ECOLOGICAL FARMING IN AUKŠTADVARIS AND KREKENAVA REGIONAL PARKS

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Abstract
Ecological farming is relevant to protected areas. The aim of the study is to perform an analysis of farms applying organic farming measures as well as the analysis of the change of their areas in Aukštadvaris and Krekenava regional parks (RP).

Introduction
Ecological or environmental farming is a conservation measure that protects the environment and a perspective farming branch, supported by the European Union. European Union’s Common Agricultural Policy is oriented to the organic farming, which provides environmental and social-economical benefits.

Organic farming is a form of agriculture that relies on techniques such as crop rotation, green manure, compost, and biological pest control. Depending on whose definition is used, organic farming uses fertilizers and pesticides (which include herbicides, insecticides and fungicides) if they are considered natural (such as bone meal from animals or pyrethrin from flowers), but it excludes or strictly limits the use of synthetic petrochemical fertilizers and pesticides; plant growth regulators such as hormones; livestock antibiotics; genetically modified organisms (Directorate, 2013); human sewage sludge; and nanomaterials (Paull, 2011).

Organic farming is important because conventional agriculture - which involves high-yielding plants, mechanized tillage, synthetic fertilizers and biocides - is so detrimental to the environment. For instance, fertilizer runoff from conventional agriculture is the chief culprit in creating dead zones–low oxygen areas where marine life cannot survive. Proponents of organic farming argue that conventional farming also causes soil erosion, greenhouse gas emission, increased pest resistance and loss of biodiversity (Grandi, 2010; Triantafyllidis, 2010). The aims of organic farming are to protect: the environment, by using organic management practices that do not have the adverse effects of conventional practices, and the health of consumers, by the provision of organic products (Argyropoulos et al., 2013).

One of the reasons determining an increasing number of organic farms is the EU’s state support. From support measures (direct and compensatory payments), allocated to organic farms, the greatest impact have benefits for the certified area used for organic farming and food production (Kazakevičius, 2010).

Some of the reasons affecting the increase of organic farms across Europe have been increasing since 1990. The growing demand for organic products has accelerated the growth of organic farming in Europe, and the development of organic farms is determined by the financial support from the EU funds.

Protected areas are considered to be an important instrument ensuring general ecological balance of the countryside in the presence of intensive farming.

The intensification and expansion of modern agriculture is amongst the greatest current threats to worldwide biodiversity (Hole et al., 2005). The object of the investigation – the farms of Aukštadvaris and Krekenava regional parks.
The aim of the investigation is to perform analysis of farms applying organic farming principles as well as the analysis of the change of their areas in Aukštadvaris and Krekenava regional parks (RP).

Tasks of the investigation:
1. To characterize Aukštadvaris RP and Krekenava RP.
2. To analyze the numbers and the declared areas of the farms applying organic farming methods in Aukštadvaris RP and Krekenava RP.
3. To perform the comparison analysis with the Regional Parks and subdistricts, situated outside the territory of the parks.

Materials and Methods
Comparative, analytical as well as statistical and logical analysis methods were used during the investigation.

The study was carried out to determine how many farms, forming regional parks' territory, apply organic farming measures. The change of the above-mentioned farms area for 2009-2011 was analyzed as well. Paluknys and Naujamiestis subdistricts, not incorporated into the territory of regional parks, were chosen for the comparison analysis.

The analysis of the agricultural lands in Aukštadvaris regional park and Paluknys, Naujamiestis subdistricts was carried out following the data of the Agriculture information and rural business center on the declared areas of agricultural lands.

Results and Discussion
Analysis of the current situation in Aukštadvaris and Krekenava regional parks

Nowadays the protected areas occupy some 10 percent of the Earth’s surface, in a landscape dominated by the agricultural sector. Even within certain protected area categories, much land is used for agriculture (i.e. 30 percent of categories V and VI). More importantly, connecting areas between protected areas run through croplands, pastures and forests - which globally occupy over 60 percent of the Earth’s surface. Clearly, relationships with the inhabitants of these areas are fundamental to their management (Grandi, 2010; Triantafyllidis, 2010).

The national network of protected areas in Lithuania covers 1,021,471.16 ha and makes 15.64 per cent of the total area of the country (Saugomų, 2012). The regional parks in Lithuania cover 449,363.59 ha and make 44 per cent of the total area of the protected areas and 6.88 per cent of the country. There are 30 regional parks in Lithuania (Overview, 2013).

Aukštadvaris regional park is situated in southeastern Lithuania, in the most remarkable part of the Dzūkai upland. Almost entire territory is situated in the Trakai district. Only a small northwestern part belongs to the Prienai and Kaišiadorys districts. The area of the regional park covers 17,032.43 ha, in which Mergiškiai nature reserve (covering the area of 157 ha) is situated. There are 15 reserves in Aukštadvaris regional park.

27 territories correspond to the criteria of the habitats of European importance (Ivavičiūtė, 2011).

The largest area is occupied by the functional priority zone – the territory of reserves covering 61.95 per cent of the whole park’s territory, and the ecological protection priority zone, covering 23.09 per cent of the whole park’s territory (Table 1).

The agricultural lands in Aukštadvaris RP make up 38.09 per cent of the whole park’s territory (Aukštadvario, 2013) (Table 2).

Agricultural land productivity (quality) score describes agricultural conditions best of all. The average efficiency of the agricultural lands in Trakai district is 33.4 scores, i.e. is lower than the average point of Lithuania (39.1).

![Figure 1. Proportion of protected areas by types (Proportion, 2013).](image-url)
The areas of the functional priority zones of Aukštadvaris regional park

<table>
<thead>
<tr>
<th>Number</th>
<th>The name of the functional priority zone</th>
<th>Area, ha</th>
<th>Percent from the RP area</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Conservation priority zone - reserve</td>
<td>156.39</td>
<td>0.92</td>
</tr>
<tr>
<td>2</td>
<td>Conservation priority zone - parks</td>
<td>10,551.10</td>
<td>61.95</td>
</tr>
<tr>
<td>3</td>
<td>Ecological protection priority zone</td>
<td>3,932.69</td>
<td>23.09</td>
</tr>
<tr>
<td>4</td>
<td>Recreational priority zone</td>
<td>1,474.29</td>
<td>8.66</td>
</tr>
<tr>
<td>5</td>
<td>Economic priority zone</td>
<td>692.64</td>
<td>4.06</td>
</tr>
<tr>
<td>6</td>
<td>The living zone</td>
<td>225.32</td>
<td>1.32</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td></td>
<td><strong>17,032.43</strong></td>
<td><strong>100</strong></td>
</tr>
<tr>
<td></td>
<td>The area of the buffer protection zones</td>
<td>6,839.62</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total area</strong></td>
<td></td>
<td><strong>23,872.05</strong></td>
<td>-</td>
</tr>
</tbody>
</table>

Table 2

Distribution of agricultural lands in Aukštadvaris RP

<table>
<thead>
<tr>
<th>Number</th>
<th>Agricultural lands</th>
<th>Area, ha</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Agricultural lands</td>
<td>6,487.27</td>
<td>38.09</td>
</tr>
<tr>
<td>2</td>
<td>Forest area</td>
<td>8,707.36</td>
<td>51.12</td>
</tr>
<tr>
<td>3</td>
<td>Water bodies</td>
<td>1,299.30</td>
<td>7.63</td>
</tr>
<tr>
<td>4</td>
<td>Swamps</td>
<td>94.00</td>
<td>0.55</td>
</tr>
<tr>
<td>5</td>
<td>Other</td>
<td>6.04</td>
<td>0.04</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td></td>
<td><strong>17,032.43</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Aukštadvaris RP is located in jauric areas in which, although less dominated by soils affected by jauric processes, the averagely podzolized soils share a considerable part of them. From the agricultural point of view, these are soils of lower productivity with significantly lower conventional crop yields. These farmland soils, usually of a lighter granulometric composition, are distinguished by light vulnerability of agro-ecosystems as well as by sensitivity to the use of various agrochemicals - modern intensive farming measures.

Thus, the presence of protected areas in them is very logical, because one of the objectives of the establishment of regional parks is the promotion of organic farming. A variety of recommendations on how to farm in unfertile areas, indicating that the most rationally is to plant forest plantations, to develop non-traditional businesses, rural tourism and others, are prepared (Marcinkonienė et al., 2010).

Paluknys subdistrict, situated outside the territory of Aukštadvaris RP, was chosen to perform the comparative analysis. Paluknys subdistrict, situated in the southeastern part of the Trakai district, was chosen for the comparison of the use of agricultural lands in Aukštadvaris regional park. The territory covers the area of approximately 14 thousand ha. A part of the inhabitants upholds the traditional agriculture.

The average efficiency of the agricultural lands in Paluknys subdistrict is 31.8 points.

Characterization of Krekenava Regional Park

Almost entire park’s territory is situated in the Panevėžys district municipality of Panevėžys County,

The areas of the functional priority zones of Krekenava regional park

<table>
<thead>
<tr>
<th>Number</th>
<th>The name of the functional priority zone</th>
<th>Area, ha</th>
<th>Percent from the RP area</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Conservation priority zone - reserve</td>
<td>4,089.9</td>
<td>35.3</td>
</tr>
<tr>
<td>2</td>
<td>Ecological protection priority zone</td>
<td>538.6</td>
<td>4.6</td>
</tr>
<tr>
<td>4</td>
<td>Recreational priority zone</td>
<td>266.7</td>
<td>2.3</td>
</tr>
<tr>
<td>5</td>
<td>Economic priority zone</td>
<td>6,582.2</td>
<td>56.8</td>
</tr>
<tr>
<td>6</td>
<td>The living zone</td>
<td>112.3</td>
<td>1.0</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td></td>
<td><strong>11,589.7</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
only the south-western edge marginally intervenes into the Kėdainiai district municipality of Kaunas County.

Krekenava Regional Park was founded on September 24, 1992 following the decision “Concerning the establishment of regional parks and reserves” to preserve the landscape of Nevėžis river valley, its natural ecosystem and cultural heritage treasures, to look after them and use rationally (Ivavičiūtė, 2011).

The largest area of Krekenava RP is occupied by the functional priority zone – Economic priority zone 56.8 percent of the whole park’s territory.

The ecological protection priority zone covers 4.6 percent of the whole park’s territory (Table 3).

Agricultural farming lands make up 33.0 percent of the Krekenava Regional Park’s territory (Raudonytė, 2009) (Fig. 2).

The average productivity of soils of agricultural farming lands in the Panevėžys district municipality is 47.5 scores. The average productivity of the agricultural farming lands situated in the park is higher than 45 scores.

The Naujamiestis subdistrict was chosen for the comparison of the use of agricultural lands and ecological farming in Naujamiestis and regional park. The territory covers the area of approximately 15.6 thousand ha. There are 66 villages in the subdistrict, 4 agricultural companies and agricultural cooperatives (Naujamiesčio, 2013).

The average efficiency of the agricultural lands in Naujamiestis subdistrict is 50.6 scores.

Thus, for the fulfillment of analysis the following regional parks, situated in different regions of Lithuania, were chosen: Aukštadvaris RP in eastern Lithuania, Krekenava RP – in central Lithuania.

In the aforementioned parks the land productivity is also different: in Aukštadvaris RP the land productivity is below 35 scores (Paluknys subdistrict - 31.8 scores), while the soils of Krekenava RP are much more efficient (in Panevezys district - 47.5, in Naujamiestis subdistrict - 50.6).

Having performed the analysis of the distribution of land use in parks, it was found that agricultural land in Aukštadvaris RP makes up 38.09 per cent, in Krekenava RP – 33 per cent of the parks’ land area.

Ecological farming in Aukštadvaris and Krekenava regional parks

The performed comparative analysis of the declared farm areas in Aukštadvaris RP shows that the total farm area decreased by 1,058.13 ha (Fig. 3) and the number of those declaring their farms decreased by 142 farms.
In 2009, the total area of declared farms made up 24.81 per cent of the total Aukštadvaris RP area, in 2010 – 23.45 per cent, in 2011 – 18.16 per cent. The number and area of farms applying organic farming measures increased each year. In 2009, these measures were applied by 3.47 per cent of the declared farmers in the 410.94 ha area, and it made up 9.72 per cent of the total area declared and only 6.33 per cent from RP's agricultural land area. In 2011, 6.61 per cent of farmers applied organic farming measures in the area of 598.3 ha (18.89 per cent of the total area declared and 22.9 per cent from the RP's agricultural area). So, the number of organic farms increased by 1.5 times in Aukštadvaris RP over the period of 2009 – 2011, and the area has increased by 187.36 ha.

In Paluknys subdistrict, unlike Aukštadvaris RP, the total area declared gradually increased for the period of 2009 – 2011 (Fig. 4), but the number of farms, which have submitted declarations, decreased by 19 farms. Only one farmer applied organic farming measures in the analyzed municipality in 2009 in the area of 11.85 ha. It made up 0.53 per cent of the total area declared.

The number farms applying these methods, rose slightly - by one during one year period, and the area has increased to 66.22 ha and made up 2.59 per cent of the total area declared. So, the number of organic farms in Paluknys subdistrict increased almost 6 times or by 50.37 ha in 2009 – 2011. The number of farms, which submitted declarations, as well as the area declared in Krekenava RP, decreased in 2009-2011. In 2009, 424 farmers submitted declarations and declared the area of 8,502.08 hectares, or 73.36 per cent of the total area of Krekenava RP (Fig. 5). In 2010, the declared area increased by 2.92 hectares, but the number of declared farms decreased by 5 farms. In 2011, 371 farmers declared the area of 8,184.19 hectares, which made up 70.62 of the total area of RP. Thus, during the period of 2009-2011 the number of declared decreased by 317.89 hectares.

Only 4 farmers (0.94 per cent of all who had declared) applied organic farming measures in the area of 58.6 ha in Krekenava regional park in 2009. It made up just 0.69 per cent of the total area declared. In 2010, these methods were applied by 6 farmers in the area of 112.71 ha (1.32 per cent from the total area declared), in 2011 – 7 farmers in the area of 140.29 ha (1.71 per cent).

The analysis of the 2009 – 2011 period showed that the declared areas in Krekenava RP have decreased, and the area of farms applying organic measures has increased by 81.69 hectares (nearly 2.5 times).

In Naujamiestis subdistrict both the declared farm areas and the number of farmers, who had submitted
declarations in 2009 – 2011, decreased. During the above-mentioned period, the number of farmers applying organic farming measures in Naujamiestis subdistrict has increased twice and 12 farms i.e., 3.63 per cent of the declared had organic farms in 2011.

In 2009, the area of 271.12 ha (2.74 per cent of the total area declared), in which organic farming measures were used, was declared in the subdistrict (Fig. 6).

In 2010, the area increased to 646.62 ha (6.56 per cent of the total area declared), in 2011 - up to 852.67 and made up 8.66 per cent. During the period of 2009 – 2011, the analyzed area increased by 581.55 hectares or 3 times.

The analysis of Aukštadvaris RP and the Paluknys subdistrict (which is not incorporated into the park’s territory) as well as Krekenava RP and Naujamiestis subdistrict of 2009-2011 showed that organic farming has been introduced at the number of farms and the area has increased. The percentage calculations revealed that in 2011 the area of farms applying organic farming measures in Aukštadvaris RP made up 18.89 per cent of the total area declared, the number of farms - 6.61 per cent. In Paluknys subdistrict - 2.59 and 1.55 per cent, respectively.

The area of farms using organic farming methods in Krekenava RP was only 1.71 per cent, methods were applied only by 1.89 per cent of all the declared. Meanwhile, the percentage in Naujamiestis subdistrict, which is not incorporated into the area of Krekenava RP, is distributed as follows: 8.66 per cent of the total area declared and 3.65 per cent from the number of farms that submitted declarations. It was thus found that the area of the farms applying organic farming measures in Krekenava regional park is the smallest compared to Naujamiestis subdistrict and Aukštadvaris RP, although one of the activities promoted in Krekenava RP is organic farming.

Organic farming, clearly a viable option in many situations, is still not fully exploited and is not wide spread in protected areas. Organic farming is important because the conventional agriculture - which involves high-yielding plants, mechanized tillage, synthetic fertilizers and biocides - is so detrimental to the environment.

Conclusions
1. The national network of protected areas in Lithuania covers 1,021,471.16 ha and makes 15.64 percent of the total area of the country. The regional parks in Lithuania cover 449,363.59 ha and make 44 percent of the total area of the protected areas and 6.88 percent of the country.
2. The largest area of Aukštadvaris RP is occupied by the functional priority zone – the territory of reserves covering 61.95 percent of the whole park’s territory, and the ecological protection priority zone, covering 23.09 percent of the whole park’s territory.
3. The largest area of Krekenava RP is occupied by the functional priority zone – Economic priority zone 56.8 percent of the whole park’s territory. The ecological protection priority zone covering 4.6 per cent of the whole park’s territory.
4. The number of organic farms increased by 1.5 times in Aukštadvaris RP over the period of 2009 – 2011, and the area has increased by 187.36 ha. The number of organic farms in Paluknys subdistrict increased almost 6 times or by 50.37 ha in 2009 – 2011.
5. The analysis of the 2009-2011 period showed that the declared areas in Krekenava RP have decreased, and the area of farms applying organic measures has increased by 81.69 hectares (nearly 2.5 times). The number of farmers applying organic farming measures in Naujamiestis subdistrict has increased twice and 12 farms i.e., 3.63 per cent of the declared had organic farms in 2011, the analyzed area increased by 581.55 hectares or 3 times.
6. The percentage calculations revealed that in 2011 the area of farms using organic farming methods in Aukštadvaris RP made up 18.89 per cent of the
total area declared, the number of farms - 6.61 per cent. In Paluknys subdistrict - 2.59 and 1.55 per cent, respectively.

7. The area of farms applying organic farming measures in Krekenava RP was only 1.71 per cent, measures were applied only by 1.89 per cent of all the declared. Meanwhile, the percentage in Naujamiestis subdistrict, which is not incorporated into the area of Krekenava RP, is distributed as follows: 8.66 per cent of the total area declared and 3.65 per cent from the number of farms that submitted declarations.

References