

# Can agricultural practices contribute to multifunctional landscapes in Europe?

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## 1. Introduction

Europe's old cultural landscapes are characteristic spatial arrangements of agro-ecosystems, that were highly controlled in former days by traditional farming and forestry. Most of these landscapes were very multifunctional: they supplied a broad spectrum of both removable and non-removable products and benefits, frequently including a considerable biodiversity at different levels of space and organization. Moreover, many of them had both relatively sustainable means of production and states of nature and landscape. To some degree, the local society of owners, tenants and other users with their specific organizations, practices and rules were self-determining.

Many of these landscapes, that still today make up the cultural and physiographical identity of many regions, are recently threatened by over-intensification and/or abandonment. In other cases, where regions have already strongly been transformed by 20th century socio-economic and technological conditions, land use systems are facing new demands of multifunctionality due to the growing emphasis on environment, nature and landscape as a by-product of agricultural and silvicultural production.

In this paper we discuss whether and how traditional land use systems may provide guiding principles for planning and management of future multifunctional landscapes in Europe.

## 2. Landscape concepts

We consider landscape to be a characteristic spatial arrangement of land units combined with particular agro-ecosystems in a given territory. Agro-

ecosystems are ecosystems with agricultural and/or forestry components in their primary production processes. They may cover the whole range of land use-controlled to spontaneously developed life-communities, together with their functionally connected environment.

This landscape concept implies certain spatial and temporal dynamics of landscape and nature, as land use is continuously changing, and as all ecosystems are subject to natural dynamics as well. In this way, the landscape is viewed as a physical environment with a set of objectively measurable attributes at both the level of the plant and animal species and the agro-ecosystems, and the emergent level of spatial arrangements and structures. Apart from these physical features, landscape has intersubjective qualities perceived and valued by men, that depend on the characteristics of the observer. And, as cultural and aesthetic values of observers change over time, the images and values of landscape change over time too.

Thus, both the physical landscape and the landscape in our mind change continuously. Therefore, it makes no sense to consider landscape as a static phenomenon that should definitely be conserved in a certain fixed state. Nevertheless, some landscape states are more attractive to man than others, raising the question how land use may contribute to their maintenance.

### **3. Is agriculture a threat to landscape ?**

This question centers around an interesting paradox. In many areas of intensive agriculture there is a measurable decline of biodiversity and spatial variability. But, at the same time, agriculture and forestry created our highly valued cultural landscapes, and they still may do so today. However, not only the land use systems themselves are changing, also the perception and appreciation of the role of agriculture and forestry changed. Recent shifts in values and organizations induced a polarity between production and quality of life in many European countries. As a consequence, agriculture has become the great suspect in the public mind.

Against this background, in recent land use planning in The Netherlands the need for the zonal segregations between intensive production areas and large-scale "natural" areas is stressed. There is a tendency to restrict the positive role of farmers and foresters as "producers" of nature and landscape to reserve-like areas with "very valuable cultural landscapes". In these areas, they are remunerated by the authorities for the fact that they accept lower yields, instead of for "nature and landscape" as marketable products from their multifunctional practices.

"Classical" agricultural science has thusfar mainly been concerned with dry matter production per hectare. However, the land use systems that are considered in landscape planning are frequently highly multifunctional. In order to examine the role of agriculture and forestry in maintaining landscape diversity, we need to look more in detail at the possibilities offered by multifunctional types of agricultural systems.

#### **4. Traditional land use systems**

At their relatively low intensities of use of external chemical and energy sources, traditional agriculture and forestry were sufficiently inefficient to produce or allow "useless" nature and sceneries as by-products. Much of the apparently "unused" nature was, however, in some way integrated in overall land use systems, delivering a broad spectrum of products like fruits, mushrooms, honey, firewood, game, tree leaves, twigs and bark as livestock fodder, etc. (cf. Vos & Stortelder, 1992; Vos et al. 1994).

Although natural and cultural conditions in different European regions may be quite diverse, many of the traditional land use systems had much in common in the way they were organized. Practical management knowledge was accumulated through centuries of oral tradition, trial and error, which included experimentation. These practices have transformed the life communities and their sites to a large extent, because management and selfregulation by plants and animals worked together in achieving continuity of life and landscape. In many cases steady states of site characteristics were reached, allowing sustainable yields and relatively stable life communities.

As a result of both the natural conditions and the land use, different spatial patterns have emerged. To a large extent, the chemical and energy demand of the biomass production was covered by rotation and spatial and functional relations between land units (e.g. nutrient subsidy through manure from the livestock to the crop component, or through mulch from the forest). The classical 'trinity' of arable lands - shrublands/grasslands - woodlands (Le Coz, 1990), in many cases combined within one land use system and frequently even on one plot with a mixed use, seems to have been widespread.

These three components supplied different products that were either of direct use for man, or that were indirectly useful through their contribution to the productivity of other components (e.g. as livestock fodder, manure, fences and poles, slope stabilization, climate control):

- arable lands:  
crops and biomass (fodder), enabled by organic matter and nutrients from livestock (e.g. from sheep penned in small areas during the night or from sheep stables, enriched with heather sods or leave litter);
- shrublands (mato, matorral, garrigue, maquis, macchia, phrygana) and grasslands:  
grazing land for livestock, frequently in rotation with arable crops; in some areas coppice woodland functioned at least during part of the cycle as grazed shrubland;
- woodland:  
timber, fencewood, firewood and fibers, but also meat through hunting, pigs feeding (with acorns), fur and hides (especially before the 13th century the main goal of hunting by noblemen), animal fodder, bark (fodder, cork, tannin), products from pollarding (e.g. elms, ash, birch), fruit, honey and mushrooms as human food, and last but not least mulch for arable farming. Other functions include increased nutrient supply and water retention capacity of the soil, climate control, and stabilization of slopes.

The spatial relations within this trinity contributed highly to the specific spatial arrangements of landscapes. The sustainability of these old cultural landscapes, their constituting agro-ecosystems and their specific biodiversities can only be understood in relation to well-defined temporal and spatial scales (Fresco & Kroonenberg, 1992). At least the following spatial scales may be relevant in this respect: continental, watershed, local/farm, and site level (Fresco et al., 1994; Vos et al., 1994).

## **5. Changing land use - changing landscapes**

In response to population pressure in combination with innovative technology, the traditional land use systems in a large part of Europe reached their highest levels of labour and land use intensity in the late 19th century (Grigg, 1987). Land management and other human influences have been all-pervasive in the landscapes created by these land use practices: practically every tree and every tillageable site was used. Impacts ranged from slight vegetation disturbances to large-scale deforestation and forest transformations, as well as land reclamation, creating polders in NW-Europe, the drainage of extensive marshes and the terracing of slopes in all mountain areas.

The socio-economic development of the past half-century has strongly affected many of our idealized old cultural heritages in Europe. Especially since WWII, the number of people active in agriculture and forestry in the less favourable areas has decreased dramatically, mainly due to large-scale emigration. This trend is reinforced by product specialization and bulk carbohydrate production in the most suitable areas.

These opposite trends, extensification and intensification, affect landscapes in two distinct ways. Extensification, implying both the withdrawal of land from production and reduced inputs (labour, energy, selected species, nutrients, biocides, etc.) per unit area, results from abandonment and relaxation of management. The basic reason is that there is no longer an economic base for many labour-intensive activities (shepherding, constructing and repairing numerous small terracettes, burning charcoal, gathering chestnuts, coppicing trees for firewood, peeling bark, pollarding trees for fodder, etc.). Often, but not always, this allows spontaneous recuperation of natural successions. Nature "wins" here at the costs of the cultural landscapes. Intensification, meaning both the increase in area cultivated as well as a sharp increase in the use of inputs per unit area, frequently leads to the well-known negative effects on the environment. Pre-existing land use systems are replaced and related landscape elements (e.g. hedgerows and single trees in fields, drinking ponds, old drainage and irrigation systems) disappear. The biomass production "wins" here at the costs of the cultural landscapes. A further over-all result is the segregation between 'production' and 'nature' in the European countryside (Rossi & Vos, 1993). Both in the case of extensification and of intensification cultural landscapes are threatened.

## **6. Threatened landscapes in Europe**

As a result, many of the characteristic old cultural landscapes all over Europe are threatened, displaying at least three different types: (1) relict landscapes, (2) vanishing landscapes, (3) stressed landscapes.

### **6.1. *Relict landscapes***

These are landscapes that mainly consist of relicts of relatively undisturbed ecosystems. Their environmental conditions are in general not suitable for agriculture, due to a limiting physiography or an isolated location. In Europe, these natural relicts have escaped from cultivation in areas with an unsuited agroclimate (due to latitude, altitude or any specific, dominant climate factor) or extreme azonal conditions (in ravines, on steep cliffs, in marshes, on flooded plains, in coastal wetlands, etc.). Especially in these landscapes still remnants of virgin or nearly-natural forests may still be found (Broekmeyer & Vos, 1993). At this moment agriculture is most often not a threat any more, but intensive forestry in the cold climate zones may become so. And, in our days, tourism takes a heavy toll, especially in the high mountains, the wetlands and along the temperate and Mediterranean coasts.

### **6.2. *Vanishing landscapes.***

The old cultural landscapes, originally oriented towards subsistence agriculture, are vanishing gradually. They may still be found, but their functions have changed and are threatened by area expansion of productive systems, and by emissions from agricultural fields due to insufficient attention to flows of energy, water and chemical compounds. Originally, these landscapes displayed the refinement of the pattern given by macroclimate and lithology by characteristic combinations of land use. A main trend in their recent transformation is the replacement of the fine-grained pattern of the traditional landscape by a coarse pattern with a segregation of secondary "nature" on one hand and intensive agriculture on the other. Secondary succession on abandoned pastures and fields causes a limited number of secondary life communities to develop practically everywhere within the same climate zone on the same parent material. Especially around the Mediterranean and in Eastern Europe, their geographical and political position has safeguarded them until recently, but the opening of the European market and the development in mass tourism induce rapid changes.

### **6.3. *Stressed landscapes.***

These are landscapes that are neither natural relicts nor old cultural landscapes or their relicts, but large-scale agricultural landscapes with an increa-

singly intensive land use. High input use with insufficient attention to emissions have lead to monotonous or patternless uniformity, as well as to serious air, water and soil pollution, soil degradation, slope instability, increased run-off, drought, etc. with numerous secondary effects on ecosystems. New elements replace the former diversity, but are not concordant with the pre-existing spatial arrangements: they tend to dominate entire areas (such as widespread monocropping of silage maize, rational olive groves or vineyards) or are dispersed without any local physiographic differentiation (such as stands of Eucalyptus and of coniferous trees).

## **7. Decision making on future land use**

In the agrarian societies that shaped the old cultural landscapes in Europe, decision making on land use was primarily a local and autonomous action. Although the opening of rural communities for external socio-economic and political influences is far from recent, its pace has certainly accelerated since WWII. As a result, decision making on land use is now shared among many parties from national and European political authorities to local management bodies and farmers. Also scientists at a distance and external funding agencies add to this.

The opening of rural societies has a direct impact on landscapes in the sense that those who are most directly engaged become less directly responsible for the changes in the landscape. Moreover, local land managers are forced to rapid changes and the introduction of new products and technologies that may only be maintained with a continuous external input of matter and energy. On the other hand, the same openness has promoted the creation of "nature and landscape" as marketable products, especially for recreation. In forestry it is a well-accepted practice for a long time already that wood-production is combined with wild-life management, renting for hunting, management of recreation facilities, etc..

The question is how local land managers may regain a prominent role in decision making on the future land use in anticipating the demands of society for their products "nature and landscape" and their control of pollution. The answer may be in the marketability of these non-removable products. Without profits that clearly contributes to a sound cost-benefit balance at the level of the enterprises that manage the land, it is not reasonable to expect the land owners and managers to be engaged in such "production".

## **8. Guiding principles for the future**

Can "traditional" land use systems and the agricultural practices applied in them provide guiding principles for planning and management of future multifunctional landscapes in Europe, and possibly elsewhere as well ? The answer to this is not unequivocally affirmative. The purpose of agricultural and forestry systems of the past was not in producing "nature" or "landscape", but in the appropriation of photosynthetic flows in the agro-ecosystems for "useful"

products. In most cases, nature and landscape had no purposes of their own: they were the by-products of land use, but at the same time they offered the conditions for socio-economically (productive), ecologically and culturally balanced land use systems. These systems of the past have, largely through serendipity, produced landscapes that we now consider highly desirable. Rather than repeating the haphazard and often unsuccessful ways of the past (let us not forget that in many cases land use has also been very destructive), time has now come to use scientific principles in understanding the processes and spatial ecological structure to maintain, restore and create these or similar landscapes. In doing this, we may learn from history, at least at the level of general guiding principles. The exact ways of applying agronomic principles to "landscape production" still require more research.

The distinction between relict, vanishing and strained landscapes is highly relevant in the formulation of guiding principles:

### ***8.1. Relict landscapes:***

These relatively "natural" landscapes need to remain untouched for reasons of ethics, gene conservation and global system stability. This implies a restriction and sufficient control of possible distant influences of pollution, drainage and irrigation.

### ***8.2. Vanishing landscapes:***

As under traditional conditions, new or intensified land use practices should be adapted to natural spatial patterns, such as climate zones, watersheds and soil patterns. In the same time, the internal control of the land use should be based as much as possible on natural feed-back mechanisms (e.g. biological control of pests). Low-input practices may contribute to a reduction of pollution. In this context the search for "new products" for "old structures" is stressed.

Especially in many of these landscapes, the "production" of nature and landscape as marketable by-products of agriculture and forestry should be stimulated. These landscapes frequently still have high levels of biodiversity and spatial charactericity as relicts from the past that offer opportunities for the future. This implies that in these landscapes the land use planning should focus on multifunctionality at both farm and landscape level.

### ***8.3. Stressed landscapes:***

Adaptation to natural spatial patterns and the application of natural feed-back mechanisms are general principles that apply to these landscapes too. But, the high-input character of agriculture in these landscapes asks for an extra emphasis on the introduction of technical innovations for pollution control.

A more fundamental change in the agricultural production in these areas

that may contribute to the quality of nature and landscape, is a gradual shift towards quality in stead of bulk production. On line with this, the introduction of "new" products with less environmental impacts (e.g. short rotation forestry, agro-tourism) might be promoted. Unless these possible changes, the intensity of the agricultural production in these landscapes will still be incompatible with historical land allotments, uncontrolled soil drainage, high biodiversities, etc.. This implies that it is reasonable to separate these intensive production areas from large-scale "natural" areas.

## **9. Instruments**

For the decision making on the future of the old cultural landscapes and on the role that agricultural practices can play in enhancing and maintaining the landscape diversity in Europe, the following instruments are needed:

- reference systems for land use and landscapes, as well as indicators of the quality of the farming systems and the nature and landscape they produce;
- classification and identification of nature-based management units, such as watersheds or lowland drainage units;
- marketing strategies for multifunctional farming with nature and landscape as marketable products;
- management systems with integrated and balanced socio-economical, ecological and cultural dimensions;
- positive planning approaches instead of the negative gate-watchers approaches;
- user-friendly decision-support systems (e.g. dynamic expert systems, exploring local experiences, GIS, linear programming instruments) for managers, planning officials and politicians (cf. Fresco et al., 1994).

Finally, it may be emphasized that similar considerations apply to the so-called developing countries. In these regions, however, the role of "traditional" agro-ecosystems in shaping the landscape, as well as the opportunities of re-creating vanishing landscapes through cultural (agricultural) practices, have hardly been documented thusfar.

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