



**‘Complementary financing for Environment in the context of
Accession - Innovative sources’**

**National-level analysis
Country: Croatia**



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1 CHARACTERISTICS OF THE CASE STUDY AREA

Overview of biodiversity and agriculture in Croatia

The high biodiversity in Croatia is enhanced by its location in several different climatic, geomorphological and hydrological zones: the Danube floodplain, the Karst limestone zone, the Dinaric Alps and the Mediterranean Coast with its unique islands. There is a huge diversity of ecosystems, land use practices and agriculture schemes, from intensive agriculture in the western part of the country to the across karstic area in the middle and the coastal area along the Adriatic Sea.

At the European level, Croatia ranks second in the number of fish species, third in the estimated number of invertebrates, fifth in number of reptiles and seventh in the number of vascular plants and mammals (DUZPO, 1999). When the number of species is expressed in relation to land area, Croatia ranks third in the number of plant species per area and fourth in the number of vertebrates per area. Croatia has an unusually high concentration of endemic species, particularly in the Karst (calcium carbonate limestone) region.

Land use in Croatia has been strongly influenced by the process of economic transition and the exodus of the rural population caused by the war. The dissolution of a number of large state co-operatives and the failure of the state-planned economy resulted in the abandonment of large areas of land. During the period 1991-2002, on average 26% of all arable land remained uncultivated. Such a high share of unutilised agricultural land is caused by:

- The shift to a market economy and non-coordinated agricultural policies;
- The lack of an updated land cadastre, land register and a land transfer mechanism which permits the easy transfer of ownership and/or tenancy;
- The recent war (1991-1995). During this period, some 30% of agricultural land remained inaccessible for cultivation and agricultural land remained “contaminated” by numerous minefields. With an estimated 450,000 ha covered by minefields, 1-1.2 million mines and unexploded ordnance devices, Croatia belongs to the worlds’ top ten countries contaminated by landmines. Approximately one out of three minefields was laid on agricultural land. The mines occupy 140,000-180,000 ha of Croatia’s cultivated land, almost 10% of total cultivated land.

The Croatian agricultural sector has two parallel production systems: private family farms and agricultural companies. Family farms prevail, as their number (448,532) by far outstrips that of the agricultural companies (1,364). Private farming (family farms) constitutes the core of the agricultural sector of Croatia. It occupies 80% of the total utilised agricultural land and 75% of the arable land, owns 82% of the livestock, and 99% of all tractors, and accounts for approximately 95% of the total workforce in agriculture. The average family farm in Croatia is 1.9 ha in size. However, the farms are very fragmented and split into eight plots on average, mostly due to the inheritance law allowing farm splitting. As much as three quarters of all Croatian family farms are smaller than 3 hectares and they farm only 21% of all utilised agricultural land owned by the private sector. However, a recent survey suggests that

the average size of a vital, commercial family farm is substantially larger, ca. 11.5 ha. Some 75% of all private farms have three cows or less, while only 200 private farms keep more than 15 cows. The average size of the agricultural companies is 159 ha.

In Croatia both intensive and extensive agriculture have an adverse impact on landscape, habitat, species and genetic diversity. Intensive use of agri-chemicals, as well as reduction of the genetic pool caused by narrow crop rotations, lack of mixed-cropping and the use of a limited number of breeds and varieties have had a significant negative impact on biodiversity. Drainage of wetlands (which are among the most important in Europe) and their conversion to arable land, as well as removal of hedges and trees from agricultural land has had a negative biodiversity impact, too. Although Croatia has numerous local breeds and crop varieties, these have been replaced by modern stock that is likely to better suit the demands of the modern market. Some less favoured areas and less-productive breeds, and crop varieties have been neglected or left out from production all together.

Description of the case study site

The Lonjsko Polje Nature Park represents the largest maintained inundation area in the Danube river catchment. It comprises an area of 506 km² and is a key element of the flood control system formed by the Sava River basin, affecting Bosnia and Herzegovina and Serbia. The Park is a Ramsar site and is home to seven important habitats and 89 species mentioned in the EU Habitats Directive. In the preliminarily developed Croatian Ecological Network, Lonjsko Polje Nature Park area is evaluated as a core area of international importance e.g. a potential Natura 2000 site.

The landscape of Lonjsko Polje Nature Park is a mosaic of traditional villages, orchards, hedges, meadows, common pastureland, ox-bows, ponds, rivers, untouched tributaries and riparian forests and depends on flooding dynamics.

The Lonjsko Polje Nature Park consists mainly of lowland riparian forest and about 83 km² of common pasture land. It contains the Krapje Đol and Rakita ornithological reserves. Krapje Đol was proclaimed as the first bird sanctuary of Croatia in 1963. Its spoonbill colony is important for the entire European spoonbill population. With its indigenous breeds of cows, horses and pigs and the typical Posavina wooden houses, the Park also represents valuable cultural heritage.

The protected area has been managed by the Lonjsko Polje Nature Park Public Service since 1998. Management of state-owned forests and water resources are the responsibility of the public enterprises “Croatian Forests” and “Croatian Waters”.

Small-scale semi-subsistence private farming prevails and the area does not have any significant agricultural companies. The population in the Park is quite old and not well educated. However, there are a few more dynamic villages with relatively young farmers.

Table 2. Information about (agricultural/forestry) sites of highest biodiversity value in the area

TOP HIGH BIODIVERSITY VALUE AREAS				
Name (1)	Biodiversity Description (2)	Approximate land cover in study area (ha. and percentage)	Where is it	Interaction between biodiversity and farming practices and/or other land use interactions
Forest		40 370 ha	Lonjsko Polje	Pigs grazing
Semi-natural grassland	Hydrocharition Crex crex, Cicconia, etc.-to be completed	9 848 ha	Lonjsko Polje	Grazing and cutting
Arable land		13 366 ha	Lonjsko Polje	Production of arable crops
Mosaic landscape meadows/arable/hedgerows		718 ha	Lonjsko Polje	Crop and livestock production
Ponds		1 006 ha	Lonjsko Polje	Important for birds, nutrient cycling

Forest

Traditional pig rearing, which includes grazing pigs in forests, is not only essential for nature but is also essential for the cultural and historical heritage of Lonjsko Polje. Traditional pasturing in Lonjsko Polje is very likely the last living example of such a land management system, which was common in all the larger drainage basins in Europe until the mid 1900s.

Grassland

Pasturing in Lonjsko Polje is a dynamic system which, depending on needs, involves areas that in other parts of the year or under changed conditions are excluded from the system. Traditional land use preserves some autochthonous domestic breeds, including the Posavina horse, the Turopolje pig, the Posavina pointer and the Posavina goose. The Park administration owns a herd of Slavonian-Podolian grey cattle, which has a very important role in the restoration of areas affected by *Amorpha fruticosa*.

Three basic types of pasturing can be distinguished in the Park:

1. **Commons:** It is practised by villages whose pastures are owned by the former public sector. These pastures are managed jointly.

2. Hay-field pasturing: The villages have large haymaking complexes. Up to May 1, or after mowing, the meadows are managed in common. Here it is not essential whether the meadow is privately or publicly owned. In the event of high water during the summer, the commons type of management is abandoned in favour of the hay-making type.
3. Poloj: Some villages practice a pasturing system that is based on the intensive use of grass growing along dikes, road edges, groves and the inundation area between the old dike and the Sava (the so-called poloj). This is common for villages that which are short of both private and common pasture land.

Pasturing begins when the snow has melted or when the pastures are dried enough (after the spring floods) for the animals to walk on them. The state of the turf is not a criterion, and the animals are often driven to the pastures when the grass has not grown high enough. In the event of a high spring water level, the animals first graze on the meadows, until May 1 at the latest. Then the meadows have to be left, so that the grass can recover until hay-making. Hay-making typically begins on July 1 and lasts until August 15. Nevertheless, some areas can remain unmown after this date if there are more urgent tasks, e.g. bringing in late harvests due to floods. Late mowing makes possible self-sowing in the meadows.

Many of the meadows are mown only once a year. Hay is rarely made a second time. Meadows for mowing that are inundated and muddy are mowed last, because the hay is used only as feed for horses. This kind of hay is not used for dairy cattle. Large animals are on the pastures all summer long, right until late autumn (the first frosts) or until the new floods (October/November). The stocking density in the Park is 0.5 LU/ha, consisting of about 2,300 cows, 1,100 horses and 1,400 pigs.

Grasslands in Lonjsko Polje are habitats for numerous endangered plants, among which the most important are the whole family of orchids (Orchidaceae) and exemplars of diverse other families or genera.

Arable land

The narrow crop rotation that is practised by most farmers in Lonjsko Polje have a negative impact on soil fertility and biodiversity, although small farms with fragmented plots provide a good starting position for nature protection.

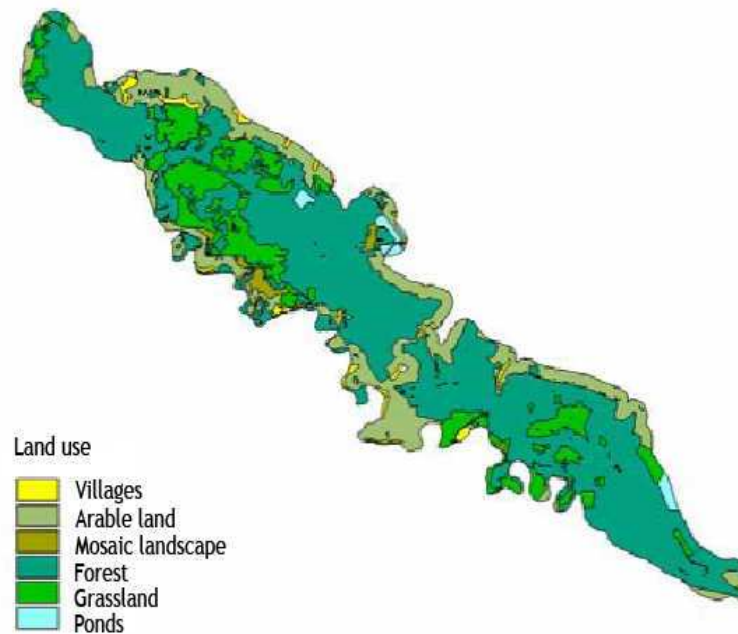
The changes in arable farming practice that have taken place during the last decades are either a result of intensification of farming or abandonment of farming activities. These comprise the specialization of production, a decrease in traditional farming, the use of high quantities of industrial fertilisers and plant protection preparations, narrow crop rotations, changes in the types of crops grown, loss of field boundaries, etc. Intensive farming increases environmental pressures including soil erosion, loss of organic content, water pollution and a decreased number of wildlife species.

Although existing Croatian regulations limit the application of agricultural inputs, notably pesticides and fertilisers as well as some other agricultural practices in nature-protected areas, they are not sufficiently precise. Thus, their interpretation is quite liberal and monitoring and control over farming protected areas is modest.

Table 3. Information on largest/most important land-uses (agricultural/forestry) by area (including the identified biodiversity friendly farming practises)

TOP LAND USES IN STUDY AREA					
Name	Description (1)	Approximate land cover in study area (ha. and %)	Biodiversity existing/affected by the land-use	Interaction between farming practice and biodiversity	Indicator of interaction (2)
Forestry	Public/private ownership; extensive management; typical use	40,370 ha	YES	Pigs grazing Habitats for plants, birds and other species listed on Habitats/Birds Directive	☺
Agriculture-arable	Private ownership, intensive management, typical use	13,366 ha	YES	Production of arable crops- Habitats for plants, birds and other species listed on Habitats/Birds Directive	☹
Agriculture-grassland	Public/private ownership; extensive management; typical use	9,848	YES	Grazing and cutting Habitats for plants, birds and other species listed on Habitats/Birds Directive	☺
Settlements	Small villages, still lot of traditional architecture	1,258 ha	NO	/	☺
Ponds	Public/private ownership; extensive management; typical use	1,006 ha	YES	Important for birds, nutrient cycling Habitats for plants, birds and other species listed on Habitats/Birds Directive	☺
Mosaic landscape meadows/arable/hedgerows	Private ownership, extensive management, typical use	718 ha	YES	Crop and livestock production Habitats for plants, birds and other species listed on Habitats/Birds Directive	☺
Roads	Mostly local roads, highway close to the northern border of area		NO		☹

Map 1. Land uses in Lonjsko Polje



Institutional and administrative framework relevant to nature conservation and agriculture

Nature conservation

The Ministry of Culture is responsible for all aspects of nature protection policy and coordinates activities in protected natural areas. The State Institute for Nature Protection is the main organisation at national level providing expertise and is responsible for the systematic and well co-ordinated collection and processing of nature protection data.

Croatia has also many other organisations dealing with nature conservation and environmental protection. These include universities, research institutes, associations, and environmental and nature protection NGOs.

The *Law on Nature Protection (NN 70/05)* deals with all major aspects of nature protection. It sets out a framework for nature protection across the entire territory of the country, including non-protected areas. It regulates the protection of flora and fauna, geological heritage, and protected areas of nature, as well as the sustainable use of nature resources. The law also defines the National Ecological Network (NEN) as a network of nationally and internationally important areas.

The National Environmental Strategy and its corresponding action plan were adopted in 2002 (NN, 46/2002). *The National Strategy and its Action Plan on Biological and Landscape Diversity Protection* (NN, 81/1999) defines priorities and actions with regard to nature protection. It also deals sporadically with agriculture, mostly in relation to grassland biodiversity.

A CORINE Land Cover Database has been prepared for Croatia according to the common European methodology. The CORINE Land Cover Database also makes it possible to distinguish between land use changes caused by the war (e.g., depopulation of rural areas) and natural land use changes caused by other environmental impacts. The completed databases are managed by the Environmental Protection Agency and are publicly available.

Mapping of habitats of Croatia has also been completed at the beginning of 2004. A total of ca 120,000 habitats were mapped, with ca. 64,000 polygons classified according to over 120 different habitat types.

The National Ecological Network (acronym CRO-NEN) has been established as one of the obligations Croatia has to meet in its process of accession to the European Union. CRO-NEN has been set-up as a part of the Pan-European Ecological Network and in preparation for implementation of the EU Habitats and Birds Directives.

Agriculture

Most of the governmental support for agriculture and rural areas operates through one of the aid schemes run by the Ministry of Agriculture, Forestry and Water Management. These are regulated by *the Law on State Subsidies in Agriculture, Fisheries and Forestry (NN 87/02)*.

The total state support available for agriculture, fishery and forestry in 2005 was approximately €350 million, of which some 98% has been earmarked for production support subsidies and only 2% for rural development measures.

The major contribution of the subsidy scheme to environmentally friendly farming is the payment of subsidies for organic farming and traditional and protected breeds. The Law on Organic Agriculture (NN 12/01) was adopted in 2001 and supplemented by several directives. All registered organic farmers (both in conversion and fully converted) are entitled to subsidies. Depending on the type of production, these are 30%-140% higher compared to conventional farming.

The rural development aid scheme consists of three sub-schemes. One of them provides support for keeping traditional and protected breeds. The subsidy is paid per head. For particularly endangered varieties whose population is less than 100 individuals, the subsidy level may be increased by 50%. In 2005, the government spent some €1.5 million on this sub-scheme.

2 SWOT ANALYSIS

Table 1. Synthesis of SWOT analysis for Lonjsko Polje

Strengths	Weaknesses
<p>Agriculture and forestry are still important economic activities (employment and income), providing food and fibre</p> <p>Agriculture and forestry are decisive for biodiversity</p> <p>Many habitats and species listed on Birds/Habitats Directive</p> <p>Retention system of regional/national and importance</p> <p>Socio-economic development entirely depends on biodiversity and agriculture/forestry</p> <p>Local traditional products</p> <p>Active Management Authority of Lonjsko Polje Nature Park</p>	<p>Current trends and practices favour land abandonment and use of agrichemicals on arable land</p> <p>Due to abandonment of traditional farming practices semi-natural grassland overgrown by forest vegetation</p> <p>Extinction of local breeds. Critical!</p> <p>Ageing and depopulation</p> <p>Unclear land-ownership</p> <p>Very small farms with fragmented plots</p>
Opportunities	Threats
<p>Various forms of eco/agro tourism</p> <p>Vicinity of Zagreb, the national capital, which is an important market for agricultural products</p> <p>Whole area is a proposed Natura 2000 site</p> <p>Proposed IPARD pilot agri-environment site</p>	<p>Further ageing and depopulation likely</p> <p>Further abandonment of grassland</p> <p>Husbandry of modern breeds</p> <p>Questionable farming profitability</p> <p>Excessive hunting</p> <p>Land-ownership not clear</p>

3 DEVELOPMENTS AND PRESSURES

As a result of depopulation and changes in the local economy, farming activities are diminishing and much of the grassland has been out of production. The dissolution of a number of large state co-operatives and the failure of the state-planned economy has resulted in the abandonment of large areas of land. Due to the abandonment and low number of cattle, but also because of the recent war (1991-1995), hay-making activities and grazing with indigenous breeds of cows, horses and pigs has ceased on large parts of the less productive but species-rich grassland. The composition of vegetation has changed from a predominantly open landscape with pastures to a landscape with a mosaic of riparian forests and herbaceous vegetation. There has also been a great loss of in the former hedgerow landscape. All of these developments have contributed to the loss of species-rich grasslands and the open landscape important for migratory birds and many other species.

Due to the uneven intensity of grazing, large complexes of meadows and pastureland have become overgrown by small bushes (*Genista tinctoria*) or by the invasive species *Amorpha fruticosa*. Undergrazing also prevents the beneficial influence of animals on biodiversity, such as species selective grazing, seed dissemination, re-rooting of pasture flora, maintenance of soil organic matter, pest and disease control, etc.

Although exceptionally valuable in terms of biodiversity, the Lonjsko Polje region at present is not a very attractive place to live. Aside from agriculture and some government services (local administration, post office, police, etc.), there are scarcely any other employment opportunities. Since agriculture requires hard work and is not economically attractive, there is also no demand for land and the land market is not well developed. Younger people are leaving the area and trying to find jobs in nearby cities. The remaining population is very old and poorly educated (80% of them have primary school or lower education).

Since rural/biodiversity tourism is still underdeveloped and there is no expansion of existing settlements, the agricultural and forestry land is not being bought for purposes of construction. In other words, there are no threats and opportunities associated with construction, especially since the existing legislation on construction projects in nature protected areas is well regulated and enforced.

On the other hand, there is also no threat from converting valuable grassland into arable land. This is not feasible because the majority of the Lonjsko Polje grassland is flooded for several months, including vegetation period.

The intensification of arable production is not likely. The existing arable farming practices are already pretty intensive using a substantial amount of fertilizers and pesticides. However, intensification might take place in the sense that existing small plots will be agglomerated by removing the dense network of linear landscape features (grassland strips, hedges, water ditches) that currently divide them. This practice would enable a more efficient crop production and the use of heavier machinery.

As far as livestock production is concerned, there is unlikely to be a negative impact on biodiversity even if stocking density increases. The existing stocking density is quite low and, indeed, to a certain extent biodiversity would in fact benefit from greater grazing pressure. However, this scenario is unlikely due to the lack of active farmers.

Intensive concentrate-fed livestock production is also unlikely in the area. This is because the existing legislation would most likely prohibit the building of large-scale livestock housing and because of the lack of investors, who are more interested in investing in other, more suitable regions.

Table 4. Information on significant trends in land-use in the study area

SIGNIFICANT TRENDS IN LAND-USE IN THE STUDY AREA						
	Past Trends			Future Trends		
Name	Description of the trend – crop type, farming practice and measures	Insights on costs, profits, land value	Socio-economic drivers behind the trend	Description of the trend – crop type, farming practice and measures	Insights on costs, profits, land value	Socio-economic drivers behind the trend
Forestry	Mixed forests, sustainable use (FSC certificate last 3 years), pig grazing		Hunting and wood logging	Mixed forests, FSC certificate, increase of area due to spreading on grassland, pig grazing abandoned	Pig grazing not profitable, Land value uncertain	Ageing and depopulation
Agriculture - arable	Narrow crop rotation (maize and wheat only), intensive use of agrichemicals, very small plots	Questionable profitability, cheap land	Former co-operatives determined farming practice	Abandonment	Cheap land on sale, nobody interested to buy	Ageing and depopulation
Agriculture - grassland	Extensive grazing and hay making, low stocking density, abandonment	Low profitability, cheap land	Ageing and depopulation	Polarization between areas managed by Park (increase) and private farmers (decrease)	Not profitable Cheap land, partly overgrown by shrubs	Ageing and depopulation
Settlements	Small villages, traditional architecture	Cheap houses	Ageing and depopulation	Inhabitants moving to cities, part of houses will be used only for holidays	Cheap houses	Ageing and depopulation
Ponds	Fishing/angling, sustainable use	Important source of income	Food supplement and additional income	Less fishing/angling, sustainable use	Less important source of income	Ageing and depopulation Recreation
Mosaic landscape meadows/arable/hedgerows	Mixed use-crops and livestock, lot of hedgerows	Self-subsistence farming	Family needs	Mixed use-crops and livestock, clearance of hedgerows	Self-subsistence farming	Ageing and depopulation
Roads	Mostly local roads			Mostly local roads		

4 VALUE OF BIODIVERSITY

The Park is home to seven important habitats and 89 species mentioned in the EU Habitats Directive (92/43/EEC). The fauna of Lonjsko Polje Nature Park consists of 250 species of birds (134 nest in the area), 58 mammals, 16 amphibians, 10 reptile and 45 fish species and 550 species of plants. Its pastures and mezofile grasslands are a feeding area for many birds that are endangered at national and global levels.

In terms of ecosystem services, the area of Lonjsko polje forms a key element in the natural flood control system of the Sava River basin. This flood control system affects also the neighbouring countries Bosnia and Herzegovina and Serbia. The inundated floodplains play also an important role in maintaining local and regional climate conditions. The area has significant potential for tourism and recreation thanks to its rich natural as well as cultural heritage, located scarcely 50 km from the national capital Zagreb and the main economic and population centres of the country.

Unfortunately, no data is currently available that can help to quantify the socioeconomic value of these ecosystem services.

5 SELECTION OF STUDY SITES

The whole case study region of Lonjsko Polje Nature Park has been selected as the study site.

6 OPPORTUNITY COSTS OF MAINTAINING BIODIVERSITY

The opportunity costs and proposed payments for environmental services (PES) have been calculated using the most likely development scenarios for the three major land use categories: grassland, arable land and forest. In all scenarios transaction costs have been taken into account.

The following development scenarios have been considered:

6.1. Grassland

In the case of grassland, the gross margin has been calculated on the basis of animal production. An annual yield of 300 kg of meat/ha has been assumed to be produced each year, at a market price of 2,12 EUR/kg. The variable costs taken into account include: animal costs of 325 EUR/year¹, animal feed cost of 200 EUR/animal/year, veterinarian costs of 14 EUR/animal/year and miscellaneous costs of 50 EUR/ha/year (eg machinery, etc.).

Grassland scenario A 1 (GS A1): continuation of the current grazing practice

Since the current management practice is biodiversity friendly one of the possible scenarios could be the continuation with the existing grazing practice. Based on a

¹ Calculated as the cost of a cow (about 2-3.000 EUR in Croatia) divided by 8-year-life span of an animal

current gross-margin of €47/ha for this practice, an annual PES of €55/ha has been proposed.

Grassland scenario A2 (GS A2): abandonment of the current grazing practice

Due to unfavourable social (old and uneducated farmers) and economic (unprofitable) conditions in the area, it is very likely that a substantial portion of grassland will end up abandoned. This scenario involves no investment costs. Moreover, it results in one-off revenue of €700 from the sale of meat of 0.7 LU/ha, which divided over a period of 20 years makes €35/ha per year. At the same time, there is no gross-margin to be generated. This scenario also assumes that the land ownership stays unchanged or remains in the family who continues to be disinterested in grassland management. From the perspective of biodiversity, this scenario is undesirable as it leads to gradual conversion into forest. An annual PES of €20/ha is proposed.

Grassland scenario A3 (GS A3): conversion of the current grazing practice to organic management

This scenario causes a one-off cost of €100/ha per year for investments costs related to conversion (adjustment of stables, some special machinery, new animals, etc.). There is also an annual cost of €85 associated with additional cost of inspection and certification. The gross-margin that would be generated is about €136/ha which is about 2 times higher than the gross margin generated by the current practice. The opportunity cost is €-96/ha and the proposed PES is €110/ha. In terms of biodiversity there would be hardly any difference since the on-going grassland management practice is already organic-like.

Grassland scenario A4 (GS A4): participation in IPARD pilot AE scheme

The scenario requires no additional one-off investments but it also does not save any money. There is an additional annual cost of €45/ha associated with the additional time required to comply with the administrative requirements of the IPARD pilot measure. The future gross margin is €2/ha and the opportunity cost is €-90. The proposed PES is €100/ha. The envisaged payment under the pilot agri-environmental measure is €116/ha, which is slightly higher than the estimated PES. Similarly, like the organic scenario there would be hardly any impact on biodiversity due to insignificant changes in management practice.

Description of proposed pilot agri-environmental measure under IPARD

Name of the measure: Grazing sub-measure

Objective

Restore and maintain wetland grassland as a habitat for endangered habitat types and species included in the annexes of the Council Habitats (92/43/EEC) and Birds (79/409/EEC) Directives (especially Hydrocharition and *Chlidonias hybrida*).

Description of measure

Practise extensive grassland management through grazing of pastures

Eligible sites within the Park

Poganovo polje and other grassland area in Nature Park Lonjsko Polje featuring species included in annexes of Council Habitats (92/43/EEC) and Birds (79/409/EEC) Directives (especially Hydrocharition and *Chlidonias hybrida*).

Management requirements

- Grazing of at least of 3 ha
- Clearance of shrubs and small trees to enable regular grazing
- Application of pesticides and mineral fertilizers is not allowed
- Compulsory stocking rate between 0.5 and 1.5 LU
- Grazing period: minimum 180 days (April-November)
- Grazing requires supervision by shepherd

Grassland scenario B1 (GS B1): abandoned pastures conversion to organic management

This scenario causes a one-off cost of €497/ha per year for investments costs related to the start of production (shrubs clearance €1,500 plus investments of €5,750/LU for herd, stables, machinery, etc.). There is also an annual cost of €85 associated with additional cost of inspection and certification. The gross-margin that would be generated is €136/ha. The opportunity cost is €-446/ha and the proposed annual PES is €500/ha. The biodiversity value would be significantly increased due to the fact that abandoned pastures which have already been overgrown by shrubs and forest-like vegetation would be managed organically.

Grassland scenario B2 (GS B2): abandoned pastures participation in IPARD pilot agri-environmental scheme

This scenario causes a one-off cost of €497/ha per year for investments costs related to the start of production (shrubs clearance €1,500/ha plus investments of €5,750/LU for herd, stables, machinery, etc.). There is an additional annual cost of €45/ha associated with the additional time required to comply with the administrative requirements of the IPARD pilot agri-environmental measure. The gross-margin that would be generated is approximately €2/ha. The opportunity cost is €-540/ha and the proposed annual PES is €600/ha. The biodiversity value would be significantly increased due to the fact that abandoned pastures which have already been overgrown by shrubs and forest-like vegetation would be managed according to agri-environment prescription measures.

Grassland scenario C1 (GS C1): continuation of current meadows management

Since the current management practice is biodiversity friendly one of the possible scenarios could be the continuation with the existing mowing practice. Based on current gross-margin of €320/ha for this practice, an annual PES of €350/ha has been proposed.

Grassland scenario C2 (GS C2): abandonment of current meadows management

It is very likely that a substantial portion of hay-meadows will be abandoned. This scenario involves no investment costs. At the same time, there is no gross-margin to be generated. The opportunity cost is €-320/ha and the proposed annual PES is €350/ha. This scenario also assumes that the land ownership stays unchanged or remains in the family who continues to be disinterested in hay meadow management. From the biodiversity point of view, this scenario is undesirable since it leads to gradual conversion into forest.

Grassland scenario C3 (GS C3): conversion of current meadows management to organic

This scenario causes one-off cost of €50/ha per year for investments costs related to conversion (e.g. some special machinery). There is also an annual cost of €85/ha associated with additional cost of inspection and certification. The future gross margin is the same as for the current practice (€320/ha). The opportunity cost is €-135/ha and the proposed annual PES is €150/ha. In terms of biodiversity there would be hardly any difference since the on-going grassland management practice is already organic-like.

Grassland scenario C4 (GS C4): participation in IPARD pilot Agri-Environmental measure

The scenario requires no additional one-off investments but it also does not save any money. There is an additional annual cost of €45/ha associated with the additional time required to comply with administrative requirements of the IPARD pilot Agri-environmental measure. The future gross is €225. The opportunity cost is €-140/ha and the proposed annual PES is €160/ha. Envisaged payment under pilot agri-environmental measure is €129/ha for the mowing sub-measure and €141/ha for the corncrake sub-measure, which is slightly lower than the estimated PES. Similarly, like the organic scenario there would be no major impact on biodiversity due to relatively small changes in management practice.

Description of proposed pilot Agri-Environmental measure under IPARD

Name of the measure: Mowing sub-measure

Objective

Restore and maintain grassland as a habitat for endangered habitat types and species included in the annexes of the Council Habitats (92/43/EEC) and Birds (79/409/EEC) Directives (especially *Aythya nyroca*)

Description of measure

Practise extensive grassland management through mowing of meadows.

Eligible sites within the Park

Meadows in Kratečko and Rakita ornithological reserve (part of the IBA HR012) and other meadows in Nature Park Lonjsko Polje featuring species included in annexes of Council Habitats (92/43/EEC) and Birds (79/409/EEC) Directives (especially *Aythya nyroca*).

Management requirements

- Mowing of at least 2 ha
- Clearance of shrubs and small trees to enable regular mowing
- Application of pesticides and mineral fertilizers is not allowed.
- Delayed hay cutting: not until July 20
- all mown grass should be harvested as hay and removed

Name of the measure: Corncrake protection sub-measure

Corncrake (*Crex crex*) is a globally threatened species. Its survival is directly linked with grassland management. The Corncrake requires tall grass, as this provides the best shelter, feeding and nesting place. The Corncrake is widespread in the Park. Recent ornithological investigations have recorded more than 200 corncrake singing males in the Park area. In order to keep the present Corncrakes a special sub-package has been developed. Although primarily directed at the Corncrake, the management prescribed by this sub-package will also benefit several other small animals whose existence depends on grassland habitats (birds, small mammals, insects, etc).

Objective

To protect and possibly increase the Corncrake population by providing grassland habitats managed in a way favouring the Corncrake's specific needs.

Eligible sites within the Park

Orlinci Pasture, meadows around Jasenovac and other grassland in Lonjsko Polje Nature Park harbouring the Corncrake. The beneficiaries taking part in the scheme have to show evidence of the Corncrake on the grassland for which the support has been requested (e.g. a statement from competent bodies such as the Park Public Service, State Institute for Nature Protection or the Ministry of Culture).

Management requirements

The Corncrake favours hay fields with tall vegetation. Its breeding season is from late May to early August and it nests on the ground in well-hidden locations among tall vegetation in hay fields. Therefore the management involves:

- Delayed hay cutting: not until July 20, with the farmer agreeing to postpone the mowing where birds are present on the site. This will allow the Corncrake to rear its offspring.
- Minimum plot surface 0.15 ha
- Application of pesticides and mineral fertilizers is not allowed. The Corncrake's diet depends on insects, snails, earthworms and other pesticide-sensitive organisms.
- Keeping field borders (2-3 m wide) uncut. These strips provide shelter, as the Corncrake needs these for ease of movement. The strips should be cut once in three years in order to prevent shrub encroachment. Cutting should alternate between different sides of the field.
- The stocking rate should not exceed 0.3 LU per hectare. Grazing is forbidden in the period May 15 – August 31.
- Grass cutting must take place in a spiral form from the centre out towards the edges. It is important to cut slowly since this will give the birds the chance to escape to the field margins.

Grassland scenario D1 (GS D1): abandoned meadows conversion to organic management

This scenario causes a one-off cost of €202/ha per year for investments costs related to the start of production (shrub clearance €1,500 plus investment of €1,250 for machinery). There is also an annual cost of €85/ha associated with additional cost of inspection and certification. The gross margin that would be generated is €320/ha. The opportunity cost is €33/ha and the envisaged annual PES is €40/ha. The biodiversity value would be significantly increased due to the fact that abandoned meadows that have already been overgrown by shrubs and forest-like vegetation would be managed organically.

Grassland scenario D2 (GS D2): abandoned meadows participation in IPARD pilot agri-environmental scheme

This scenario causes one-off cost of €202/ha per year for investments costs related to the start of production (shrubs clearance €1,500/ha plus investments of €1,250 for machinery). There is an additional annual cost of €45/ha associated with the additional time required to comply with administrative requirements for the IPARD pilot agri-environmental measure. The gross margin that would be generated is €225/ha. The opportunity cost is €-22/ha and the annual PES is €25/ha. The biodiversity value would be significantly increased due to the fact that abandoned meadows that have already been overgrown by shrubs and forest-like vegetation would be managed according to agri-environmental prescription measures.

6.2. Arable land

Arable scenario A1 (AS A1): further intensification of maize production

Current maize production is quite intensive and it is not very likely that it will be abandoned. The scenario of further intensification causes a one-off cost of €7/ha per year for clearance of hedges (estimation for clearance of 600 m² of hedge per hectare). Moreover, it results in annual revenue of €13/ha (gross margin from gained surface of 600 m² per ha from cleared hedges) and estimated annual saving of €20/ha for not maintaining hedges. The gross margin that would be generated is €219/ha and the opportunity cost is €213/ha. The annual PES is €250/ha. In comparison with the current state, biodiversity would be further degraded.

Arable scenario A2 (AS A2): conversion of maize production to organic

This scenario causes one-off cost of €50/ha per year for investment costs related to conversion (e.g. some special machinery). There is also an annual cost of €85 associated with the additional cost of inspection and certification. The future gross margin is €190/ha. The opportunity cost is €22/ha and the proposed annual PES is €25/ha. In terms of biodiversity, it is most likely that there would be some improvement since organic management is expected to be more biodiversity friendly.

Arable scenario A3 (AS A3): further intensification of wheat production

The scenario of further intensification causes a one-off cost of €7/ha per year for clearance of hedges (estimation for clearance of 600 m² of hedge per hectare). Moreover, it results in annual revenue of €9/ha (gross from gained surface of 600 m²/ha from cleared hedges) and estimated annual saving of €20 for not maintaining hedges. The future gross-margin is €142/ha. The opportunity cost is €178/ha and the proposed annual PES is €200/ha. In comparison with the current state, the biodiversity value would decline even further.

Arable scenario A4 (AS A4): conversion of wheat production to organic

This scenario causes a one-off cost of €50/ha per year for investments costs related to conversion (e.g. some special machinery). There is also an annual cost of €85/ha associated with additional cost of inspection and certification. The future gross-margin is €150/ha. The opportunity cost is €29/ha and the proposed annual PES is €35/ha. In terms of biodiversity, it is most likely that there would be some improvement since organic management is expected to be more biodiversity friendly.

6.3. Forests

Forest scenario F1 (FS F1): continuation of grazing of pigs in forests

Since the current management practice is biodiversity friendly, continuation of existing practice is desirable from the biodiversity point of view. Based on a current gross-margin of €82/ha for this practice, an annual PES of €90/ha has been proposed.

Forest scenario F2 (FS F2): abandonment of grazing of pigs in forests

It is very likely that the practice of grazing of pigs in forests will be abandoned in the future. This scenario involves no investment costs, but there is also no gross margin. The opportunity cost is €-82/ha and the proposed PES is €90/ha.

7 PAYMENTS FOR ENVIRONMENTAL SERVICES

Annual and one-off payments

All scenarios presented involve annual remuneration for the PES. An interesting one-off payment scheme might be land clearance. This could present a strong incentive for some farmers to clear grassland and arable land of shrubs and continue with its management. The current payment/subsidy schemes offered in Croatia do not envisage this possibility. The same goes for the pilot IPARD agri-environmental schemes envisaged for Lonjsko Polje. The IPARD programme does not recognise or compensate this type of cost, since shrub clearance is not seen as a measure going beyond good farming practice.

Land purchase

The majority of high nature value grassland and arable land in Lonjsko polje is privately owned, while a smaller portion is in state hands. However, due to

depopulation and ageing problems, large areas remain out of cultivation. This situation could be improved should there be a fund for land purchase, enabling the park management authority to purchase the land. These institutions usually have interest and sufficient capacity to manage land according to biodiversity friendly practices but lack the means to acquire the land. Some of them have also started negotiating a long-term land lease with the state and/or local authorities, but due to various administrative barriers this process is very time consuming.

Direct regulation

The Act on the Financing of Local Self-Government and Administration Units allows local governments to tax the landowners or those leasing the land in case they neglect their land. This tax would permit taxing abandoned grassland with €35/ha and arable land with €70/ha. However, as the introduction of this tax is not popular politically, not a single municipality in Croatia has introduced such a measure. However, in the case of Lonjsko Polje such a tax would be more justified than elsewhere.

Monitoring requirements

Monitoring and evaluation are important elements of any payments for environmental services (PES) measure and their planning should be built in from the very beginning of the scheme's design. Since the monitoring and evaluation procedures can be rather complex, early and careful planning is essential.

Monitoring and evaluation should provide information on the relevance, effectiveness and efficiency of these programmes. In order to obtain clear and useful information through the monitoring and evaluation process, the objectives of the PES schemes must be clearly defined. Distinctions should be made between operational, specific and general objectives.

Since it is impossible to monitor the effects of PES schemes on each single parameter affected by the measure, a system of indicators should be developed. These indicators should be simple, clear, effective and relevant for Croatian conditions.

Monitoring indicators could include:

- The area (ha) of agricultural land under the PES scheme;
- Number of farms;
- Percentage of uptake as compared to estimations and targets;
- Geographic distribution of farms covered by PES;
- Relation between farm size and participation in PES scheme;
- Area of proposed Natura 2000 sites participating in the scheme
- Number of certain species, etc.

8 INTERPRETATION OF RESULTS

Sources of funding

The sources of potential funding for payments for environmental services in Croatia in general and Lonjsko polje in particular are limited, with public funds being the most important if not the only funding source available for the time being. Local private enterprise is still not sufficiently strong to support significant payments for environmental services. Outside investors still do not sufficiently recognise the potential of Lonjsko polje for business development, and thus are unlikely to be willing to invest payments for environmental services. However, over the long run it is very well possible that some investors will recognise the link between the biodiversity value of Lonjsko polje and business opportunities, notably for tourism and development of regional food specialities, resulting in greater openness to payments for local environmental services. The same applies to water-harvesting companies. Lonjsko polje has a unique potential for water purification, resulting in lower operating costs for the water supply companies benefiting from these services.

Beneficiaries

Both upstream and downstream populations benefit from the services provided by Lonjsko polje. Nearly one third of the Croatian population lives in a radius of some 50 km upstream of Lonjsko polje, including the inhabitants of Zagreb, the capital. In addition, some 50% of the total Croatian property value is located here, and some 50% of the country's entire gross domestic product is produced in this area. Lonjsko polje plays an important role in protecting this important region of Croatia from flooding and in purifying water, notably from nutrients. Furthermore, the benefits that Lonjsko polje provides in terms of water retention and purification relate not only to important areas of Croatia, but also neighbouring countries further downstream: Bosnia and Herzegovina and Serbia. Consequently, it appears necessary to develop cross-border co-operation and install a corresponding mechanism for the payments for environmental services.

Representativity

The biodiversity features of Lonjsko polje are quite unique not only in Croatia but also in the European context. However, the problems associated with grassland abandonment in this region are quite common for the rest of the country. In this respect, the scenarios for payments for environmental services developed for the grassland in Lonjsko polje are quite applicable to other regions facing the same problem.

No change in value of agricultural land

None of the scenarios considered in this case study substantially change the present market value of the land. Regardless of the options, the land price seems to be rather stable and constant. A slight difference might arise in the scenario involving land abandonment since such land requires clearance of shrubs. However, for the time being this is not the case and there is hardly any price difference between abandoned and cultivated land.

Potential benefits of more biodiversity-friendly practices

The spread of more biodiversity friendly land management practices could potentially benefit the local population in terms of tourism development and development of local food specialty products, notably processed meat.

Consideration in light of existing EU agri-environment schemes

The existing EU agri-environmental programme and its “rules of the game” do not offer a genuine solution for solving some country-specific problems related to agriculture and nature/environmental protection. A number of existing EU agri-environmental requirements are difficult to fulfil under Croatia's current circumstances. Croatia cannot easily qualify to benefit from a range of advantages offered by the current EU agri-environmental programme, which has been designed primarily to target agricultural problems in the older EU member states, notably agricultural intensification. However, the majority of Croatian problems with regard to agriculture and environment/nature protection are quite different, often linked to extensive agriculture, notably land abandonment and under-stocking.

9 SUMMARY AND RECOMMENDATIONS

Appropriate land management is essential for the biological diversity and wildlife of Lonjsko polje. The landscape, ecosystem, species and genetic diversity of the region is enhanced or preserved with appropriate land management techniques, primarily by mowing, grazing, browsing and trampling. Due to various ecological and socio-economic circumstances, significant areas in Lonjsko polje have been abandoned. The absence of livestock and related mowing and grazing has led to the decline of biological diversity in the region. The result has been the invasion over large areas of shrubs and other pioneering vegetation leading to natural succession. This process leads to the development of semi-woody species and eventually closed canopy forests. Such ecosystems have substantially lower nature/biodiversity value than fragmented, park-like landscapes. In addition, they are at risk of fire because the excess biomass is not subject to grazing pressure.

Social and human capital

The most critical threat regarding the implementation of biodiversity friendly scenarios is the declining number of farmers. The Lonjsko polje farming population is relatively old and younger farmers are tending to switch to other, more profitable jobs. This trend is likely to continue and will pose a serious problem in the future. There are too few farms with young successors. On the other hand, the urban population might question the need and justification for public money going to the protection of birds, flowers and other creatures, while there are so many other areas in need of public financing. This problem is linked to the lack of recognition for social services provided by farmers. The problem is even more pronounced due to the lack of civil society organisations in rural areas promoting concepts of multifunctional land use and environmental services.

Massive information and education programme needed

The concept of payments for environmental services (PES) is completely new in Croatia. Croatian social and human capital required for the adoption and implementation of measures to improve or maintain biodiversity in agricultural land is quite poor and stands in strong contrast with Croatia's rich natural capital. These measures require specific knowledge and skills, first of all from farmers but also from farm advisors, administrators, nature conservation officers and a number of other stakeholders. Most of these stakeholders have limited interest and/or knowledge of measures maintaining biodiversity in agricultural land. For the majority of stakeholders, such measures are perceived as something of marginal importance and low priority. The majority of Croatian farmers are old, poorly educated in general and in agriculture in particular. On the other hand, for the younger and better educated group of farmers, biodiversity measures do not appear "serious" enough. This group of farmers is focused on high-input and highly specialised farming. Therefore, an appropriate education and dissemination programme is essential to widen their horizons.

EU policy reform needed

In the light of the biodiversity-linked problems both in Croatia and several of the EU's new member states (and also in some older member states, e.g. Spain, Portugal), it is strongly recommended to re-examine and re-design existing agri-environmental policies. Namely, some of the most biodiversity valuable agricultural areas are under threat not – as in older EU member states -- due to agriculture intensification, but rather due to abandonment and the lack of grazing pressure. The existing EU agri-environmental policies do not sufficiently take into account these problems.

In addition, it should be noted that in many countries, including Croatia, the biodiversity problems related to agriculture are part of a wider social crisis in rural areas. Depopulation, ageing, migration of vital inhabitants to urban areas, lack of social services and infrastructure are among the most important drawbacks for living in rural areas. Neither the existing agri-environmental payments nor the potential introduction of payments for environmental services will be sufficient to hold back the exodus of rural population. Reform of existing agri-environmental schemes should go hand in hand with a comprehensive set of rural development measures that would make life in rural areas more attractive.

Reform national rural development policy

Current Croatian agriculture policy stimulates high-input farming. The total state support budget for agriculture, fishery and forestry in 2003-2005 was nearly €280 million and comprised some 90% of the entire budget of the Ministry of Agriculture. Some 98% of the agricultural aid was earmarked for Pillar I production support subsidies while the rural development scheme received only 0.4% of the total budget (Znaor and Karoglan Todorović, 2004).

Consequently, in order to stimulate rural development in general and biodiversity friendly farming in particular, it is crucial that Croatia boosts funding for rural development.

As an EU candidate country, Croatia has been involved in intense negotiations with the European Commission and EU member states regarding the future of its

agriculture policy. With this in mind, it is highly recommended to earmark sufficient funds for rural development already at this stage so that this reflects the current priorities of the EU's rural development policy.

Advisory service

The Croatian Agricultural Extension Institute is not acquainted with measures to improve or maintain biodiversity in agricultural land and has no related educational and advisory activities. Of the ca. 200 farm advisors working in 22 county offices in Croatia, there is not a single one who is an expert in biodiversity protection measures. Special training programmes for state and private advisors should be developed and implemented. At least one state or private biodiversity advisor per county should be employed.

Civil Society

Civil society organisations can fulfil the key function of providing information to particular stakeholder groups, can raise awareness and stimulate public debate, and can act as political pressure groups.

Nature conservation and environmental protection organisations should start implementing biodiversity programmes directed toward farming and farmers. At present, Croatia does not have nature conservation organisations that are actively working to promote biodiversity protection measures among farmers, advisors and policy makers. Among nature conservation experts there is hardly any practical knowledge on grassland management that is beneficial to biodiversity (e.g. the selection of appropriate grazing animals and conditions, mowing terms and techniques, etc).

Organic farming organisations should broaden their focus toward nature conservation issues. They are mostly focused on production, marketing and inspection issues and do not communicate the environment/nature conservation aspects of organic farming to farmers nor to consumers.

Research and education

Neither of the two Croatian agricultural faculties nor any of the agricultural colleges or secondary schools has been running compulsory or optional education programmes on nature conservation. Consequently, students (future advisors and farmers) are not familiar with the link between agriculture and nature. There is also very little research that has been done in this area.

Universities and other research institutions should adapt their curricula and include biodiversity topics in their programmes. Research on biodiversity protection measures in farming should be encouraged by the Ministry of Science and Ministries of Agriculture and Culture/Nature conservation.

Mass media

The mass media can be important players in communicating the importance and benefits of biodiversity friendly farming to the public and thus raising general awareness and acceptance of this approach. This can be done for example through

popular but educative TV and radio programmes, articles in daily press and magazines, etc.

Media channels can be used as powerful and effective tools for increasing awareness of local products produced in environmentally friendly way (e.g. organic products, products from particular nature protected areas, products from autochthonous breeds and plant varieties, etc.).

Consumers

Consumers have great power in the marketplace and could be encouraged to purchase products deriving from biodiversity-friendly farming. In order to encourage consumers to demand such products and eventually to pay a premium price for them, it is necessary to provide them with relevant information (e.g. via labels, leaflets, opportunities to visit biodiversity friendly managed farming areas, etc.). This requires creating institutional structures for consumer advice and information.

Environmental and ecological services of abandoned land: a few thoughts on biodiversity versus carbon sequestration

Totally abandoned land is most likely to decline in biodiversity value, but will at the same time become more valuable for carbon sequestration (soils and biomass). The European Commission currently attaches a value of €19 for the external costs generated by one tonne of CO₂. In the foreseeable future, it is possible that industrialised countries will promote and invest in land abandonment projects in countries like Croatia, as these will enable them to offset their own emissions of CO₂, i.e. farmers could soon be expected to harvest carbon subsidies (carbon farming) for their abandoned land. This option must be weighed against the potentially lost biodiversity associated with land abandonment.

10 ACKNOWLEDGEMENTS, DATA SOURCES, REFERENCES AND DATA ANNEXES

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