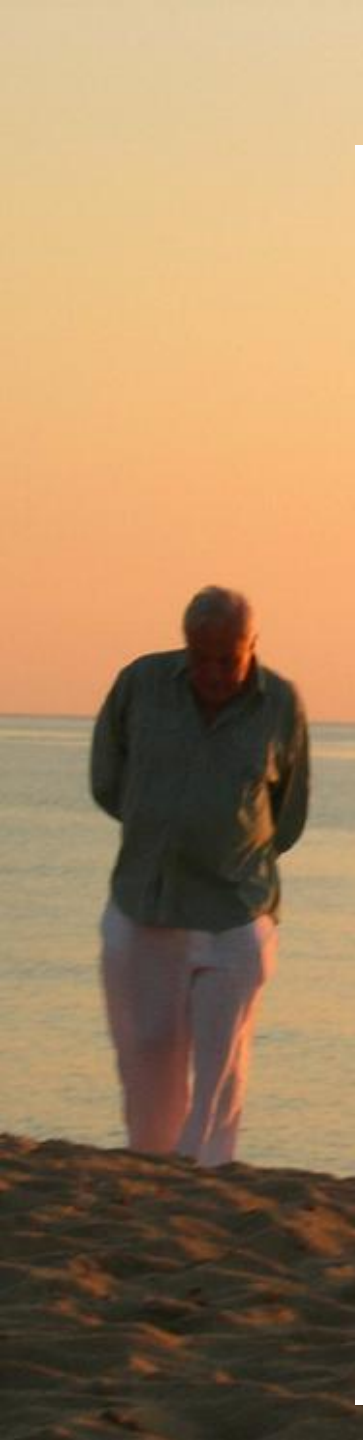
BRAZIL

median





Further results will be provided.....



to be good
to be beautiful

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Thank you

In passato erano importanti solo la crescita, l'economia e le questioni sociali. Adesso abbiamo bisogno di etica e estetica, di bellezza... di beni comuni. Adesso dobbiamo ricercare il buono e il bello.
Enzo Tiezzi

In the past, only growth, economics and social issues were important. Now we need ethics and aesthetics. We need beauty. We need common goods. We need to be good and to be beautiful as much as possible.