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MEETING NATIONAL LAND USE RELATED OBJECTIVES WHILE SAFEGUARDING TYPICAL LANDSCAPES

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Abstract. Landscapes play a significant role in the regional development by providing ecosystem services to the local communities. Significant changes in land management due to the political decisions may significantly change the typical landscape in rural areas. Therefore, the aim of this study is to explore how to use the landscape differences to facilitate achievement of national socio-economic and environmental objectives, while avoiding significant changes and safeguarding typical landscapes. Cluster analysis was used to identify relatively homogeneous groups with four socio-economic and environmental indicators, namely, profit, employment, net GHG emissions, habitat quality. Results show that clusters with the highest socio-economic return are located closest to the capital city and carbon sequestration measures may be concentrated in the landscapes that are geographically farthest from the capital city, but then the abandonment of rural areas and the disappearance of typical landscapes may occur. The political decisions related to land use change should be adapted to the specific landscape, so that not only socio-economic and environmental objectives are achieved together with the fulfilment of international obligations, but also the typical landscape of the specific landscape region is preserved.

Keywords: land management, multifunctionality, agriculture, forest, biodiversity, land functions

Introduction

Landscape describes the changes that have taken place over thousands of years, facilitated by natural processes and human activities. Landscapes takes important role in formation of local culture and well-being of citizens. The aesthetic values of the landscape are related to both the biophysical and ecological characteristics of the landscape, as well as the biological diversity, however, one of the most important factor determining the aesthetic value is the perception of people, which can be different for each individual [1]. Any changes in the landscape and multiple societal demand for various ecosystem services affect the functionality of the landscape. For instance, the growing demand for bio-products has increased the production and promoted the development of bioeconomy. At the same time has also created challenges how to simultaneously achieve socio-economic and environmental targets. Climate change mitigation is one of the challenges, as the European Union is committed to make the EU the first climate-neutral economy and society by 2050, which consequently means that each member state has an obligation to reduce GHG emissions also from agricultural and land use, land use change and forestry sectors. Another societal challenge is how to tackle with biodiversity loss, therefore the EU has set the targets to expand the protected areas and to restore degraded ecosystems. All of these land-related societal demands require changes in land use and are going to affect multifunctionality of landscape in various ways.

The multifunctionality of the landscape is considered as the capacity of the ecosystem to provide the society with multitude of benefits, which are formed as a result of complex interaction amongst various land units and stakeholders. Heterogeneous agro-forestry landscapes may provide higher levels of multifunctionality, while heterogenous landscapes with the domination of built-up show less multifunctionality [2]. In homogeneous agricultural landscapes even abandoned land is important in providing environmental [3]. Such unmanaged or abandoned habitats, large trees, rock piles or any other natural elements in the landscape may be beneficial for species persistence. Agricultural expansion reduces forest areas and natural habitats, for instance, in a [4] study, agriculture expansion in Lishui, China has led to a 6.08% loss of habitat quality between 2000 and 2020, extensive forest loss and land fragmentation. In addition, the expansion of agriculture, the construction of infrastructure, regional and urban planning, as well as globally caused economic and environmental challenges also changes the usual and historically formed landscape. Therefore, the research question of this study is how to fulfil all of the land use related national objectives while preserve typical landscapes?

So far, the studies have been conducted to evaluate the supply and demand for soil-based ecosystem services of foodscape, namely primary productivity, water purification, nutrient cycling, carbon regulation, habitat for biodiversity [5], [6], [7] using Functional Land Management framework [8], [9]. For instance, the case study in eastern Amazonia showed that the demand for agricultural production can stimulate the expansion of agriculture in areas with fertile soils which in turn could compromise environmental objectives and change the typical landscape [5]. And the study in Philippines showed although there is a high demand for concentration of agricultural production in lowlands from policy makers, but due to low production potential, farmers have concentrated production on erosion-prone terrains [6]. Another study in Latvia, on the other hand, has selected spatial locations for specific land use changes in order to achieve bioeconomy and environmental objectives [7]. All of these studies have investigated the spatial distributions for supply and demand of soil functions and incentives how to achieve the balance between demand and supply, but most often, to achieve this, a land use change is required, which may significantly change the typical landscape. Therefore, the aim of this study is to explore how to use the landscape differences to facilitate achievement of national socio-economic and environmental objectives, while avoiding significant changes and safeguarding typical landscapes.

Materials and Methods

Generic Research Approach

In this study, the Functional Land Management framework is used to determine the societal benefits derived from agricultural and forest land use. Four categories of land use related societal benefits are evaluated: social, economic, climate regulation, and biodiversity protection.

The first step involves creating two spatial datasets: one for agricultural land and another for forest land (Figure 1). This is done to generate a single-layer detailed spatial datasets with attributes for agricultural and forest land fields. For agricultural land dataset several sources of information are used: Rural Support Service data (with attributes of crops, soil type, land quality, type of support, and owner's id for each land field of), Agricultural Data Center data (location of animal holdings, number of animals), Soil maps (soil type, land quality) and spatial locations of landscape regions. For forest land dataset, primarily information from the State Forest Service is used (incl. dominant specie, dominant specie age, forest type, forest age group, standing volume, height of trees, number of trees, stand density, standing volume, restrictions, year of last activity and type of the last activity).

The second step involves preparing algorithms to calculate the societal benefits related to land use, using the information from the datasets as input. Societal benefits are calculated for each land field and then, in the third step, summarised for landscape regions.

R along with the "tidyverse" and "sf" packages are used for data processing.

Economic function

The indicator used to determine economic impact is profit, which is calculated per each agricultural and forestry land use field. Profit in agriculture is calculated as the difference between revenue and production costs and estimated in euro per ha. Revenue depends on crop type, its price, yield (which itself depends on land quality and size of farms), and support payments. Production costs include labour costs, depreciation of fixed assets, intermediate consumption, and taxes. Both, revenue and production costs, are adjusted with production scale coefficients depending on the farm size.

To determine the yearly profit in forest lands the following methodology is used. Initially profit for the whole rotation cycle is calculated as the difference between all incomes and expenditures within the rotation circle. Incomes within a rotation cycle include incomes from the main felling and stock maintenance felling. Expenditures within a rotation cycle include costs for soil preparation, planting material, planting, agro-technical maintenance, composition maintenance felling and main felling. The difference between incomes and expenditures divided by number of years in rotation cycle is considered as yearly profit in forest lands. Length of rotation circle depends on dominant species in each forest parcel. All calculations are made in current prices. Yearly profit is calculated for each individual forest parcel. Information on the type and volume of logging is obtained from the annual reports of the State Forest Service, which is then spatially linked to the database of the State Forest Register.

Social function

The indicator used to determine the social impact is employment. Employments in agriculture and forestry are calculated as labour input per each land field and depends on crop type, farm size, and forest type. The Latvian farm accountancy data network (FADN) data from 2021, Latvian Rural Advisory and Training Centre standard income-costs calculations per crop from 2021 and unpublished spatial administrative data about each agricultural field from Rural Support Service agency are used to determine both profit and labour input indicators per each agricultural and forest land field.

Climate regulation function

In order to determine the climate regulation function, the net GHG emissions from agriculture sector and land use, land use change and forestry sector (LULUCF) per each agricultural and forestry land field were calculated. Using IPCC guidelines [10] and national emission factors from the Latvia`s national inventory report [11], for each emission source (animals, manure management, mineral fertilizer management, crop residues, organic soil management, soil liming, carbon changes in living biomass, dead wood, litter, soil, wood products) emission coefficients for different land use types were calculated. Later for each specific land use type the relevant emission coefficient is multiplied by the area of the field to get the yearly net GHG emissions from each agricultural and forest land field. GHG emissions are recalculated in CO2 equivalent corresponding to global warming potential of AR4 [12].

Biodiversity protection function

The habitat quality for birds is chosen as an indicator for biodiversity. In this study, the evaluation of habitat quality requires reference to both land use and a specific territorial unit, so the analysed criteria and data were performed at the hexagon level (size of each hexagon is 100 ha), covering

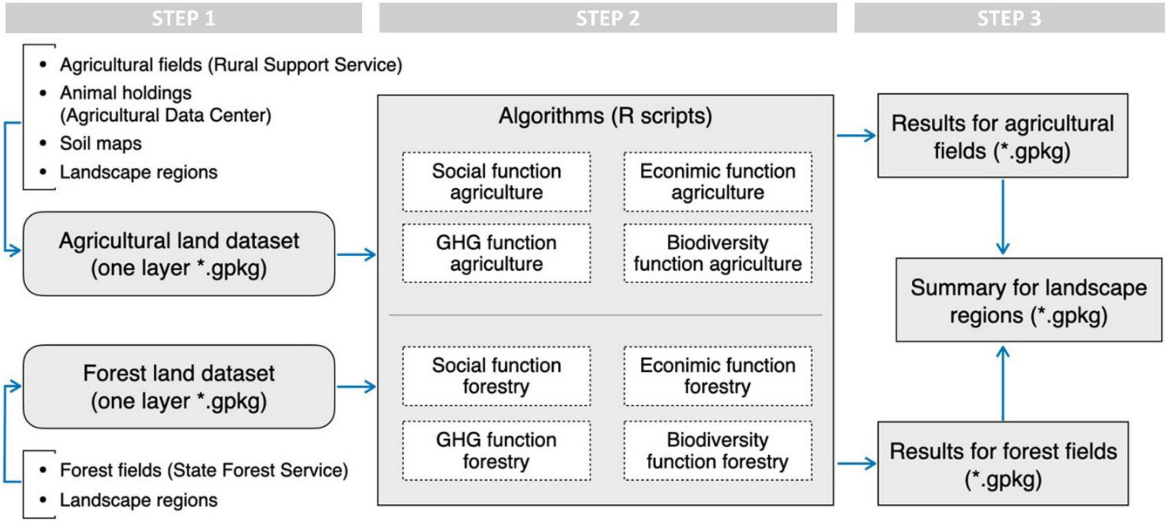

Fig. 1. Methodological steps for land function evaluation [created by authors]

Table 1. The characteristics on landscape regions [18]

Landscape region	Characteristics
Piejura	The relief is formed by the plains, dune ridges and ramparts formed by the Baltic Ice Lake and the Litorina Sea. Forests occupy 60% of the territory with the pine as a dominant tree species. Agricultural land is located in polder systems. Rich in peatlands and shallow lagoon type lakes. The climate is moderately warm and humid with the average precipitation of 700 to 750 mm per year. Current ecological problems are related to eutrophication and rapid overgrowth of shallow lakes, extinction of biotopes, especially biologically valuable grasslands. The biggest challenge is ensuring the ecological quality of forest landscapes.
Ventaszeme	The relief and sediments are created by islands of moraine sediments, and the land cover is dominated by agricultural land. In places where sandy soils dominate, the forests spatially form one of the largest continuous forest massifs. The main tree species are pine and spruce. Climate is moderately warm and moderately humid with the average yearly precipitation of 650-750 mm.
Rietumkursa	Hilly terrain with wavy and flat plains. Agricultural land dominated, forests occypy 39% and are located in the moderately drained wide relief depressions. A dense network of small rivers. Large drained fields dominate, little meadows and pastures, and unused agricultural land. Average yearly rainfall exceeds 800 mm. As a results of agricultural land intensification, many small landscape elements (individual trees, groups of trees) have disappeared, which reduces biological diversity. Landscape region has a potential for development of wind farms.
Austrumkursa	Diverse terrain and the sediments. Arable land dominates, little pastures and meadows. Very few unused and abandoned agricultural land. Forest occupies 45% of the territory and the main tree species are pine, spruce and birch. The climate is moderately warm, the average amount of precipitation is 600-700 mm per year. The current ecological problems are related to the intensive use of agricultural land. The landscape is characterized by the homogenization of crop rotation.
Rietumzemgale	The terrain is flat and slightly wavy. Forests occupy 14%. The dominant species in the forest stands is pine. Soils are fertile. 85% of agricultural lands have been drained. Landscape is homogeneous dominated by agricultural land mixed with small groups of trees. Climate is moderately warm and relatively dry with average yearly precipitation 589 mm. The thickest river network, distinct river valleys, little lakes. Poor or very poor ecological quality of water bodies.
Austrumzemgale	Slightly wavy terrain with ridges, ramparts and hills. The 62% of the total area is occupied by forests. The main tree species are pine, birch and black alder. Agricultural lands have been preserved in the form of massifs of drained lands of various sizes in the vicinity of rivers and near major roads. Climate is moderately warm and moderately humid with precipitation of 700-750 mm per year. The most important ecological problem is forest fragmentation.
Dienvidvidzeme	A very homogeneous relief forms, the largest part of the territory is occupied by elongated ramparts. Forests occupy 55%. Pine, birch and spruce dominate in forests. Lakes of different origins. Typical karst processes. A lot of peatlands. Overgrowth of natural grasslands in river valleys. Homogenization is observed, fragmentation is increasing in the forest landscape.
Daugavzeme	The surface of the terraces is broken by ravines, ancient ravines and depressions created by the runoff of glacial waters. Agricultural land dominates in the landscape. Rapid overgrowth of unused agricultural land with pines and bushes. Floodplains are clearly visible in the valleys. The landscape is dominated by a reservoir. Forests occupy 26%. The climate is very different, more features of the marine climate. Precipitation is 655 mm per year. The main ecological problems concern construction of fishways and increase of biological diversity.
Augszeme	The marginal landforms of the glacier dominate - ridges and ramparts of moraines, massifs of half-ridges. Massifs of agricultural land dominate, fragmented by small groups of trees and homesteads. Forests occupy 48%. The dominant tree species in the forest stands are birch and pine. Moderate continental climate. The amount of precipitation is 590-700 mm per year. Many lakes and small rivers. Landscapes are becoming more homogenous and biodiversity conservation becomes crucial.
Latgales augstiene	The topography consists mainly of hilly terrain of various shapes and sizes, often in complex combinations with distinct depressions occupied by lakes and low peatlands. Agricultural land dominates. Due to the complex terrain, the mosaic-like spatial structure of the landscapes is dominated by forest lands, while the agricultural lands are dominated by grasslands, which form separate patches. The forests are dominated by birch, aspen and black alder. The overgrowth of grasslands creates serious difficulties in maintaining the quality of landscapes. A lot of abandoned farmland. Forests occupy 36%. Continental climate. The average annual rainfall is 650 mm. The region with the most lakes. The most significant problems are the abandonment of agricultural lands and homesteads. Loss of biodiversity.
Aiviekstes zeme	Great variety of landscapes. The depressions between the ramparts are swamped. Rapid overgrowth of agricultural land. Birches and pines are common in the forests. In some places, clumps of oak trees have been preserved. Pronounced agricultural land and forest land mosaic. Deciduous young growth forests dominate. Forests occupy 53% of the area. There are many large peatlands. The climate is moderately warm and humid. Precipitation 550-700 mm per year. Many lakes. The main ecological problem concern conservation of floodplain meadows.
Austrumlatgale	The relief is wavy. Agricultural land forms large reclaimed massifs that are used as grasslands. The dominant tree species in the forests are pine, spruce, birch and aspen. Forest massifs are fragmented. Peatlands occupy 30%. Forests occupy 47 %. The climate is distinctly continental. Precipitation 600-700 mm per year. There are not many lakes. Agricultural lands are overgrown or afforested. Rapid decline of natural grasslands. Abandonment and collapse of single-family homes.
Vidzemes augstiene	The terrain consists of hill bands of different sizes. Forests, meadows and pastures cover larger areas, and wet and permanently wet meadows and pastures are preserved. Forests occupy 52%. The dominant species in the forest stands is spruce. There are very large areas of abandoned agricultural land, which are naturally afforested. Average annual precipitation exceeds 750 mm. Many lakes. The most significant ecological problems are related to the non-management of the agricultural land and the disappearance of natural meadows, as well as the risks of erosion.
Gaujaszeme	The relief is formed by a river valley. The landscape is dominated by forests. Peatlands are located in the lower parts of the terrain. Forest stands is dominated by pine. Forests occupy 62%. Climatic conditions in the landscape are very different. Precipitation 650 – 850 mm per year. The ecological problems are related to the operation of small hydroelectric power plants on rivers. The hydrological regime of the river has changed, the river ecosystem and landscape have been affected.
Austrumvidzeme	The relief consists of separate massifs and depressions. Lakes and peatlands are found in the depressions. The landscape is distinctly mosaic, consisting of agricultural land and forest clumps. Agricultural land is dominated by grasslands, overgrowth of pastures and meadows can also be observed. There are many peatlands. Average yearly rainfall is 758 mm. The shortest vegetation period in Latvia. Many lakes. The most significant ecological problems are related to the non-management of natural meadows and the disappearance of natural meadows, as a result of which the nature of the mosaic landscape changes, which affects biological diversity and the aesthetic quality of the landscape.
Ziemelvidzeme	Moderately wavy relief. A lot of peatlands. Large forest massifs dominate. The main tree species in forests are birch, spruce, pine and black alders. A lot of young growth forests with deciduous trees. The climate is influenced by the Gulf of Riga. The amount of precipitation is 700-850 mm per year. The landscape is rich in lakes. Fragmentation is increasing in the forests, homogenization is observed in the rural landscape, abandoned settlements and abandoned agricultural land occurs.

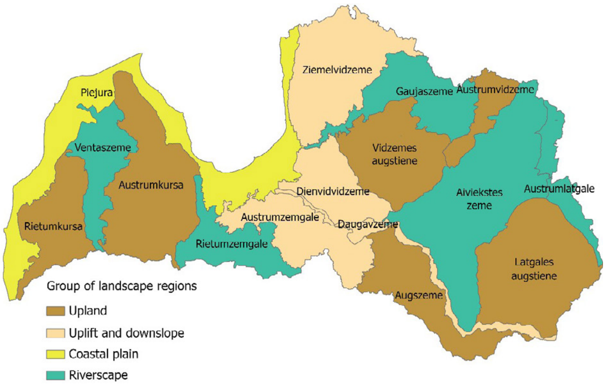

Fig. 2. Landscape regions in Latvia [created by authors]

the entire territory. The habitat quality has been evaluated within ecosystems using an integrated two-stage evaluation system, which considers interaction of several elements: land use, land use intensity, length of ecotone, and presence of the EU protected habitats.

In the first step, the weighted average value of the hexagon`s ecosystem quality is evaluated according to the ecosystem composition, with the rationale that the highest biodiversity of species is in undisturbed ecosystems, and it decreases depending on the land use intensity and other anthropogenic factors in the specific location [13], [14], [15]. The ecosystem quality value is determined in points ranged from 1 to 10. The 10 points indicates an undisturbed natural area, where one point represents a completely transformed natural ecosystem without the wildlife species specific to a particular ecosystem. The ecosystem quality is determined for these ecosystems and subsystems: meadow and pasture, grassland, perennial plantations, arable land (organic and integrated), forest land (with restrictions, without restrictions), water bodies (lakes and river), bogs (natural and managed).

In the second step, the elements important for higher habitat quality are evaluated in the hexagon: the presence of the EU protected habitats in the hexagon and the relative length of the ecotone in the hexagon. Habitat quality assessment is calculated as the sum of the average weighted values of habitat quality of a specific area and the values of elements important for higher habitat quality. This approach allows for a conceptual assessment of habitat quality potential at the ecosystem level in the country and in different regions.

Landscape regions

Landscape region is the highest division of landscapes in Latvia. The formation of these landscape complexes is based on the differences in the forms of the land surface and its constituent sediments [16]. In Latvia, 16 landscape regions have been distinguished, and the main criteria in their classification are relief forms and large river basins (Figure 2). Landscape regions are grouped in four groups: upland, which represents the most elevated watershed areas; uplift and downslope, which is transition between highlands and lowlands; coastal plain, the characteristics of which determine the final stages of the transfer processes caused by runoff with an accumulation of sediments; riverscape territories have been formed by various historical valley development processes and economic activities, for instance, land cultivation, construction of infrastructure, urban development.

Within the framework of the project of Latvian State Research Programme "Sustainable Land Resource and Landscape Management: Challenges, Development Scenarios and Proposals" (LandLat4Pol), the boundaries of landscape regions have been reviewed and digitized [17]. The characteristics on landscape regions are described in Table 1.

Cluster analysis. K-Means cluster analysis was used to identify relatively homogeneous groups with four land functions using IBM SPSS Statistics Version 22. Characteristics used for clustering are profit (EUR per ha), employment (EUR per ha), net GHG emissions (CO_2 price per ha), habitat quality (points per ha). The values of land functions were standardised before cluster analysis to create equal weights to all indicators. The overview map with cluster`s groups and average indicators of land functions for each cluster was created in ArcGIS Pro 3.1.2.

Results

Land functions in landscape regions. The highest profit is concentrated in the Rietumzemgale and the Austumkursa, where the most fertile soils are located, as well as in some areas of the Ziemelvidzeme and Aiviekstes zeme (Figure 3). In Vidzemes augstiene, Latgales augstiene and Augszeme are also territories without profit from agriculture which means that agricultural activities are subsidized with lower wage. Profits are most often made on market-oriented farms and losses on smaller farms, which means that labour on smaller farms receives less or no pay and invests additional funds and work. Profit in forestry is not obtained every year, but on average two to three times during one stand rotation cycle (30 to 100 year cycle on average, depending on the dominant species and quality of stand). In the forestry sector, both accumulated profits and, in some cases, small losses are formed - in places where forest restoration is more active – Aiviekstes zeme, Austrumzemgale, Augszeme.

Differences in employment between landscape regions are relatively small. The lowest number of people employed in agriculture and forestry is in Piejura, Austrumzemgale and Austrumvidzeme (Figure 4).

GHG emissions are emitted in the regions with the largest proportion of agricultural land, but in the large forested areas carbon stocks are formed (Figure 5). The areas with the higher emissions are located in the landscape regions Rietumkursa, Austrumvidzeme, un Rietumzemgale where intensive crop production occurs. Another source of emissions is located in the Latgales augstiene, where small and medium livestock farms are concentrated. The lowest GHG emissions are observed in the territories with the lowest agricultural intensity – in Piejura, Aiviekstes zeme and Austrumzemgale.

Territories with high habitat quality are concentrated in the coastal area, nature protected areas, on the banks of rivers and lakes, and the forests around the capital (Figure 6). While the lowest habitat quality is located in areas where agricultural production is concentrated: the landscape regions of Rietumzemgale, Austrumkursa, and Rietumkursa. Also in the landscape region of Vidzemes augstiene the habitat quality is low, which could be explained by the unfavourable terrain for crop production.

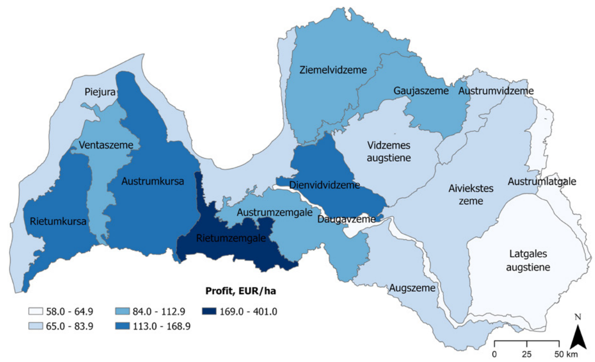

Fig. 3. Profit from agriculture and forestry per 100 ha of total land area in Latvia in 2021. Black lines indicate the boarders of landscape regions [created by authors]

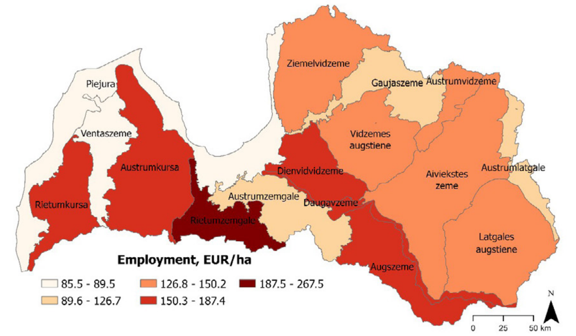

Fig. 4. Geographical distribution of people employed in agriculture and forestry per 100 ha of total land area in Latvia in 2021. Black lines indicate the boarders of landscape regions [created by authors]

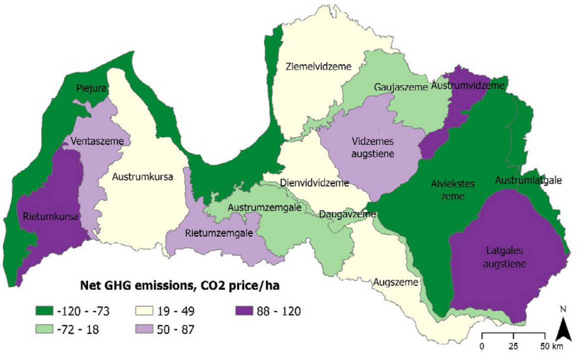

Fig. 5. GHG emissions and carbon stocks in agriculture and forestry per 100 ha of total land area in Latvia in 2021. Black lines indicate the boarders of landscape regionsboarders of landscape regions [created by authors]

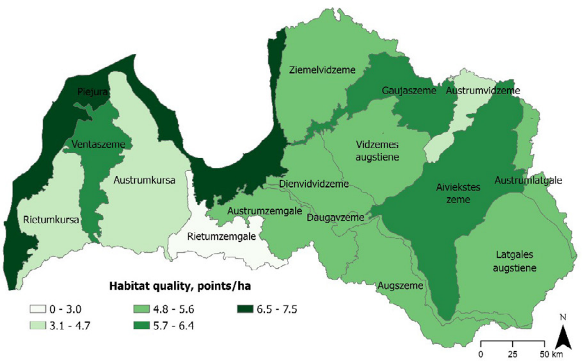

Fig. 6. Habitat quality points per 100 ha of total land area in Latvia in 2021. Black lines indicate the boarders of landscape regions [created by authors]

Table 2. Overview of the clusters

Clus-ter	Profit, EUR/ha	Employment, EUR/ha	Net GHG emissions, CO2 price/ha	Habitat quality, points/ha
1	401.0	304.9	77.1	61.7
2	130.8	181.5	43.0	100.5
3	80.2	161.1	62.2	110.8
4	72.9	137.3	-93.1	126.0

Cluster analysis of landscape regions

Cluster analysis shows that landscape specialization has already occurred due to differences in topography and historical anthropogenic impacts (Table 2).

The cluster 1 represents landscape region with high socioeconomic return, high emissions and low habitat quality, and can be considered to be specialized in bioeconomy production. The cluster 2 combines landscape regions with average indicators of land functions, compared to the other clusters, so it can be considered that this cluster represents the average

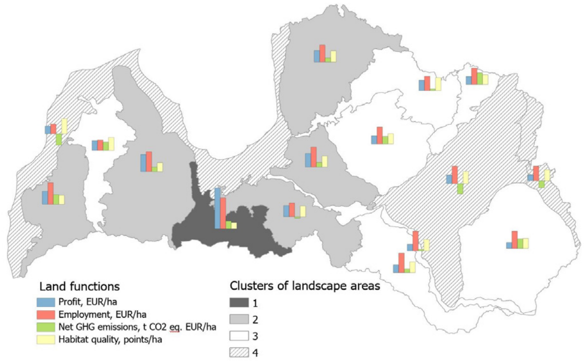

Fig. 7. Suite of land function for clusters of landscape regions [created by authors]

situation in Latvia and has no pronounced specialization. The cluster 3 shows both high emissions and high potential of habitat quality, but low profit, so this cluster is important from a habitat quality potential perspective. The cluster 4 represents landscape regions with the lowest profit and employment indicators comparing to other clusters, but these landscape regions are specialized in carbon sequestration, and also show the highest average indicator for habitat quality.

Discussion

Already decades ago, a debate was started in forestry, that land use specialization is needed to concentrate timber production in the most relevant areas, and ensure recreational and biodiversity functions of [19]. Simulations of different scenarios representing the demands for carbon storage and biodiversity protection show greater intensification and less expansion of agricultural land [20] which in turn raises concerns about ecological state of agricultural land. This study shows that intensification of agricultural land is occurred in cluster 1, and further consideration is needed to limit the extra intensification and protect the typical landscape of rural areas (Figure 8). To deliver higher local ecosystem services to society, [21] recommends a holistic approach to landscape planning, where the landscape consists of some protected areas, a mosaic of optimised smallholder agricultural systems, and a bufferzone in between.

Significant changes in land management due to the political decisions may significantly change the typical landscape in rural areas, but these changes do not mean that it is the most efficient way to reach socio-economic and environmental objectives at national level. Most often the changes in typical landscape is related to economic and social considerations. For instance, family decides to move to the city because of the lack of necessary infrastructure in rural areas and as a result the land abandonment may occur [3].

Clusters with the highest socio-economic return are located closest to the capital city, which on the one hand is explained by the fact that it is easier to reach the market, as 30% of the population in Latvia lives in the Riga region, but on the other hand it has also been affected by natural processes, because the large part of the fertile agricultural land is located close to the Riga region. Which means that we may concentrate carbon sequestration measures more in the landscapes that are geographically farthest from the capital city, but then we would further encourage the abandonment of rural areas and the disappearance of typical landscapes. Therefore, the political decisions related to land use change should be adapted to the specific landscape, so that not only socio-economic and environmental objectives are achieved together with the fulfilment of international obligations, but also the typical landscape of the specific landscape region is preserved. Table 1 already shows that the land use changes and land abandonment are found in several landscape regions, as a result of which biologically valuable grasslands have overgrown. Typical landscapes are not only an aesthetic pleasure for local residents and tourists, but these landscapes have also created specific conditions for the development of biodiversity and economic activities for decades.

Conclusions

Due to ambitious land use related political objectives, many policy makers are primarily focused on achieving objectives such as financially sustainable and profitable production of bioresources (agricultural and forest products), increasing job opportunities in rural areas, reducing net GHG emissions, and giving more attention to biodiversity. However, given the ambitious nature of these objectives and the lack of the solutions on how to simultaneously address these conflicting objectives, there is limited discussion on how these efforts might reshape the typical landscape.

The importance of the typical landscape is not only from aesthetical point of view, but understanding of typical landscapes may help to reach the political objectives. The reason why the landscapes are as they are today are based not only in geography, but also economics behind the current land use. In this research we concluded, that there are differences in the societal benefits what different landscapes provide and this should be used in policy making process developing smart specialization. National and regional goals are directly related to the ability of the given landscape to achieve these targets, so they should be linked to the specifics of the given landscape. Nevertheless considering the differences of landscape regions, it may be reasonable to establish differentiation of ambitious targets to the clusters of landscape regions which are best suited for particular objective.

Acknowledgements

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Kopsavilkums

Ainavām ir nozīmīga loma reģionālajā attīstībā, nodrošinot ekosistēmu pakalpojumus vietējām kopienām, tāpēc šī pētījuma mērķis ir izpētīt, kā izmantot ainavu atšķirības, lai veicinātu valsts sociālekonomisko un vides mērķu sasniegšanu, vienlaikus būtiski neizmainot tipisko ainavu. Pētījumā ir izmantota klāsteru analīze, lai identificētu ainavzemju grupas ar līdzīgu sociālekonomisko ietekmi un vides rādītājiem, piemēram, peļņu, nodarbinātību, neto SEG emisijas un biotopu kvalitāti. Rezultāti parāda, ka, pielāgojot politiskos lēmumus, kas saistīti ar zemes lietojuma veidu maiņu, konkrētajai ainavai, ne tikai palīdzēs sasniegt sociālekonomiskos un vides mērķus, bet arī saglabāt konkrētajam reģionam raksturīgo ainavu.