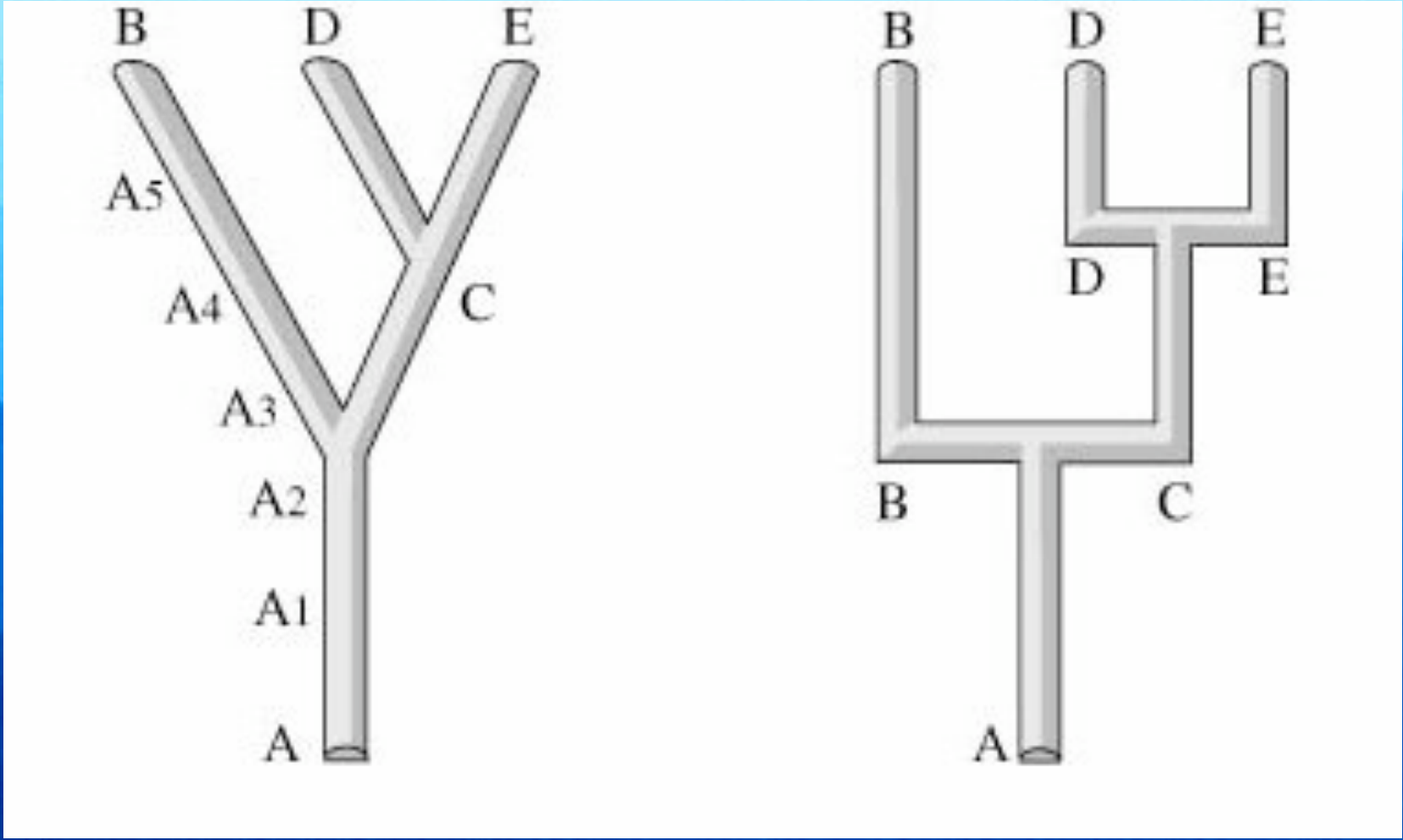


RISK & CONSERVATION
in
Ecology



Ecology who?

Ecology is the science of the functioning of living organisms on the earth.

The use of terms “eco+something” is confusing:

in any case meaning something that directly or indirectly reminds “nature” and/or “nature conservation”.

Nature conservation/modification

Conservation is meant as an alternative to the “modification” of the nature as a result of human activities’ impact.

Nature (*naturality, naturalness*): resources that **allows the existence/presence of the life and of its maintenance, from sun to water, from air to climate, to food, to landscape...**

We need **quantity and quality** of natural resources to live a decent life

Wise reflections

A wise man's reflections

1. we are the result of billions of years of biological evolution
2. conservation is not necessarily a good thing
3. modification can produce something new and better (from bacteria to ... me), but
4. **cultural evolution kills the biological one**
5. So take care of **the risks**, wise man, and make your own evaluations.

For an Ecologist, this is the
Environmental Impact Evaluation.

Risk what?

“Risk”

means the possibility of a damage derived from a danger which can provoke

- wounds,
- illness,
- economic loss or
- environmental damages.

Risk what?

1. **Cultural risks:** unsafe job or life conditions, smoking, poor diet, drugs, alcohol, car driving, crimes, unsafe sex and **poverty**.
2. **Chemical risks:** mutagenic, teratogenic and carcinogenic effects
3. **Physical risks:** radiations, noise, fire, tornados, earthquakes, volcanic eruptions, floods
4. **Biological risks:** virus, bacteria and parasites, other allergens, animals

Risk evaluation

Risk evaluation is a study which utilizing data, hypothesis or models

(many deriving from Business Analysis, e.g. trade off Analysis, environmental Kuznets' curve, etc.)

estimates the probability that a **damage** would happen **to the human health, the society or the environment** as a result of the exposition to certain dangers and/or as result of nature modification.

It is not so simple

An example of how is difficult to evaluate certain risks.

Why did we know so little of the noxious effects of the **chemical compounds**?

The National Academy of Science of America estimates (1999) that **only 10%** of the 72,000 chemical compounds on the market were thoroughly analyzed for toxicity, and **only 2%** tested to evaluate if they are carcinogenic, teratogenic or mutagenic.

It is not so simple

The reasons (example of the US)

1. the large majority of the chemical compounds are **considered harmless** from the existing laws till the contrary is proved
2. **a lot of money** is needed to test only a minimum fraction of the chemical compounds we meet during our lifespan
3. **even more money** are needed to test the interactions among the chemical compounds (e.g. for interactions of 3 compounds \$ 20.7 million)

The precautionary principle

The **precautionary principle**

is a moral and political principle which states that **if an action or policy might cause severe or irreversible harm to the public or to the environment,** in the absence of a scientific consensus that harm would not ensue, **the burden of proof falls on those who would advocate taking the action.**

The precautionary principle

Only in some legal systems, as the European Union Law, the precautionary principle is also a general principle of law: this means that it is compulsory.

The principle in the face of uncertain risks states that **the absence of full scientific certainty shall not be used as a reason to postpone measures where there is a risk of serious or irreversible harm to public health or the environment.**

The contents

Precaution is caution in advance, or 'caution practiced in the context of uncertainty'.

All definitions have two key elements.

1. an expression of a need by decision-makers to anticipate harm before it occurs.

Within this element lies an implicit reversal of the onus of proof.

In practice

2. the establishment of **an obligation**, if the level of harm may be high, **for action to prevent** or minimise **such harm even when the absence of scientific certainty** makes it difficult to predict the likelihood of harm occurring, or the level of harm should it occur.

Precautionary principle or approach?

Precautionary **principle** or
precautionary **approach**?

Principle 15 of the Rio Declaration 1992:

*“in order to protect the environment, **the precautionary approach** shall be widely applied by States **according to their capabilities**. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall be not used as a reason for postponing cost-effective measures to prevent environmental degradation.”*

Precautionary principle or approach?

The wording of **the approach**, largely similar to that of **the principle**, is subtly different in that:

(1) it recognizes that there may be **differences in local capabilities** to apply the approach, and

(2) it calls for cost-effectiveness in applying the approach, e.g., taking economic and social costs into account.

The 'approach' is generally considered a softening of the 'principle'.

Steps of Risk analysis

We evaluate/estimate the risk through

Risk analysis

with the following steps:

- danger identification and related risk evaluation
- risk comparative analysis and ranking
- risk management
- risk communication

Risk-benefit analysis

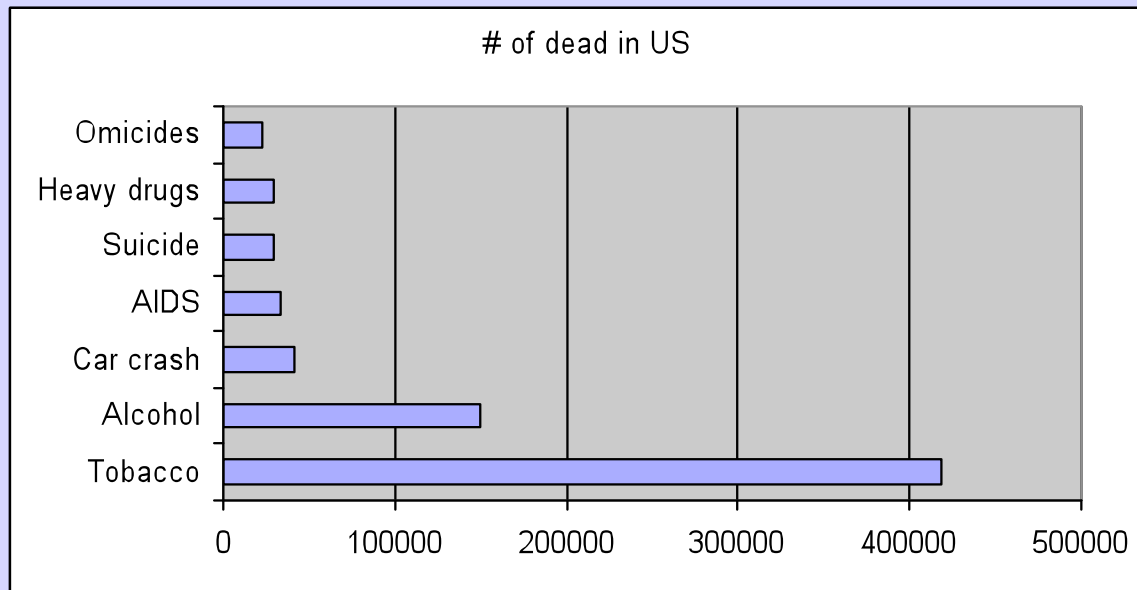
Are long term estimated risks due to new product or new technology greater than short or long term benefits derived from other alternatives?

An answer to the question is the **Risk-benefit analysis**, the comparison of the **risk** of a situation to its related **benefits**.

The investigator must assure that the amount of benefit clearly outweighs the amount of risk.

Only if there is favourable risk benefit ratio, an action may be considered .

The main perceived risk



What are the greater risks we can face with?
In terms of reduction of average lifespan the greater risk is by far **the poverty**, the other causes being reduced with a correct life style.

To live longer

Golden rule to avoid premature death...

no smoking,

not to stay too much in the sun,

not to drink alcohol,

not to eat cholesterol and saturated fats,

to eat on the contrary fruits and vegetables,

to keep fit,

lose the weight excess

to drive safe cars only in a safety conditions

...is to live in a monastery

% reliability

The safety of each technological system
% reliability = technological reliability
(TR) x human reliability (HR) x 100

If you can reach very high level of TR
"errare humanum est" and the HR is always
very low if compared with the TR.
If the TR of a nuclear power plant is 1, and
the HR is 0.75, then the total reliability will
be 75%...

The case of biotechnology

Theory and practice

Unfortunately,
there are **many limitations** as far as risk
evaluation and risk-benefit analysis are
concerned.

Up to now,
**results of risk evaluation and risk-
benefit analysis can be interpreted in a
way to support any kind of decision,**
which is then sold as “scientific”.

Open questions

1. How are data and models for risk evaluation reliable?
2. Are more important short or long term risks?
3. Risk analysis must determine the acceptable level of risk or must define the way to minimize the damage?
4. Very seldom combined effects are considered, instead of separate effects.
5. In the LDC the risk levels for the workers are very high: is this a cost to pay to make money?

And now

Among the indicated risks, the activity of a town-planner regards

urban impacts

on the environment and/or
on the life quality.

In the past, in setting up town-planning schemes, not urbanized grounds were normally considered only as a potential base for buildings, without considering their ecological role.

From the past

Urban development is responsible of losses of natural value, which too often were not even evaluated.

New urban vision takes now in consideration the ecological structure of a territory, knowing that its conservation is necessary to the **quality of life** in urbanized areas.

There is an ecological problem

Today we search for **sustainable town**: something that ranges from the quality of the global production chain to the quantity and quality of its public heritage, represented by culture and natural environments, both around and inside the town itself.

The town planner must be aware of the ecological problem, having in mind the long term effects of urban impacts on the nature.

What is sustainability?

It is generally agreed upon that town planning schemes must now contain

- the natural heritage map, and
- an estimate of urban and infrastructure development impact on ecosystems

What is generally intended as **ecological sustainability of urban and infrastructural development?**

What is sustainability?

Ecological sustainability is a complex concept which is defined through other concepts, like

- degree of naturality
- impact on nature
- mitigation and/or compensation.

To apply these concepts we need quantitative methods of analysis, as

Indexes of the degree of naturality, and

a **balance** between positive and negative impacts.

From Bruntland' Report...

The sustainability is a concept whose meaning depends upon the cultural basis of a single researcher working, e.g., on Ecology, Urban development, Geography, Sociology, etc.

In the **Brundtland' report** of 1987, *Our Common Future*, for the first time the concept of economic development ecologically sustainable is defined

From Bruntland' Report...

Sustainable development is that which satisfying the present needs do not endanger the possibility for future generations to satisfy their own needs:

this implies that the ecological resources utilization by the present generation remains below certain levels.

... the concept of sustainability

What are “certain levels” of exploitation?

It is a question of **intergenerational responsibility**, whose definition is matter of politics and finally of standards and laws. To fix the threshold **a risk evaluation** is needed, in which some key-concepts can make the difference, as

A) What is the level of responsibility of the present generation compared with the future generations?

B) Is there possible substitution for productive factors?

Soft sustainability

A) Consider two categories.

A1) "Soft sustainability": it is sustainable every action for which there is a positive variation of the sum between the variation of the natural heritage and/or the degree of natural value of the environment, and of the material richness or that of the total economic revenue.

$$d(N+U) \geq 0$$

N = natural heritage U = man made capital

Strong sustainability

A2) “Strong sustainability” condition is met when an action determines positive variations both for the economic welfare and for the natural heritage.

$$d(N) \geq 0 + d(U) \geq 0.$$

where:

N = natural heritage

U = man made capital.

Differences

In comparison with soft sustainability, **strong sustainability** **better corresponds to the general principle of sustainability**, for which the ethics of an ecologically sustainable behavior wants that a generation leaves in heredity to the next generations an economic and ecologic situation at least not worse than that they received from past generations.

A bent for risk

Long term effect of human impacts are part of the intergenerational heredity.

A Risk analysis can result in soft or strong sustainability depending from the bent for risk.

Soft sustainability accepts – as a rule – the natural heritage reduction when there is an increment of the economic welfare.

A bent for risk

Soft sustainability trusts in the economic development produced by the scientific and technological one, which will be able to face the problems arose by the decrease of the natural heritage.

Strong sustainability sustains that it is now the time to stop reducing the nature value below the level we received from the past generations, which not aware of the risk involved in the natural resources uncontrolled exploitation.

Can we Substitute..

B) Is it possible to **substitute** what we received through the long history of the evolution **by man made resources**?

The main question is not if the scientific and technological development can allow the maintenance of an acceptable quality of life, but in a scenario of growing demographic and economic problems **if the politics** will be capable of controlling the complex equilibrium of the earth.

Compensation

Both soft- and strong-sustainability **needs a quantitative measure of**

(i) the **naturality** degree of a particular environment, and

(ii) The **variations** induced by the human activities; and

(iii) **balance** between reduction and/or implementation of nature value)

Compensation

This process aims at:

All those actions that reduce the naturality degree need **compensation measures** to increase it (re-naturalization), in order that the balance between nature losses and gains is at least zero.

Trade off analysis

Since we must accept that mankind (cultural evolution) will continuously change the natural heritage derived from biological evolution,

we need to **define a measure of how can we substitute natural resources with artificial products** able to fulfill an analogous ecological function:

the ecological trade off between artificial products and natural resources must be defined.

We have no choice

Like many other human activities there is no final answer to the question if, after trade off, **the man modified nature will be always kind-earthed for mankind.**

Even if there is not – at the moment – any theoretical model of the functioning of the earth that can demonstrate that only a NOT-REDUCTION of the naturality level is the necessary and sufficient condition for the sustainability of the economic and demographic development, the strong sustainability approach must be the choice.

A social demand

The nature protection – besides the ecological questions – is now part of the contemporary cultural values.

All things that – in some way – pay attention to the nature, to biodiversity and that realizes a lifestyle respectful of the natural heritage are the **answer to a widespread social demand.**