WHY NATURE HASN'T INVENTED (EXOTIC) PLANTATIONS YET

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Good Old Times : Sustainable Forests

Millions of years ago 6.2 billion hectares of forest grew on almost any soil, ready to continue for another eternity until, 8.000 years ago humankind turned forests into an object of seemingly rational economy – instead of a subject which allows diverse and sustainable life.

These **primary** or **virgin forests** were the most developed and sophisticated companies one can imagine with endless experience in ups and downs, in disturbances, always ending up in new successful starts under changed conditions. We should study these **timeless and successful mechanisms** which probably are the secret behind **sustainable development**.

Research in primary forests either in the boreal, the temperate or in the tropical zones has identified common **characteristics**:

- **High biodiversity** is an insurance **against risks**. The higher the number of different tree species and their different functions, accompanied by all the other elements of the ecosystem, and the wider the gene pools, the more successfully can forests survive under the diverse risks. Biodiversity however is not just a question of quantity. It must support and stabilize natural associations, according to their site and climate, respectively.

- **Continuance** of natural forest life enables all elements of the system to permanently **specialize** and **adapt**. Millions of years of development in the tropical rainforests produced perhaps 30,000 different tree species. In some boreal forests by contrast, only 15 different tree species have remigrated 15,000 years after the last Ice Age and have not split up yet into new species or subspecies.

- **Disturbances** like fire, storm and insects do not destroy the forest permanently but are the signal for **restructuring** and **adaptation** under changing life conditions.

- **Natural regeneration** occurs permanently whenever the conditions are favourable. The new plant generation starts with an incredible **abundance** of 50,000 or even 100,000 seedlings per hectare. This leads to extreme **competition** and **selection**, finally to **specialization** in the evolutionary process. The

different species have different **functions** in the system. Pioneer species appear first, climax species only later. This **succession** is guided by different inherent abilities of the species.

- **Low entropy** is a characteristic of primary forests. They are well organized as mainly self-sustaining systems with minimum imports from surrounding systems.

Modern Times: Man-made Forests

Modern times are different. The total **forest cover** has shrunk to **3.3 billion hectares** at a rate of 20 million hectares a year. These remaining forests can be classified into

- 1.1 billion hectares **primary forests** (old growth)
- 2.2 billion hectares **secondary forests** (man-made)

with

- 1.2 billion hectares suitable for sustainable forest management
- 1.0 billion hectares without capacity for intensive sustainable wood production.

Another **1 billion hectares** of former forests are destroyed, degraded and now poor land **without economic and social use.**

The **world population** is now about **6.5 billion people**. This means **0.5 hectares of forest per person**. The

population is estimated to arrive at a balance of 11 to 16 billion people.

Growing population could mean **growing demand of timber products**. Industrialized countries (20 % of the world population) consume mainly advanced, processed products like paper, boards and timber for construction (80 %). Developing countries need mainly fire wood (70 %) beside a wide range of non-timber forest products.

Official statistics state a world-wide timber production and consumption of 3.3 billion m³, which means 0,5 m³ per capita and year. Everybody knows that the true rate is at least twice as much, which means roughly **1 m³ timber production and consumption per person and year**. If we assume the doubling of the world's population within the next 50 to 100 years one could assume the doubling of timber demand at the same rate. But this is neither predictable nor probable.

Several scientific studies demonstrate that the **consumption (and demand) of nearly all wooden products can be reduced by at least 50 %** by substitution, economizing, recycling and technical improvements.

These mechanisms will work immediately when wooden products become rare, difficult to obtain and more expensive.

A comprehensive study on solutions for a global sustainable development (Wuppertal Institute 1996) ends with a quantitative prediction for possible improvements in Germany: **"the factor 4"**.

This means that we can (and must) reduce consumption of raw material, nature etc. by 2 and improve the effectiveness of technologies and processes by 2 as well.

Professionals from science, forestry and the timber industry facing the rising demand of wood from the forests are responsible for a wise response which enables sustainability of forests, industry and society. Their task should be first and foremost **to explain to their customers the consequences if all their demands were satisfied**. They should explain the negative effects on nature, forests, fresh water, long-term economy and welfare of the society. Only then will customers have a real choice and the chance to take responsible decisions.

Case Study: Forests in Germany

Germany is situated in the middle of Europe with a population of 82 million people. Forests are young here in terms of geological times. The last Ice Age ended 10,000 years ago. Only **60 different tree species** remigrated from the southern and warmer parts of Europe.

The **forest cover** around the year 0 was 80% declined to a minimum of 25% in the 17th century and is now **30 %** with rising tendency. The total area of German forests is **10.7 million hectares** now, i.e. **0.1 hectare per person**.

2,000 years ago the forests consisted of 80% decidious trees (mainly beech/ fagus sylvatica) and 20% coniferous trees (mainly spruce/ picea abies and pine/ pinus silvestris). Intensive management during the last 250 years turned this relation around to **65 % coniferous trees** and **35% decidious trees**.

The age distribution of the trees is well balanced with 1/3 in each of the age classes 1-40 years, 41-80 years and above 80 years.

The **allowable annual** cut is **70 millions m³**, this is **0.8 m³ per person**.

Professional training in forestry began 250 years ago as a reaction to a general state of emergency. Forests were overexploited in those times. They were in danger of being devastated without professional support and protection through military and police. German forestry and those new man-made forests became famous in the world. What are the **experiences and lessons learnt?**

- Forest cover increased and the standing timber volume is now on average 300 m^3 per hectare.
- Clear cuts, even–aged forests and pure coniferous stands lead to high-risk forests with poor economic results.
- Forest soils are degraded by compactation through heavy skidding machines, by pesticide application and by acidification in spruce, pine and douglas fir monocultures caused by thick humus layers.
- Forest management often did not maintain but, on the contrary, reduce and endanger native species and natural associations of flora and fauna.
- Artificial (coniferous) forests need permanent and expensive tending and repair. Frequent storms in the past 15 years have affected these stands more than deciduous ones.
- International certificates for good forest practices and sustainable forestry, such as FSC, could not be given to most of those forests of the past.

250 years' experience and bad economic results in the past 30 years made governments and forest owners **return to nature-oriented measures**. They now plan and aim at sustainable development in the sense of the 1992 Earth Summit in Rio de Janeiro.

Spaceship Economy and Sustainable Forest Management

Our globe has limited resources only. Forests are productive resources, renewable within defined limits, defined by nature itself. Economy generally is a discipline which aims at the satisfaction of demands under shortage conditions. Shortage conditions in forestry are mainly the existing forests themselves in quality and quantity and **nature,** since forests are living eco-systems.

If management and harvest exceed or violate the limits of sustainable life in forests they lose the cost-free productivity of natural systems. They do not lose only timber productivity, but they lose at the same time all other beneficiaries and basic life conditions which forests offer for all elements of the eco-system, one of which is humankind.

The Primary economic sector, of which forestry is part, is defined by the fact that the **production factor "nature"** makes the main contribution to the process, beside the production factors "labor force" and "capital investment". The limited factor nature produces its goods **free of charge and for ever** – if treated wisely. This cost-free characteristic, and only this, compensates the economic disadvantage that nature is not a man-made design, organization or machine, which can be regulated at any input-output ratio, according to the demand. Today's industrial agriculture has lost the advantage of a high and for-free contribution of the

production factor “nature”; Modern agriculture has substituted “nature” by expensive inputs of fertilizers, pesticides, gene technology, massive soil treatment etc. Consequently today’s agriculture has lost its economic net product. It has only survived so far through massive government subsidies.

Forestry is not dependent on external subsidies if it respects ecological limits. **Ecological health is the basic precondition for economic success**. Forestry is an excellent example for a possible perfect **harmony of economy and ecology**, an inborn **win-win system** for elements of the same eco-system in the spaceship earth.

The New Paradigm: Adaptation to Nature

There is sufficient knowledge in forestry to do the right things, or at least to avoid doing the wrong things. Unfortunately humankind as a collective does not act very rationally. Obvious proof is the fact that forests are being reduced continuously in quantity and quality. At the same time governments, timber industry and forest owners demand – at least verbally - that forests should be managed in a sustainable way to sustain human culture and economy.

Industrialized countries in Central Europe like Germany and Austria have an almost 300 years’ tradition of professional forestry and know about its effects. Most of their first growth had been converted to man-made forests, such as monocultures, stands with monolayer structures and fast-growing but often not native species. Harvest usually meant clear-cuts, tending and thinning was to accelerate growth and maintain the geometric distribution of the trees. Fertilizers in the beginning and pesticides later seemed necessary in order to achieve maturity and economic dimensions of the final product.

This model was successful as long as nature's reserves could buffer these stressing disturbances, labour force was cheap, timber products achieved high revenues and the public was not aware yet of the ecological time bomb which would reduce life conditions and welfare of the future generations dramatically.

The **1992 Earth Summit in Rio de Janeiro** was the final and most spectacular event to stop this long lasting Odyssey. Beside ecological and social erosion caused by an exploiting, non-sustainable forest use, it became obvious that the economy of Central European forestry got stuck in a dead end. Forest management with intensive input costs into declining ecosystems without self-sustaining capacity had economically come to an end.

This was the birth of new forestry concepts. **The new paradigm** was simply a strategy of **adaptation to nature**.

Instead of intensive "interventions" in forests and "substitution" of nature by physical, chemical and genetic materials forest management now acknowledged **natural processes** in forests as an essential production factor which is **to be strengthened and protected**.

The first management concept based on strict adaptation to nature was elaborated and published in 1994 in the city forest of Luebeck as "**Nature Oriented Forest Use**" (International Journal of Ecoforestry 11(1), 1995, Canada)

In 1996 the **European Paper Industry** gave its award for "excellent environmental management" to the Luebeck Forest.

The **German Government** followed in 1998 with an award for best performance of Agenda 21 in forestry.

Finally most of the **international NGOs** joined this concept and made it a part of their own forest campaigns world-wide.

In 1996 Greenpeace, Friends of the Earth and WWF set up a common guideline for the first national Certification of forests in Germany ("Naturland") identical to the Luebeck concept. Its main criteria were later adopted by the national FSC-working group which started in 1997.

The Luebeck Forest received the first "Naturland"-Certificate in Germany in 1997 which was followed by the international **FSC-Certificate** in 1998.

Nature-oriented Forest Use

The example of the Luebeck Forest and its "Nature-oriented Forest Use" is symptomatic for a drift towards eco-based forest use, not only in Germany but also within the European Union, laid down in EU guidelines for sustainable forest development and use. The **central ideas** of the Luebeck-Concept are:

- Managed forest must in the long run approach the composition, structure and functioning of **natural forest associations**.
- Naturalistic and economic targets must be set in accordance to the **potential productivity of the natural eco-system**.
- The economic principle is only to be achieved by **minimizing the input** (and not by maximizing the output).

Behind the concept stands the assumption that men will never understand the super-complex forest ecosystem in all its elements, interrelations and its dynamic. Consequently a leading idea is the **"precautionary principle"** which goes

partly along with the minimum principle. But in addition, if the manager is not sure that his activities will maintain, restore or protect the forest he should modify the activity or even refrain from it.

Technical components are based on the view at forests as a complex community whose ecological, social and economic productivity provides for plants, animals and human beings. The methods of forest use are based on the natural processes observed and documented especially in 10% reference areas where no human intervention takes place:

- There is only **single tree cutting**. The opening of the canopy may not exceed 0.25 hectare.
- **Natural regeneration** is the main force of renewal. Planting should be the exception and if done at all, only with **native species**.
- The concept can go **without tending** in most cases because self-structuring is preferred. **Thinning** shall remove worst stem qualities and competing exotic trees but thinning shall not abolish the competition between trees.
- **Final harvest** of single trees is defined by **minimum target diameters** for the different species.
- At least **10% of the trees remain permanently** as snags, nest trees, biotope trees or because they are extremely rare or aesthetic.

Forbidden are the following:

- clear-felling
- monocultures
- introduction of (exotic) tree species
- application of pesticides and fertilizers
- affecting the soil by compacting, ploughing etc.
- clearing an area or burning of bio-mass
- drainage of moist areas
- disturbing activities during ecologically sensitive times in the year
- feeding of wild animals

At first glance this concept seems to be born by NGOs. It could be, because it fulfils ecological and social demands. But at the same time and because of this it means a considerable **economic improvement** compared to former silvicultural concepts in Europe.

The **reasons for improved economic results** are among others:

- low input
- low risks and diseases
- low damage of soil and remaining stands
- high natural productivity
- high value of the final timber and non-timber products

An economic study (KAISER, M. and STURM, K., 1999) comparing common forest management concepts in Germany to the Luebeck concept indicated:

Concept	Revenue	
	DM/ha/year	DM/m³
clear-cutting and age classes (state forest)	103	24
mixed forests with only small clear-cuttings (state forest)	121	29
nature-oriented forest use (Luebeck forest)	207	53

An additional economic advantage is the fact that ecologically and socially sound managements can receive **FSC-certification** and product labelling on the market.

FSC-certification aims at putting the Rio-conventions and –declarations from 1992 into practice. It promotes an environmentally responsible, socially beneficial and economically viable management of the world's forest.

A major problem for certification is arising with **industrial tree plantations**, which are often monocultures with exotic tree species. They are obviously not in accordance with most of the principles and criteria from FSC. As an exception they could at best be planted as pioneers for restoration on degraded land.

Seeing this problem FSC inaugurated a Political Working Group (PWG) on plantations which shall describe the problems and propose solutions. First results from the PWG indicate that ecological and social effects of industrial tree plantations are mainly negative, but even the economic results would not satisfy those investors who consider plantations as a long-term sustainable project.

Certification supports the access of forest products to the international market. This is of importance for **Chile,** where nearly **80 %** of the **annual timber production** arise from **industrial tree plantations**.

Plantations – again?

> "**Plantations** are forest areas lacking most of the principal characteristics and key elements of native ecosystems …, which result from the human activities of either planting, sowing or intensive silvicultural treatment." (FSC 2004)
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> "**Industrial tree plantations** are artificially established stands in which wood is produced as a raw material with methods that are more closely related to agriculture systems of cultivation than to traditional silvicultural methods." (LAMPRECHT, H. 1989)

I have been studying and evaluating tree plantations in Asia, Africa and North and South America for almost 30 years. I have seen most of these wonder species like acacia, Douglas fir, eucalypt, gmelina, pine and teak. And everywhere I noticed the same **succession of events** with plantations:

phase 1: great **expectations,** gold digger's atmosphere

phase 2: technical **performance** on vast areas with support of public subsidies

phase 3: **good economic results** in the first and second rotation period

phase 4: **increase of diseases** in number, intensity and frequency, increase of pesticide and fertilizer input, protests from the local communities

phase 5: **degraded land**, for sale or just left behind, local communities impoverished and unable to survive at their homes

This process occurs to industrial tree plantations, regularly, on a large scale, and in a frightening way. I noticed it in South Carolina / US (pine), Jari/Brazil (gmelina, eucalypt, pine), Malaysia (acacia), Ghana (teak), Portugal (eucalypt, pine)and even in Germany (pine, spruce).

Against rational learning from the series of almost complete failure in the past there stands a **psychological problem**: The first and second phases, often successful, seem to show that the specific site, planted with the new fast-growing exotics, is the successful exception from the former failures in other regions. When the trap snaps shut, it is too late. The responsible decision makers are retired or no longer alive, investments are lost, ecosystems spoiled, local people uprooted. The companies are long gone, starting a new experiment on a different site, perhaps with a different, a new wonder species.

Usually such experiments do not exceed **four or five rotation periods**. This means 30 to 100 years in the moist tropics, 100 to 300 years in temperate or boreal zones. In other words: **Industrial tree plantations are not sustainable**.

And what is more: They leave ecosystems heavily damaged and externalise huge costs to local people and the public.

Plantations are often said to be justified by the huge demand of wood products in a particular country or in the world. Knowing the destructive middle and long term effect

of plantations on nature and the public, nobody can really recommend such a remedy which may bring short relief but is sure to kill soon afterwards.

To balance on this earth the rational demand and supply of wood products for the future it is necessary to take a package of **responsible measures**, i. g.:

- avoid, reduce or substitute wood consumption
- increase recycling rates
- improve the technical effectiveness of cookers, stoves and heating systems
- introduce sustainable forest management to the existing commercial forests
- replant and restore 1 billion hectares of degraded former forest land
- stop the loss of about 20 million hectares of forest per year in the world

Thus sustainability of a good life on our globe will be supported.

Another reason for plantations, so some people think, is their function as a **CO^2 sink** to fight global warming. Plantation may indeed help to reduce CO^2, but at a tiny rate and for a very short time period.

It would be much more efficient to **maintain the diverse old growth forests** and to **manage forests** i**n a nature-oriented way**. Such rich and healthy forests are as a1 CO^2 sink **10 to 20 times more effective** than young plantations. What is more, old growth forests store CO^2 over a much longer period of time, since wood products from plantations, like pulp, paper, chips and fuel wood, have a

short life cycle and return CO^2 after only a few years. Many **plantations** are even **CO^2 sources** in the first years because destroyed sites release CO^2 after clear cut, sun insulation and soil denudation.

Shall forestry really continue to run industrial tree plantations, even though the destructive result of such experiments can easily be anticipated?

Chile needs an answer because it is in plantation phases 1 to 3 which will not end here.