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Chapter 1 : Metropolitan foodscapes with multifunctional land use - Epsilon Archive for Student Projects

The sustainable development of rural areas nowadays faces the challenges of global changes. This paper aims to review the concept of land use and landscape multi-functionality in order to help adapting land and landscape use to the new social, economic and ecological demands.

In this article it is argued that creating multifunctional landscapes or allowing a landscape to serve multiple purposes is the key to sustainable landscape development. For a landscape to be sustainable, it needs to be well cared for and maintained. It also needs to have a built-in mechanism to absorb changes disturbances and developments toward increasing resiliency. Land- scape ecological planning such as greenways, ecological networks, and ecological infrastructure is suited to address multifunctional landscapes. This leads to a lasting support from these user groups and this support is crucial for landscape sustainability. Multiple uses also facilitate efficient use of time and space, which is an especially attractive feature in urban landscapes where space is limited and a land mosaic is fine and heterogeneous. These conflicts can be dealt with strategies such as spatial and temporal separation of uses, stacking, limiting access, and the use of permit to control use. Introduction Global trends such as the migration of rural populations to cities, the decline of biodiversity, and climate change call for landscape planning that can anticipate and adapt to changes, and that can address these issues in a creative way. Creating multifunctional landscapes may help deal with these challeng- ing issues and play an important role in developing sustain- able landscapes. Multifunctional landscapes are those landscapes that can provide multiple functions. According to Lagendijk and Wisserhof , multifunctional land use is achieved if at least one of the following four conditions is met: Therefore, it is important to consider not only the number of functions diversity but also the use of vertical space and time in developing multifunctional land- scapes. We argue that multifunctional landscapes are generally more desirable than monofunctional, or single-purpose, land- scapes. This proposition can be supported by the following reasons: We further argue that multifunctional landscapes are an important and necessary component of sustainable landscapes. Sustainable landscape plan- ning strives to achieve a long-term i. Landscape ecological planning LEP is arguably a means to achieve multifunctional landscapes. LEP refers to "planning of ecologically sustainable landscapes; considering the spatial structure of the system, the flows of energy and materials among system components and between the system and its surroundings, and the evolution of the system over timeâ€"ex plicitly including the values, actions and impacts of humans" p. In the next section, we will examine how greenways and ecologi- cal networks, as example concepts and strategies, can provide multiple functions. One of them is the hypothesis of the co- occurrence of greenway resources. According to the hypothesis, in any cultural landscape, many important abiotic, biotic, and cultural resources are concentrated along corridors such as river valleys, ridgelines, and coastlines8. For example, a Native American trail may run close to a natural bank of a river, which is important for protecting riparian vegetation, accommodating natural flooding regimes, being a conduit for animal movement, and providing access to sports fishermenâ€"these are all functions provided by the river bank if protected. A greenway can be developed along the river cor- ridor to protect ecologically significant and natural areas greenway resources and provide historical heritage and cul- tural values a Native American trail is an example of a cul- tural resource , at the same time allowing appropriate level of both passive and active recreation another greenway func- tion. This concept of linked linear corridors providing multiple functions, developed around , was later applied to greenway planning. The Emerald Necklace, designed by Olmsted in , which later became part of the Boston Metro- politan Park System, is another early example of what now can be called greenways with multiple functions e. Greenways can accommodate com- patible multiple uses and, at the same time, take advantage of the synergy they create by building wide constituents and thus support for greenways from respective user groups e. The functions of ecological corridors include: Multifunctional habitat net- works try to include many landscape functions when reconnecting the remnant habitats, facilitating animal movement4". They conclude that extending the ecological network concept with multifunc- tional indicators is a promising step towards sustainable land- scape development and stakeholder decision-making. The ecological corridor has become multifunctional to serve the different interests of multiple actors; it has become a robust framework LRJ 72 5 , because the involvement of multiple actors in the development process can foster a sense of ownership and thus, commitment to the process of corridor development0, Satoyama, or coppice woodlands on the hillsides in Japan, once actively managed by villagers as a common land for col- lecting fuel woods and making charcoal, edible and medicinal plants, and litter for agricultural fertilizers, were largely abandoned after WWII as the reliance on fossil fuels increased and farmers moved to cities to look for jobs Researchers and policy-makers have their eyes again on satoyama for its po- tential to provide multiple functions. They include wildlife habitat, recreation, environmental education, amenity, nature conservation, water retention and purification, air purifica- tion, etc. Besides recreation, transportation and nature conservation, "modern greenways are expected to provide many other benefitsâ€”from environmental education to neighborhood enhancement to water quality protection" Ahern0 argues that greenways can show various ways of combining compatible uses as well as separating incompatible ones. For example, spatial separation can be used when con- flicts in site related objectives arise when planning multifunc- tional networks The strategies such as temporal and spatial separation of uses to deal with incompatible uses will be dis- cussed in more detail later. When Multiple Uses Conflict Some areas are intrinsically suitable for multiple land uses20 and some uses e. The types of conflicts can be categorized into time or space conflicts, and use con- flicts based on their nature Table 1. Time conflicts arise when the time of use e. For example, the preservation of historical heritage, which is ongoing, can be disrupted by a fair that promotes a different objective. Time conflicts are more likely to occur at a particular site or with regards to the use of facilities; they are less likely to occur over a broad area. Since the longer the time period is considered, the greater the number of land uses can be provided20,30, time becomes less of a constraint in a long time frameâ€”use of the fourth dimension to increase multifunctionality. For example, the protection of riparian vegetation to accommodate wildlife habitat and movement conflicts with neighboring agricultural land use partial overlap or providing active recreation and transportation along the river. The space required by two or more uses activities overlaps. The hatched area is where the con- flict occurs. Use conflicts are perhaps the most common land use conflicts. In a forested landscape with a couple of lakes, for example, use conflict may arise between powerboat use on the lakes and forest bird conservation. Both uses rely on the same resources, the whole forest landscape, but the nature of their use one is more active and the other is protective creates the conflict. In an urban land use example, heavy industry and residential land use are not compatible at all. In sum, in areas where multiple land uses can be supported, multifunctionality can be increased by combining compatible uses. The types of conflicts that arise can be categorized into time, space, and use conflicts. Time and space conflicts are like the two sides of a coin: In time conflicts, what is con- flicting is the time of use in the same space. In space conflicts, the space needed for specific uses or activities overlaps at the same time. In use conflicts, incompatible or contradicting uses compete for space, time, or resources. The strategies to address these con- flicts depend on whether or not space is limited and on the nature of conflicts Table 1. The types of strategies that can address these conflicts i. Temporal phasing refers to allocating uses over time day, season, year, etc. There are different phases of use for the same space. For example, the use rules of a park can specify that vehicular traffic is only allowed in the mornings and the evenings; the park is to be used by pedestrians, bicyclists, and rollerbladers during the daytime. Temporal phasing intends to alleviate the demand in this case, different movement modes for the same space by separating out competing uses temporally. Time con- flicts over a broad landscape, although much less common, can also be mitigated by the temporal separation of uses. In the end, when the time period the fourth dimension is extended to a year, several years, and decades, time becomes less of a constraint to achieving multifunctionality. If extending a time frame does not solve the problem, as in the example of the conflict between historical heritage preservation and a fair that promotes a different objective, either a fair can be held at another site spatial solution or the nature of the fair can be changed to the one that is more compatible with historical preservation. Alternatively, when space is not limited, spatial shifting can be used to alleviate the stress on resources. Spatial shifting can be used for a single intensive use such as slash-and-burn agriculture, which moves around in a landscape every couple of years. For example, competing uses can be spatially separated so that they do not interfere with one another more examples of this later.

While spatial separa- tion of uses requires a large enough area, stacking is a strat- egy used when space is a limiting factor. It literally means stacking competing uses on top of one another such as an underground storage, a deck parking, and a rooftop gardenâ€" the use of the third dimension. Mixed use can be called stacking because different uses e. Human cross- ings can also be combined in the use. This is another site-based example of providing multiple uses. It is also a strategy to deal with land use conflicts in general. Spatial separation of uses means literally separating contradicting uses at some distance. A solu- tion for the example of the conflict between powerboat use and forest bird conservation in a forested landscape see Section 3 under use conflicts may be to create buffer areas around the lakes in order to reduce the noise and the presence of people and their activities, and to focus on conserving forest-interior birds. Creating buffer zones between conflicting uses may be a useful strategy. Another strategy to manage the whole forest landscape might be designating some areas of the forest as strict conservation areas prohibiting human access and other areas as buffer zones to protect the core conservation areas, and others as more active zones of human activities. This strategy of developing multiple zones for different activi- ties can be applicable to a broad landscape to mitigate land use conflicts. The caveat here is that by recommending the creation of multiple zones for different uses activities , we are not advo- cating the traditional zoning approach. Creating multiple zones is a way to deal with multiple contradicting land uses at a broad spatial scale. By having multiple zones, a variety of uses can be ac- commodated in a given area. We would emphasize that these are the strategies to deal with multiple competing uses. For the industrial vs. Separat- ing the contradicting uses at some distance or erecting physi- cal barriers is a useful strategy since the degree of nuisance usually takes the form of a decaying function of distance. For example, the negative effects of highways e. Finally, limiting access to various degrees and using permit to control use are both a means to control the amount and intensity of use to protect the natural and cultural resources from overuse and exploitation. All the strategies described so far may be applied to urban areas where land is more limited and thus the competition for the land is higher. The types of conflicts and their examples, and the types of strategies to address these conflicts and their examples are summarized in Table 1. These strategies are tempo- ral, vertical, and spatial horizontal separation of uses. Space conflicts can be re- solved by stacking or the vertical separation of uses, using the third dimension of multifunctionality. Other strategies to deal with competing land uses include limiting access and controlling the use by the number of permits. Conclusion The key to developing multifunctional landscapes are strate- gies and management schemes that would allow the co- existence of competing objectives or uses. The types of conflicts concern temporal, spatial, and use aspects. Deciding on the strategy to employ depends on whether or not space is limited and on the nature of conflicts. When space is limited, temporal phasing or temporal sepa- ration of uses is used to deal with time conflicts. Vertical sepa- ration of uses such as stacking and overpasses is also a strategy to deal with time, space, and use conflicts when space is limited. When space is not limited, spatial shifting can be used to reduce the stress on resources caused by a single inten- sive use; spatial separation of uses can be used for multiple, Table 1. Types of conflicts and their examples, types of strate- gies to address the conflicts and example strategies.

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Multifunctional Land Use Next to the provision of fresh food and animal feed, urban agriculture may play other functions in the city system, and combine different functions in one area of land (multi-functionality).

Box 50, DK Tjele, Denmark. Halle Saale , Germany. During this transformation, substantial parts of the previously direct support for agricultural production 1st pillar measures are now decoupled from production. Moreover, a share of direct payments is modulated to the rural development programme, which is the 2nd pillar of the CARPE Table 1. The three axes of the EU rural development programme , and examples on policy measures related European Commission, Axes Examples on policy measures 1 Improved competitive- ness, structural develop- ment and innovation in agriculture and forestry â€" Loans to young farmers â€" Incentives for high quality production â€" Advisory service, training and information 2 Sustainable land use and preservation of environ- mental and nature values â€" Agro-environmental schemes â€" Less Favoured Area subsidies â€" Afforestation 3 Attractiveness of rural areas, economic diversifi- cation and quality of life â€" Infrastructure improvement â€" Preservation of cultural heritage â€" Tourism and micro-enterprises development Today, the rural landscapes of Europe are undergoing major changes. From , most of the 1st pillar subsidies are decoupled from the production, there- Tommy Dalgaard et al. Though, since the policy is not implemented uniformly across Europe but country-specific, the consequent adjustment reactions of farms may differ. Figure 1 exemplifies adjustment reactions of two of the largest farms nearby the DIAS research centre in Foulum, Denmark. The first farm Tjele has converted ha out of ha arable farm land into extensive cattle grassland. The second farm Viskum , has reduced its beef cow production from to mother cows. However, a nearby dairy farmer has now rented the areas vacant, because a large part of his own farm is to be turned into wetlands for nature protection. In both cases, decoupling of the 1st pillar subsidies is the trigger for the changes, but the choice of what to change the land use into is effected by 2nd pillar measures; i. Similar adjustments may take place in other parts of Europe, but this also depends on the policy implemented, the predominant farming structure, location factors, and the specific pre-conditions of the individual farms themselves. There is no doubt, that the types and extent of such changes will have profound effects on the future rural development in Europe. The design of the rural development measures is an opportunity to facilitate a sustainable development in the rural areas. Examples on land use dynamics at two Danish farms. At Tjele top , traditional farm land for cereal production is converted into extensive grassland. At Viskum bottom the beef cattle production is significantly reduced, and grassland and whole crop fodder areas are rented to a nearby dairy farmer, whose own land is affected by wetland construction. Multifunctional farming, multifunctional landscapes and rural development This paper presents a methodology for multifunctionality impact assess- ments of the CARPE at two scales: Especially, we focus on methods to model the structural change of farming and land use as a result of decoupling direct payments, the effects of rural development measures, and the multiple goods and bads related to such change Vejre et al. Focus is attended to the potentials for the development of a conceptual framework for studying multifunctional agriculture, and on the development of methods which can evaluate effects of the CARPE, and the related second axes rural development measures Table 1 at the landscape and farm scale. All landscapes are characterised by a significant agricultural land use and livestock production. It should be noticed, that cattle farming is present in all these areas. This is important because especially this type of farming is expected to be significantly effected by CARPE changes see example in Fig. While this farm type is also recognised to deliver a number of goods demanded by society fx grazing-related biodiversity protection in Natura sites , many of the rural development policy measures Table 1 are related to this type of farming. Therefore, the development of the MEA- scope impact assessment tool, especially concentrates on methods to assess the multifunctionality of this specific farm type and landscapes which have been shaped by cattle farming. Tommy Dalgaard et al. The seven MEA-scope case study landscapes. Livestock and farming structure is based on national censuses and Land Parcel Information Systems Kjeldsen et al. The core of the MEA-Scope tool to be developed, is a framework based on the hierarchical linking of three independent models. Multifunctional farming, multifunctional landscapes and rural development Figure 2. The five step MEA-scope modelling procedure. The step 1 data collection delivers input to three farming models: Finally, the results are integrated and upscaled for the step 5 landscape level impact assessments after Damgaard et al. In step 1, landscape and farming data from the seven study landscapes Table 2 is collected and stored in a database. In step 2, 3 and 4, these data are then used by the three integrated farming models AgriPoliS Happe et al. Finally, in step 5 the landscape data and the farm model results are combined and upscaled for landscape level impact assessments. Here, we will go into more details with the step 2, 3 and 4 modelling, while the step 1 and 5 data collection and upscaling are discussed in the following chapter. The three farming models are run in sequence, thereby covering a variety of the economic-, environmental- and social impacts of farming, required by the European Commission Secondly, the linear programming model MODAM models the land-use and production decisions of specific farm types in the landscape, especially focusing on cattle farms. Thereby, the allocation of resources is modelled, and trade-offs between resource use, farm economics and the achievement of environmental goals can be assessed. Finally, the third model, FASSET, is able to simulate matter flows for the farm types selected, and quantify key environmental impacts like ammonia volatilization air quality , nitrogen leaching water quality and emissions of greenhouse gasses climate effects. With AgriPoliS, effects of the decoupling of subsidies or other 1st pillar measures relevant can be assessed, and the present situation can be compared with a future situation after, for example, 20 simulated years of structural development. The expected effects of such measures can be evaluated for the future situation with decoupled 1st pillar subsidies. The resulting model outputs represent various indicators for those economic, environmental and social dimensions of multifunctional agriculture relevant in the seven case study areas Waarts Not all indicators relevant can be modelled by the models. Those indicators, respectively included or missing in the models, expose the strengths and weaknesses of the model framework with respect to its use for policy impact assessments, and the eventual needs for further developments. Now we will move to the integration of these farm model data with other landscape features like topography and non- agricultural land cover as well Vejre et al. First, farming data are collected in order to feed the farming models, and upscale the results for landscape scale analysis Figure 3, left side. Second, results of the farming models are set into the landscape level context Figure 3, right side. It this landscape level context that end-users define which farm- and landscape level policy scenarios they wish to evaluate with the Figure 2 modelling procedure. Multifunctional farming, multifunctional landscapes and rural development Figure 3. Framework for collection of farm- and landscape level information for the use in policy scenarios, where potentials for multifunctional farming in multi- functional landscapes are illustrated. To adjust the models to the case study regions, the first step in the farm level data collection is to collect structural data from each of the seven landscapes â€” i. The second step is to define a number of typical farms, which are representative for the actual study landscape â€” i. In MEA-scope, around 20 typical farms are selected for each study landscape, and procedures to select these farms from Farm Accountancy Data Network databases McClintock are developed where available see Happe Using a pc-based solver programme the weight of each typical farm is derived, minimizing the squared deviations for all structural variables Figure 4. The weight is used to initialise each typical farm in AgriPoliS. For example, farm type 1 is initialised X times, farm type 2 Y times, etc. For each case study landscape, around 20 typical farms are selected, and the weight of each typical farm is derived via a solver program, minimizing the squared deviations for all structural data variables. The first step in the landscape level data collection Fig. The second step is to create a site topology based on GIS- layers about the natural conditions for farming soil fertility, land cover, topography, climate , and to allocate the farm types defined Figure 4 to each of these site typologies Rounsevell et al. The aim of this allocation is to provide locally adapted soil type and climate information for the farming models, and to assess local differences in the impacts of the farm structural developments predicted. Finally, step 3 is the inclusion of end-user demands for impact assessments of farm- and landscape level scenarios, evaluated in landscape specific contexts. Solver FADN list Multifunctional farming, multifunctional landscapes and rural development favoured areas. In MEA-scope, end-user workshops are arranged in Brussels. Moreover, focus groups of local stakeholders are formed in some of the landscapes studied see Piorr et al. The role of these stakeholders is to define which subjects and policy measures they would wish the project to focus upon. One of the key issues, which were identified at the first end-user workshop in Brussels, September 15th , was exactly the need for landscape level impact assessments of second axes rural development measures Table 1. Evaluation of land use changes imposed by agro-environmental schemes, such as those exemplified for the Natura sites in the Danish study landscape Figure 1 , will help to better understand the multiple effects of the rural development measures, and qualify the design of new measures. Such documentation will be needed in the coming years, where agricultural subsidies are diminished and decoupled from the production. The alternative rural development measures must be designed after local needs. In some parts of Europe, problems are caused by intensification from agriculture and the related pollution and extinction of wildlife habitats. In other parts, the problem is extensification or even abandon- ment of agricultural land. The point is, that actually parallel intensification and extensification processes often takes place within the same landscapes, and landscape level studies are needed to understand those processes. For example, in the Danish landscape of Table 2, extensification in the form of afforrestation is subsidised in one part of the landscape, while intensifi- cation in form of loans to young farmers increasing livestock production is supported in another part of the landscape. The question is whether this is desirable, and what the combined effects are on other factors like water protection, greenhouse gas emissions, unemployment, or income possibilities for the locals. It is for sure, that major changes will happen in the seven landscapes studied in MEA-scope. The effects of globalised markets and an ageing population will push to a structural development towards more specialised farms, as seen in the Danish, German and French landscapes, and fewer of the mixed farms dominating in the other study landscapes of Table 2. However, the future is open for choices where these general trends are Tommy Dalgaard et al. Danish Journal of Geography 3: Integrated assessment of the land system. Institute for Environmental Studies, Amsterdam, pp. European Commission Impact assessment guidelines. European Commission, Brussels, June Hatch DJ et al. McClintock J Farm accountancy Data network. An A to Z Methodology. Commission of the European Communities, Brussels. Meeting future demands for landscape goods and services. Agriculture Ecosystems and Environment Sattler, C, Zander P Environmental and economic assessment of agricultural production practices at a regional level based on uncertain knowledge. 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Chapter 3 : Multifunctional Land Use - Katharina Helming, Hubert Wiggering, Ãœlo Mander - Science de la

Global change, land use policies and EU enlargement affect the driving forces for landscape functioning, land use management and rural development. New demands on landscapes and natural resources call for multifunctional approaches to land development. Tools are required to (i) identify the effects.