

Landscape changes in the Dovinė river basin after restoration of Independence

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Landscape changes in the Dovinė river basin after the restoration of Independence are analysed. The main factors that caused landscape changes in the Dovinė river basin as well as in other rural areas of Lithuania in 1990–2003 were the restitution of private land property and the poor social, demographic and economic situation. Restitution of private land property and liquidation of collective farms (“kolkhozes”) increased land cover fragmentation and landscape diversity. The domination of small farms, lack of support and the poor social, demographic and economic situation determined deintensification of agriculture and such typical land use changes as expansion of grasslands, decrease of cultivated land as well as abandonment and afforestation of agricultural land. After 2003; the EU agri-environmental schemes have become the most significant driving forces. Afforestation of valuable agricultural habitats, eutrophication of water bodies, transformation of former collective farms and technical infrastructure are significant environmental and landscape management problems closely related with landscape changes.

Key words: rural landscape, landscape changes

INTRODUCTION

The Dovine river basin covers an area of approximately 589 km² and is located in the south-western part of Lithuania. This relatively small river basin is outstanding in terms of landscape diversity (there are many landscape types of Lithuania presented), natural values and scientific interest. Therefore, the Dovinė river basin has a very long history of investigations, large protected areas (approximately 40%) and can be successfully used as a pilot area for evaluation of Lithuanian rural landscape development.

The northern and central parts of the Dovinė river basin are composed of large wetland complexes surrounded by productive agricultural plains with relatively homogeneous landscapes, while the southern part of the basin is located in hilly morainic uplands with particularly mosaic landscapes. All these areas are connected by a network of rivers and water bodies formed by five big lakes (Dusia, Žuvintas, Simnas, Giluitis, Amalvas) and a number of rivulets and small lakes.

There are no clear data about land use or land cover changes in the Dovinė river basin area after the restoration of Independence. In the year 1985, cultivated land occupied approximately 42.6%, gardens 0.9%, pastures and meadows 20.2%, forests and scrubs 10.3%, peat bogs and marshes 11.8%, water bodies 7.9%, built-up areas 3.7%, other land 2.6% of the Dovinė river basin area (Милюс et al., 1993). According to GIS evaluation of aerial photos, in 2003 cultivated land covered 46%, gardens 0.5%, perennial pastures and meadows 15.6%, forests and scrubs 19.6%, peat bogs and marshes 8%, water bodies 7.6%, built-up areas 2.6%. Because these data were gathered using different

methods and data sources, it is difficult to compare them. Therefore special investigation was performed to assess landscape changes in this particular area.

MATERIALS AND METHODS

For detection of land cover changes in the Dovinė river basin area, various available cartographical materials of different periods were used: Soviet military topographical maps (showing the situation of 1983–1985, scale 1 : 10 000), aerial photos (made in 1976–1977, scale 1 : 20 000), land use plans (showing the situation of 1990, scale 1 : 10 000) and aerial photos (black and white aerial photos from 1996 and multi-coloured aerial photos from 2003, both at a scale 1 : 10 000). ESRI ArcGis software was used for analysis and comparison of these data and for detection of land cover changes.

For a detailed detection of land cover changes at a scale 1 : 10 000, three pilot areas in different parts of the Dovinė river basin were chosen: in the surroundings of Daukšiai, Simnas and Šventėžeris. Each of them covers 25 km² (i. e. as much as of one aerial photo). The chosen pilot areas represent the main landscape types of the Dovinė river basin.

The Daukšiai pilot area is situated in the northern part of the Dovinė river basin and represents landscapes of morainic ridges and marshy lowlands. The Simnas pilot area is situated in the central part of the basin and represents a landscape of clayey morainic plains. The Šventėžeris pilot area is situated in the southern part of the basin and represents a landscape of hilly morainic uplands.

Detection of land cover changes was subdivided into two periods taking into consideration the features of available data sources: from the end of Soviet occupation to 1996

(based on a comparison of military topographic maps and land use plans with aerial photos from 1996) and from 1996 to 2003 (based on a comparison of aerial photos).

Also, the gathered results were compared with data from CORINE Land Cover projects (1995 and 2000, scale 1 : 100 000).

Analysis of Lake Žuvintas overgrowth was based on aerial photos from 1977, 1996 and 2003. The overgrown and not overgrown areas were digitized from those data sources, calculated and compared.

The influence of EU support and agricultural policy on landscape changes in the Dovinė river basin was explored by analysing of statistical data of declared agricultural landed properties and crop areas in the period from 2004 to 2006, provided by the Agri-Information and Rural Business Centre.

RESULTS

The main factors that influenced landscape development in the Dovinė river basin as well as in other rural areas of Lithuania in 1990–2003 were the restitution of private land property and the poor social, demographic and economic situation. The restitution of private land property and liquidation of collective farms (“kolkhozes”) increased land cover fragmentation and landscape diversity. The domination of small farms, lack of support and the poor social, demographic and economic situation determined deintensification of agriculture and such land use changes as expansion of grasslands, decrease of cultivated land as well as abandonment and afforestation of agricultural land. After 2003, EU agri-environmental schemes have become the most significant driving forces.

Analysis of pilot areas shows quite big land cover changes during both periods (11.2% in 1990–1996 and 11.4% in 1996–2003). However, due to the high fragmentation of land property most of the detected change areas are quite small (Table 1), especially in the hilly southern part of the river basin. As expected, most of detected

changes are transformations of the two agricultural land cover classes: cultivated land and grasslands (Table 2). Expansion of grasslands and decreasing cultivated land areas are a general trend not only in the Dovinė river basin, but also in the whole Lithuanian countryside (Česnulevičius et al., 2005).

The increase of built-up areas was more significant in 1990–1996 (20 new sites with a total area of 15 ha were detected in the pilot areas analysed). Establishment of new homesteads during this period (Table 3) was caused by restoration of private farms and demand of better living conditions in compact settlements (general intention to move from Soviet low quality blocks of flats to new houses). It should be noted that in the early years of the Independence, living conditions in the countryside were better than in cities because of the collapse of Soviet industry. Due to this fact as well as to the restoration of private farms, migration of urban population to the countryside was quite significant in this period. Furthermore, in this borderline area there were good possibilities for business (often illegal), and incomes from different kinds of business also influenced establishment of new homesteads.

In 1996–2003, the situation changed essentially. The economic and social conditions in rural areas declined, while the main cities developed rapidly. Therefore, in this period rural population started to decrease, and the development of built-up areas was very slow. Moreover, part of old homesteads, especially in the less favourable southern part of the Dovinė river basin, were abandoned due to the death of their old-aged owners, and some of them decayed (Table 3). Even in areas with a high recreational potential in the southern part of the Dovinė river basin (e. g., Dusia lakeside), building of new homesteads was not very significant because of the peripheral situation of this territory (a relatively long distance from main cities) and the impact of protected areas (Lake Dusia with surroundings belongs to the Meteliai Regional Park). This feature differentiates the Dovine river basin from subur-

Table 1. Distribution of detected changed areas by size

Size of changed areas	1990–1996				1996–2003			
	Number		Area		Number		Area	
	Total	%	Total, ha	%	Total	%	Total, ha	%
<0.5 ha	130	31.1	40	4.8	313	46.4	88.2	10.3
0.5–1.0 ha	95	22.7	68.2	8.1	159	23.6	114.4	13.4
1.0–2.0 ha	86	20.6	120.5	14.4	111	16.4	153.2	18
>2.0 ha	107	25.6	608.5	72.7	92	13.6	497.6	58.3

Table 2. Land cover changes in the Dovinė river basin (based on 3 pilot areas with total area of 7500 ha)

Changes	1990–1996				1996–2003			
	Number	Area			Number	Area		
		Total, ha	Mean, ha	Rate, %		Total, ha	Mean, ha	Rate, %
From cultivated land into grasslands	237	578.5	2.4	69.1	337	415.1	1.2	48.6
From grasslands into cultivated land	112	156.7	1.4	18.7	275	375.6	1.4	44
Other changes	69	102.1	1.5	12.2	63	62.6	1.0	7.3
Total	418	837.2	2.0	100	675	853.3	1,3	100

Table 3. Development of homesteads in Dovinė river basin

Changes	1990–1996			1996–2003		
	1	2	3	1	2	3
New homesteads	90	53	37	10	3	7
Disappeared homesteads	–	–	–	8	3	5

1 –total, 2 – homesteads located in compact settlements, 3 – single homesteads.

Table 4. Changes of the Dovinė river basin CORINE land cover in 1995–2000 according to data of Lithuanian CLC projects

(Lietuvos CORINE žemės dangos 1995–2000 m. pokyčių duomenų bazė © Aplinkos apsaugos agentūra)

Changes	Number	Area	
		Total, ha	%
Forest cuttings	16	312.9	35.9
Transformation of grass-lands into cultivated land	12	513.8	59
Transformation of cultivated land into grasslands	1	44.2	5.1
Total	29	870.9	100

ban rural areas where the residential and recreational development in the last few years is extremely rapid.

A very significant trend of rural landscape development in the Dovinė river basin, as well in whole Lithuania, is abandonment and afforestation of less favourable agricultural land, especially semi-natural meadows, grasslands and open bogs. A lot of drained areas become less favourable for agriculture due to abandonment of land-amelioration systems.

The forest area in Lithuania after the restoration of Independence expanded from 30 to 32.5%. Such a significant increase is caused mainly by spontaneous overgrowth of abandoned agricultural land with forest. In the last few years, support from national government and the EU for afforestation of unfavourable agricultural areas is also very important.

Analysis of land cover changes in the pilot areas also shows expansion of forest, especially in 1996–2003 (48 afforested sites with the total area of 50.6 ha were detected in the pilot areas analysed during this period). Most of new forests are located in areas with less favourable conditions for agriculture, such as landscapes of hilly morainic uplands, river valleys and drained peatlands. Because of the high fragmentation of land property, areas of new forests usually are quite small.

Comparison with the data of CORINE Land Cover projects (Table 4) clearly shows that the spatial accuracy (1 : 100 000) and land cover classification used for these projects are not sufficient for Lithuanian conditions due to the high diversity and fragmentation of Lithuanian rural landscapes. In 1995–2000, only 871 ha (1.5% of total river basin area) of land cover changes were detected, all of them in less mosaic central and northern parts of the river basin. Moreover, the detected changes don't highlight the main trends of landscape development.

One of the most actual questions is the influence of EU support on landscape changes in Lithuania, but because of a short period of membership it is difficult to

Table 5. Changes of declared agricultural landed properties and crop areas in proportion to total agricultural area (%) in local communities completely or partly located in the Dovinė river basin area

(data provided by Agri-Information and Rural Business Centre)

Local community	In 2004	In 2006	Change
Gudeliai	83.1	86.3	3.1
Igliauka	80.0	83.2	3.2
Krosna	72.2	86.1	13.9
Liudvinavas	65.4	86.2	20.9
Marijampolė	75.8	86.5	10.7
Naujoji Ūta	80.6	80	-0.6
Seirijai	57.7	62.5	4.8
Simnas	79.1	80.8	1.7
Šėstokai	61.3	72.9	11.6
Šilavotas	75.7	84.5	8.8
Šventežeris	65.1	71	6.1
Teizai	65.9	68.5	2.6
In total	72	79.6	7.6

make clear conclusions. The amount of declared agricultural landed properties and crop areas for direct payments increases year by year (Table 5). It should be noted that the percentage of declared agricultural landed properties and crop areas in proportion to total agricultural area is much higher in communities with more favourable conditions for agriculture (communities with a rate higher than 80% in 2006). At the same time, the amount of declarations decreased from 10377 in 2004 to 9614 in 2006. All these figures show tendencies of intensification of agriculture and consolidation of farms as well as differences in the intensity of agriculture in several parts of the river basin depending on natural conditions.

There is also special support available for early retirement, less favourable areas and areas with environmental restrictions, agri-environmental measures (e. g., keeping of natural meadows and open peatlands), afforestation of unfavourable agricultural land, restructurisation of semi-subsistence farms and other activities through the national Rural Development Programme (Ministry..., 2006). Therefore, we can expect intensification of agriculture, consolidation of farms and a decrease of abandoned areas as well as preservation of valuable habitats and landscapes, improvement of the environment, quality of life and diversification of rural economy in the near future.

A significant environmental problem closely related with landscape changes is eutrophication of water bodies, especially Lake Žuvintas. Analysis of aerial photos (1977, 1996 and 2003) shows a rapid development and even acceleration of this negative process: the area of open water surface in Lake Žuvintas decreased by 47.4 ha (from 734.2 to 686.8 ha, 6.9%) in 1977–1996, while in

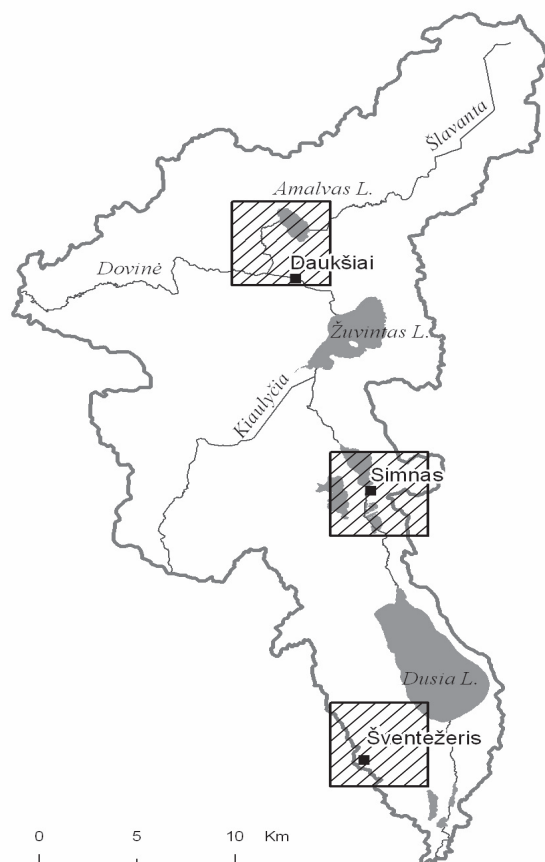


Figure. Pilot areas chosen for evaluation of landscape changes in the Dovinė river basin

1996–2003 the decrease of open water surface reached 73.4 ha (from 686.8 to 613.4 ha, 12%) despite the relative deintensification of agriculture. Anthropogenic impact on the eutrophication of Lake Žuvintas is well described by R. Linkevičienė, J. Taminskas and R. Šimanauskienė (Linkevičienė et al., 2006).

Similar trends were detected also in other biggest lakes of the Dovinė river basin. Notably, eutrophication of water bodies reduces the recreational potential, water quality and conditions for biodiversity.

Another more significant environmental problem is afforestation of open raised bogs, predominantly in Žuvintas and Amalvas peatlands. Afforestation of these very valuable natural habitats continues from the Soviet period and is caused predominantly by land reclamation. Some special investigations also indicate the influence of climate changes (lack of rainfall in summer) on this process (Zingstra, 2006).

Transformation of the former collective farms and technical infrastructure is also a very actual environmental problem. At the end of Soviet occupation, there were 76 such objects in the Dovinė river basin area. Only 19 of them are completely applied for new purposes, 26 – partly applied, and 4 – completely liquidated, while 27 are in ruins. The situation is similar also in the whole countryside of Lithuania. The remains of Soviet collective farms are sources of pollution and considerably reduce the aesthetic value of rural landscapes.

DISCUSSION

The detected land cover changes indicate a tendency of partial renaturalisation of rural landscapes in Lithuania after the restoration of Independence. Similar changes and trends may be observed also in the other Baltic countries (Mander and Kuuba, 2004; Nikodemus et al., 2005). Increase of land cover fragmentation and landscape diversity, decline of land-amelioration systems as well as transformation of cultivated land into grasslands are positive changes in landscape ecology, while abandonment of agricultural land and spontaneous afforestation should be qualified as negative. Marginalisation and abandonment of agricultural land is considered as a very significant problem across the whole Europe (Brouwer et al., 1995).

Without doubt the forest area in the Dovinė river basin, as well as in the whole Lithuania, will continue increasing in the future due to EU and national government support as well as land abandonment in less favourable areas. Although the increase of forest area could be qualified as renaturalisation of landscape, it should be noted that abandonment and afforestation of agricultural land often cause loss of some particularly valuable habitats (e.g., natural grasslands and meadows, glades and open bogs) as well as simplification of landscape structure, decrease of landscape diversity and aesthetic value. Therefore, afforestation should be closely controlled, especially in protected areas.

EU and national agri-environment support schemes strongly influence rural landscape development across Europe. However, recent studies highlight the gaps between centrally defined policies and awareness and management practices at local level (Pinto-Correia et al., 2006). Moreover, there is still poor understanding of land owners' decision-making in a policy context. These gaps decline the effectiveness of current landscape management policies. Considering that the human factor plays the main role in the rural landscape development (Nikodemus et al., 2005), a lot of recent landscape studies are focused on relations between EU and national policies, land owner's decision-making and landscape development (Latruffe, Davidova, 2006; Prestholm et al., 2006; Primdahl, 1999; Primdahl et al., 2004).

Although EU support is very helpful for rural development in Lithuania, the applied measures of Rural Development Programme are not effective enough in terms of landscape management, mainly due to unpreparedness of authorities and land owners as well as the lack of a clear landscape policy. It should be noted that high dependence on EU support is very dangerous for weak Lithuanian farmers. After 2007–2013, support for agriculture will likely reduce in the whole EU, and these changes will definitely be a huge stress for the Lithuanian rural sector. Unfortunately, there is no clear plan how to deal with this situation.

Looking to the future, there are three possible ways of the further development of peripheral rural landscapes in Lithuania, depending on natural conditions: (1) formation of homogeneous high-productive agricultural landscapes in fertile plains (e.g., in northern and central parts of the Dovinė river basin), (2) development of recreational land-

scapes in areas with a high recreational potential (e. g., Lake Dusia surroundings) and (3) marginalisation of agricultural land (including afforestation and abandonment) in less favourable areas, conserving some structures and elements of traditional mosaic landscapes of extensive use which are especially valuable for biodiversity. Development and effective work of protected areas and implementation of special management measures are essential for the protection of valuable landscapes and habitats. It is expected that due to processes of intensification and marginalisation a lot of old farmsteads will disappear, while most of rural population will concentrate in compact settlements. In areas with a high recreational potential, establishment of new homesteads and cottages is likely to take place.

The gathered experience clearly shows that for assessment of land cover changes in Lithuania, an accurate and detailed evaluation is necessary because of the high diversity and fragmentation of landscapes, especially in hilly morainic uplands and river valleys. The Pan-European CORINE Land Cover projects are not effective in Lithuania due to the insufficient spatial accuracy and land cover classification.

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KRAŠTOVAIZDŽIO POKYČIAI DOVINĖS UPĖS BASEINE ATKŪRUS NEPRIKLAUSOMYBĖ

Santrauka

Pagrindiniai veiksniai, lėmę kraštovaizdžio pokyčius Dovinės upės baseine, kaip ir kitose šalies kaimo vietovėse 1990–2003 m., buvo: (1) privačios žemėvaldos atkūrimas ir (2) bloga socialinė, demografinė ir ekonominė padėtis. Privačios žemėvaldos atkūrimas turėjo įtakos ženkliam žemės dangos mozaikiškumo ir kraštovaizdžio įvairovės padidėjimui. Vyraujantys smulkūs ūkiai, paramos stoka bei bloga socialinė, demografinė ir ekonominė padėtis lėmė žemės ūkio intensyvumo sumažėjimą bei tokius būdingus žemėnaudos pokyčius kaip: pievų ir ganyklų ploto didėjimas, dirbamos žemės ploto sumažėjimas, žemės ūkio naudmenų apleidimas ir užaugimas arba užsodinimas mišku. Nuo 2003 m., įstojus į Europos Sąjungą, ES parama ir vykdoma politika tapo viena svarbiausių kaimiškojo kraštovaizdžio kaitą lemiančių jėgų, kurių poveikis visų pirma pasireiškia žemės ūkio intensyvėjimu ir apleistų naudmenų ploto mažėjimu. Atlikto tyrimo rezultatai taip pat atkreipia dėmesį į nepakankamą Lietuvoje atliekamo Corine Land Cover žemės dangos pokyčių įvertinimo tikslumą bei ekologiniu ir kraštotvarkos požiūriu aktualias problemas, glaudžiai susijusias su kraštovaizdžio kaita: vertingų atvirų buveinių (natūralių pievų ir ganyklų, atvirų pelkių) užaugimą mišku, vandens telkinių eutrofikaciją, buvusių kolektyvinių fermų, technikos kiemų bei melioracijos stočių pritaikymą ir sutvarkymą. Būtina pabrėžti, kad Dovinės upės baseino teritorijoje nustatytos kraštovaizdžio kaitos tendencijos yra būdingos visoms periferinėms šalies kaimo vietovėms.

Raktažodžiai: kaimiškasis kraštovaizdis, kraštovaizdžio kaita