

# Landscapes and Rural Development in Europe

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Revision 2  
10. November 2002

Paper prepared for the  
2<sup>nd</sup> Expert Meeting on European Land Use Scenarios  
November 25-26, 2002  
Copenhagen, Denmark

The photo was taken by the author during a case study on “innovative rural development projects” in Europe. It shows a traditional farm in the southern province of Carinthia in Austria (Patergassen, Ebene Reichenau).

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## Introduction

Most *economic* activities in rural areas are directly or indirectly affecting the landscape. This is obvious with the traditional sectors of agriculture and forestry, which have shaped the cultural landscapes of Europe for centuries. Many parts of rural Europe are still dominated by a patchwork of private farmland and forests, sprinkled with villages and small towns in unique agricultural landscapes that are a part of Europe's cultural heritage.

However, from the perspective of rural development we are also interested in *non-agricultural* economic activities, such as tourism, rural industry, natural resource extraction and *non-tourist* services. These non-agricultural activities are becoming more and more important for the rural economy, and are therefore also becoming more relevant for the rural landscape. Non-agricultural activities can often alter the landscape in ways that are different to the impact of agriculture and forestry. Usually, they are also utilizing different functions. For instance, for a farmer, landscape aesthetics is only a nice side aspect of the land; it is the soil productivity that is most relevant. For a rural tourist business, on the other hand, landscape beauty is a vital asset.

In this discussion we will focus on five *non*-agricultural landscape functions:

1. The recreational function
2. The water-protection and climate functions
3. The biodiversity protection function
4. The physical resource base function
5. The waste dump and safety distance function

### ***The recreational function of landscapes***

Woods, meadows and wheat fields are not only relevant for agricultural production and forestry. Their arrangement also determines the landscape value for a whole range of economic activities in the tourist and recreation industry. Many tourist areas could not survive, if the current landscape would be changed significantly. This, for instance, is obvious with Austria's winter tourism, which is greatly depending on Alpine meadows for downhill ski-slopes, cross-country ski tracks, and many other tourist facilities on the mountains. If those areas would be overgrown by thick forests, the attraction for winter tourists would decline dramatically. Winter tourists like the relatively *open* Alpine landscape with sunny ski lifts on high plateaus with only small patches of (protective) forests on the steeper slopes.

The recreational value of landscapes is also obvious to those who like to hike in valleys or climb mountains, bicycle along a river, play golf, swim in a lake, or fly a model airplane. There are dozens of sports and recreational or leisure activities that require open space in a rural landscape. Imagine how frustrating it would be to pick-nick in a city environment. We often don't think about it, but there is a reason why *millions* flee from cities on sunny weekends to spend their time in the *rural* hinterland.

The following statistics illustrate the relevance of tourism, sports and leisure activities. In 1995, Germany's tourist sector contributed 8% to the Gross National Product (GNP) – *not* including investments in tourist-related infrastructure. This is far more than the contribution of agriculture which is less than 3% of GNP. Roughly 2.8 million people were employed in tourism. In 2001, more than 107 million visitors of tourist facilities and almost 327 million overnight stays were registered in Germany (Statistisches Bundesamt, DESTIS). Detailed statistics on *rural* tourism are not available, but there can be no doubt that rural landscapes are important attractions. For instance, in 2001 roughly 5.5 million tourists visited Germany's camping sites – which are mostly in rural areas. There were 21.3 million overnight stays on camping sites -. 4.5 million of these were visitors from Germany, 1.0 million came from a foreign country (Statistisches Bundesamt, DESTIS). In its 2000 Annual Report, the German Center for Tourism (Deutsche Zentrale für Tourismus, e.V.) analyzed the major new trends in tourism. They concluded that the "experience of nature and landscape" is becoming more and more important (p.13). With its 13 national parks, 13 biodiversity reserves, 40,000 km long-distance biking trails, as well as 320 wellness and health centers ("Heilbäder und Kurorte"), Germany's rural areas greatly contribute to the country's tourist attractions (Deutsche Zentrale für Tourismus, e.V.)<sup>2</sup>.

The German Institute for Economic Research (Deutsche Institute für Wirtschafts-forschung, DIW) in Berlin has analyzed the economic relevance of tourism in Germany.<sup>3</sup> They found that in 1995, some 395 billion DM were spent in tourism, or about 8% of the GNP. Most of it, 127 billion DM (or 2.1% of the GNP), was spent on *day* trips. These day trips usually consist of short-distance travels. Many of these are short-distance trips on the weekend, where city people visit the rural hinterland for recreation and leisure. Finally, we can use statistics on *winter*-tourism to estimate the economic relevance of rural landscapes for the tourist sector. Winter tourism typically depends on certain landscape characteristics, such as mountains (for downhill skiing), open meadows and trails (for cross country skiing), lakes (for skating) etc. Some landscapes in Europe are obviously more privileged than others. For instance Austria, with a population of 8.1 million, was visited by 12.4 million foreign guests between November 2001 and April 2002 - (Statistik Austria). During the winter season of 2001/2002 there were almost 53 million overnight stays at Austrian tourist facilities – pre-dominantly in mountain areas. Alpine landscapes are certainly a major “production factor” for Europe’s tourist industry.

### ***The water protection and climate function of landscapes***

In recent years, large-scale flooding catastrophes in Europe have reminded us that landscape characteristics can play a vital role in flood control. Currently, (August 2002) large parts of Europe are suffering severe flooding. Widespread sealing of the soil in built-up areas, mono-tonous agricultural fields, deforestation in upstream areas, and canalization of small tributaries are all increasing the danger of disastrous floods. When we transform natural flood-planes into cultivated land or settlements, we not only

**Table 1: Germany: Water protection areas by Federal State in 1997**

Federal States	Area (km <sup>2</sup> )	Water protection areas			Used for					
		Number	Area		Agriculture		Forestry		Other	
			(km <sup>2</sup> )	%	(km <sup>2</sup> )	%	(km <sup>2</sup> )	%	(km <sup>2</sup> )	%
Baden-Württemberg	35751	2552	7253	20,3	4134	57	2713	37,4	406	5
Bayern	70548	3794	2401	3,4	1321	55	1008	42	72	3
Berlin	889	19	248	28	0	0	87 <sup>1)</sup>	35 <sup>1)</sup>	161 <sup>1)</sup>	65 <sup>1)</sup>
Brandenburg	29476	988	1790	6	859	48	752 <sup>1)</sup>	42 <sup>1)</sup>	179 <sup>1)</sup>	10
Bremen	404	4	29	7	6,8	23,4	1,9	6,6	20,3	70
Hamburg–	755	3	88	11,7	47,6	54,1	12,8	14,5	27,6	31,4
Hessen	21114	1605	5800	27,5	2670	46	2710	46,7	420	7,3
Mecklenburg-Vorpommern	23170	1100	4370	18,9	2491 <sup>1)</sup>	57 <sup>1)</sup>	1516 <sup>1)</sup>	34,7 <sup>1)</sup>	363 <sup>1)</sup>	8,3
Niedersachsen	47606	310	4524	9,5	2334	51,6	1697	37,5	493	10,9
Nordrhein-Westfalen	34072	390	4501	13,2	2250	50	1350	30	900	20
Rheinland-Pfalz	19848	1353	547	7,8	774	50	696	45	77	5
Saarland	2570	51	403	15,5	137	33,9	163	40,5	103	25,6
Sachsen	18413	1495	2280	12,4	1053	46,2	1042	45,7	185	8,1
Sachsen-Anhalt	20446	423	1593	7,8	792,4	49,7	625,9	39,3	175	11
Schleswig-Holstein	16175	15	172	1	112 <sup>1)</sup>	65	15 <sup>1)</sup>	9	45 <sup>1)</sup>	26
Thüringen	16175	3482	4916	30	2087	42	2262	46	600	12
<b>Germany</b>	<b>357412</b>	<b>17584</b>	<b>41915,3</b>	<b>11,7</b>	<b>21068</b>	<b>50,27</b>	<b>16651,6</b>	<b>39,73</b>	<b>4226,9</b>	<b>10,08</b>

Note 1: Estimated; Source: LAWA-AG: Grundwasserschutz und Wasserversorgung (16-42); extracted from web site of the Umweltbundesamt

change the natural landscape – we also destroy one of its most critical functions, namely to temporarily retain excess water in the case of heavy rain.

Another water-related function of certain landscapes is water purification and the protection of our groundwater supply.<sup>4</sup> High-quality freshwater supply from watersheds in rural areas can save urban areas *millions* in water treatment costs. Germany has designated almost 12% of its land area as water protection areas with strict regulations concerning the use of fertilizers, pesticides, and other substances that might pollute the groundwater, such as oil or gasoline. Most of these sites are located in agricultural areas (50%) and forestland (40%) (See table 1). This is necessary, because high-intensity agriculture (such as in vineyards or vegetable production areas) can pose a high risk on our freshwater supply. Here the groundwater is often polluted with the residuals from nitrogen fertilizers, in particular nitrate, which is converted to health-threatening nitrite in the human body. Only recently, the EU commission has warned Austria to apply more efficient measures for reducing nitrate levels in the most affected agricultural areas.

Finally, we have to think about the climate functions of certain landscapes. Extended forests are not only CO<sub>2</sub> sinks<sup>5</sup>; they can also dampen storms and reduce erosion.<sup>6</sup> Open landscapes with (seasonally) little or no vegetation, such as many intensive agricultural landscapes, are more vulnerable to wind and water erosion and provide little protection against storms.

### ***The biodiversity protection function of landscapes***

A lot has been written about the value of certain landscapes for the protection of endogenous animals and plants, which we have to preserve for future generations.<sup>7</sup> Conserving the genetic diversity of plant and animal species should *not* be seen as the romantic idea of nature lovers. It has important economic and human health implications.<sup>8</sup> It could help future generations in the breeding of new food crops and domestic animals; it might serve the pharmaceutical industry in the development of new drugs<sup>9</sup> and it provides a broad basis for research in the study of evolution.<sup>10</sup> Many insect species provide valuable pollination services to farmers.<sup>11</sup>

However, one should not be naïve in biodiversity questions. Many people (in particular farmers) would prefer to have fewer species of insects around, particularly fewer mosquitoes and flies, but also fewer mammals such as mice and rats and fewer birds, such as saw crabs. A huge industry serves farmers with pesticides for that purpose. We also should not forget that worldwide *more* people are dying from water-borne diseases transmitted by insects, such as malaria, than from *any other cause of death*. Humans might also be better off without the tuberculosis bacteria, the smallpox or the human immunodeficiency virus (which causes AIDS) – a species, which is currently killing some 30 *million* people. From a human perspective, the protection of biodiversity is a delicate balancing act. We have to protect our own species, but we must also preserve ecosystems (and thus certain landscapes) for those other species that do not harm us or might even provide us with valuable services.<sup>12</sup>

It is obvious that human intervention in the natural environment can change conditions for other species – sometimes to such an extent that this species is threatened by extinction. Most European countries have therefore created natural parks and other protected

areas. In Germany, almost 19% of the land is covered by natural parks (See table 2). For the outside observer this seems like a large percentage of protected landscapes. However, a detailed investigation by the Umweltbundesamt found that 69% of all biotypes in the country have to be classified as endangered.

Protected areas in many parts of Europe are often relatively small and isolated from each other. There are many more unique landscapes where one finds habitats of rare or even endangered species. To protect these landscapes, the European Union is promoting the “Natura 2000” network.<sup>13</sup> It should help to re-establish a favorable conservation status for key habitats through a variety of measures, including land purchase or renting, habitat restoration, income compensation for land-owners (farmers), site protection and wardening. The total size of Natura 2000 sites in Europe is currently unknown because the program is still being developed; however the EU Commission recently estimated that all “Natura 2000” areas might cover about 15% of the EU territory (or approximately 485,000 square kilometers).<sup>14</sup>

While the Natura 2000 network is certainly a most welcome initiative from the overall perspective of nature conservation, the designation of 2000 sites has sometimes met stiff opposition from local populations. Despite financial compensation, farmers are sometimes rather unwilling to “give away” some of their land. For these farmers, land primarily has a production function, while for the environmentalists the site may have a key function in the habitat protection of a species. These two perspectives are not always compatible.

People often believe that *cultural* landscapes always have a lower biodiversity than *natural* landscapes. But this is not necessarily the case. Recent research has shown that Alpine meadows used for cattle ranging (the so-called “Almen”) typically display a wide range of animal and plant species. If these meadows are abandoned and “natural” forest re-growth occurs, they often *lose* many plants and animal species, which had previously flourished on the open grassland spaces.

**Table 2: Germany: Nature parks by Federal State (as of 31.12. 1998)**

Federal State	Number	Area (ha)	In % of area of Federal State
Baden-Württemberg	5	354 504	9,9
Bayern	16	2 145 525	30,4
Berlin	–	–	–
Brandenburg	9	571 702	19,4
Bremen	–	–	–
Hamburg	–	–	–
Hessen	9	620 412	29,4
Mecklenburg-Vorpommern	4	182 450	7,9
Niedersachsen	12	795 310	16,7
Nordrhein-Westfalen	14	1 001 100	29,4
Rheinland-Pfalz	6	458 917	23,1
Saarland	1	103 262	40,2
Sachsen	1	149 500	8,1
Sachsen-Anhalt	2	98 988	4,8
Schleswig-Holstein	5	196 000	12,5
Thüringen	–	–	–
<b>Germany</b>	<b>78<sup>1)</sup></b>	<b>6 677 670</b>	<b>18,7</b>

Note: The total number of natural parks in Germany is 78; six of these parks are crossing borders between two Federal States (hence the difference in the total number calculated from the Federal States)  
Source: extracted from web site of the German Umweltbundesamt

Another interesting example are golf courses. They are often considered the ultimate pseudo-natural landscape, managed to such an extreme that only few animal and plant species (in particular certain types of cultivated grass) can survive. Surprisingly this is not always the case. The author has recently visited a large golf course in the Eastern part of Austria and joined a local bird watcher, who counted and *documented* more than 54 bird species nesting on or close to the golf course. Some of these bird species actually found such generous food supply on the shortcut “grassland” that they multiplied in numbers.

These two examples should illustrate that the relationship between landscape characteristics and biological diversity is rather complex. The simplistic dichotomy of *natural*, in the sense of high biological diversity and *cultural*, in the sense of low biological diversity is certainly incorrect.<sup>15</sup> Biodiversity conservation, agricultural land use and rural development must not be seen as zero-sum games, where one side must lose what the other wins. Instead we have to balance these activities in smart ways, so that the overall benefit for the environment *and* for the people is greatest.<sup>16</sup>

### ***The physical resource base function of landscapes***

We often forget that the raw material we use for building our houses and roads are extracted from rural areas, as is the material used for most of our urban-industrial infrastructure. Pit mines for minerals, gravel, marble, sand, clay, chalkstone, and many other raw materials for the construction industry are shaping some of our landscapes in most significant ways. Large-scale extraction landscapes are the marble quarries of Carrara, the China clay mines of Cornwall, or the coal, brown coal and steel mines in many parts of Europe.

In any modern society with its brick or concrete houses, tarred roads, bridges, railways, and factory buildings, the demand for raw materials is *enormous*. In 1997, the German construction industry (“Bauhauptgewerbe”) used some 412 million tons of gravel and sand, 170 million tons of other stones, almost 37 million tons of cement, 62 million cubic meter of concrete (“Transportbeton”), 13 million cubic meters of brick, and 797 million roof tiles.<sup>17</sup> The raw material for all these construction products has to be extracted *somewhere*.

It is one of the responsibilities of regional planners and local decision makers to designate areas for natural resource extraction that are not too far away from the major construction or production sites. Otherwise trucks and trains would have to transport these raw materials over large distances, causing rather negative side effects on the environment.<sup>18</sup> Regional governments across Europe have set up plans for locating resource extraction sites in an attempt to balance the needs of the (construction) industry for raw material, and the desire of the population for an undisturbed landscape.<sup>19</sup>

A major problem in this context is what to do with these extraction sites when the deposits have become exhausted. In some places, landscape planners and ecologists have developed sophisticated schemes for the re-cultivation of former mining areas (“Berg-baufolgelandschaften”), such as the “Ruhrgebiet” or the open pit mines for brown coal in Eastern Germany.<sup>20/21</sup> Sites for gravel extraction (“Sand-gruben”) are often converted into recreational lakes. However, these re-cultivation programs do not

proceed without conflicts.<sup>22</sup> Some groups have criticized the “beautifying” of former mining areas, instead favoring the conservation of “*industrial* landscapes” as an important element of our cultural heritage.

### ***The waste dump and safety distance function of landscapes***

Landscapes are also used to dump the (solid) waste of our civilization. We use certain ecosystem functions in these landscapes for detoxifying and decomposing the waste, or at least to prevent it from contaminating other environments (for instance, when we use deep salt mines to store radioactive waste). In 1997, Germany produced almost 387 million tons of solid waste; including some 45 million tons of household waste, almost 58 million tons of mining waste, 62 million tons of industrial waste and 222 million tons of waste from the construction industry (Source: Statistisches Bundesamt). There are various concepts for solid waste treatment and recycling in order to minimize the need for landfills. Environmentalists have promoted the idea of reducing material flows in our production and consumption systems; and if this is not possible, to *close* the cycles of material flows by feeding back waste into the production process. While the concept of de-materialization (or reducing material flows) is certainly beneficial, it would be unrealistic to assume that *all* (solid) waste can be recycled. Landfills will be unavoidable in the foreseeable future. For practical reasons, these landfills will be located in rural areas.

Finally, a landscape function should be mentioned that might seem a little odd: the safety distance function. However, this function is used, when nuclear power plants are placed in the middle of rural areas in some distance of big cities. Rural landscapes typically have *lower* population densities than urban landscapes. Hence, they can be used to minimize the risk of technical disasters. On the same principle we use remote areas for high-security prisons, military exercise grounds, nuclear test sites, ammunition storages, hazardous chemical dumps, nuclear waste sites, or other potentially dangerous facilities. The German Federal Office for Radiation Protection (Bundesamt für Strahlenschutz) reported that by the end of 1998 Germany had to dispose 34,299 cubic meters of *untreated* nuclear waste (including 454 cubic meters of heat producing, untreated nuclear waste) and 62,323 cubic meters of *conditioned* nuclear waste (including 1428 cubic meter heat producing, conditioned nuclear waste) (Quelle: Bundesamt für Strahlenschutz). This, by the way, does *not* include the fuel from nuclear power plants (“Brennelemente der Leichtwasserreaktoren”).

We may not like it, but it is a fact that we use certain landscape characteristics (such as remoteness or certain geological characteristics of the ground) to hide some dangerous materials and facilities as far away as possible from densely populated areas.

One of the peculiarities in land-use and land-cover modelling is the great attention that is still given to agriculture and forestry. While it is obvious that these economic activities play a dominant role in the land-cover change of *agricultural* areas and *commercial forests*, this is certainly not the case in many other landscapes. Especially in Europe, but also in many densely populated countries of Asia, we have large landscapes, which are shaped by driving forces that are basically *unrelated* to the traditional sectors of agriculture and forestry.

There is, for instance, the largely unmanaged, semi-natural land in the Far North (Northern parts of Scotland, Sweden, Norway, Finland, and Russia), the high Alpine Mountains, or the peripheral regions in the North-west of Spain and in the North of Greece. In some parts of these areas the land cover might be affected by animal husbandry (elks, cattle, sheep, goats), but the main drivers that affect these lands are bio-geophysical and climatic conditions. At the other extreme we have significant land areas in Europe (and Asia), which are used for (semi-) urban, industrial, or infrastructure purposes, which have nothing to do with agriculture and forestry. The land-use footprint of our modern, urban societies is mainly determined by *non*-agricultural (and *non*-forestry) landscape functions. These functions include, among others things, provision of residential and recreational space, areas for industrial production, for resource extraction, and for energy generation, as well as land used for transportation networks.

In a different context I have shown that land-*use* statistics are often rather biased, because they typically include large natural or semi-natural areas, which are only managed in a very rudimentary way or not at all<sup>23</sup>. Of course, we can also experience land-*cover* changes in these areas, but these changes are either driven by *non*-anthropogenic bio-geophysical factors or by *indirect* impacts of our modern, industrial world, such as effects of climate change. These indirect impacts, however, have little to do with the *use* of land. They are the results of industrial production, mass-consumption and modern life-styles primarily in *urban* areas.

In other words: land-use and land-cover research in Europe has to take into account *urban* sectors, lifestyles and consumption patterns, as well as the systems of production and transportation, which are supporting the urban-industrial world<sup>24</sup>. The focus on agriculture and forestry is misleading. We are not in the tropical rainforest, where agricultural expansion and slash and burn farming are major factors of land-cover change! Natural land or previously unused areas in Europe are not declining due to agricultural expansion, but as a result of structural changes in modern industry, infrastructure construction and (sub-) urbanization. In its Report on the “Environment in the European Union at the Turn of the Century” the European Energy Agency acknowledged this primarily urban-industrial driving forces of land-use change in the Chapter on “Land use footprints” (EEA, 1999, 69–77), which included extensive discussions and data related to the “pressures of urban areas and transportation networks”, the expansion of “built-up land in river catchments”, and on land cover changes in densely populated coastal areas.

## ***Multi-functional* land-use modelling**

A balanced modelling approach to land-use and land-cover change in Europe would include the following steps:

1. Identification of the *dominant landscape functions* for the predominantly urban-industrial society
2. Definition of empirical *indicators* for these functions
3. Specification of the *interdependencies* between various landscape functions
4. Selection of a modelling *framework* for these interdependencies
5. *Development* of the model

As we have pointed out above the land in Europe is used in many different ways. Other than in *traditional* societies, where most of the land is either (semi-) natural or used for agriculture, animal husbandry or forestry, modern societies typically use land for many different purposes. This does not only include *production*-related land-use (such as in the case of agriculture and forestry), but also a whole range of land-use types related to the economic *service* sectors (such as tourism, recreation, sports). Accordingly, the driving forces of these land-use types are linked to economic demands, but also to consumption patterns and lifestyles. In Table 1 I have listed various land-use types. They are also organized according to the sector for which they are most relevant. This table is certainly not complete, but it gives a first impression of the great range of land-use functions in a modern, industrial society.

The next step in the development of a multi-functional land-use model would be the definition of empirical indicators for the various land-use functions. The value of a certain area of previously unused land, for instance, *greatly* differs, whether it will be used for grain production, for building a golf course, for designating an ecosystem reserve, or for building a suburban housing project. In an urban-industrial society the value of land is *not* (primarily) determined by its intrinsic biophysical *characteristics*, such as soil quality or

**Table 3: Multi-functional land-use types in modern societies**

<b>Land-use function</b>	<b>Subtype</b>	<b>Sector / Purpose</b>
Agriculture	Food (Grain, Livestock)	Production
	Fiber / Industrial Crops	Production
	Energy Crops / Biomass	Energy generation
Forestry	Biomass for paper industry / Pulp	Production
	Log wood / Construction material	Production
Tourism	Ski slopes / golf courses / race tracks	Services
	Natural monuments / aesthetics	Cultural values
	Tourism-related infrastructure (tracks, huts, hotels, etc.)	Construction
Transportation	Physical structures (roads, railways, airports, power lines, pipelines, etc.)	Construction
Energy generation	Space for energy generation facilities (wind generators, power plants, hydro-electric stations)	Construction
	Space for fuel production (Oil fields, open pit mines, biomass plantations, etc.)	Production
Waste disposal / Sanitation	Solid waste dumps	Services
	Water treatment facilities	Services
Freshwater supply	Water shed areas	Services
Preservation	Landscape preservation (national parks)	Cultural heritage
	Protection of valuable ecosystems	Nature protection
	Protection of rare species	Nature protection
	Prevention of ecosystem fragmentation	Nature protection
Extraction of natural materials	Gravel pits, quarries,	Physical resources
Urban	Residential areas	Housing
	Commercial areas (shopping centers, business districts, office buildings)	Housing
	Recreation and leisure (stadiums, tennis courts, parks)	Housing
Industry	Factories and related infrastructure	Industry
	Storage facilities / industrial dumps	Logistics
Real estate	Land development / Financial speculation	Investment / Finance
	Security	Investment / Finance

Source: Classification by the author.

the amount of rainfall this land receives. It rather depends on the *functions* it might have for a particular economic sector or group of people. These anthropogenic factors of land-use are typically underestimated by those researchers, who are primarily interested in the bio-geophysical characteristics of the land or its agricultural suitability.<sup>25</sup> In other words: economic, social, and political factors determine the use of land much more than bio-geophysical characteristics. Land-use models that are based on bio-geophysical characteristics of the land are therefore inappropriate for modern societies.

The problem with socio-economic models of land-use is the enormous complexity of interdependencies. We have great experience in calculating the *quality* of land for agricultural purposes based on chemical, physical and organic soil characteristics, terrain features (such as steepness and soil depths), average conditions in precipitation, temperature and sunshine duration, etc. But these calculations are largely irrelevant if the land could be used for an oil refinery or an open brown coal pit mine. The problem with modelling land-use in a modern society is that we have to compare various land functions without having a comparative criterion. A piece of land may have zero value for grain production (because of the infertile soil or the lack of water), but it may be immensely valuable for a residential area, because it is located at an urban fringe.

If we would only use the market value of land for modelling land-use change, we would end up with very little space for habitat protection – particularly in more densely populated areas. Some land-use types are just more likely, if only money determines its use. Fortunately, money is not the only criterion that determines land-use in modern societies. Usually there is a whole range of land-related legislation and administrative regulations – from zoning laws to large-scale regional development plans. These political, legal and administrative conditions must be included in a land-use model, if it should realistically represent land-use in a modern urban-industrial society.

## **Conclusions**

The above discussion might surprise those readers, who had expected an analysis of more traditional rural landscape functions and ecosystem services, such as those related to the food and fiber supply or to the preservation of plant and animal species.<sup>26</sup> But European landscapes are no longer shaped by agriculture or forestry alone. There are many other economic activities in rural areas that utilize landscape functions. Many of these functions are primarily serving *urban* populations. They may fulfill vital urban needs, as in the case of water purification and protection services; or they may provide recreation for those seeking relaxation from the stress of city life. We also have activities in the industrial sector, in energy production, and waste management that make use of certain landscape functions. From the perspective of rural development this broad range of *non-agricultural* landscape functions are highly relevant: They provide new opportunities for rural entrepreneurs *outside* the agricultural and forestry sectors, and might thus help slow down the economic, socio-cultural and demographic decline in rural areas.

We have also seen that landscape functions are not necessarily compatible with each other. In fact, conflicts between landscape functions are common in Europe's rural areas.<sup>27</sup> There is, for instance, the stiff competition between those who are interested in the land for cultivation and those who would like to use it for environmental protection, tourism, and human settlement construction. Land prices reflect these diverging

interests. Much of the land is “given up” by farmers not because it is *unsuitable* for agriculture, but simply because tourist developers and city people pay astronomical prices (as compared to the prices between farmers). The land is then used for ski-slopes, golf courses, or apartment houses. In other words, land-scape functions are changing due to market conditions and economic pressure.

We have also emphasized the fact that one particular landscape typically has *different* functions for different people. An Alpine meadow is a place of recreation and beauty for the hiking tourist; it is a source of income (and subsidies) for the mountain farmer; and for the environmentalist, it may be the natural habitat of a rare animal and plant species. The challenge is to *balance* these views and interests. We must accept that *universal* criteria for evaluating landscapes are not available – and will probably never be available.<sup>28</sup>

Obviously, the beauty of a landscape is often just in the eye of the observer. But the value of many other landscape functions also depends on the (eco-)nomic interest of those who use them. Finding markets for ecosystem services, for instance through the trading of permits for using particular services, might be a promising strategy to balance the various interests.

## Footnotes

- <sup>1</sup> Part of this paper was published by the author under the title “Multifunctionality of Landscapes and Ecosystem Services with respect to Rural Development”. In: Helming, K. / Wiggering, H. (Eds.) (2002): Sustainable Development of Multifunctional Landscapes. Berlin, New York (Springer Verlag)
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