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Case Study – Bulgaria

Sustainable Agriculture and Soil Conservation (SoCo Project)

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Sustainable Agriculture and Soil Conservation (SoCo Project)

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Preface

Agriculture occupies a substantial proportion of European land, and consequently plays an important role in maintaining natural resources and cultural landscapes, a precondition for other human activities in rural areas. Unsustainable farming practices and land use, including mismanaged intensification and land abandonment, have an adverse impact on natural resources. Having recognised the environmental challenges of agricultural land use, in 2007 the European Parliament requested the European Commission to carry out a pilot project on 'Sustainable Agriculture and Soil Conservation through simplified cultivation techniques' (SoCo). The project originated from close cooperation between the Directorate-General for Agriculture and Rural Development (DG AGRI) and the Joint Research Centre (JRC). The JRC's Institute for Prospective Technological Studies (IPTS) coordinated the study and implemented it in collaboration with the Institute for Environment and Sustainability (IES). The overall **objectives of the SoCo project** are:

(i) to improve the understanding of soil conservation practices in agriculture and their links with other environmental objectives;

(ii) to analyse how farmers can be encouraged, through appropriate policy measures, to adopt soil conservation practices; and

(iii) to make this information available to relevant stakeholders and policy makers EU-wide.

In order to reach a sufficiently detailed level of analysis and to respond to the diversity of European regions, a case study approach was applied. Ten case studies were carried out in Belgium, Bulgaria, the Czech Republic, Denmark, France, Germany, Greece, Italy, Spain and the United Kingdom between spring and summer 2008. The case studies cover:

- a screening of farming practices that address soil conservation processes (soil erosion, soil compaction, loss of soil organic matter, contamination, etc.); the extent of their application under the local agricultural and environmental conditions; their potential effect on soil conservation; and their economic aspects (in the context of overall farm management);
- an in-depth analysis of the design and implementation of agri-environmental measures under the rural development policy and other relevant policy measures or instruments for soil conservation;
- examination of the link with other related environmental objectives (quality of water, biodiversity and air, climate change adaptation and mitigation, etc.).

The results of the case studies were elaborated and fine-tuned through discussions at five stakeholder workshops (June to September 2008), which aimed to interrogate the case study findings in a broader geographical context. While the results of case studies are rooted in the specificities of a given locality, the combined approach allowed a series of broader conclusions to be drawn. The selection of case study areas was designed to capture differences in soil degradation processes, soil types, climatic conditions, farm structures and farming practices, institutional settings and policy priorities. A harmonised methodological approach was pursued in order to gather insights from a range of contrasting conditions over a geographically diverse area. The case studies were carried out by local experts to reflect the specificities of the selected case studies.

This Technical Note is part of a series of ten Technical Notes referring to the single case studies of the SoCo project. A summary of the findings of all ten case studies and the final conclusions of the SoCo project can be found in the **Final report on the project 'Sustainable Agriculture and Soil Conservation (SoCo)'**, a JRC Scientific and Technical Report (EUR 23820 EN – 2009). More information on the overall SoCo project can be found under http://soco.jrc.ec.europa.eu.

BE - Belgium	**West-Vlaanderen** (Flanders)
BG - Bulgaria	**Belozem** (Rakovski)
CZ - Czech Republic	**Svratka river basin** (South Moravia and Vysočina Highlands)
DE - Germany	**Uckermark** (Brandenburg)
DK - Denmark	**Bjerringbro and Hvorslev** (Viborg and Favrskov)
ES - Spain	**Guadalentín basin** (Murcia)
FR - France	**Midi-Pyrénées**
GR - Greece	**Rodópi** (Anatoliki Makedonia, Thraki)
IT - Italy	**Marche**
UK - United Kingdom	**Axe and Parrett catchments** (Somerset, Devon)

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Acronyms

MAF	Ministry of Agriculture and Food
MEW	Ministry of Environment and Water
WUA	Water User Association

1 Introduction to the case study area

Soil salinisation is one of the major soil degradation problems for Southern European countries and the rise in average temperature increases the threat of secondary salinisation. There are more than 35,000 hectares of salt-affected soils in Bulgaria, but this number does not include the areas with a high risk of salinisation. Unlike most of the other soil degradation problems, preventing soils from salinisation processes, in most cases, requires not only technical measures but also active cooperation and voluntary participation of the local actors.

The salt affected areas in the Plovdiv region are estimated at more than 6,000 hectares (Petkov *et al.*, 1985). Among the main reasons for salinisation in the country and the Plovdiv region are: (1) insufficient soil draining, shallow ground water table with high mineral content; (2) destruction and poor maintenance of the existing irrigation and drainage systems after the agrarian reform (1990-2000); (3) fragmentation in land ownership and land use after the land restitution.

The village of Belozem, is located in South Bulgaria, the eastern part of the Thracian plain, 30 kilometres east of the town of Plovdiv. This village was selected as a case study area because it provides a good example how the positive effects of technical measures (drainage-irrigation system and chemical melioration) introduced during the sixties and seventies are at risk after the agrarian reform. The name of the village, Belozem translated into English is 'White-soil village' reflecting the soil colour typical for saline soils.

Belozem has 4,200 ha of land, of which 40 % are affected by salinisation process. The relief is predominantly flat, 130-170 m above see level. The climate is transitional - continental. The winters are mild and summers hot. The average temperature in January is 0.20º C, and during the hottest month, July, 23.3° C. The average annual precipitation is low (572mm) and rain distribution is uneven.

The soil in Belozem is heterogeneous. There are 28 different soils around the village and 13 of them are affected by salinisation. The main soil types in the area are Luvisols, Solonetz, Vertisols and Gleysols. About 65 % of the cultivated land is occupied with cereals: wheat, barley, maize, rice; 26 % with forage and industrial crops: alfalfa, sunflower; 5 % vegetables; and 1.5 % orchards.

The first information regarding salinisation processes in Belozem date back to the 15th century when the flooded rice production was introduced in the area. Because of improper choice of location for the rice fields and use of tail waters (waters released from rice cells) for irrigation, salinisation started to increase gradually. During the 19th century, the forests surrounding the village were cut down and the meadows ploughed up. This destroyed the natural soil drainage. The waters streaming from the hills surrounding the village slow down when reaching the valley and feed into the shallow underground water. Because of the slow movement, the mineral parts of the soil dissolve in the water and enriched it with soluble salts. In 1928, there was an earthquake in the area, which caused the land surface to sink down, bringing it closer to the underground waters. During the sixties and seventies, the State initiated an extensive programme for the reconstruction of the existing irrigation system, the development of a drainage system and chemical melioration. As a result, soil salinisation was reduced significantly and a large part of the land surrounding the village was reclaimed. Following the agrarian reform and land restitution of the 1990s, the irrigation system in the area is somehow maintained, while the drainage system is neglected. The new institutional settings do not support the previously implemented technical measures. This poses a real threat for the level of salinisation to reverse back to the situation that existed before the sixties.

1.1 Spatial and natural characteristics

The village of Belozem is located in South Bulgaria, the eastern part of the fertile Pazardzik-Plovdiv plain of the Upper Thracian lowland, 30 km north-east from the town of Plovdiv. The relief of the terrain is predominately plain, 130-170 m above the sea level and it is composed mainly by Pliocene and quaternary deposits. The depth of pliocene deposits, on some places, varies from 200 to 500 m. Above these deposits there are alluvial sediments from the Maritsa river and its tributaries with depth up to 100 m. The slope of the terrain is to south-east direction with value up to 0.08 %.

Figure 1: Location of the village of Belozem

Source: Adapted from http://memory.loc.gov/cgi-bin/map_item.pl

The climate in the area is transitional-continental. Spring comes early under the influence of the Mediterranean Sea. The air temperature grows up rapidly and at the beginning of April the average daily temperature often exceeds 10º C. Winter is mild and summer hot. The average yearly temperature is 12.3º C. The snow covers the ground on average for 22 days. The average temperature in January is 0.2º C. The hottest month is July with an average temperature of 23.3º C. Average annual precipitation is low (572 mm) and the rain distribution is uneven. May and June are the months with the highest precipitation, 71 mm and 77 mm respectively. The period July-October is dry, having 42 mm of rainfalls with frequent droughts. The water deficit for the period July-August is over 400 mm. Precipitations above 700 mm are observed in 1968 and below 500 mm in 1959/64/70/78. During the period 1959-1979, five years in May and seven years in June precipitations have been higher than 100 mm

The nearest meteorological stations to Belozem are in Sadovo and Plovdiv. The absolute maximum and minimum temperatures for Belozem, Sadovo and Plovdiv for a 21-year period are: max 40.6; 40.7; 39.5º C and min -27.4; -27.8; -27.0º C respectively.

Table 1: Average monthly and yearly air temperature tº C

Station	Months	I	II	III	VI	V	VI	VII	VIII	IX	X	XI	XII	year
Sadovo	Average daily t	-0.5	1.9	5.8	12.2	17.1	20.9	23.6	23.2	18.7	12.7	7.4	1.9	12.1
	Average max t	3.6	6.8	11.6	18.5	23.3	27.5	30.4	30.3	25.9	19.2	12	6	17.9
	Average min t	-4.5	-2.6	0.3	5.2	10.2	13.9	16	15.4	11.5	7	3.4	-1.8	6.2
Plovdiv	Average daily t	-0.4	2.2	6	12.2	17.2	20.9	23.2	22.7	18.3	12.6	7.4	2.2	12
	Average max t	3.6	7	11.8	18.5	23.6	27.6	30.3	30.2	26	19.4	12.1	6.1	18
	Average min t	-4.1	-2	0.9	5.6	10.8	14.4	16.2	15.4	11.7	7.2	3.6	-1.4	6.5
Belozem	Average daily t	0.2	3.1	7	12.3	17.3	20.9	23.3	22.7	18.4	12.6	7.8	2.4	12.3

Source: Meteorological stations Sadovo and Plovdiv for the period 1959-1979; for Belozem Kavardziev, 1980

Table 2: Average monthly and yearly precipitation (mm)

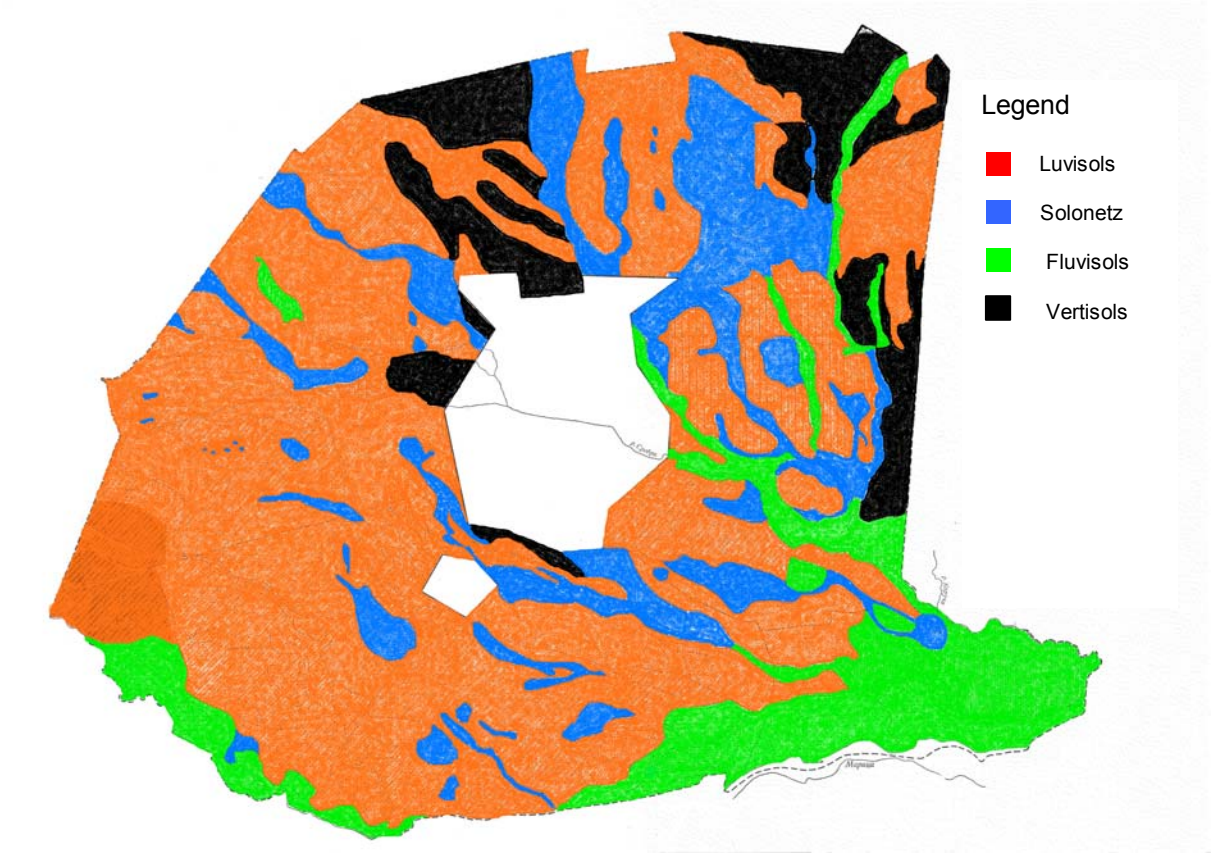
Station	Month												Year
	I	II	III	VI	V	VI	VII	VIII	IX	X	XI	XII	
Plovdiv	42	32	38	45	65	63	49	31	35	43	47	49	540
Sadovo	42	35	38	45	61	68	48	31	36	43	5	52	551
Belozem	41	36	35	51	71	77	48	42	36	43	51	41	572

Source: Meteorological stations Sadovo and Plovdiv for the period 1959-1979; for Belozem Kavardziev, 1980

Soil formation and salinisation processes in the region are influenced by karsts water running through Eocene limestones. Waters streaming from the Boliarian hills (North from Belozem) down to the village land create conditions for over moistening the soil surface and feed the shallow underground waters. Moving through quaternary and clay Pliocene horizon, the water gradually comes out near the soil surface, often on depth of 1-2 m and less. Because of the slow movement, the water dissolves the mineral part of the soil, and gets enriched with soluble salts. In this way, the water mineral and chemical contents changes from hydro carbonate - calcium to sulphate - hydro carbonate calcium - sodium; sulphate - hydro carbonate sodium or hydro carbonate - sulphate magnesium sodium. The mineralization of shallow underground water in the land located south from Belozem, reaches extreme values and high concentration of carbonates, hydrocarbonates, sulphates and chlorides.

The soil in Belozem is heterogeneous. The total number of soil differences in the village region is 28 (Raikov, 1962). Thirteen of them are affected by salinisation and alcalinisation processes. There are four main soil types: Luvisols, Solonetz, Vertisols and Gleysols. The texture of Luvisols is loamy to slightly clayey. The Vertisols are heavy loamy to slightly clayey, and Gleysols are loamy. Except Solonetz, large part of Fluvisols are also strongly affected by the salinisation processes (Figure 2 and 3). Soils are heavy, difficult to cultivate, and insufficiently drained. On most of the fields, there are spots with different sizes and level of salinisation and solonetzisation.

Figure 2: Soil types in the village of Belozem



Source: Own presentation based on Rajkov, 1962

All policy measures and activities regarding salinisation in Belozem have been implemented before 1990. In the last 17 years, the agricultural policy was concentrated mainly on land restitution. In 1957 the Soil Science Institute-Sofia opened a research station in Belozem with the task to study and develop methods for reclamation and improvement of the saline soils productivity in Bulgaria. With State support, several activities were carried out: (1) building drainage-irrigation system; (2) chemical melioration; (3) deep chemical melioration combined with planting forest on heavily salinisated soils.

- Development and implementation of the project for drainage-irrigation system. This project had the task to build drainage and to reconstruct the existing irrigation systems. During the first stage, main drainage canals were dug, riverbeds were corrected and deepened, rice irrigation practices were improved. The depth of drainage canals was about 3 meters. After implementation, the water table had decreased under the critical level for a large part of the fields. One of the canals took away from the fields the karst waters coming from the Boliarian hills. The decrease of the water table has created conditions for chemical melioration of the solonetz soils. The second stage, building of secondary drainage canals has not been implemented.
- Chemical melioration was applied to more than 1,500 ha of the solonetz and solonetz-like soils on the upper 0-30 cm soil layer. Because of comparatively high solubility (in the case of alkali conditions), phosphorus gypsum (by product of phosphorous fertilisers) was used as an ameliorant. The application rate of phosphorus gypsum was calculated in a way to exchange and leach the “harmful” sodium from CEC (Stajkov and Abadzieva, 1965). The melioration has led to improvement of the soil quality and productivity. For instance, wheat and barley yields have increased from 1.2-1.5 tons to 4-5 tones per hectare.

- Deep layer melioration was carried out on about 20 hectares (Haplic strongly Solonchak, like Solonetz and Haplic solonchak, like sodic Solonetz, shallow, average columnar). The goal was to create conditions for growing plants with deep root system. Two soil horizons 0-30 and 30-60 cm were treated with phosphorus gypsum after deep ploughing in autumn. On the following spring forest was planted on this spot. Currently, this forest plays a role of biological drainage stopping part of the waters coming from the Boliarian hills.

1.2 Land use and Farming

Agriculture is one of the main sources of income for the Belozem population. The total area of village's land is 4,200 ha. The village itself covers 200 ha, 3,300 ha is agricultural; 3,000 ha arable land and 300 ha are pastures. At present, for economic and social reasons and also because of salinisation about 1,200 ha are not cultivated. There are 722 agricultural farms, who cultivate 1,485 ha of land. (MAFS, 2005).

Nearly 64 % of the actually cultivated land is occupied with cereals: wheat, barley, maize, rice; 26 % are forage and industrial crops: alfalfa, forage peas, sunflower, broad leaves tobacco, 5 % vegetables: tomatoes and pepper and about 1.5 % orchards. The typical crop rotation for the area is winter-cereals followed by an arable crop-maize, sunflower or tobacco. Rice rotation includes rice cultivation for 4-5 years and one year a cereal crop. There are six comparatively large farmers in the village. All of them cultivate grain and forage crops.

The soils in the region are heavy in texture. The high content of salts and sodium additionally worsens the soil quality. The terrain can become very sticky after rainfalls and in this situation, the cultivation gets difficult for a long period. When the soil gets dry, cracks are opening on the soil surface. Deep tillage of such soil leads to formation of hard compact clods, which destruction is not easy even with heavy machines. Because of these soil characteristics, frequently the cultivation practices cannot be carried out on time. For instance, the optimal period for sowing cannot be kept and this is one of the reasons for the yield reduction.

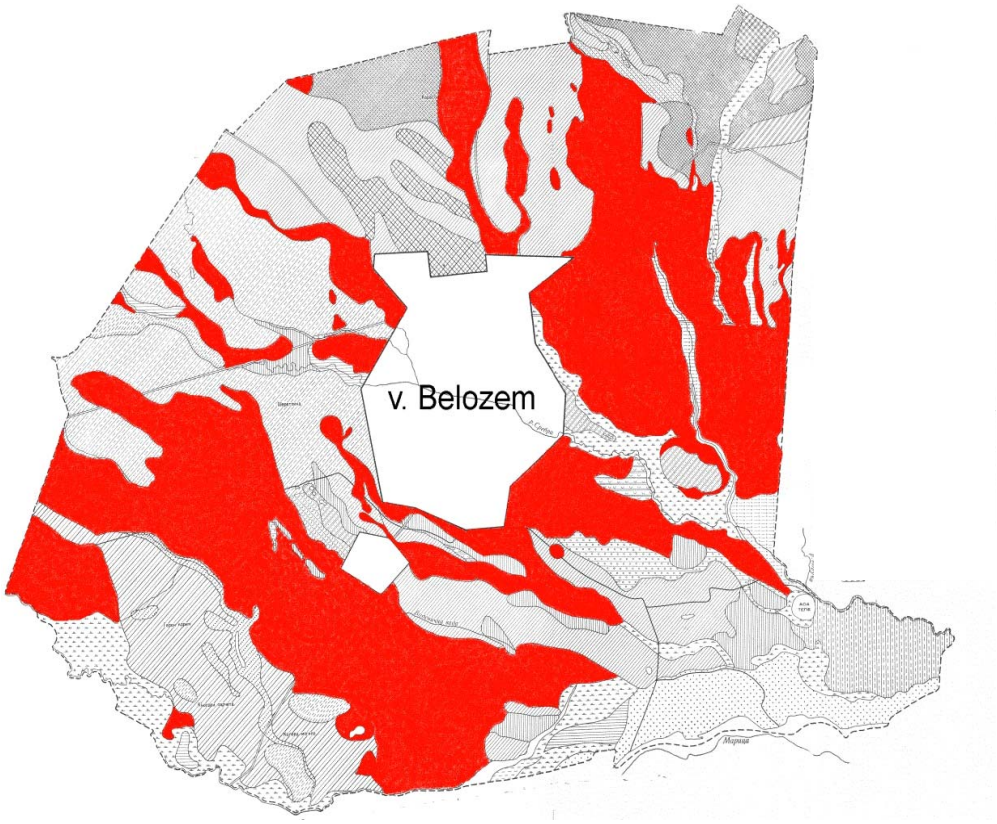
About 1,500 ha of the village land were irrigated in the past. However, after 1990 large parts of the irrigation and drainage canals are destroyed or not well maintained. Currently only about 900 ha can be irrigated from the system and even less are actually irrigated. The Maritsa river and the Piasachnik water reservoir are the main water sources for the area. The rice fields are fed with water mainly from the Maritsa river. The unreliable water supply from the irrigation system presses, especially the small farmers, to use underground water for irrigation. The composition of underground waters in the neogen horisont of Belozem region is hydro carbonate, and sodium-calcium. The content of dry residue varies between 0.2 and 0.7 g/l. This water often contains higher concentration of salts compared to the water from the centralized irrigation system. Several types of irrigation techniques are used: gravity irrigation; flooding (rice), and drip irrigation (mainly in vegetable production).

Livestock production was well developed in the past. Cattle, buffalos and sheep with excellent quality of meat were reared, but now this agricultural branch is declining. Currently, livestock production is carried out in small family and subsistent farms. The number of sheep and goats is comparatively larger, while that of cattle declines. There are two relatively large dairy farms in Belozem (30-40 cows per farm). Among the main reasons for declining in stock breeding activities in the area are: (1) after the land restitution (1990-2000), it became difficult to maintain and improve the herds' breed composition and special breeding animals are used only occasionally; (2) because of the existing land fragmentation (in term of ownership), land cultivation and salinisation, the land suitable for pastures has decreased.

1.3 Main soil degradation problems

There are three main soil degradation problems in Belozem: soil salinisation; decline in organic matter; and soil compaction. The last two problems, to some extent, are a consequence of the first one and the soil type.

Figure 3: Saline soils in the village of Belozem



Legend: the red is salt affected soils

Source: Own presentation based on Rajkov and Behar, 1962; Trendafilova, 1997; Aleksiev, 2001 and 2005

Soil salinisation. Salinisation in Bulgaria and Belozem is secondary in nature. There are several groups of factors that have led to the problem in Belozem. The first group includes the tectonic activities in the area; the geological conditions; and the Maritza river bed rising. The land surface sinking (especially after the 1928 earth quake) and the gradual river beds rising brings the underground waters close to the surface. This disturbs the natural soil drainage and the water starts to dissolve more minerals from the rocks and the soil. As a result, the water mineral contents increase. *The second group includes deforestation, ploughing up the meadows and pastures* which started at the beginning of the 19th century. Because of increased land demand during that period, the forests surrounding the village were cut down and the meadows were ploughed up. This decreased or even destroyed the natural soil drainage in the area. *The third group includes the cultivation practices*. The flooded rice cultivation in Belozem started during the 15th century (Stranski, 1956). Because of improper choices of rice fields, combined with a lack of drainage, the soil salt content has gradually increased on many places. In addition, the farmers before and even now, do not fully understand the crops' role as a soil cover, which can prevent evaporation during the hot

seasons. The same applies for the tillage practices. Conducted properly, these practices destroy the soil capillary, and hence prevent the upward flow of water with higher salt content from the deeper soil horizons. *The fourth group includes the Institutional factors*. The state has developed in the area a drainage-irrigation system during the sixties and seventies. This system was supposed to serve the local coops and agro-industrial complexes. After the land restitution (1990-2000), there are several comparatively large agricultural producers and many small ones. The use and maintenance of the existing system requires collective actions. Currently, cooperation among the actors in Bulgaria is difficult to sustain (Theesfeld, 2008). The unclear property rights structure, and from here, the unclear rights and duties of actors further complicates the problem. After the land reform, the drainage system is poorly maintained and this creates conditions for restoring the state before 1957. Unfortunately, the processes of salinisation and solonetsation of land are not obvious at the initial stages.

Decline in organic matter. As for all cultivated soils the typical reasons for the decrease in soil organic matter in Belozem include: (1) the soil cultivation practices; (2) farming without application of organic fertilisers; (3) improper use of crop residues, burning stubbles, removing the organic residues from the field, instead of their composting, the limited use of green manure, etc. Additional factor in solonetz soils and strongly alkaline saline soils is the specific chemical reaction between sodium and humus. The sodium humates are more soluble and can be leached from the soil's surface. Loses of the most precious soil compound, humus are especially high. The Haplic (meadow) soils are naturally rich of organic material (humus content 2.0-3.0 % and more). The humus content in old salt affected soils near Belozem has decreased with more than 1 % (Rajkov, 1962). A decline in the soil humus content is also observed for the Luvisols, due to the changes in soils chemistry, when the eluvial and illuvial processes are in advance stages.

Soil compaction. Soil compaction in Belozem is mainly due to the naturally heavy soils and less to anthropogenic factors. The farming practices also contribute to the problem. Deep ploughing, subsoiling and application of organic fertilizers and crop residues are agricultural practices which can decrease soil compaction, but they are rarely applied. Important problem for Belozem is the compaction of the soil horizons due to the textural differentiation of soil profiles. The lessivage and podzolisation lead to formation of illuvial horizon, typical for the Luvisols, which is compact, heavy, and with altered chemistry. This horizon is virtually impenetrable especially for the Solonetz soils.

1.4 Land tenure system

Most of the land in Belozem is privately owned. There are two types of landowners: local and absentees. The local landowners live in the village. Many of them are either subsistent farmers or agriculture is an additional source of income for them. They cultivate part of their land and the rest is rented out. The absentees' landowners live in the towns, but they have received land trough the restitution process. In most cases, they rent the land out, or leave it to relatives in the village. The land rental and sale markets in the area are still not well developed.

The land of the village (as in the rest of the country) is highly fragmented in term of ownership. About 48 % of the parcels are with average size of 0.6 hectares. In addition many of these parcels are owned by 2-3 individuals and this increases the cost of rental and sale contracts. Until 2003 most of the rental contracts were informal and short-term. However, with approaching the EU accession in 2007 and the opportunity for participation in the EU and Bulgarian funded programs most of the farmers started pressing for longer-term formal contracts. But still since the contract costs for the smaller parcels are high, mainly the large farmers, have-long term formal contracts for the large parcels and rice fields and informal for the smaller ones.

2 Methodology

In order to investigate the soil degradation problems in Belozem, semi-structured interviews with the actors involved have been conducted. Four different questionnaires have been used: for soil experts Questionnaire 1 (Q1); for farmers Questionnaire 2 (Q2); for administrative actors Questionnaire 3 (Q3); and for actors outside the State bureaucracy Questionnaire 4 (Q4). The questionnaires were translated in Bulgarian and adapted to the local conditions.

There is one soil expert in the area with a long experience in salinisation problems. He was the manger of the Salinisation Research Station in Belozem, therefore he was not only interviewed but also invited to join the team. There are five large-scale farmers in the village and interviews were conducted with all of them. The smaller scale farmers were chosen randomly and we continued to conduct interviews until we stopped receiving new information about the issues. Interviews were taken also from all important actors from the local administration. We found three organisations outside the state administration working in the area of Belozem. Although soil conservation issues are not among their main priorities, they were also included into the sample because they are involved in solving rural development issues.

The total sample includes 31 interviews: 1 soil expert; 18 farmers; 9 actors from the state administration, and 3 actors outside of the administration (Annex 1). All interviews were conducted face-to-face, the majority with semi-structured questionnaires. However, for a few interviews an open-ended questionnaire was used.

3 Perception of soil degradation in the case study area

In this part of the report, the local actors' perception of the soil degradation problems will be contrasted with the experts' evaluation. In order to investigate the state of the problems the respondents were asked: (1) to choose, from in advance listed soil degradation symptoms, ones that they have observed on their farms and in the area; (2) to evaluate the severity of the problem on a scale from 1 (no problem) to 5 (a severe problem) and the tendency, 0 (no worsening) and 1 (deterioration). The sample description is presented in tables 4-6.

3.1 Soil degradation problems

Farmers' perception of the soil degradation problems. Most of the reported symptoms of soil degradation by farmers are related to salinisation (changes in plant growth caused by salinisation, crusting/sealing and salt crusts) and compaction (compaction of soil causing lower infiltration rates) (Table 3). Farmers also report that it is difficult to cultivate the soil in the area. When the soil is wet, it is sticky and the tractors cannot enter the field; when it is dry, the cultivation is also difficult since the soil breaks into big clods and then additional cultivation is needed to break them into smaller pieces.

The farmers rated salinisation as the most severe soil problem in the area. The mean rating regarding the severity of this problem is 4.11 for the area outside the farm and 3.50 on the farm (coefficient of variation 20.25 and 31.38) (Table 4). These results show that farmers have detected the main soil problem. Eleven out of eighteen farmers reported that they found changes in plant growth caused by salinisation in the area, while 14 of them observed this problem on their farms (Table 3). Fifteen respondents reported that they have seen salt crusts in the village fields. Only nine detected these visual symptoms of soil deterioration on their cultivated land. The results show that the farmers are familiar with the problem and recognise the symptoms and their impact.

Table 3: Symptoms of soil degradation problems (number of responses)

Symptoms for soil degradation	Occurs in the area	Occurs on my farm
Changes in plant growth caused by salinisation	11	14
Compaction of soil causing lower infiltration rates	15	13
Crusting/sealing	15	12
Forms of water erosion: rills, gullies	4	2
Loss of topsoil	1	0
Salt crusts	15	9
Slumping caused by instable soil	2	0
Soil being blown by wind onto roads (overblowing)	9	4
Soil run-off from field onto roads	6	3
Other symptoms of damages to soils	4	3
Total	82	60

Source: Interviews with farmers (n=18)

Table 4: Perception of farmers regarding soil degradation problems (Q2)

Soil degradation problem		Mean	St. Error	St. Deviation	Coef. of Variation	Sample Variance	Min	Max	Count	Conf. Level (95.0 %)
Soil erosion (water)	Area	1.83	0.12	0.51	28.06	0.26	1	3	18	0.26
	Farm	1.56	0.12	0.51	32.87	0.26	1	2	18	0.25
	Trend	0.17	0.09	0.38	230.09	0.15	0	1	18	0.19
Soil erosion (wind)	Area	1.72	0.16	0.67	38.85	0.45	1	3	18	0.33
	Farm	1.39	0.12	0.5	36.12	0.25	1	2	18	0.25
	Trend	0.11	0.08	0.32	291.04	0.1	0	1	18	0.16
Decline in organic matter	Area	1.94	0.21	0.87	44.88	0.76	1	4	18	0.43
	Farm	1.78	0.17	0.73	41.18	0.54	1	3	18	0.36
	Trend	0.61	0.12	0.50	82.09	0.25	0	1	18	0.25
Carbon balance	Area	1.11	0.08	0.32	29.1	0.10	1	2	18	0.16
	Farm	1.17	0.09	0.38	32.87	0.15	1	2	18	0.19
	Trend	0.06	0.06	0.24	424.26	0.06	0	1	18	0.12
Diffuse contamination	Area	1.61	0.14	0.61	37.72	0.37	1	3	18	0.30
	Farm	1.56	0.17	0.7	45.31	0.5	1	3	18	0.35
	Trend	0.22	0.10	0.43	192.51	0.18	0	1	18	0.21
Compaction	Area	2.44	0.23	0.98	40.24	0.97	1	4	18	0.49
	Farm	2.22	0.22	0.94	42.43	0.89	1	4	18	0.47
	Trend	0.56	0.12	0.51	92.04	0.26	0	1	18	0.25
Salinisation	Area	4.11	0.20	0.83	20.25	0.69	2	5	18	0.41
	Farm	3.50	0.26	1.10	31.38	1.21	2	5	18	0.55
	Trend	0.67	0.11	0.49	72.76	0.24	0	1	18	0.24
Acidification	Area	1.67	0.14	0.59	35.65	0.35	1	3	18	0.30
	Farm	1.78	0.17	0.73	41.18	0.54	1	4	18	0.36
	Trend	0.22	0.1	0.43	192.51	0.18	0	1	18	0.21
Retention capacity	Area	2.00	0.27	1.14	56.88	1.29	1	4	18	0.57
	Farm	1.72	0.21	0.89	51.96	0.80	1	4	18	0.44
	Trend	0.11	0.08	0.32	291.04	0.10	0	1	18	0.16
Off-site damages	Area	1.11	0.08	0.32	29.1	0.10	1	2	18	0.16
	Farm	1.11	0.11	0.47	42.43	0.22	0	2	18	0.23
	Trend	0.06	0.06	0.24	424.26	0.06	0	1	18	0.12

Source: Interviews with farmers (n=18); 1-no problem; 5 severe problem

Farmers' perception for the other soil degradation problems such as soil erosion, decline in organic matter or off-site damages is not so clear and the answers are not homogenous. In most cases, farmers were better in observing the symptoms but not able to determine the severity of the problem.

The second important soil degradation problem, determined on the basis of the questionnaire is compaction. However, its severity is much less than salinisation according to the respondents. The mean rank values of this problem are 2.44 for the village area and 2.22 for the farms of respondents (Table 4). However, the coefficients of variation are above 30 % indicating that the answers are not homogeneous. The compaction of soil is related to the soil properties of Solonetz soils. These soils are characterised by a heavy texture, and the excess amount of sodium further deteriorates their physical and chemical properties as well as their granular structure. These soil properties are directly related to other symptoms of soil degradation, i.e. crusting and sealing of soil surface and lower infiltration rates due to compaction of the soil. 15 of the interviewed farmers reported that above symptoms can be observed in the area and almost the same number (12 and 13) has noticed them on their farms.The decreasing retention capacity of soil, a degradation problem associated with its compaction, ranks third according to the severity in the area (mean rate 2.00).

The farmers' opinion about the decline of organic matter varies from 1 to 4, with a mean value of 1.94 for the area and 1.78 on-farm. However, the coefficients of variation are again above 30 % showing heterogeneous answers. This indicates that the farmers lack a clear picture about this process. This is not surprising since they do not have analytical data about the organic matter content in their soil.

Most of the farmers reported that erosion (water and wind), diffuse contamination, acidification and off-site damages are not a serious problem for the area and on their farms. The answers vary from 1 to 3, but prevailing answer is 1. Symptoms related to water erosion, are not typical for the plain terrain of Belozem region. That is why only few of respondents reported about this problem.

Soil specialists. The soil expert assessed salinity as a main soil degradation problem in the village of Belozem (rank 5) (Table 5). The second important problem is compaction (rank 3), followed by decline of organic matter, a negative carbon balance and water retention capacity (rank 3). A teacher from the local agricultural school (a soil specialist) gave priority to salinisation as the main soil degradation problem (rank 4) followed by the compaction and retention capacity of soil (rank 3). According to the specialist the other soil degradation problems, diffuse contamination, water and wind soil erosion are not a serious threat for the region.

State officials. The director of the local MAF office and the ecologist of Rakovski municipality (Belozem belongs to this municipality) both assess salinisation as the most important soil problem for the region (Table 5). Their opinions about the other soil problems differ: the expert from MAF office determines decline of organic matter and soil compaction as the second important problems, while the ecologist does not recognise these problems.

The experts from the local MEW office and the regional agricultural advisory services in Plovdiv provided their assessment about the soil degradation problems in the Plovdiv region. According to the expert from the local MEW office soil degradation problems exist in the region but their severity is not high (1-2). However, the specialist from the regional agricultural services evaluated the severity of the problems higher (2-3). He also stated that for Belozem salinisation traditionally is a severe problem.

A summary of the expert opinion regarding the soil degradation problems, causes and impact is presented in Table 6.

Table 5: Perception of actors for soil degradation problems (Q1, Q3 and Q4)

Soil degradation problem	Soil expert Answers are for village of Belozem			School teacher (agronomist) Answers are for village of Belozem		
	Severity	Trend	Drivers	Severity	Trend	Drivers
Soil erosion (water)	1	1		1	1	
Soil erosion (wind)	1	1		1-2	1	
Decline in organic matter	2	2	deterioration	2	2	deterioration
Carbon balance	2	2	deterioration			
Diffuse contamination	1	1		1	1	
Compaction	3	2	deterioration	3	3	deterioration
Salinisation	5	3	deterioration	4	4	deterioration
Acidification	2	2		2	3	deterioration
Retention capacity	3	2		3	1-2	
Off-site damages	1	1		4	3	-

Soil degradation problem	Municipal office of MAF Answers are for Rakovski municipality			Rakovski Municipality Answers are for Rakovski municipality		
	Severity	Trend	Drivers	Severity	Trend	Drivers
Soil erosion (water)	1	1		2-3	1	
Soil erosion (wind)	1	1		1-2	1	
Decline in organic matter	2-3	2	deterioration	1	1	
Carbon balance						
Diffuse contamination	1-2	1		1-2	1	
Compaction	2-3	1				
Salinisation	4	2	deterioration	4-5	2	deterioration
Acidification	1-2	1		1-2	1	
Retention capacity	4	2				
Off-site damages						

Soil degradation problem	Local office of MEW Answers are for Plovdiv region			Agricultural advisory services Answers are for Plovdiv region		
	Severity	Trend	Drivers	Severity	Trend	Drivers
Soil erosion (water)	2	1		2-3	2	deterioration
Soil erosion (wind)	2	1		1	1	
Decline in organic matter	1	1		2	2	deterioration
Carbon balance	1	1		2	2	deterioration
Diffuse contamination	2	1		1	1	
Compaction	2	2	deterioration	2	1	
Salinisation	2	1		3	2	deterioration
Acidification	2	1		3	2	deterioration
Retention capacity	1	1		1-2	1	
Off-site damages	2	2	deterioration	1-2	1	

Source: Interviews with stakeholders. Note: Severity - Rating 1-5 (no problem to a severe problem); Trend, i.e. has this increased or decreased during the last 10 years. Rating 1-5 (1- no change; 5 - large change); with 'Drivers' indicating whether the situation has deteriorated or improved. No improvement of soil condition has been reported.

Table 6: Experts' assessment of soil degradation causes and impacts

Soil degradation process	Causes	Impact
Salinisation Process of accumulation of water-soluble salts in soil, sometimes combined with increase content of exchangeable-sodium.	• insufficient soil draining • shallow ground water table with high mineral content • the tectonic activities in the area • destruction of the natural soil drainage - deforestation, ploughing up the meadows and pastures • cultivation practices - flooded rice cultivation on improper rice fields • destruction and poor maintenance of the existing irrigation and drainage systems	• toxic levels of salts in soil for plants • water stress for plants, due to decreased osmotic potential of the soil • reduced crop productivity • dispersion of soil colloids • short period for soil cultivation: wet soil is sticky, dry soil is cracked • reduced infiltration • reduced soil fertility • salt crusts
Compaction: Soil compaction is a form of physical soil degradation. It is a result mostly of heavy machinery use on the same piece of agricultural land (especially on wet soils).	• naturally heavy textured soils • working the land when wet • increased number of crossings/tracks within the field per year • excess amount of sodium deteriorates physical and chemical properties as well as soil granular structure	• reduces infiltration • reduces water retention capacity of land • crusting/sealing of the soil • Increased risk of further compaction • reduced crop yield/quality because of poor root development and less water and air available to the crop
Decline in organic matter: Organic matter improves soil physical and chemical properties, (water retention, aeration, CEC, content of available nutrients) and soil biological activity	• increased number of cultivation practices • restricted application of organic fertilizers • improper use of crop residues – burning stubbles, removing the organic residues from the field • use of only mineral fertilisers • specific chemical reaction between sodium and humus (sodium humates are more soluble and can be leached)	• structural degradation • soil sealing/crusting • reduced infiltration • increased vulnerability to compaction • low biological activity

Source: Case study interviews

3.2 Trends in soil degradation and consequences

The opinion of different interviewed groups about the main soil degradation problems depends on their position and knowledge, and the region they are working in. Regarding the trends of soil degradation problems the farmers' answers are ambiguous; the farmers do not have a clear perception whether the problems increase or decrease over time (Table 4).

The soil expert considers salinisation as the main problem and he states that it deteriorates (Table 5). According to him, the effects of deterioration are still not visible since the salt concentration in the soil has not yet reached a certain threshold. In addition, the effect of the chemical melioration conducted during the sixties and seventies is still present. He mentioned that the abandonment of drainage system and the current farming practices have increased the risk for secondary soil salinisation.

The schoolteacher and the experts from the municipality centre Rakovski have also pointed out salinisation as the main soil degradation problem for the region and they mentioned that the situation is getting worse (Table 5). The respondents from Belozem who are most affected by the problem rank the deterioration tendency with 3 and 4, while people from Rakovski consider the tendency less serious and rank it with 2.

The experts from Plovdiv (municipality Rakovski belongs to this administrative region) do not mention a tendency of increasing soil salinisation (Table 5). Actually, the salinisation problem is most severe in Belozem, but it can also be observed in many other areas of Plovdiv district (villages of Boliarino, Shishmanci, Rakovski, Manolsko Konare, Manole, Skutare, Graf Ignatievo, Trud, Radinovo, Kostievo, Benkovski and others).

4 Farming practices and soil conservation measures

In order to investigate the effects of farming practices on soil degradation processes 18 farmers from the village of Belozem were interviewed. Five of them can be classified as large-scale (farm size: 150 to 1,300 ha), while the others are small-scale (farm size: 3 to 27 ha). All together, these farmers cultivate 2,080.8 ha land: 1,580 ha non-saline land and 500 ha Solonetz soils, meliorated in depth 0-30 cm in the past (25-30 years ago).

4.1 Farming practices and their effects on soil

Farming practices may have both, positive and negative effects on soil. In the following section, typical aspects of farming in Belozem and their impact on soil degradation processes are described, including crop structure, crop rotation, tillage, fertilisation, irrigation and drainage, and livestock. Table 12 at the end of the section provides an overview of positive and negative effects of farming practices on soil degradation.

The production orientation of farms in Belozem region is conventional (Table 7). There are no organic farms in the region. Most farms grow mainly crops but a few breed animals as well.

Crop structure. The main crops grown by the interviewed farmers are field crops (1,734.6 ha): wheat, rice, maize, sunflower, barley, triticale, alfalfa, and maize-silage. Vegetables are grown on 298.4 ha and include tomatoes, peas, watermelon, cabbage, pepper, and potatoes. Seven of the interviewed farmers do not cultivate part of their land at present. About 75 % of the land farmers cultivate is non-saline while the remaining 25 % are ameliorated Solonetz and weakly salt-affected soils. This is because most of them avoid renting or cultivating saline land.

Depending on salt-tolerance, plants can be divided into 4 groups (sensitive, moderately sensitive, moderately tolerant and tolerant). Most crops are highly sensitive to salinity stress during the germination and seedling stages. Young plants seedlings and young transplants are also particularly sensitive to salt exposure (Appleton *et al.*, 2003). However, after these stages many crops can tolerate higher salinity levels (Kavardziev, 1985; Cardon *et al.*, 2007). Crop salt tolerance depends also on many other factors such as variety, local soil and climate conditions, etc.

Table 7: Typical cropping systems, their characteristics and estimation of impacts of soil degradation problems in the case study Belozem

Crop	Soft wheat, winter – Grain	Barley, winter – Grain	Maize – Grain	Alfalfa – Fodder	Rice – Grain	Tomato – Fruit	Paprica – Fruit	Sunflower – Grain	Maize, Fodder – Fodder	Cabbage – Ware	Melon (all varieties) – Fruit	Triticale – Seed	Potato – Root	Pea – Grain
Production orientation	conventio-nal	conventio-nal	conventio-nal	conventio-nal	conventio-nal	conventio-nal	conventio-nal	conven-tional	conven-tional	conven-tional	conven-tional	conven-tional	conven-tional	conven-tional
Farm type	arable farm	arable farm	arable farm	arable farm	arable farm			Arable farm	livestock farm < 1,5 LU	arable farm	arable farm	arable farm	arable farm	arable farm
Tillage type	ploughing	ploughing	ploughing	ploughing	ploughing	ploughing	ploughing	ploughing	ploughing	ploughing	ploughing	ploughing	ploughing	ploughing
Irrigation type	no irrigation	no irrigation	surface irrigation – furrow	surface irrigation – border irrigation	surface irrigation – border irrigation	surface irrigation – furrow	surface irrigation – furrow	no irrigation	no irrigation	surface irrigation – furrow	drip irriga-tion	no irrigation	surface irrigation – furrow	surface irrigation – furrow
Other manage-ment op-tions	incorporation of finally cut straw into the soil after harvest improve content of soil organic matter	incorporation of finally cut straw into the soil after harvest improve content of soil organic matter	subsoiling – depth up to 40 - 45 cm. (for soil class 1 and 2)		Incorpora-tion of cut up straw and stubble into the soil	Incorpora-tion of cut up plant residues into the soil	Incorpora-tion of cut up plant residues into the soil	subsoiling – depth up to 40 - 45 cm	subsoiling – depth up to 40 - 45 cm	Incorpora-tion of cut up plant residues into the soil	Incorpora-tion of cut up plant residues into the soil	incorporation of finally cut straw into the soil after harvest improve content of soil organic matter	Incorporation of cut up plant resi-dues into the soil	subsoiling – depth up to 40 - 45 cm
Soil quality class[a]	1 - 2	1 - 2	1 - 3	2	1 – 2	3	3	1 – 2	1	3	3	2	3	1
Soil degra-dation problem	Vulnerability													
Decline in organic matter	low	low	low	medium	low	low	low	low	medium	medium	medium	low	medium	low
Compaction	medium	medium	low	medium	high	Low	low	medium	medium	low	low	medium	low	low
Salinisation	low	low	low	Low	low	low	low	medium	low	low	low	low	low	low

a: There are three soil quality classes in the case study: class 1 means loamy to slightly clayey luvisols (medium quality); class 2 means Solonetz (poor quality) and class 3 means loamy Fluvisols (good quality)
Note: in addition to these results further statements to typical cropping systems were given in Questionnaire

Table 8: Crop structure and cultivated area of interviewed farmers in hectares (Q2)

Crops	Non-saline soils	Salt-affected soil	TOTAL
Field crops	1241.20	493.40	1734.60
Wheat	729.50	81.20	810.70
Barley	11.40	4.20	15.60
Corn	2.70	259.70	262.40
Triticale	2.40	10.90	13.30
Rice	210.00	35.00	245.00
Sunflower	278.10	56.90	335.00
Corn-silage	0.00	20.40	20.40
Alfalfa	7.10	25.10	32.20
Vegetables	297.40	1.00	298.40
Pepper	1.60		1.60
Tomatoes	170.20		170.20
Potatoes	0.20	1.00	1.20
Cabbage	6.70		6.70
Peas	75.00		75.00
Watermelon	43.70		43.70
Other crops	0.20		0.20
Strawberry	0.20		0.20
Abandoned land	39.50	8.20	47.70
Rented out land			6.50
TOTAL	**1,578.30**	**502.60**	**2,087.30**

Source: Interviews with farmers

Table 9: Relative salt tolerance of crops

Crops	Threshold dS/m	Rating
Field crops		
Barley	8.0	Tolerant
Triticale	6.1	Tolerant
Rye	5.9-7.6	Tolerant
Sugar beet	6.7-7.0	Tolerant
Safflower	5.3	Moderate Tolerant
Sorghum	4.0-6.8	Moderate Tolerant
Wheat	4.7-6.0	Moderate Tolerant
Soybean	5.0	Moderate Tolerant
Sunflower	2.3-4.8	Moderate Tolerant
Peanut	3.2	Moderate Sensitive
Rice (paddy)	3.0	Sensitive
Corn	1.7-2.7	Moderate Sensitive
Beans (field)	1.0	Sensitive
Vegetables		
Beets	5.3	Tolerant
Garlic	3.9	Moderate Sensitive
Pea	3.4	Moderate Sensitive
Broccoli	2.8	Moderate Sensitive
Cauliflower	2.7	Moderate Sensitive
Cucumber	2.5	Moderate Sensitive
Tomato	2.5	Moderate Sensitive

Source: own modification based on (Brady, 1974; Kavardziev, 1985; Rowell, 1993; Soltanpour & Follett, 1995; Kotuby-Amacher *et al.*, 1997; Kenneth & Neeltje, 2002; Cardon *et al.*, 2007).

The winter cereals are generally tolerant to saline soils. Barley and triticale are classified as tolerant, while wheat and rice are moderately tolerant; sunflower, maize and alfalfa are moderately sensitive crops. Tomatoes are among the most salt tolerant vegetables and they are classified as moderately sensitive to moderately tolerant crops (Kavardziev, 1985; Soltanpour & Follett, 1995; Kotuby-Amacher *et al.*, 1997; Kenneth & Neeltje, 2002). Adaptability of

tomatoes allows farmers in Belozem to grow them on slightly saline, chemically meliorated and non-saline soils (Luvisols, meliorated Solonetz and Fluvisols). The other vegetables grown (cabbage, pepper, potatoes) are moderately sensitive to salinisation. They are mostly allocated on Fluvisols, which are not affected by salinisation process due to the light soil texture.

Crop rotations. The most common crop rotation in the village is an alteration of winter cereals (wheat, barley, triticale) with summer crops (sunflower, maize). Cereals decrease evaporation, especially during some of the hottest summer months. A suitable practice is also a summer fallow tillage (12 - 15 cm) after the cereals' harvest. This practice controls the weeds and decreases evaporation from the soil.

Field crops are cultivated on both saline (including chemically meliorated in the past) and non-saline soils (Luvisols and Solonetz). Paddy rice is cropped 4-5 years and then on the same place, alfalfa is planted for 2 years, followed by corn, wheat or barley. The water, used for rice growing, leaches the salts from the soil and decreases to some extent the exchangeable sodium content (Kavardziev and Popandova, 1989). Several of the interviewed farmers reported that crops grown after rice develop better on salt-affected soils and on ameliorated Solonetz. Therefore, the enlargement of rice fields may be considered a conservation measure and partially a reclamation measure for this type of soils. Alfalfa is grown on parts of the land for 3-4 years. Vegetables are usually altered with corn or winter cereals.

Table 10: Yields from non saline and saline soils (t/ha)

Crop	Wheat		Barley		Triticale		Rice		Maize		Sunflower		Alfalfa		Potato	
	n.s.*	s**	n.s.*	S**	n.s.*	s**	n.s.*	s**	n.s.*	s**	n.s.*	s**	n.s.*	s**	n.s.*	s**
Mean	2.6	2.1	2.6	2.9	2.6	3.1	6.5	5.3	6.3	5.3	1.3	1.1	8.2	5.6	20	18
Standard Error	0.2	0.2	0.5	0.1		0.1	0.5		0.9	0.2	0.2	0.2	1.3	0.4		
St. Deviation	0.8	0.7	1	0.2		0.1	0.7		1.5	0.3	0.4	0.4	2.9	0.9		
Coef.of variation	29	33	37	7.1		3.5	11		24	5.4	35	40	36	15		
Sample Variance	0.6	0.5	0.9	0		0	0.5		2.3	0.1	0.2	0.2	8.6	0.7		
Minimum	1.8	1.2	1.8	2.7	2.6	3	6	5.3	5	5	1	0.5	4.5	4.5	20	18
Maximum	3.9	3	4	3.1	2.6	3.3	7	5.3	8	5.5	1.9	1.7	12	6.5	20	18
Count	11	8	4	3	1	4	2	1	3	3	4	5	5	4	1	1
Conf. Lev.(95.0 %)	0.5	0.6	1.5	0.5	2.6	0.2	6.4		3.8	0.7	0.7	0.5	3.6	1.4		

*non-saline soil; ** salt affected and meliorated soil
Source: Interviews with farmers

Soil tillage. Because of characteristics of the most spread soils in the region Luvisols and Solonetz (heavy soils with poor physical and chemical properties, with tendency to compaction and heavy water-air regime), more tillage practices are necessary.

Deep ploughing (up to 30 cm) is a basic farming cultivation practice for all crops grown in Belozem area. It restricts the influence salt concentration on soil fertility (Aleksiev, 2005), improves the soil drainage, and contributes to dislocation and vertical salts' distribution. There are several factors that determine the effect of tillage; (1) the time of performance; (2) the soil moisture; (3) the depth, and (4) the machines and equipment used. This practice creates better conditions for root development, improves the drainage and salts leaching from the upper soil horizon during rainfall periods of the year. Deep ploughing is not a typical practice for winter cereals in places where the soils are not so heavy. Soil preparation, before sowing of winter cereals in such places, includes only disk harrowing.

The next tillage practice used for soil preparation for most crops is disk harrowing. This practice is applied two or three times, before sowing, depending on the soil conditions. Some farmers perform also chisel cultivation and rotary tilling mainly when vegetables and other high value crops are grown.

After sowing of winter cereals, many farmers roll on the soil surface with rollers to increase capillary upward movement of water, which ensures enough moisture for seed germination.

This practice is not suitable for Solonetz and Alkali Solonchaks soils, because keeping the soil surface in a crumbly condition decreases the risk of soil swelling, compaction and creation of anaerobic conditions. Ploughing (up to 30 cm) is also done in autumn for the vegetables. The suitable period for the spring cultivation on salt-affected and Solonetz soils is very short. In addition, soil heterogeneity shortens this period. If farmers wait for the last wet slick spots on the field to dry out and become suitable for tillage, the rest of the field is too dry and soil breaks into big hard clods.

In order to destroy weeds and decrease evaporation of soil moisture, farmers hoe one or two times when maize and sunflower are grown. This is a good practice for decreasing upward moving of salts from lower soil horizons.

Most of farmers use unspecialised machinery for conducting soil tillage practices, but on larger farms modern machinery is used, which can perform several soil tillage operations at the same time. These machines allow deeper soil cultivation, which improves the salts leaching.

Reduced tillage is not an appropriate cultivation practice for saline soils. Some farmers do not perform all necessary cultivation practices. However, their behaviour is motivated by economic factors (cost reduction) rather than soil conservation. Most farmers in Belozem have experienced the positive effect of subsoiling up to 40-45 cm, which is a suitable practice for heavy soils. Some of the farmers managing large farms apply this practice periodically.

Fertilisation. The farmers in the village predominantly apply nitrogen fertilisers (ammonium nitrate and urea). Mainly the bigger field crop producers and almost all vegetable producers employ phosphorus fertilisers (triple super phosphate) and very little potassium. Some of them also use combined fertilisers (N, P, K). Farmers are aware of the benefits of a balanced fertilisation with nitrogen, phosphorus and potassium, but they are constrained by two main factors. First, especially the small farmers do not have sufficient financial resources and therefore they use the cheapest fertilisers, nitrogen, with clear visual effects on crops. Second, the larger farmers cultivate rented land with contracts up to 5 years. This discourages them to invest in the improvement of soil fertility by applying more expensive and long lasting fertilisers such as phosphorus and potassium fertilisers. In the long run, this practice exhausts the soil reserves and leads to a sharp decline in yields.

The application rates of nitrogen are adequate for wheat, barley, triticale and rice crops and vary between 100 and 120 kg N/ha. The amount of nitrogen used for maize is higher and varies between 140 and 170 kg N/ha. Farmers apply comparatively small amounts of nitrogen for silage corn and do not use nitrogen for alfalfa except before sowing (first year of cropping). Higher nitrogen rates are applied to vegetables from 120 to 160 kg N/ha but they can be classified as comparatively low for this type of crops.

Among all field crops, only rice is well provided with phosphorus. Most of respondents reported that they do not use phosphorus for field crops. Vegetables are better supplied with this nutrient, mainly because they are grown on a smaller scale and respond better to fertilisation.

Overall, reduced application of fertilisers has a negligible effect on soil salinisation, but it leads to a depletion of the soil nutritional reserves, lower the yields, revenues and incentives to invest in agriculture.

Irrigation and drainage. All winter field crops, silage maize and in parts alfalfa are grown without irrigation. Winter cereals are rarely irrigated in Bulgaria because there is sufficient precipitation during their vegetation period. However, good yields from alfalfa and maize (grain and silage) can be obtained with only 2-3 irrigations during the vegetation period.

The amount of irrigation water used for vegetables varies from 3,500 to 7,000 m^3 per vegetation period depending on soil and crop type. Most vegetables are irrigated from wells, but unfortunately, quality and salt content is not controlled. This may cause secondary soil salinisation.

Nobody applies special irrigation practices with the goal of leaching excess salts from upper soil layers. Reasons for this situation are: (1) the existing land fragmentation (in ownership and use) which impedes the organisation of water supply from the central irrigation system; and (2) the additional expenses for water that has to be used. In addition, the irrigation system (especially the secondary canals) is partly destroyed and/or not well maintained. Many small landowners have abandoned their land. Some of the larger farmers (mainly rice producers) sometimes clean the canal system themselves, which is an obligation of the state organisation "Irrigation Systems" or/and the land owners/users (for the secondary canals).

The main sources for irrigation water are Maritza River and Piasachnik Water Reservoir. Water from Maritza River is used for irrigation of the rice fields, vegetable crops, alfalfa, and maize, which are cultivated in the southern part, while Piasachnik Reservoir serves the western part of the village. The water quality and chemical composition of both sources are suitable for irrigation and can also be used for salts leaching without special salinity control. It belongs to water quality class C2, medium salinity hazard (EC is 263 µS/cm for Maritza water, and 376 µS/cm at Piasachnik Reservoir). The pH values are uncommonly high for both sources (8.69 and 8.45).

Table 11: Properties of water from Maritza River and Piasachnik Water Reservoir (beginning of irrigation season)

Parameters	Maritza river		Piasachnik reservoir	
	Value	Threshold	Value	Threshold
pH	8.69	6.0-9.0	8.45	6.0-8.5
conductivity - µS/cm	263	1,600	376	1,300
Soluble compounds (mg/l)	187	1,500	425	1,000
Insoluble particles (mg/l)	103	100	6.0	50
Degradable organic matter (Biochemical Oxygen Demand - mg/l)	4.9	25.0	2.4	15.0
Oxidizable Matter (Chemical Oxygen Demand - mg/l)	39	100	36	70
Ammonium nitrogen (mg/l)	0.15	5.0	0.29	2.0
Phosphates (mg/l)	0.07	2.0	<0.03	1.0

Source: "Irrigation systems", branch Plovdiv

Maritza River water quality indexes differ from data presented in Table 11 in the period of active irrigation when river water level is low. During this period, the salt content is higher and often reaches 500-600 µS/cm. In this case, the water is also C2 class (medium hazard) but the EC values are near the upper limit for this quality class. However, the water chemical contents can change after releasing into earthy irrigation canals passing through salt affected soils. Due to infiltration, the content of dissolved salts in water can increase from 627 µS/cm before releasing in the canals to 994 µS/cm after infiltration.

Irrigation during autumn leaches the excessive salts from the soils. Farmers have observed this effect (Q2), because they can obtain much higher yields from every crop grown after rice. The amount of irrigation water for one cropping season of rice is about 20,000 m^3/ha.

Some of the small producers use water from the drainage canals for irrigation. In certain places the drainage canals are blocked to keep the water from flowing out. Transforming the drainage canals into water reservoirs can have serious consequences. First, waters from drainage canals often have higher mineral contents and second, the underground water level rises and the process of secondary salinisation could speed up.

Belozem's water reserves include: (1) underground karst waters in the northern part of the land (EC 600 – 700 µS/cm); (2) underground waters with low mineralisation near to the river Maritza (EC 300 – 400 µS/cm); and (3) deep ground water. The latter contains smaller

amounts of water-soluble salts and has a better salt composition in comparison with the water from the upper soil horizons.

Livestock. Currently livestock breeding is poorly developed in Belozem. Only three out of 18 interviewed farmers have been seriously involved in this business, respectively with 8, 17 and 30 cows. Four other farmers have between 1 and 5 cows, mainly for own needs. Most animals in the village graze on pastures, which comprise about 700 ha of land around the village. These pastures either belong to the municipality or are not cultivated private lands. On one hand, the low stocking density has the advantage that it does not have a deteriorating impact on the soil. On the other hand, the small number of cattle provides insufficient amounts of manure. Farmers mostly use manure for vegetable crops and sometimes for arable crops such as maize and sunflower. One of the farmers rears ducks for liver and meat (60.000 ducks). He produces most of the needed forage himself, cultivating 610 ha land (most rented in another village).

By-products from crop production. Straw is the main residue from crop production in the village. However, there is a problem especially for the rice straw, which is firm, sharp and contains more silicon. Because of these characteristics, animals do not eat it. Most of the interviewed farmers showed awareness of the problems caused by burning straw on the fields, so they are trying to avoid this practice. Some farmers contract with people, often from other regions, who take the straw free or at a low price, but with the obligation to clean the entire field. When there is no enough demand for straw farmers, especially the large ones, cut the straw into small pieces, spread them on the field and later plough them into the soil. The same practice is also used for the stubbles. In fact, cutting into pieces and spreading straw on fields plays the role of mulch diminishing evaporation during the summer time.

Crossing tracks. The machines cross the fields 7-12 times per vegetation period. Because of the specific physical properties, the saline soils require more tillage practices (average number varies between 5 and 6). The remaining crossing tracks are for sowing, plant protection and harvesting, as well as mowing, packing in bales and removing the straw from the field. Large-scale farmers use new tractors that put less pressure on the ground, while smaller ones use older tractors with higher impact on soil leading to compaction. Renewing of this equipment would improve the situation by reducing soil compaction. The small-scale vegetable farmers use many manual cultivation practices (except soil tillage), which do not increase compaction.

The effect of farming practices on soil. Farmers' choice of crops depends on yields and market prices. Costs saving motives are the guiding force behind the choice of cultivation practices. The soil conservation issues are also important but they are ranked behind the other two.

As discussed earlier, soil compaction in Belozem is mainly due to the naturally heavy soils and to anthropogenic factors, hence deep ploughing at about 30 cm contributes to soil loosening. Ploughing with a tillage depth over 30 cm is not recommended since the chemical melioration was done on this depth. However, many of the small farmers complained that they lack the necessary financial resources to conduct all tillage operations.

Farmers in the region do not apply sufficient amounts of phosphorous and potassium fertilisers and manure. In addition, they do not grow cover crops, intercrops or green manure crops. As a result, some humus compounds become more soluble, in case of Solonetz soil, and may be leached from the soil surface. Because of the low livestock number in the village the total amount of manure is insufficient. This leads to a decrease in soil organic matter.

The most severe problems are irrigation and drainage. There is a sufficient amount of water with low mineral contents in the area. However, some of the smaller farmers use water from the drainage canals and from shallow wells, which increases the risk from secondary salinisation. In addition, the drainage canals are blocked in certain places, contributing further to the salinisation process.

Table 12: Effects of farming practices on soil degradation in Bulgarian case study

Soil degradation	Positive effect	Negative effect
Salinisation	• maintaining of existing drainage system • chemical melioration of soils with excessive amount of exchangeable sodium • using of clean water from centralized irrigation system • growing of rice decrease soil salinisation under field • increased number and depth of the tillage • periodic subsoiling • summer fallow after harvest of cereals • restricted application of mineral fertilisers during last decade • growing of salt tolerant crops	• bare soil surface for long time period especially during summer • using of shallow well water for irrigation • using of water from drainage canals for irrigation • reduced application of organic fertilisers
Compaction	• use of modern equipment for soil tillage and other farming practices that put less pressure on the ground • low stocking density decreased its effect for soil compaction • deep ploughing • subsoiling	• use of old tractors and machinery • increase number of soil tillage practices • application of manual cultivation practices in small-scale vegetable farms, which do not increase compaction • application of organic fertilisers and crop residues
Decline in organic matter	• cutting and incorporation of straw into the soil • application of manure	• Frequent soil tillage • restricted application of manure, compost and green manure • removing straw from fields • burning straw and stubbles

Source: Case study interviews

4.2 Suitable soil conservation measures

There are several soil conservation measures that can be applied on saline soils: (1) changing the crop structure; (2) application of suitable cultivation practices; (3) maintaining the irrigation-drainage system; (4) chemical melioration; (5) planting tree strips. The effects of these measures on soil conservation is estimated in tables 12 and 13.

Improvement of crop rotations (crop structure). Crops which are tolerant to salt and sodium concentration are included in the crop rotation. This choice must also consider the long-term effect on the salts concentration of the crops included in the rotation. These crops need to ensure that the soil is covered with vegetation during most of the year. The period June-September and the months with high temperatures and active evaporation are of a particular importance. Plant cover will limit surface transpiration and hence will decrease the risk of additional salt accumulation. In this situation, crops will not only provide soil mulching, but can also supply green manure. Most crops grown in Belozem are tolerant to salinisation in the area (salt accumulation with hydraulic alkali salts and exchangeable sodium concentration). However, the yields from even the most tolerant crop barley are considerably lower compared to the yields received from non-saline or chemically meliorated plots. Single application of this measure will have a marginal effect on soil conservation and the farm income. Therefore, this measure should be combined with the other measures described below.

Improvement in the cultivation practices. This measure includes three cultivation practices: (1) using crops' residues for mulching and returning part of organic matter to the soil; (2) summer fallow after harvesting of winter cereals; (3) keeping the traditional deep tillage; (4) subsoiling. All of these measures either decrease evaporation or prevent the underground salty water to move upward to the soil surface.

Spreading cut straw from winter cereals on the soil surface could decrease water evaporation during the summer. Summer fallow after harvesting of winter cereals to control weeds and preserve soil moisture is a suitable practice when cover crops are not grown.

Deep tillage (up to 30 cm) is a basic farming cultivation practice for Belozem and at the same time a suitable conservation measure because it decreases the harmful effect of the exchangeable sodium and salt concentration on the soil fertility, improves the soil drainage and constraints the vertical salt distribution. However, tillage deeper than 30 cm is not recommended because the chemical melioration with phosphorus-gypsum was carried out at a depth of 30 cm in Belozem during the 1960s and 1970s.

Subsoiling is defined as breaking compact subsoil without inverting it with a special tool (chisel) which is pulled through the soil at a depth of 30-40 cm. This cultivation practice increases water infiltration and decreases the capillary upward movement of underground water with high salts contents. It also improves the drainage and can help the leaching of excessive salts from the upper soil layers. However, without introducing soil amendments, this practice will have a short-term effect.

All cultivation practices which increase the soil organic matter are suitable for application in the region. Supply of organic matter into the soil, such as compost, manure, green manure and the incorporation of crop residues improves the soil properties (e.g. porosity, water-holding capacity) of salt affected and Solonetz soils. All these materials sustain the content of organic matter into the soil. Finally, in order to avoid soil compaction all cultivation practices need to be performed with special machinery with thicker wheels. The use of heavy machinery should be avoided.

Table 13: Effects of cropping/tillage soil conservation measures on soil degradation problems

	Soil degradation problem									
Measures	soil erosion water	soil erosion wind	decline in organic matter	negative carbon balance	diffuse contamination	compaction	salinisation	acidification	decrease of water retention capacity	Off-site damage
Wheel sizes and pressure / restricting excessive heavy machinery use	1					2				
Restrictions of manure application to a certain time period					1					1

Note: The numbers indicate *the general effects of soil conservation measures on soil threats in the case study*, examined in questionnaire 1 with the following units: 2 = farming practice highly mitigates the threat, 1 = farming practice mitigates the threat, 0 = farming practice has no effect on threat. The grey marked cells are not relevant because this measure has no relationship to the threat.

Table 14: Effects of long term soil conservation measures on soil degradation problems

	Soil degradation problem									
Measures	soil erosion water	soil erosion wind	decline in organic matter	negative carbon balance	diffuse contamination	compaction	salinisation	acidification	decrease of water retention capacity	Off-site damage
Use of organic soil improvers/exogenous organic matter	1	1	2	2		1				0
Irrigation management to mitigate salinisation							2			
Control of irrigation water/use of appropriate water quality							2			
Drainage management to mitigate salinisation and/or compaction						1	2			
Chemical amendments (application of gypsum on salinised-sodic soils)	1	1	1	1	0	2	2	0	1	0

Note: The numbers indicate *the general effects of soil conservation measures on soil threats in the case study*, examined in questionnaire 1 with the following units: 2 = farming practice highly mitigates the threat, 1 = farming practice mitigates the threat, 0 = farming practice has no effect on threat. The grey marked cells are not relevant because this measure has no relationship to the threat.

Drainage-irrigation system. The development and maintaining of the drainage-irrigation system is a measure that can substantially reduce the factors that lead to soil salinisation in the area. The irrigation system brings water with lower salt content from other areas. This water can be used for irrigation and for leaching the excess salts from the soil. The drainage system keeps the water table under the critical level. This prevents the upward water capillary movement near soil surface.

After the modernisation of the existing irrigation system and digging the main drainage canals during the sixties, a considerable reduction of soluble salt content in the soil was observed 3-4 years later. Currently, most of the main irrigation canals are somehow maintained, but the drainage canals are neglected. Rebuilding, maintenance and improvement of the drainage-irrigation system in Belozem is a crucial task that farmers as well as the state authorities responsible for soil conservation must consider. Using water from the centralised irrigation system is an important measure for decreasing the salinisation problem in the area. If the system is not managed properly, and the water supply is unreliable, the farmers will be pushed to use water from shallow wells, tail waters, and water from drainage canals for irrigation.

Chemical melioration. Chemical melioration is the most effective way for reclamation of Solonized, Solonetz and Sodic Solonchak soils. Application of soluble in high pH calcium-based soil amendments (gypsum, phosphorus-gypsum, calcium chloride, etc.) is one of the best practices for improving of Solonetz soils. The most common form of calcium used for this purpose is gypsum. Calcium chloride, which reacts faster, can also be used, but it is more expensive.

The melioration had led to an improvement of the soil quality and crop productivity and in some fields the effect is lasting until present days. Chemical melioration considerably improves the soil quality and allows growing of sensitive to Sodic soil conditions crops and receiving high yields.

Tree strips or small spinney. A suitable conservation measure for regions with saline and sodic soils could be planting of tree strips or small spinney with tolerant tree and shrub species on uncultivated land (for instance along the drainage canals). The deep trees' root system facilitates soil drainage and improves salts leaching. Some of the salt tolerant tree species are: Honeylocust (*Gleditsia triacanthos*), different varieties of oaks (*Quercus*), Black poplar (*Populus Nigra*), Black Locust (*Robinia pseudoacacia*), White poplar (*Populus alba*). Suitable shrubs are Tamarisk (*Tamarix ramosissima*), and Rugosa rose (*Rosa rugosa*), (Kavardziev, 1985; Swift, 1997; Appleton *et al.*, 2003).

5 Evaluation of soil conservation measures

In this part, four soil conservation measures will be evaluated: (1) improvement of the crop rotation; (2) development and maintaining of the drainage system; (3) chemical melioration; and (4) planting tree strips.

5.1 Improvement of crop rotation and cultivation practices

Technical implementation. Changing of crop rotation (structure) is comparatively easy from the technical point of view. The measure requires the cultivation of crops, which are more tolerant to salinisation. Moreover, the local farmers are adapted to the situation and they already grow crops, which are more or less tolerant to saline sodic soils (mainly winter cereals such as wheat, barley triticale, and less tolerant maize, sunflower and alfalfa). Flooded rice is also a suitable crop, at least for the Belozem case. Constructed and located in appropriate places, rice fields can support the salt leaching processes. Although the rice production was in the past part of the salinisation problem, it could be now part of the solutions. The sensitive vegetable crops are mainly grown on good quality soil (Fluvisols).

Economic efficiency. Despite the appropriate crop structure in the region, the economic efficiency of the rotations is comparatively low, yields of the main cereal crops are low mainly due to the unfavourable soil properties. The experts' opinion is that the structure of the crops is suitable for the situation and can be only marginally improved.

Environmental effects. Improving of the crop structure will have several environmental effects. First, including crops covering the soil surface in the rotation, especially during hot summers, will reduce the danger of secondary soil salinisation. The application of subsoiling will improve the surface soil drainage, reduce the risk of salinisation, and decrease the soil compaction. Incorporation of crop residues in the soil will mitigate three important soil degradation issues of the region, i.e. salinity, reduction of organic matter and compaction.

Social constraints. There are no social norms that could constrain or impede the implementation of this measure. If farmers are convinced of the usefulness of change, they will adopt the new structure. Most of the soil conservation practices we observed have been voluntary introduced in the area.

5.2 Development and maintaining of the drainage-irrigation system

Technical implementation. Both the irrigation system and the main canals of the drainage system are already in place but after 1990 both were poorly maintained. Especially for the secondary canals, the problem is severe. Further development of the drainage system is not imperative and may not even be necessary. However, maintenance activities such as cleaning and unblocking the drainage canals are essential. This type of maintenance does not pose any technical problems, it merely requires organisation and financial support.

Economic efficiency. A simple financial cost-benefit analysis would reveal that the reconstruction of the system is promising to be very efficient, especially if we consider the risk of secondary salinisation of already chemically meliorated fields and related costs for improving the soil quality again. As mentioned before the yields from the tolerant crops would increase and farmers would have expanded choices.

Environmental effects. Reconstructing, maintaining, and possibly expanding the drainage-irrigation system would have considerable environmental effects. It would not only greatly reduce the risk for secondary salinisation, but without this measure, all other measures will have either temporary or marginal effect.

Social constraints. All interviewed farmers, state officials, and people outside bureaucracy understand the need of rehabilitation especially of the drainage system. Despite its benefits, this measure will face serious constraints. Rehabilitation will require financial resources that none of the actors can provide themselves, but there is state funding (programmes) available for this purpose. The core problem, however, is the organisation of maintenance, which requires some level of voluntary participation and cooperation of all actors, especially from farmers.

5.3 Chemical melioration of Solonetz soils

Technical implementation. Chemical melioration was carried out in the village in the past. There is a sufficient amount of phosphorus-gypsum in the enterprises that produce triple-superphosphate. In addition, this soil amendment could be obtained free of charge or at a very low price, since it is a by-product of the main production.

Economic efficiency. Results from long-term experiments established in the local research station showed a long-lasting positive effect on soil fertility. Although the costs for implementation are high, the possible benefits streams are also high. In some cases, the yields could triple after melioration. Therefore, this is an economically efficient measure.

Environmental effects. Due to the measure's long-term effects on soil quality and fertility, the measure will have a strong environmental effect. According to the former director of the Salinity Station, the positive effect could last infinitely if land is managed properly.

Social constraints. There are no social norms that can seriously constrain the application of this measure. Most of the older farmers in the village have taken part in this process in the past. They know how to accomplish chemical melioration of soil and they know its impact on yields. Most of them are ready to apply this soil amendment again if the State can finance the transportation to the village. Moreover, the chemical melioration requires cooperation to a less degree compared to drainage system maintenance. Cooperation can lower the transport cost per unit of soil-amendment material. The melioration can be conducted in cooperation as well as by individual farmers.

5.4 Planting and maintaining tree strips

Technical implementation. This measure could be applied on the most severely affected by salinisation land or along the drainage canals. There is a successful experiment at the edge of the village, where a small forest was planted about 20 years ago. This forest has several tree species Honeylocust (Gleditsia triacanthos), Black Locust (Robinia pseudoacacia) and Tamarisk (Tamarix ramosissima). The Honeylocust develops better compared to other species. One possible technical problem of this measure is the availability of seedlings of resistant tree species.

Economic efficiency. Unlike the other measures, planting tree strips does not readily generate positive income streams. However, the trees' root system improves the soil drainage. This, in a combination with the drainage system can lead to soil desalinisation.

Environmental effects. Forests create a permanent soil cover and decrease soil moisture evaporation. In addition, forests also increase the biodiversity in the area creating habitats for animals, birds; insects, etc., and diversify the region's landscape.

Social constraints. There are no social norms that can seriously constrain the application of this measure. One possible constraint may be private land property rights, in case forests strips need to be planted on private land.

5.5 Conclusion

All of the aforementioned technical measures can be applied individually or in combination. However, the measures' impact on soil conservation and their efficiency will heavily depend on whether the drainage system works properly. Applied alone, improving the crop structure and planting trees strips would have a marginal effect on soil preservation. The chemical melioration would have a medium effect because in time the soil would return to the initial state due to secondary salinisation processes. Therefore, the first step would be to organise the maintenance of the existing drainage canals and possibly expand the system by digging secondary ditches. All local actors support this measure, but it would require collective actions and coordination between the parties involved. As a next step, all other recommended technical measures could be applied separately or in combination.

6 Soil related actors

This part analyses attitudes and behaviour of the actors first at farming practice arena and second, at the policy design and implementation arena.

6.1 Actors in the farming practices arena

There are four types of actors in the farming practice arena: large farmers; medium size farmers; small size farmers; landowners. The characteristics of the interviewed farmers are compiled in Table 15. The large farmers cultivate rented land. The medium-size farmers cultivate their own and relatives' land. The small farmers mostly cultivate their own land. The landowners have received land through the restitution process and currently many of them live in the towns. Some do not even know where their land is located. At present, the landowners are "passive" actors, since farmers take the decisions about land cultivation. Therefore, they are not included as a separate group in the sample. Unlike many of the Bulgarian villages, there are no cooperatives in the Belozem area.

Table 15: Farmers included in the sample

N	Education	Farm size hectares	Number of plots	Own land- hectares	Rented-in hectares	Rented-out hectares	Crop specialisation
1	High school	27	3	5	22		Field crops
2	Primary school or lower	10	6	7	3		Field crops
3	High agricultural school	10.8	14	10.8			Field crops
4	High school	11	3	11			Field crops-vegetables
5	University agricultural	1,300	5		1,300		Field crops-vegetables
6	High school	9.5	2	9.5		6.5	Field crops-vegetables
7	High school	6.9	13	6.9			Field crops-vegetables
8	High agricultural school	11.2	5	11.2			Field crops
9	High agricultural school	11.6	6	3.7	7.9		Field crops-vegetables
10	High agricultural school	3	5	3			Field crops
11	Primary school or lower	3.5	3	3.5			Vegetables -field crops
12	Primary school or lower	3.8	2	3.8			Field crops
13	University- agricultural	25	3	4	21		Vegetables
14	University	4	2	4			Vegetables -field crops
15	University	150	3		150		Field crops- Rice production
16	High agricultural school	180	4		180		Field crops- Rice production
17	High school	150	2		150		Rice production
18	High school	170	4		170		Field crops
	TOTAL	**2,087.3**		83.4	2,003.9	6.5	

Source: Interviews with farmers

6.1.1 Description of characteristics and attitudes

After the agrarian reform in Bulgaria, the farming area of the village of Belozem was parcelled out into nearly 3.300 plots belonging to almost 1.100 landowners. A large number of these plots are subject to another division among heirs of deceased owners. One outcome of the reform is the bi-polar farm structure with many small-scale farms and a few large ones. The small-scale farmers cultivate about six hectare on average, divided into five plots, located in different parts of the village's territory.

There have been several unsuccessful attempts, in the period 1992-1998, for setting up an agricultural cooperative for common land cultivation. These efforts failed due to: (1) the state of social capital in the village and country as whole; (2) comparatively low agricultural products prices; (3) lack of financial resources; and also (4) the landowners' low interest in land. Most of the landowners live in towns and work for other sectors of the economy. According to the village mayor, less than 20 % of the agricultural land of Belozem was cultivated at this stage.

With the development of product and input markets and the rise in the relative agricultural products prices, a growing interest in managing the land of the village appears. Some producers start looking for and rent additional land for cultivation. Several leasehold farms in the village manage up to 100-150 ha. In the period of the country's integration to the EU, this trend became stronger. During the present year, nearly half of the farming area of the village is being cultivated.

According to 2003 and 2005 farm censuses, there are 722 farms in the village with an average size of 2.06 ha, which cultivate almost 1,500 ha of land. 95 % of all the farms are subsistence farms and produce agricultural products mainly for home consumption. The country's agricultural policy does not have a great influence on subsistence farms' behaviour. These farms cultivate about 350 ha of the village land and they are not of special interest within this study. Around 5 % of the total number of farms (35-45) in Belozem are market-oriented and semi-subsistent and cultivate about 1,150 ha of the village's farming land and about 600 ha of neighbouring villages' land. Their average size is 50 ha. In this study, 18 farms of this type were included, which represents half (50 %) of their total number and they cultivate 94 % of the total village land.

Farm size is an important factor that determines: (1) the market behaviour, (2) the attitude towards soil degradation, and (3) the attitude towards soil conservation policies. Market-oriented and semi-subsistence farms included in the sample can be further divided into three classes: large, medium and small size farms.

Large farmers. There are five large farms in the sample cultivating 1.950 ha. About 600 ha of this land are located in the territories of neighbouring villages. On average, one of these farms manages 390 ha of rented land. The major leaseholder in the village is an Italian citizen who cultivates 1,300 ha rented from three neighbouring villages. During the last years, the number of these farms has increased and they have become determinative units in the region's farming structure. They use hired labour and usually the owner makes the decisions.

Medium-size farms. The medium-size farms are family businesses. This study includes 7 family farms with an average farm size of 15.2 ha. In total, they cultivate nearly 110 ha land that is owned and/or rented from relatives, friends and neighbours. These farms use family labour but during labour-intensive periods, such as harvesting, they hire labour. In spite of their market orientation, these farms also produce products for home consumption. Often, the production decisions are a result of family discussions and considerably depend on the professional training of the family members. In the case study region, the number of this farm type is expected to increase as a result of the country's accession to the EU.

Small-size farms. The sample includes six small-size farms cultivating 30.7 ha of land with an average farm size of 5.1 ha. Most of them can be classified as semi-subsistence farms, but besides their striving for self-sufficiency, they also become specialised in producing one or two crops for the market. Their choice focuses mostly on high-income generating crops such as strawberries, fruits and vegetables. This partial market orientation aims at providing additional income for the family. They utilise the family resources and rarely hire labour. The production decisions are usually made by the family member who is most actively involved in farming. These farms represent the traditional way of farming in the country and the possibilities for their development will considerably depend on the successful implementation of Measure 124 (supporting the semi-subsistence farms) of Programme for Development of Rural Regions in Bulgaria 2007-2013.

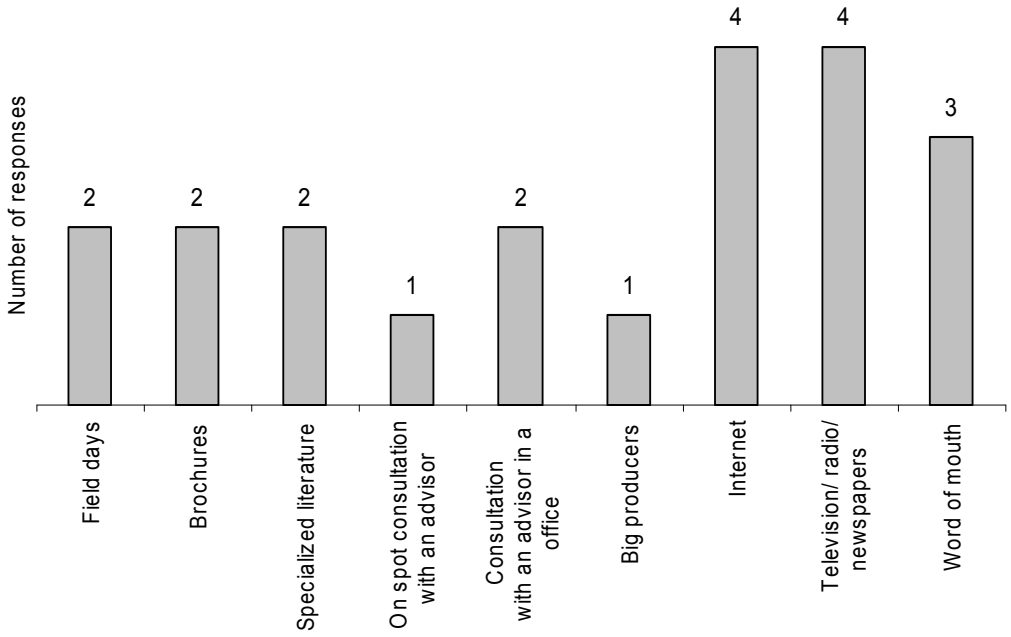
The examination of the existing farming structure in Belozem did not provide an opportunity to distinguish some other social networks besides the traditionally known ties of relationship, friendship and neighbourhood. The exchange of production services between farms has an incidental character and is based on the market situation. The communication among farmers is casual and with low intensity. It is indicative that some of the large leaseholders in the village did not know the telephone numbers of the other farmers. The rental contracts in the region are predominantly middle-term but there are also cases of short-term written or oral rental contracts.

6.1.2 Factors influencing adoption of soil conservation measures

The farmers in the village have knowledge about the soil conservation practices suitable to saline soils. They are aware of the importance of the drainage system, the positive impact of chemical melioration and the importance of the crop rotation. Farmers perceive insufficient financial resources (72 % of cases), inadequate information (33 %) and lacking benefit from participation in measure implementation (28 %) as the main restrictions and holdbacks to implement conservation measures.

Most of the farmers have heard about the Nitrate Directive, the Rules for Good Agricultural Practices, and the Programme for Development of Rural Regions of Bulgaria 2007-2013; but they do not have a clear idea what these documents are about. The farmers were better informed but critical regarding the SAPARD programme. One of the interviewed large farmers bought a modern harvester through this programme; three other farmers tried to apply but gave up at some stage of the application procedure. Both large and small farmers stated that SAPARD procedures are too complex and not transparent. All of them were well-informed and currently participate in the per hectare payment programme which was implemented in 2007. All farmers have already received the payments in their bank accounts.

Figure 4: Sources of information regarding the policy measures

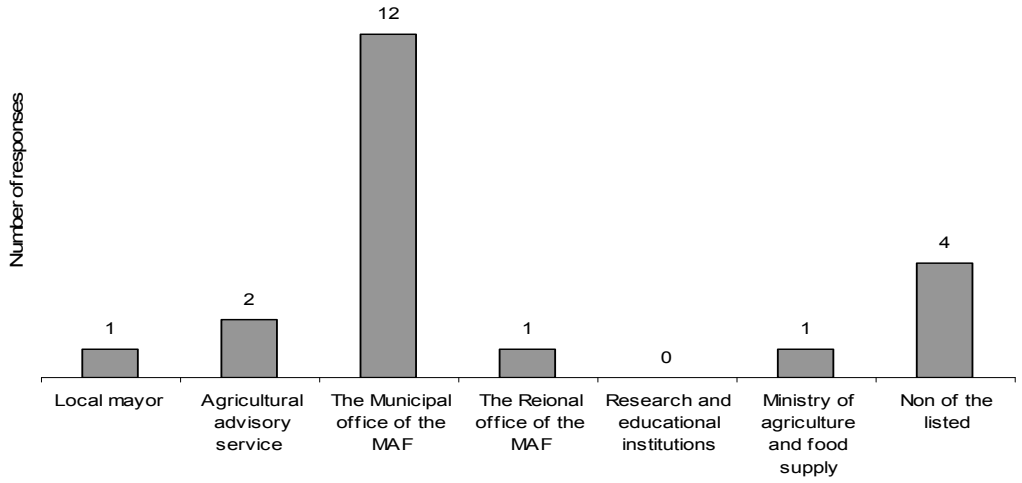


Source: Interviews with farmers

According to the farmers, the accessible information sources regarding the policy are not sufficiently clear (Figure 4). Eleven farmers obtain information from non-specialised sources (television/radio/newspaper, internet or word of mouth); five obtain information from consultants (open days, on spot and in office with advisor); four from specialised literature; and one

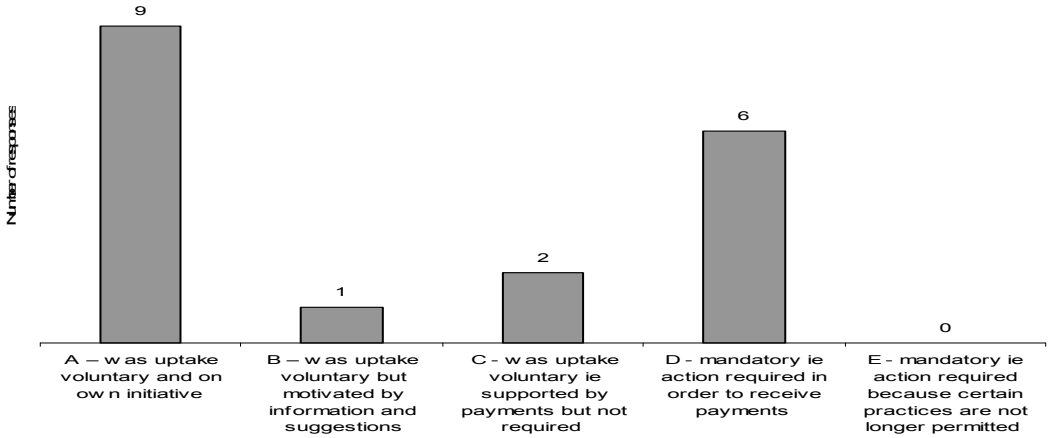
farmer from larger producers. Interestingly, most of the interviewed farmers use only one source of information. When farmers need information regarding policy, 67 % of the respondents visit the local office of the MAF (Figure 5).

Figure 5: Institutions and information for policy measures



Source: Interviews with farmers

Figure 6: Farmers' motivation to implement technical soil conservation practices

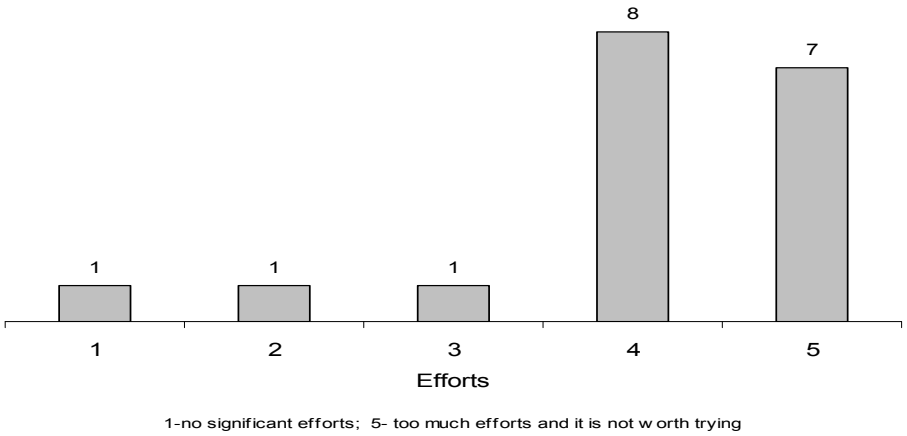


Source: Interviews with farmers

The effect of policy and technical measures for soil conservation depends on their range and extent of farmers' commitment. In 50 % of cases, the implementation of technical measures on-farm was a voluntary decision by the farmers, while in 33 % of the cases the decision was made in order to receive payments (Figure 6). Farmers are familiar with the technical measures, i.e. they have seen them applied in the local cooperative or in the village research station before 1990. As most important constraint to the implementation of soil conservation measures 13 farmers pointed out the lack of financial recourses; six pointed out the lack of information; five think that the measures are not worth implementing; and one said that he is not interested.

Generally, the respondents consider the efforts for applying to the State programmes as high (86 %) and beyond their abilities (67 %) (Figure 7). Farmers usually fill in the documents themselves or with relatives and/or friends; only sometimes they rely on the MAF officers. They evaluate some of the measures as efficient and others as not well adapted to the specific conditions of the country and their region. For example, all farmers consider the application process for the general per hectare payments programme as well organised. People from the municipal office of MAF have assisted them in filling the application forms. In contrast, regarding the programmes for purchasing equipment, farmers have complained that it is nearly impossible to meet all requirements. One of the farmers who has tried to apply said "…after spending much time and nerves to prepare the documents, finally I tore them up and threw them in the garbage". Another farmer, who received SAPARD funding also said that it took him a lot of time and effort to go through the application process, and he was about to give up when he was informed that the project was approved.

Figure 7: Effort to apply for the state programme



Source: Interviews with farmers

6.2 Actors in the policy design and implementation arena

The actors in the policy deign arena include governmental organisations, civil society and NGOs. We concentrate on the local actors and their opportunity to influence the policy design and participate in policy implementation process. The civil society and the NGO sectors are underdeveloped especially on local level.

6.2.1 Governmental organisations

In order to investigate the policy implementation issues, interviews were conducted with representatives of the following organisations: (1) the Local municipality; (2) the Local office of the Ministry of Agriculture and Food; (3) The Regional Agricultural Advisory Services in Plovdiv; (4) the Regional office of the Ministry of Environment and Water; (5) the Local branch of the irrigation company; (6) the Local branch of the Executive Hydromelioration Agency.

The Rakovski municipality, as a body of local self-governance, is responsible for implementation of the legislation regarding soil conservation. The requirements of the Law for Preservation of Environment; the Soil Law; and the Law for Preservation of Agricultural Land are imperative for all municipalities and they have to adhere and implement them on their territory. Rakovski municipality covers 264 square kilometres and includes six villages: Belozem, Striama, Chalucovi, Shismantzi, Boliarino and Momino selo. As all municipalities in the country, Rakovski has a municipal plan for development (2007-2013) where the main

priorities are outlined. In this plan, the existence of salinisation is acknowledged for not only Belozem, but also for the villages Boliarino, Shishmanci, Chalacovi, Striama and the town of Rakovski. Rakovski municipality owns the drainage canals that pass through Belozem and some of the small water dams. The drainage canals are under municipal-public ownership regime. Assets under this regime cannot be sold without a decision of the municipal council (local parliament).

The municipal office of the MAF is responsible for the implementation of the state agricultural policy at municipal level. It has information about the land quality, land ownership and land use. Soil conservation is not a main activity of this office, but it has obligations and some control functions as set out in the Law for Preservation of Agricultural Land and other respective laws and regulations.

According to the interviewee, there are difficulties but the legislation regarding soil conservation is sufficient. However, many of the problems cannot be solved only through legislation. The main factors for success of any policy aiming at soil conservation depend, in his opinion, on (1) the information complain before implementation and (2) people participation in the process of implementation. According to the interviewee, currently people do not know what they want and who to ask. This leads to lower trust. In this respect, he thinks that, the expansion of agricultural advisory services and location of a specialist in the area could mitigate the problem to some extent. Before 1950, the effects of salinisation in the area were visible. Currently, on the surface, the situation does not look bad but this is deceptive. In addition, many people are not aware of the problem. Because of insufficient resources, the drainage canals are not well maintained. In some cases, interested farmers (mainly large farmers) and sometimes the local village mayor organise the cleaning.

The regional agricultural advisory services in Plovdiv has four employees: two agronomists, one specialist in stockbreeding, and an economist. The specialists in the office are supposed to provide consultancy services free of charge to all registered agricultural producers. According to the 2003 Agricultural census, there are about 52,000 farms in Plovdiv area (90 % individual producers). According to the interviewed specialists, the issue of soil conservation is one of their priorities but they can influence the process only through advice provided to farmers. The resources (financial, as well as farmers' and specialists' qualifications) are insufficient for implementation of many good ideas that have been around regarding soil conservation.

The regional office of the Ministry of Environment and Water conducts monitoring and carries out controls on soil in the region. Soil protection has equal priority as the other components of the environment. The ministry responsibilities are outlined in the Law of Preservation of Environment, the Soil Law, and the Law for Preservation of Agricultural Land. Regarding soil conservation, the specialists in the local office of MEW cooperate with the local office of the MAF and municipalities. The interviewee has participated in several training courses organised in the frame of "Capacity Building for Sustainable Land Management in Bulgaria" project. According to this interviewee, there are no interest groups devoting their activities to soil conservation at regional level. He also claimed that the determining factor for implementation of soil conservation policy is legislation, which at this point of time is adequate. However, he stated that there are still no sufficient resources and potential for conducting efficient soil conservation policy, and that more cooperation is necessary between the organisations involved. During the last several years, a national system for soil monitoring was established in the country and the first results are promising.

The local branch of the Hydromelioration Agency controls the irrigation and the drainage activities in the area and also works with the water user associations. The agency provides information about the rules and steps that agricultural producers must follow in order to establish an association for irrigation. It also monitors the water prices and whether the rules are followed in order to prevent possible dominant behaviour. There are nine associations in

the area and according to the interviewed official they are successful. The agency also monitors the activities carried out by the Irrigation Company.

The basin office in the town of Plovdiv is a body of the MEW. It is responsible for management of all waters that spring from Bulgaria territory and flow to Aegean see (North Greece)[5]. Soil conservation is not a priority of this office, but it issues permits for using surface and ground water resources.

The regional branch of the Irrigation Company organises the supply of irrigation water in the Plovdiv region. The company is responsible for the main irrigation and drainage canals. According to the interviewed specialist, the company is doing its best to maintain the canals and provide reliable water supply. The main canals are maintained since they generate revenue but the drainage canals are not in good condition. After the floods in 2005, the State has increased the funding for maintaining the flood prevention infrastructure, including the drainage canals. The funding is still not sufficient and the company concentrates its efforts on the most flood-endangered areas. The drainage canals outside the village of Belozem are under State-public ownership and are managed by the Irrigation Company.

6.2.2 Civil society and non-governmental organisations

According to a representative of the municipal office of MAF, groups in the area have formed in respect to certain issues. After the problems are solved, or if people realise that problems are unsolvable, the groups disband over time. The smaller farmers usually act in groups of 10-15 people with a leader, while the large farmers act either alone or in groups of 2-3 people. The small and large farmers rarely work together on an issue.

A local LEADER group was registered as NGO in Rakovski on 20 June 2006 with the support of the Swiss Agency for Development and Cooperation. The group includes three municipalities Brezovo, Rakovski, and Bratia Daskalovi. At present, the group is preparing to apply for recognition from the Bulgarian Ministry of Agriculture and Food. The ministry has introduced strict recognition procedures in order to ensure that LEADER groups are developed in accordance with the European policy requirements.

This group has a strategy for development of the area. Although the issues of soil conservation are not elaborated, the group aims to support producer associations and biological agriculture. LEADER groups can play a very important role in supporting small projects. They are managed by locals who can better evaluate the “small” problems and target local resources in an efficient way. Currently, this group has influenced the design of policy measure regarding LEADER groups in the country. It also intends to direct about 10 % of their financial resources to nature and soil protection activities. In the future, LEADER groups are expected to provide the missing link between the State policy and the local people.

The Professional Gymnasium for Agricultur*e* is a state school but from the perspective of our framework it is closer to the civil society and NGO than to the governmental organisations. The school trains 280 pupils in three areas: (1) Farming; (2) Mechanisation in agriculture; and (3) Agricultural economics. According to the interviewed teacher (agronomist), the salinisation is a serious problem for the area. The school has applied for funding from MAF to develop irrigation fields on school land. The aim of this project is to experiment with different irrigation practices and to analyse their effects on soil quality with a focus on salinisation.

Land Source of Income Foundation works with small agricultural producers of gipsy origin, in the Plovdiv region. These activities are supported by the NOVIB (Nederland) and conducted in a partnership with CEGA foundation (Sofia). The foundation provides consultancies, training activities, and small loans to farmers for purchasing land, working capital, and small equipment. It has 10 beneficiaries in the village of Chalucovi which is close to Belozem.

[5] The Water management on Bulgaria is conducted on national level (MAF) and regional level (Basin offices) There are four basin offices in Bulgaria (in towns of Pleven, Barna, Plovdiiv, and Blagoevgrad).

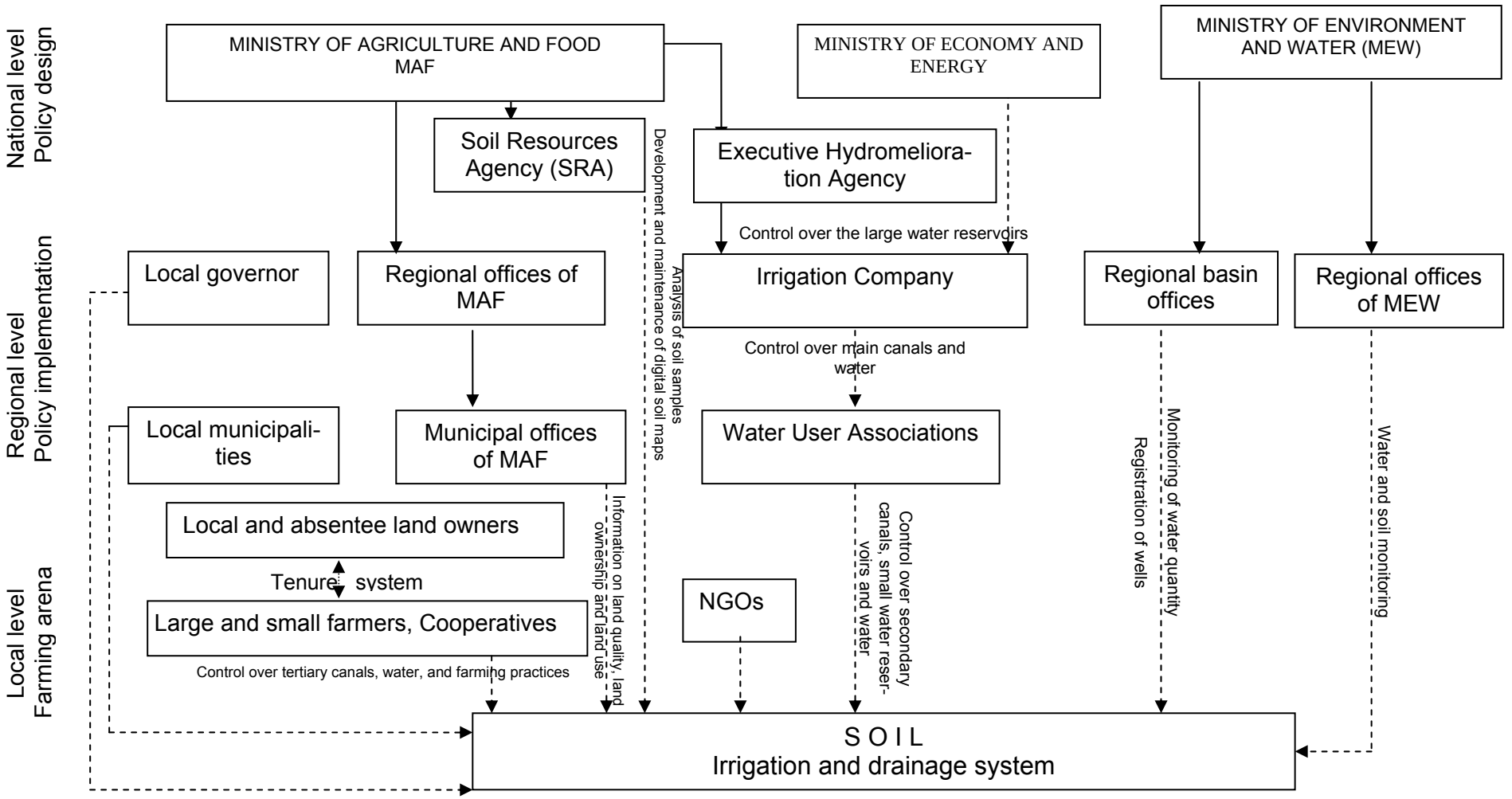
Considering the salinisation problem in the area people from the foundation always, take soil samples before purchasing land. In addition, the foundation provides free financial support for the introduction of environmentally friendly practices. According to a representative, the foundation's activities currently fill the gap between the State and the "small" people. The foundation maintains good relations with the regional offices of the MAF, the regional agricultural advisory services, and villages' mayors. The activities of this foundation are on a small scale and cannot have a direct impact on soil conservation. However, creating good examples can have an indirect impact in future.

6.2.3 Resources, capacities and networks

There are three types of soil related actors: (1) actors in the policy design arena; (3) actors at policy implementation arena; and (3) actors in the farming practice arena. The main groups of actors in the farming practice arena are farmers and landowners. The main groups of actors in the policy design arena are the Bulgarian Parliament; the Ministry of Agriculture and Food; the Ministry of Economy and Energy; and the Ministry of Environment and Water. The main group of actors in the policy implementation arena are the local offices of the above ministries, the local municipalities, the local branch of the irrigation company, the river basin offices; and NGOs. As an example, the relevant actors for the issue of salinisation across all three arenas are presented in Figure 8.

Policy design. *The Bulgarian parliament* designs the soil conservation policy of the country. The compliance with the EU requirements currently is the main driving force for the decision-making process regarding soil conservation practices. Most of the soil conservation policies and activities in Bulgaria were carried out before 1990. In the period 1990-2000, the policy was mainly concerned with the land restitution. The issues of soil preservation became increasingly important after year 2000 and especially after the country accession to EU. Although, at national level, the policy makers are aware of the soil preservation problems, still there are not many activities carried out at local level.

Figure 8: Actors related to the issue of soil salinisation



Source: Own design

Policy implementation. Important actors in policy implementation for the area of Belozem are: (1) the Municipal office of MAFS; (2) the Rakovski municipality; (3) the Mayor of Belozem; (4) the Basin office; (5) the local office of MEW; (6) the local branch of the irrigation company; (7) non-governmental organisations;(8) farmers in the area; (9) landowners. There are two water users' associations in the Rakovski municipality, but none of them serves the area of Belozem. *The municipal office of the MAFS*, implements the state agricultural policy in the region. Farmers who wish to participate in state and EU funded programs must register the fields and the crops in this office. *The Rakovski municipality* is the local government. The Mayor and the members of the municipal council are directly elected. The municipality is the unit that can apply for the Structural and the Cohesion funds and also has to participate in the establishment of the Leader groups. *The Mayor of Belozem* is also elected. He is the person closer to the locals and therefore he is in a good position to motivate them to participate in solving any local problem. *The Basin office* gives permissions and controls the wells drilling. *The local office of MEW,* located in the town of Plovdiv, conducts soil and water monitoring in the area. The office conducts regular soil quality monitoring on 4 constant points in the region of Belozem. Twice per year (spring and autumn) soil samples are taken from depth of 0-20 cm; 20-40 cm; and 40-60 cm. Water samples are also taken from the nearest irrigation canal. *The local branch of the Irrigation Company* is responsible for provision of irrigation water. *Farmers* are the actors affected by salinisation, but with their activities, they can also contribute to the problem. The landowners are passive actors (in the case of salinisation), but any large project regarding decreasing salinisation needs their participation.

At present, there are no actor groups in Belozem who can significantly influence policy design. The main actors in policy implementation - the local offices of the MAF and the MEW - can influence the policy design through the administrative system. The local municipality can potentially influence the policy design through the political process and democratic elections. One of the problems is that the communication between these organisations is not sufficient. There is moderate communication between the NGOs and the governmental organizations Even larger farmers complained that they cannot participate in the policy design process, but nearly all would like to influence the process. It seems that in the case study, the upper layer of the network (governmental and non-governmental organisations) is still weakly connected with the lower layer (farmers and other local actors).

6.3 Conclusions

Currently, there are no local groups in Belozem that can significantly influence policy design. The local office of the MAF and MEW implement the state policy and can influence its design through the administrative system. The actors from the state administration believe that the legislation is sufficient, but only legislation is not enough. Soil conservation issues are not among the main priorities of the actors outside bureaucracy working in the area. There are also not enough agricultural advisory services and information at local level.

The Irrigation Company manages the drainage canals outside the village, but the ones in the village are the responsibility of the municipality. The farmers, as a group, are not involved in the maintenance of the drainage and irrigation system. Even more, in some parts, the drainage system is blocked and this prevents the water to flow down to the rivers. Because of insufficient communication among the actors, there is a serious coordination problem.

Although soil salinisation currently is not visually obvious, local farmers showed awareness of the problem. However, they still use standard cultivation practices because they lack information and resources. Farmers consider the transaction costs to participate in the state programmes as too high. As a result, there are no sufficient numbers of activities regarding soil conservation. What was completed in this respect was mainly done on farmers own initiative.

7 Policies for soil conservation

At national level, there is a well-elaborated system of strategies, programmes and legislation regarding soil protection. The relevant strategic documents, supplementary strategic documents and main legislation are summarised in Table 15. This illustrates that the strategic and legal framework is already in place.

Currently, the soil conservation objectives for Bulgaria are outlined in the National Action Program for Sustainable Land Management and Combating Desertification. The strategic goal of this program is: To limit soil degradation and to combat desertification for preserving and development of the ecosystems capacity. The program envisages five strategic directions: (1) improvement of the national legislation; (2) preservation and improvement of land capacity and sustainable land use; (3) increasing the role of science and education for supporting the sustainable land management; (4) implementation of the policy for sustainable land use at local level; (5) improvement of information exchange and public participation in decision making.

Table 16: Overview of national legislative framework relating to soil conservation

Strategic documents	Supplementary strategic documents	Main legislation
National Action Programme for Sustainable Land Management and Combating Desertification	National Strategy for the Environment 2005-2014	Law for Preservation of Environment
Operational Programme Environment 2007-2013	National Agro-Ecological Programme of Bulgaria 2007-2013	Law for Preservation of the Agricultural Land
Programme for Development of Rural Regions in Bulgaria 2007-2013	National Strategy for Sustainable Development of the Forest Sector in Bulgaria 2006-2015	Soil Law
	National Strategy for Regional Development 2005-2015	Law for Ownership and Use of Agricultural Land
	Operational Programme Regional development 2005-2015	Water Law
		Water User Association Law

Source: Own design

The soil conservation objectives for the region of Belozem are outlined in: (1) the Regional Strategy for development of the South-Central Planning region 2007-2013; **(**2) the Municipal plan for development of Rakovski municipality 2007-2013; priority 2, development of modern agriculture in the area, which envisage development of sustainable land management. The soil preservation policy, however, is not well elaborated in this strategy.

The main legislation in the area of soil protection include: (1) Law for preservation of environment (2002); (2) Law for preservation of the agricultural land (1996); (3) Law for protection of soil against pollution (1963); (4) Water law (1999), (5) Water Users' Association Law (2001). Recently a new soil law (2007) was voted by the parliament.

Most of policy measures we observe in Belozem have a rather indirect impact on soil conservation. These policy measures include: (1) Per hectare payment programme; (2) Support for purchasing equipment; (3) Establishment of a LEADER group across three municipalities; (4) Establishment of the Water User Association in the town of Rakovski; (5) Wells registration; and (6) Monitoring of soil salinisation and salt content in water.

7.1 Existing policies and their classification

Policies related to soil conservation are compiled in Table 17. Out of these, the four most important policy measures are described in more detail in fiches (Section 7.2.1-7.2.4). Therefore, there are only brief comments on each of the policy measures below.

Well registration. Mainly small farmers use well water for irrigation. The wells were drilled because farmers had experienced problems with the water supply from the central irrigation system. The Water Law requires all existing wells to be registered in the Regional Basin Office. Some of the wells were registered, but we suspect that a good number of them are still unregistered. Farmers avoided the issue during the interviews. There are several reasons for this situation. First, there was no wide information campaign during the time of registration, and many learned accidentally from friends after the deadline. If someone wants to register a well now, he has to go through a long procedure. Second, some farmers expressed mistrust to the state authorities. They think that the State may put a high price on water from wells.

Well registration is imperative especially for Belozem village because of several reasons. First, the monitoring of underground water level is important for the preservation of the underground water resources. Second, the monitoring of the salinity level of water that farmers use for irrigation is important for preventing secondary soil salinisation. Small farmers cannot seriously affect the level of underground water resources, but they can contribute to the soil salinisation problem. The fields are large, the wells are scattered around the area and may be easily hidden from any state body that would attempt to control wells without farmers' collaboration. Therefore, easing the registration procedures and allowing farmers to use a certain amount of water free of charge can induce them to collaborate in the implementation of this important measure.

Per hectare payments. The per hectare payments programme was introduced in 2007 and includes several categories, the general per hectare payment scheme and environmental payments per hectare. In the fiche we consider only the general per hectare payment scheme. There are two reasons for this, first, both schemes are similar in term of implementation and second, still there is no enough information about how the environmental scheme will be applied.

Establishment of water user associations. In the beginning of 1990s a Water User Association was established in the town of Rakovski. The locals used the vouchers they had received from the liquidation of the cooperative to purchase some equipment and part of the irrigation infrastructure. Currently, this association experiences problem and some larger farmers in the area initiated a process to establish a new water user association. On one hand, the large farmers have resources and organisational capacity to successfully set up the new association. On the other hand, if these large farmers take a key position in the association they may be tempted to manage the infrastructure in their own interest, neglecting the interests of the small farmers.

In Belozem village there are several large farmers, but neither of the interviewed expressed interest in the establishment of an association. In addition, according to a specialist from the Irrigation Company even if the irrigation system of Belozem is technically separated from the rest (which is difficult) the water price discount is insufficient to motivate locals to have their own association.

According to a representative of the Hydromelioration Agency, most of the successful associations have a small water reservoir with water intake that is independent from the rest of the irrigation systems. The small water reservoirs are often a reason for conflict between farmers and people that want to breed fish. In the case of associations, this conflict is internalised and although reservoirs are also used for both fishery and irrigation, people negotiate rules for overcoming the problem.

There are several obstacles for increasing the number of associations in Plovdiv area. The first obstacle is the fragmentation in land ownership, which increases the transaction costs

for meeting the legal requirements. The process of establishment of an association can start if there is a written agreement with at least 50 % of landowners and users. Due to the fragmentation in ownership, this task is unfeasible in many cases. Second, the irrigation system in the area was built to supply water to large water users (the cooperatives before 1990) and now it is technically difficult to isolate the canals on the associations' territory. Third, cooperation among farmers is often insufficient.

Financial support for purchasing farm equipment. This type of support was available under the SAPARD programme and it is available now under the Programme for Development of Rural Regions in Bulgaria 2007-2013 (Axis 1).[6] Providing financial support for purchasing equipment is very important for Belozem village and for Bulgarian agriculture. Most of the interviewed small and medium size farmers use outdated farm equipment, purchased after the liquidation of local cooperative, or put together with parts from various other machines.

In order to apply for this type of support: (1) farmers must be registered as agricultural producers in the local MAF office; (2) the farm has to comply with minimum size requirements; and (3) farmers have to prepare an investment - business plan project.

Small farmers complained that only large farmers had access to SAPARD money and this programme has not contributed to their development at all. All classified this policy as unsuccessful or with very limited success. The main factors for the partial failure of this scheme are: (1) complex process of application; (2) unclear and comparatively high cost application procedure; (3) unclear evaluation procedure; (4) high cost monitoring and sanctioning procedures.

Despite the farmers' disappointment with SAPARD program, the expectations for the similar measure included in the Rural Development Program (2007-2013) are optimistic.

[6] The Programme for development of rural regions in Bulgaria 2007-2013 makes a distinction between the measures for the small farms (Axis 1 Measure: Supporting Semi-Subsistence Farms Undergoing Restructuring; Measure; Setting up of young farmers) from the measures appropriate for the medium and large farms (Axis 1; Measure: Modernisation of agricultural holdings). The instructions for development of the business plans are provided on the website of the MAF.

Table 17: Classification of policy measures in Belozem village, Bulgaria

Type of Policy Mechanism/ Mode of governance	Practical classification – Nature of the Policy Objective			Policy relationship to agriculture	Geographical level	Analytical classification - Channels of Impact – Primary (1) and Secondary (2) impacts. Y = Yes, N = No		
	Soil conservation is the **primary objective** of a policy measure	Soil conservation is the **secondary objective** of a policy measure	Soil conservation is a **By-product**	Agricultural (AG) or non Agricultural (NAG) focused policy	European (E), national (N), regional (R) or local (L) measure, and policy reference	Developing new/altering existing rules (institutions)	Developing and/or altering governance structures/ implementation approaches	Directly impacting on farmer behaviour/ decision making/ factor allocation and management practices
Command and Control			Well registration	AG	E-Water directive N-Water law		Y	
Incentive based measures/economic instruments		Per hectare payments programme. Requirement for good agricultural practices		AG	E –Council Regulation (EC) No 1782/29.09. 2003 N - Programme for development of rural regions of Bulgaria 2007-2013; Law for supporting agricultural producers	Y-development of new rules for registration of the cultivated land by agricultural producers Development of new rules for funds allocation	Y- clarification of the use rights	Y-more registered farmers
		Per hectare payments to farmers in areas with handicaps, other than mountain areas			E –Council Regulation (EC) No 1782/29.09. 2003 N - Programme for development of rural regions of Bulgaria 2007-2013			
			Water user associations	AG	N-Water user association law			
			Financial support for purchasing farm equipment (SAPARD) (RDP 2007-2013)	AG	E-SAPARD; Council regulation 1698/20.09.2005 N - Programme for development of rural regions of Bulgaria 2007-2013			
Moral Suasion Initiatives ie it has a normative dimension that farmers should protect soils			LEADER group	AG	E –Council regulation 1698/20.09.2005, LEADER+ N - Programme for development of rural regions of Bulgaria 2007-2013			
Information and capacity building measures, i.e. guidance, advisory measures and farmer support initiatives	Monitoring of soil salinisation and salt content in water			NAG	N-			
	Establishing of experimental field in the Specialised agricultural school			AG			Y	

Establishment of local initiative groups. LEADER groups are local actors but at the same time this is an important policy measure (the forth priority axis included in Programme for Development of Rural Regions in Bulgaria 2007-2013). LEADER groups can provide financial support to small and medium-size agricultural producers. Since only locals may become members of these groups, we can expect that at least the project evaluation procedure will be more transparent and monitoring of the project implementation will be cheaper. However, it is too early to asses whether these groups will meet these expectations.

Monitoring of soil salinisation and salt content in water. The water and soil monitoring procedures are well developed in a number of legal documents (Law for Preservation of Environment; Law for Preservation of Agricultural Land; Water Law; Soil Law).

The local office of MEW, located in Plovdiv, conducts soil and water monitoring in Belozem on four constant points. Twice per year (spring and autumn), soil and water samples are taken.

7.2 Analysis and evaluation of policy measures

The four most important policy measures in our case study are:

(1) per hectare direct payment programme, as it helps to clarify the use rights in the area;

(2) modernisation of agricultural enterprises, because it provides access to machinery for conducting the proper cultivation practices;

(3) establishment of associations of water users, because it could provide long-term solution to the irrigation and drainage systems maintenance; and

(4) soil and water monitoring, because this information is essential for the State to design good environmental policy.

7.2.1 Fiche 1: Direct payments

Part A: Summary of Measure	
Formal title of measure and date of implementation	Direct Payment • Council Regulation (EC) No 1782/29.09. 2003 • Law for supporting the agricultural producers State gazette *58/2.05.1998* • Regulation № 107 from 23.August, regarding the conditions and order for submitting applications for the schemes and measures for per hectare support. State gazette 84 /17.10.2006 • Programme for development of rural regions of Bulgaria 2007-2013. The per hectare payment programme was introduced in 2007.
Short description of the measure	The programme has three main elements: (1) per hectare payment to all farmers; (2) per hectare payments to farmers in areas with handicaps; and (3) environmental per hectare payments. In order to receive these payments a farmer needs to be registered in the local office of MAF, and to submit an application form to the Agricultural Payment Agency. In the application, the farmers need to specify the area and crops they cultivate.
Type of policy measure	Farmers must comply with the rules for good agricultural practices in order to receive the payments.

Objective of policy measure and relevance	The main goal of the measure is to stabilise farmers' income without distorting the market prices, and to compensate farmers for the restrictions that the State has imposed on private land (in the case of environmental payments). Soil protection is a by-product of the measure.
	How relevant are the objectives of the measure to the soil degradation threats in your region? □ □ X □ □ Not very Very
Indirect effects	Clarification of the use rights.
Linkages to other policy measures	There are several regulations that are linked to this measure. The most important are: (1) Law for Preservation of the Agricultural Land; (2) Soil Law: (3) Law for Ownership and Use of Agricultural Land; (3) Law of Preservation of Environment; (4) Ordinance № 3 regarding the permissible contents of harmful substances in the soil; (5) Ordinance for the rules for determining and imposing sanctions in case of harming or pollution of environment above the norms (State gazette 69/2003); (6) Ordinance for making inventory and examination of areas with polluted soils, the necessary reclamation measures and support of the reclamation activities; (7) Ordinance 26 for reclamation of terrains with disturbed characteristics, improvement of low fertile lands, removing and using the humus layer.
Funding	Measure funded by national and EU sources within the CAP framework.
Summary of assessment and conclusions	Although the policy was introduced very recently, it is a successful measure especially compared to the other policy instruments currently in place. The main factors for success are: (1) simple process of application: (2) clear and comparatively low cost application procedure; (3) clear rules; (4) low cost monitoring and sanctioning procedures. It has an indirect impact on land preservation since in order to get the payments farmers need to comply to the good cultivation practices
Recommendation	Better information campaign for the environmental payments
Part B: Detail on the Measures Design, Implementation, Enforcement and Impacts	
Policy design	The policy has been designed at EU level and implemented in the country.
Policy implementation I: Implementation at administrative level	The policy is implemented by the Agricultural Payment Agency and the Regional offices of MAF. These organisations use a computer database with maps of all plots. Farmers indicate the plots they cultivate and after all applications are collected, the database is checked for overlapping information. If the information is correct, the payment agency transfers the payments to farmers' bank accounts.
Policy implementation II: Method of delivery to farmers	In order to receive this subsidy the farmers must: - be registered as agricultural producers; - fill out and submit the application form to the Agriculture Payment Agency; - show the land they cultivate in the local office of the MAF; - open a bank account.

	Official documents such as rental contracts were not obligatory for the land registration procedure. A compulsory requirement for receiving the per hectare payment is land to be cultivated in an environmentally friendly way. In addition, the minimum farm size must not be below 0,5 hectares for perennial and 1 hectare for other crops.
Targeting	Generally, the measure is accessible to all farmers. The payments differ according to the type of crops (perennial or field) and location (mountainous area or plain).
	To what extent does the implementing body have flexibility in the targeting of the policy measure so that it is adapted to local conditions? □ □ X □ □ Low High
What Drives Uptake?	The main motive of farmers to participate in the scheme is financial. There was a well organised information campaign before implementation for the general per hectare payment programme, but not for the environmental per hectare payments. Although the interviewed farmers complained that the amount of the payment is not sufficient they classified this programme as successful.
	□ Obligation X Financial incentive X Information & support □ Exhortation □ Other
Technical measures	For the general per hectare programme, special technical measures for soil preservation are not prescribed, but only general gudiences. The prescriptions for the environmental payments depend on the specific condition of the area and the imposed constraints.
Enforcement and control	Since the measure is newly introduced in the country, it is difficult to evaluate the effectiveness of the sanctioning mechanism regarding soil conservation. However, if a farmer declares more land than he actually cultivates he is sanctioned. For example, if the difference is less than 3 % the payment is provided only for the areas he actually cultivates and additional sanctions are not imposed. In case the difference is from 3 - 30 %, the over-declared land is multiplied by two and then deducted from the area he actually cultivates and this difference is used for calculating the total amount of payment. If the over-declared land is between 30 - 50 % and over 50 % the farmer does not receive any payments. Therefore, in respect to over-reporting of land, the sanctioning mechanism proved to be effective. None of the interviewed farmers reported of being sanctioned for over-declaring land. However, the team knows about cases in other regions where farmers had been sanctioned for this reason.
Monitoring and evaluation	After introduction of this policy, more farmers registered their land in the local branches of the MAF and declared the plots they cultivate, Therefore, the authorities have information on who holds the use rights. As a result, the monitoring not only of this policy but also of all other policy will improve.

Outcomes of policy measure	This measure increases the farm income to some extent, but the most important outcome is the clarification use rights. The per hectare payment programme will have several positive effects on agricultural development and soil conservation. First, more farmers have registered in the local office of the MAF due to the attractive payments. Second, declaring the parcels that each farmer cultivates clarifies the user's right in the region. In order to avoid the high transaction costs and financial costs of formal rental contracts (caused by the severe fragmentation in landownership), mainly the small and often the large farmers cultivate land either with an oral contract or without any contract. Third, the opportunities for controlling whether the farming practices are really environmentally friendly will increase, since after the land registration there will be reliable information not only about who the landowners are, but also about who cultivates the land. All this increases the predictability of the agricultural system and the accountability of the actors.
Analysis of drivers of policy measures' outcomes	The driving force of this policy measure is a combination of financial incentives that stimulate farmers to register and the good information campaign. For the State, registration clarifies who has the ownership and use rights. The ownership and use rights determine not only who receives benefits from the assets, but also who is responsible for their management. Therefore, the farmers' accountability regarding soil conservation will increase.
Part C – Evaluation of the Policy Measure	
Effectiveness of policy measure (in relation to the extent to which objectives are achieved, and cost-effectiveness)	Since the measure has been implemented recently, we do not yet have evidence of its effect on soil conservation. However, we expect that it will have a positive effect compared with the current situation.
Constraints to achieving full potential of the policy measure	There are no serious constraints on the implementation of the measure.
Reasons for the success of the policy measure (where appropriate)	The main factors for success are: (1) simple process of application: (2) clear and comparatively low cost application procedure; (3) clear rules; (4) low cost monitoring and sanctioning procedures.

7.2.2 Fiche 2: Modernisation (investments) of agricultural enterprises

Part A: Summary of Measure	
Formal title of measure and date of implementation	The measure 121 “Modernisation of agricultural holdings” was opened in May 2008 as a part of the Rural Development Programme of Bulgaria (2007-2013). The main legislative documents in this respect are: • Rural Development Programme of Bulgaria (2007-2013) • Regulation № 8/22.04.2008 for terms of application under the Measure 121 “Modernisation of agricultural farms” of the Rural Development Programme 2007-2013
Short description of the measure	Under this measure, support is given to projects that aim at the improvement of farm’s overall performance: • Introduction of new products, processes and technologies, and improvement of existing assets. • Development of cooperation between agricultural producers and food processors • Preservation of the environment Individual agricultural producers and organisations are eligible candidates. The support varies from 3,500 - 1,500,000 Euros.
Type of policy measure	The measure is incentive-based since it covers 50 - 65 % of the approved project cost.
Objective of policy measure and relevance	The objective of this measure is to increase the competitiveness of agriculture through restructuring the production, developing the existing technical base on the farm, and stimulating innovations. • Improvement of the farm’s activities and competitiveness through modernisation and introduction of new technological decisions for production of quality and safe agricultural products; • Improvement of environmental protection; • Reaching the European standards and improvement of labour conditions and animal welfare.
	How relevant are the objectives of the measure to the soil degradation threats in your region? □ □ X □ □ Not very Very
Indirect effects	Improved technical capacity of farms for solving problems relevant to environmental protection and rural development.
Linkages to other policy measures	Assistance is given to applicants registered as agricultural producers under the Law for Supporting Agricultural Producers. The required farm size should be at least one economic unit and meet the criteria for minimal area according to the Scheme for unified area payments, excepting farms assisted by Measure 141 “Support to semi-subsistence farms under restructuring” and measure 112 “Setting up young farmers”.

Funding	The funding of the measure is from EU Agricultural Fund for Rural Development.
Summary of assessment and conclusions	This measure is expected to help in forwarding the modernisation of farms and increasing of their capacity to perform activities relevant to the conservation of agricultural land. Since it was recently introduced, it is still early too evaluate its impact.
Recommendation	With the purpose of more obvious support for soil conservation, the list of admissible costs may also include those for re-cultivation and restoration of degraded agricultural land.
Part B: Detail on the Measures Design, Implementation, Enforcement and Impacts	
Policy design	The measure is a part of Regulation EC 1698/2005 and its national implementation is largely determined by the characteristics of Bulgarian agriculture. Regulation № 8/22.04.2008 provides a detailed description of the eligibility criteria and application rules. This regulation was developed by MAF. Before its official publication it was introduced to the interested parties and discussed.
Policy implementation I: Implementation at administrative level	At national level the implementation of this measure is assigned to the Payment Agency at the National Fund "Agriculture". The coordination at regional level is the responsibility of the regional offices of MAF, while implementation is undertaken by the Regional Payment Agency. In order to provide transparency, the agency is supposed to publish information about each project on its internet page every three months.
Policy implementation II: Method of delivery to farmers	Farmers that wish to apply for support need to prepare an investment business plan complemented with other documents proving that they are eligible candidates. These documents are submitted to the Regional Payment Agency. The agency staff checks the documents and issues a unique number. Within a three months period the Payment Agency have to reject or approve the project. The projects approved at the first stage go through a second evaluation by an expert commission, which gives a written evaluation. Fifteen days after the second evaluation, the farmers are invited to sign contracts. The financial support is paid to the farmers after the project implementation. In some cases advance payment are possible.
Targeting	The measure targets a wide range of agricultural producers and their organisations. Farms of different sizes and specialisation are eligible to applying. Special attention is paid to the group of young farmers, semi-subsistence farms and the farms situated in regions with less-favourable conditions for their development. This makes the measure being too flexible.
	To what extent does the implementing body have flexibility in the targeting of the policy measure so that it is adapted to local conditions? □ □ □ X □ Low High
What Drives Uptake?	The financial incentive is the driving force for most of farmers. Small and medium farms often have outdated equipment and this measure could help them to modernise their farming practices.

	□ Obligation X Financial incentive □ Information & support □ Exhortation □ Other
Technical measures	This policy does not include any special technical measures. However, financial assistance is not provided to projects or investments, which do not correspond with the Law for Preservation of Environment and the Water Law. There are restrictions for supporting activities in accordance with different EU regulations.
Enforcement and control	The measure is enforced by the National Payment Agency through its regional offices. An expert commission exerts control over the assessment of projects and is supposed to ensure the procedure's transparency. The Payment Agency, MAF, the Audit Office and the European Service for Control of Deceptions perform the control over the implementation of approved projects. Final payments are released after a commission checks how projects have been implemented.
Monitoring and evaluation	The Payment Agency is responsible for monitoring the implementation of financed projects.
Outcomes of policy measure	Since the measure was introduced in 2008, it is not easy to evaluate its impact. At this point of time, the expectations of farmers and their organisations are optimistic.
Analysis of drivers of policy measures' outcomes	The Regulation № 8/22.04.2008 for terms of application under a Measure 121 "Modernisation of agricultural farms" of the Rural Development Programme 2007-2013 contains some not clear points. These are mainly connected with the criteria for projects' assessment and the procedure on monitoring and control activities.
Part C – Evaluation of the Policy Measure	
Effectiveness of policy measure (in relation to the extent to which objectives are achieved, and cost-effectiveness)	The implementation of this measure gives the farmers an opportunity to speed up the innovation process in production, which is expected to have a positive effect on the environment and food safety. The efficiency of particular activities will depend on both the level of financial support and the number of people that are able to access funding.
Constraints to achieving full potential of the policy measure	The main constraints for achieving full potential of the policy measure include: 1) small and medium-sized farms lack the capacity for working out projects, 2) complicated application procedures, and 3) still unclear formulations related to the monitoring and controls. The support varies from 3,500-1,500,000 Euros. These ranges are too large and create a disadvantageous position for the small and medium-size farms applying for smaller amounts, as compared to large farmers applying for larger amounts. The documents and application procedures are similar for both types of applicants. However, middle-size farmers would be less competitive in the application procedure since they have fewer resources to develop good business plans.

	In addition, since usually the amount of support is reported for the measure as a whole, there will be less transparency regarding to whom the funding goes. Obviously, the policy impact will be very different if most of the funding is allocated to the larger farmers.
Reasons for the success of the policy measure (where appropriate)	Not applicable.

7.2.3 Fiche 3: Establishment of water user associations

Part A: Summary of Measure	
Formal title of measure and date of implementation	The establishment and support to water user associations (WUA) for irrigation is a policy with several measures, outlined in the following legislative documents: • Law for Water User Associations State gazette N34/ 2001 • Ordinance № 2 of January 21 2002 for financial support of the water user associations State gazette *11/2002.* • Ordinance for acquisition and taking from the water user associations the right to use in the sites of hydro-melioration infrastructure and the services machinery on the territory of the associations State gazette *21/2002*
Short description of the measure	The associations of water users are voluntary organisations of agricultural producers that organise the irrigation and drainage activities on their territory. Founders and members of the associations, respectively, must be more than 50 % of the land owners and users owning and cultivating more than 50 % of agricultural land on the territory The state provides financial support to the associations and initially transfers the use rights and later, after the association fulfilled certain requirements, the ownership rights of the irrigation and drainage infrastructure.
Type of policy measure	The measure is incentive based, since farmers receive the irrigation and drainage infrastructure free. In addition, they are provided with financial resources to reconstruct the system. Associations, however, increase not only farmers' rights but also their duties.
Objective of policy measure and relevance	The main objective of this policy measure is to bring the decision-making process regarding irrigation-drainage issues down to the level where the problems originate. Important for the Bulgarian context is the objective to establish the ownership and use rights of the irrigation systems at local level. Irrigation and drainage issues are important for the case of saline soil. The secondary salinisation is a result of improper irrigation and drainage practices.

	How relevant are the objectives of the measure to the soil degradation threats in your region? ☐ ☐ ☐ ☐ X Not very Very
Indirect effects	Not applicable.
Linkages to other policy measures	This measure has linkages with several regulations: (1) EU Water Framework Directive; (2) Water Law; (3) Law for Ownership and Use of Agricultural Land; (4) Law for the State Property; (5) Law for Municipal Property; (6) Law for Preservation of the Agricultural Land; (7) Law of Preservation of Environment
Funding	The funding of this measure is mainly from national sources.
Summary of assessment and conclusions	This measure is moderately successful. Currently, there are 80 irrigators' associations in Bulgaria serving 31572,7 hectares. In the Plovdiv area there are 10 associations, serving 11190 hectares (Executive Hydromelioration Agency). There are several reasons for the limited success of this policy. First is the fragmentation in land ownership, which increases the cost for organising 50 % of the landowners. Second, although there is a process of consolidation in land use, there are still many small agricultural producers. Consequently, the costs for organising 50 % of the land users are also high. Third, some of the small farmers are subsistent farmers and for them agriculture is an additional source of income. They are less interested in participating since many have wells on their land. Currently, larger farmers are the main driving force behind the associations. Most of the successful associations have a small water dam often with an independent water catchment area. Such conditions are not rare but are not the rule.
Recommendation	This policy could provide a long-term solution to the problems related to irrigation and drainage activities. The number and speed of establishing associations are less important than insuring the democracy of the process. However, it may not be possible to establish associations everywhere, at least in a short-run, due to technical problems, level of social capital, farm structure, and other factors. Therefore, short-term solutions such as local municipalities or some of larger farmers maintaining the local drainage and irrigation systems should not be neglected.
Part B: Detail on the Measures Design, Implementation, Enforcement and Impacts	
Policy design	The policy has been designed at the national level. However, there was a World Bank project implemented during the 1990s for establishing irrigators' associations in the country. Initially, the water user associations were part of the Water Law. Later, a separate law for irrigators' association was introduced.

Policy implementation I: Implementation at administrative level	The Executive Hydromelioration Agency is responsible for the implementation of this policy. This agency is a subordinate body of the MAF and was established in 2001. It has nine regional offices, including Plovdiv, which provide guidance to agricultural producers who want to establish associations and monitor the activities of the already established associations.
Policy implementation II: Method of delivery to farmers	The process for establishment of a new water user association starts with the establishment of a constituent committee of at least 5 people. The committee sends a declaration, accompanied with documents regarding the territory and needed irrigation infrastructure, to the Hydromelioration Agency. Agency staff checks the documents within 30 days. Then the committee prepares and publishes a project for the establishment of irrigators' associations and organises the constituent assembly. All landowners and users are invited to attend the assembly. The assembly approves the statute and elects the management committees. Then the agency needs to approve the statute and association - registered by the court. The procedure is lengthy and time-consuming, but eventually could ensure a democratic process.
Targeting	In general, the measure is available to all farmers cultivating irrigated land and who are able to organise themselves. The associations, however, are local entities that can exist on a technically separable part of the irrigation infrastructure.
	To what extent does the implementing body have flexibility in the targeting of the policy measure so that it is adapted to local conditions? ☐ ☐ X ☐ ☐ Low High
What drives uptake?	This policy is incentive-based. Farmers may initiate and participate in association in order: (1) to secure better water supply at a cheaper price compared to offers of the Irrigation Company; (2) the small water reservoirs can also be used for fishery, which provides additional income. Large farmers have better opportunities to organise the process. They have the necessary resources (money and connections) to start and complete the procedures of WUA establishment. They can ask the landowners to sign the necessary documents when they come to receive their rents.
	☐ X ☐ ☐ ☐ Obligation / Financial incentive / Information & support / Exhortation / Other
Technical measures	The measure does not directly include technical measures but after the association is registered financial support may be provided for the rehabilitation of existing infrastructure.
Enforcement and control	The Executive Hydromelioration Agency is supposed to control at every stage of an association's establishment and performance. The State may not transfer the ownership rights of the irrigation infrastructure if an association does not comply with the rules.
Monitoring and evaluation	The Executive Hydromelioration Agency monitors and evaluates the activities of the associations.

Outcomes of policy measure	It is still difficult to evaluate the outcome of this policy measure. Currently, the existing associations serve more as good (or bad) examples rather having a serious economic impact.
Analysis of drivers of policy measures' outcomes	The drivers of this measure are a combination of farmers' interest (mainly large farmers) to secure reliable and cheaper water supply, and the opportunity to take over assets (especially the small water reservoirs) that can generate additional income.
Part C – Evaluation of the Policy Measure	
Effectiveness of policy measure (in relation to the extent to which objectives are achieved, and cost-effectiveness)	The policy has a moderate effectiveness since the areas served by associations is still small.
Constraints to achieving full potential of the policy measure	There are several constraints for achieving the full potential of this policy measures. One constraint is the level of social capital and the bipolar farming structure. Large and small farmers have different interests and different opportunities for water supply. These two groups rarely communicate. Another constraint is the fragmentation in landownership and land use, which hampers the establishment and management of the association.
Reasons for the success of the policy measure (where appropriate)	This policy has been successful in areas with a higher level of social capital and in areas where the irrigation system includes a water reservoir with either independent water catchment area, or the reservoirs can be filled with water from the central irrigation system during winter or spring when water price is low. The main factors for success are: (1) the political consensus at national level; (2) the support of interested parties (farmers in the area where associations have been established); (3) the adequate system for monitoring and sanctioning; and (4) sufficient information and support that the agency provides to farmers which want to establish an association.

7.2.4 Fiche 4: Soil and water monitoring

Part A: Summary of Measure	
Formal title of measure and date of implementation	The National environment monitoring system is a complex of measures as well as analytical and information activities, whose objective is to provided timely and reliable information about the environment. The policy measure is implemented through the following legislation: • Law for Preservation of Environment • Law for Preservation of Agricultural Land • Water Law • Soil Law

Short description of the measure	The National Environment Monitoring System was established with the Law for Preservation of Environment. The monitoring activities include: (1) air; (2) precipitation and surface waters; (3) ground waters; (4) land and soils; (5) sea water and other. There are 12 places in Bulgaria (2007) for monitoring soil salinisation and one of them is Belozem. There are four soil-sampling sites in Belozem. Twice a year (May and September), the local office of MEW, located in Plovdiv, takes soil samples from a depth of 0 - 20 cm; 20 - 40 cm; and 40 - 60 cm. Water samples are obtained from the nearest drainage canal.
Type of policy measure	The national monitoring networks are designed and built up in accordance with national, European and international standards.
Objective of policy measure and relevance	The National Environment Monitoring System has the following tasks: • Collecting data on the state of environmental components; • Processing, analysing, visualising and preserving the collected information; • Providing information for operation control; • Forecasting and assessment of environmental risks; • Providing information to the authorities and the public; • Developing specialised environmental maps and registers of the environmental components and of the factors that influence them; • Exchange of information about the environmental condition with the European monitoring system.
	How relevant are the objectives of the measure to the soil degradation threats in your region? ☐ ☐ ☐ x ☐ Not very Very
Indirect effects	Data from observations and assessments can be used to exercise control and impose sanctions if the normative requirements connected with soil and water protection are violated.
Linkages to other policy measures	The measure is linked with a number of political actions directed at environmental protection. It is a basis for integrating the agricultural production in the process of sustainable rural development.
Funding	The funding of this measure is from national sources.
Summary of assessment and conclusions	This policy can be classified as moderately successful, because the public is not actively involved in the process. In addition, information is still not easily accessible.
Recommendation	A wider participation of environmental non-government organisations both in the process of environmental monitoring and in the control and sanctioning of violators is recommended.

Part B: Detail on the Measures Design, Implementation, Enforcement and Impacts	
Policy design	The measure is regularised as Chapter VIII of Part III of the Law for Preservation of Environment.
Policy implementation I: Implementation at administrative level	Methodical guidance of soil and water monitoring is provided by the Executive Agency of Environment. The local offices of the MEW implement the system at local level and take the samples. The physical and juridical entities have to provide immediate access to all sites and territories and render assistance to representatives of MEW and the Executive Agency of environment for exercising control, measuring or testing of present or potential sources of pollution harming the environment.
Policy implementation II: Method of delivery to farmers	Everyone is supposed to have access to the environmental information available. Data and assessments are published in a quarterly and an annual bulletin. Every year, up to 30 April, the regional offices of MEW have to prepare a regional report on the environmental condition of their respective territory during the previous year. The contents and scope of the regional report are determined by instructions from the minister of environment and water. The Ministry of Agriculture and Food is supposed to provide the owners and users of agricultural land with official information about their land's productive and ecological qualities, including the potential risks of worsening of these qualities due to erosion, pollution, salt-affection, acidification, swamping and others. The ministry is also supposed to provide information to land owners and users about the quality of irrigation water, sanitary standards, as well as for water that is not allowed for irrigation and anti-erosion crop rotations for territories with a high erosion risk.
Targeting	This policy does not target a specific group. The objects of monitoring activities cover all factors that are import for the environment.
	To what extent does the implementing body have flexibility in the targeting of the policy measure so that it is adapted to local conditions? ☐ ☐ X ☐ ☐ Low High
What Drives Uptake?	The State organises and financially supports the monitoring activities. The farmers are not involved in this process.
	X ☐ ☐ ☐ ☐ Obligation Financial incentive Information & support Exhortation Other
Technical measures	No technical measures included.
Enforcement and control	MEW organises and is responsible for the monitoring activities.

Monitoring and evaluation	Not applicable.
Outcomes of policy measure	The outcome of this policy is a compilation of reliable information about the environment.
Analysis of drivers of policy measures' outcomes	The driving forces behind this policy are the environmental concerns and the need of information. It is difficult to design adequate and effective environmental policy without information regarding the state and development of the problems.
Part C – Evaluation of the Policy Measure	
Effectiveness of policy measure (in relation to the extent to which objectives are achieved, and cost-effectiveness)	This is a policy measure with increasing social effectiveness. It provides opportunities for the existing non-government organisations in the field of ecology, agriculture and rural development to strengthen the public pressure for developing of a dynamic environmental policy. Although the information should be widely available, this is presently not the case. If a person wants information about environmental conditions in a certain area, he/she needs to follow a specific procedure. This procedure is unknown to most farmers so many still rely on the "word of mouth" information system.
Constraints to achieving full potential of the policy measure	There are several constraints. First, the laboratories for analysing the samples for some environmental components are not well equipped. Second, the training of specialists that are supposed to take the samples and to interpret the results is insufficient. This is partly due to the weakening of research institutes after 1990 and the high turnover of people working for the state administration. Third, public and local actors are weakly involved in the process.
Reasons for the success of the policy measure (where appropriate)	Moderately successful policy. Among the reasons for success are: (1) the pressure on the country to meet EU environmental standards; and (2) the political consensus regarding the issue in the parliament.

7.3 Summary of policy use and effectiveness

In summary, the legislation regarding soil preservation is already in place. However, the effectiveness of the policy measures is still low. Information at local level is insufficient and trust in the State organisations low.

Most of the farmers have received per hectare payments. This policy is considered successful. The main factors for success are the simple application and low cost of monitoring and sanctioning procedures. This programme will help to clarify use rights, will improve soil monitoring and increase the farmers' accountability regarding soil conservation issues.

Measures related to modernisation (investments) of agricultural enterprises are classified as moderately successful. While the modernisation measures are important because the implementation of soil conservation practices requires investment in new equipment, especially smaller farmers are discouraged to apply for this measure. The small farmers complained that the procedures are time-consuming, difficult and not transparent, and that only large

farmers can access these measures. Interestingly, the large farmers also complained about difficulties with the application procedure.

We need to be aware that development measures (such as investments in equipments) are different form the per hectare payment programmes. For the per hectare support programmes farmers need only to meet the eligibility criterion, while the application for development programmes is a competitive process that always requires a business plan and selection procedure. Development of investment and business plans often goes beyond the skills of many farmers. In this respect, there are several ways for improving the application procedure: (1) to locate specialists from the agricultural advisory services in each rural municipality to provide information and assist farmers in the application procedure: (2) the leader groups can also contribute to this process, by financing smaller projects.

At present, it is difficult to evaluate the impact of the policy for the establishment of local LEADER groups. These groups will have financial resources for solving local problems and we may expect that the local population will become more active. As a result, they will start demanding, in an organised way, more transparency in all policy measures available or introduced in the area.

Establishment of water user associations is often recommended as a sustainable solution to the problems related to the management of irrigation-drainage systems. However, this option can be successful only in places with a sufficient level of social capital. If the cooperation and communication between the local actors is lacking and the financial incentives are insufficient, this option has no chance to survive. This policy could be classified as unsuccessful for the village of Belozem and moderately successful for the region.

Soil and water monitoring and wells registration can be classified as moderately successful. The local office of MEW takes yearly soil and water samples from Belozem area. Still, the system must be improved regarding several aspects. First, farmers' voluntary participation in the process must be ensured, without which many of the problems will stay "hidden" from authorities. Second, the sampling procedures and data interpretation need be further developed. Finally, the access to data has to be improved.

8 Conclusions

The salinisation process in the village of Belozem is a result of natural conditions and improper human activities over the last 500 years. During the sixties and seventies, the State initiated a massive programme to remedy the situation. The existing irrigation system was reconstructed, drainage system was developed, and chemical melioration was carried out on most of the fields. After the agrarian reform, and the land restitution (during the nineties), the drainage system was not maintained and this poses a real threat, i.e. that salinisation may reverse to the level that existed before sixties. The new institutional settings do not support the technical decisions implemented in the past.

Currently there are several technical measures that can be applied in the case of Belozem: (1) maintaining and possibly further development of the drainage system; (2) chemical melioration; (3) improvement in crop rotation and cultivation practices; (4) planting tree strips. The first measure is the most important for preventing the processes of secondary salinisation. Without its implementation, the other measures will have a short-lived effect. There is only a slight opportunity to improve the existing crop structure and rotation, but the cultivation practises can be improved if certain investments are made in farm equipment. Chemical melioration is recommended only in plots affected by secondary salinisation. Tree strips could also be planted along the drainage canals in order to improve the natural soil drainage. Finally, the reestablishment of the local research station can help in development of soil cultivation and amelioration practices that can be useful for farmers in other regions of the country.

In Bulgaria there is a well elaborated system of strategies, concepts, and legislation regarding the soil preservation. However, not much has happened at local level so far. Soil conservation is not the main goal of the policy measures implemented in the area but rather it is a by-product resulting from cross compliance requirements.

The per hectare payment programme, introduced in 2007, clarifies the use rights and increases the farmers accountability. In addition, this measure will stabilize the farm income and hence farmers will have stronger incentives to introduce soil technical conservation measures. The measures for farms' modernisation can help farmers to purchase new equipments and to improve the cultivation practices and crop structure. However, currently only few farmers from the village have participated in the programmes for modernisation (investments) in agricultural enterprises. Farmers, find the application procedure difficult and not transparent. To correct for this problem agricultural advisory services could be expanded to municipality level. The policy for establishment a water user association that has the capacity to maintain the drainage and irrigation system was unsuccessful in the village. Therefore, a temporary solution could be that both the municipality and the Irrigation Company to invest in this activity.

The finding in this report suggests lessons for land conservation policy that can go beyond the case study region. First, they suggest that the technical solutions need to be supported by appropriate institutional settings. Second, the legislation regarding soil conservation might require time and supportive actions in order to promote establishment of suitable institutions on local level. The legislation might not work if the cooperation between farmers, State organisations, and NGO's is not sufficiently developed and/or the rules are not adapted to the local conditions. Third, the policy measure might not have the desired impact if the farmers find the application procedures difficult, not transparent, and are discouraged to apply. Fourth, the economic environment influences the prospects for soil conservation. Instability of the farm income and agricultural product prices might decrease the farmers' incentives to invest in soil conservation practices. Therefore, creating a stable economic environment is a precondition for institutional development.

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Annexes

Annex 1: Overview of the results of Questionnaire 1

Main farm types	arable, livestock
Main crops	wheat, barley, maize, alfalfa, rice, tomato, paprika, sunflower, cabbage, melon, triticale, potato, pea
Livestock	bovine (race: Holstein and Red Holstein)
Main production orientation	conventional
Average field size	0,8 ha
Irrigation methods	furrow, flood, drip and furrow, gravity
Source of irrigation water	rivers
Usual salt content of irrigation water	250-500µS/cm
Drainage systems	ditches
Existing grass strips	none
Separation of fields by hedges	no
Main soil degradation problems	salinisation, decline in organic matter, soil compaction
Applied soil conservation measures (cropping/ tillage measures)	wheel sizes and pressure / restricting excessive heavy machinery use, restrictions of manure application to a certain time period
Applied soil conservation measures (long term measures)	use of organic soil improvers/exogenous organic matter, irrigation management to mitigate salinisation, control of irrigation water/use of appropriate water quality, drainage management to mitigate salinisation and/or compaction, chemical amendments

Annex 2

List of interviews conducted with Questionnaire 2

	Interview Date	Interviewee (affiliation/position)	Type of interview
1	10.04.2008	Farmer	face-to-face semi structured
2	10.04.2008	Farmer	face-to-face semi structured
3	10.04.2008	Farmer	face-to-face semi structured
4	10.04.2008	Farmer	face-to-face semi structured
5	16.04.2008	Manager	face-to-face semi structured
6	16.04.2008	Farmer	face-to-face semi structured
7	11.04.2008	Farmer	face-to-face semi structured
8	11.04.2008	Farmer	face-to-face semi structured
9	12.04.2008	Farmer	face-to-face semi structured
10	12.04.2008	Farmer	face-to-face semi structured
11	14.04.2008	Farmer	face-to-face semi structured
12	14.04.2008	Farmer	face-to-face semi structured
13	14.04.2008	Farmer	face-to-face semi structured
14	15.04.2008	Farmer	face-to-face semi structured
15	05.04.2008	Farmer	face-to-face semi structured
16	15.04.2008	Farmer	face-to-face semi structured
17	05.04.2008	Farmer	face-to-face semi structured
18	09.04.2008	Farmer	face-to-face semi structured

List of interviews conducted with Questionnaire 3

	Interview Date	Interviewee (affiliation/position)	Type of interview
19	23.05.2008	Expert Ecology Rakovski municipality	face-to-face semi structured
20	16.05.2008	Municipal office of the MAF - Rakovski	face-to-face semi structured
21	30.03.2007	Expert - Local advisory services	face-to-face semi structured
22	17.05.2008	Director in the Local Office of the MEW	face-to-face open ended
23	17.05.2008	Expert in the Local Office of the MEW	face-to-face open ended talk
24	19.05.2008	Director "Irrigation Systems" - Plovdiv	face-to-face open ended
25	19.05.2008	Chief expert "Irrigation Systems" - Plovdiv	face-to-face open ended
26	22.05.2008	Director - Local branch of the Executive Hidromelioration agency	face-to-face open ended
27	22.05.2008	Specialists - WUA - Local branch of the Executive Hidromelioration agency	face-to-face open ended

List of interviews conducted with Questionnaire 4

	Interview Date	Interviewee (affiliation/position)	Type of interview
28	15.05.2008	Chairman of the board - local LEADER group	face-to-face open ended
29	15.04.2008	School teacher - Agronomist - The professional gymnasium for agriculture	face-to-face open ended
30	01.04.2008	Coordinator - Land Source of Income Foundation	face-to-face open ended

Annex 3: Glossary of policy measures

English title of policy measure (law, regulation, initiative)	National title of policy measure
RURAL DEVELOPMENT PROGRAM (2007-2013) http://www.mzh.government.bg/Articles/432/Files/BG-RDP-2007-2013%20third%20official%20version-eng633469768098593750.pdf	ПРОГРАМА ЗА РАЗВИТИЕ НА СЕЛСКИТЕ РАЙОНИ (200702013) http://www.mzh.government.bg/Articles/432/Files/BG-RDP-2007-2013%20third%20official%20version-eng633469768098593750.pdf
LAW OF PRESERVATION OF ENVIRONMENT State gazette N91/ 2002	ЗАКОН ЗА ОПАЗВАНЕ НА ОКОЛНАТА СРЕДА Държавен вестник 91/2002
SOIL LAW State gazette N 89/ 2007	ЗАКОН ЗА ПОЧВИТЕ Държавен вестник 89/2007
LAW FOR PRESERVATION OF THE AGRICULTURAL LAND State gazette N35/ 1996	ЗАКОН ЗА ОПАЗВАНЕ НА ЗЕМЕДЕЛСКИТЕ ЗЕМИ Държавен вестник 35/1996
REGULATIONS FOR IMPLEMENTATION OF THE LAW FOR PRESERVATION OF THE AGRICULTURAL LAND State gazette *84/1996*	ПРАВИЛНИК ЗА ПРИЛАГАНЕ НА ЗАКОНА ЗА ОПАЗВАНЕ НА ЗЕМЕДЕЛСКИТЕ ЗЕМИ Държавен вестник *84/1996*
LAW FOR OWNERSHIP AND USE OF AGRICULTURAL LAND State gazette N17/ 1991	ЗАКОН ЗА СОБСТВЕНОСТТА И ПОЛЗВАНЕТО НА ЗЕМЕДЕЛСКИТЕ ЗЕМИ Държавен вестник 17/1991
ORDINANCE FOR THE RULES FOR DETERMINING AND IMPOSING SANCTIONS IN CASES OF HARMING OR POLLUTION OF ENVIRONMENT ABOVE THE NORMS State gazette 69/2003	НАРЕДБА ЗА РЕДА ЗА ОПРЕДЕЛЯНЕ И НАЛАГАНЕ НА САНКЦИИ ПРИ УВРЕЖДАНЕ ИЛИ ЗАМЪРСЯВАНЕ НА ОКОЛНАТА СРЕДА НАД ДОПУСТИМИТЕ НОРМИ Държавен вестник *69 /2003*
ORDINANCE № 3 REGARDING THE PERMISSIBLE CONTENTS OF HARMFUL SUBSTANCES IN THE SOIL State gazette *36/1979*	НАРЕДБА № 3 ЗА НОРМИ ОТНОСНО ДОПУСТИМОТО СЪДЪРЖАНИЕ НА ВРЕДНИ ВЕЩЕСТВА В ПОЧВАТА Държавен вестник *36/1979*
ORDINANCE FOR MAKING INVENTORY AND EXAMINATION OF AREAS WITH POLLUTED SOILS, THE NECESSARY RECLAMATION MEASURES, AND SUPPORT OF THE RECLAMATION ACTIVITIES State gazette *15 /2007*	НАРЕДБА ЗА ИНВЕНТАРИЗАЦИЯТА И ПРОУЧВАНИЯТА НА ПЛОЩИ СЪС ЗАМЪРСЕНА ПОЧВА, НЕОБХОДИМИТЕ ВЪЗСТАНОВИТЕЛНИ МЕРКИ, КАКТО И ПОДДЪРЖАНЕТО НА РЕАЛИЗИРАНИТЕ ВЪЗСТАНОВИТЕЛНИ МЕРОПРИЯТИЯ Държавен вестник *15 /2007*
ORDINANCE № 26 FOR RECLAMATION OF TERRAINS WITH DISTURBED CHARACTERISTICS, IMPROVEMENT OF LOW FERTILE LANDS, TAKING AWAY AND USING THE HUMUS LAYER State gazette *89/1996*	НАРЕДБА № 26 ЗА РЕКУЛТИВАЦИЯ НА НАРУШЕНИ ТЕРЕНИ, ПОДОБРЯВАНЕ НА СЛАБОПРОДУКТИВНИ ЗЕМИ, ОТНЕМАНЕ И ОПОЛЗОТВОРЯВАНЕ НА ХУМУСНИЯ ПЛАСТ Държавен вестник *89/1996*
WATER LAW State gazette N67/ 1999	ЗАКОН ЗА ВОДИТЕ Държавен вестник 67/1999
LAW FOR WATER USER ASSOCIATIONS State gazette N34/ 2001	ЗАКОН ЗА СДРУЖЕНИЯТА ЗА НАПОЯВАНЕ Държавен вестник 34/2001

ORDINANCE № 2 OF JANUARY 21 2002 FOR FINANCIAL SUPPORT OF THE WATER USER ASSOCIATIONS State gazette *11/2002.*	НАРЕДБА № 2 ОТ 21 ЯНУАРИ 2002 Г. ЗА ФИНАНСОВО ПОДПОМАГАНЕ НА СДРУЖЕНИЯТА ЗА НАПОЯВАНЕ Държавен вестник.*11/2002.*
ORDINANCE FOR ACQUISITION AND TAKING FROM THE WATER USER ASSOCIATIONS THE RIGHT TO USE IN THE SITES OF THE HYDRO-MELIORATION INFRASTRUCTURE AND THE SERVICING MACHINERY ON THE TERRITORY OF THE ASSOCIATION State gazette *21/2002*	НАРЕДБА ЗА ПРИДОБИВАНЕ И ОТНЕМАНЕ ОТ СДРУЖЕНИЯТА ЗА НАПОЯВАНЕ ПРАВОТО НА ПОЛЗВАНЕ ВЪРХУ ОБЕКТИТЕ ОТ ХИДРОМЕЛИОРАТИВНАТА ИНФРАСТРУКТУРА И ОБСЛУЖВАЩАТА ТЕХНИКА НА ТЕРИТОРИЯТА НА СДРУЖЕНИЕТО Държавен вестник.*21*/2002
STRATEGY FOR DEVELOPMENT OF PLOVDIV REGION (2005-2015) http://www.pd.e-gov.bg/scr/files/strat/	СТРАТЕГИЯ ЗА РАЗВИТИЕ НА ОБЛАСТ ПЛОВДИВ (2005-2015) http://www.pd.e-gov.bg/scr/files/strat/
MUNICIPAL PLAN FOR DEVELOPMENT OF RAKOWSKI MUNICIPALITY (2007-2013) http://www.rakovski.bg/documents.php	ОБЩИНСКИ ПЛАН ЗА РАЗВИТИЕ НА ОБЩИНА РАКОВСКИ (2007-2013) http://www.rakovski.bg/documents.php
LOCAL STRATEGY FOR DEVELOPMENT OF THE LOCAL INITIATIVE GROUP OF MUNICIPALITIES BRATIA DASKALOVI-BREZOVO-RAKOVSKI http://www.rakovski.bg/documents.php *this group is in a process of recognition by the MAF	МЕСТНА СТРАТЕГИЯ ЗА РАЗВИТИЕ НА МЕСТНАТА ИНИЦИАТИВНА ГРУПА (МИГ) ОТ ОБЩИНИТЕ БРАТЯ ДАСКАЛОВИ-БРЕЗОВО-РАКОВСКИ http://www.rakovski.bg/documents.php *Групата кандидатства за признаване пред МЗХ
LAW FOR THE STATE PROPERTY State gazette N 44/ 21.05.1996	ЗАКОН ЗА ДЪРЖАВНАТА СОБСТВЕНОСТ Държавен вестник бр. 44/ 21.05.1996
LAW FOR THE MUNICIPAL PROPERTY State gazette N44/ 21.05.1996	ЗАКОН ЗА ОБЩИНСКАТА СОБСТВЕНОСТ Държавен вестник бр. 44/ 21.05.1996
LAW FOR SUPPORTING THE AGRICULTURAL PRODUCERS State gazette *58/2.05.1998*	ЗАКОН ЗА ПОДПОМАГАНЕ НА ЗЕМЕДЕЛСКИТЕ ПРОИЗВОДИТЕЛИ Държавен вестник бр. *58/2.05.1998*
ORDINANCE № 14 FROM 3 OF APRIL 2008 FOR PROVIDING FINANCIAL SUPPORT FOR MEASURE “ACQUIRING OF SKILLS AND ACHIEVING PUBLIC PARTICIPATION ON THE TERRITORIES WITH POTENTIAL FOR DEVELOPMENT OF LOCAL INITIATIVE GROUPS IN RURAL AREAS” FROM THE RURAL DEVELOPMENT PROGRAMME 2007-2013 Issued by the Ministry of agriculture and food State gazette 39/15.04.2008	НАРЕДБА № 14 ОТ 3 АПРИЛ 2008 Г. ЗА УСЛОВИЯТА И РЕДА ЗА ПРЕДОСТАВЯНЕ НА БЕЗВЪЗМЕЗДНА ФИНАНСОВА ПОМОЩ ПО ПОДМЯРКА "ПРИДОБИВАНЕ НА УМЕНИЯ И ПОСТИГАНЕ НА ОБЩЕСТВЕНА АКТИВНОСТ НА СЪОТВЕТНИТЕ ТЕРИТОРИИ ЗА ПОТЕНЦИАЛНИ МЕСТНИ ИНИЦИАТИВНИ ГРУПИ В СЕЛСКИТЕ РАЙОНИ ОТ ПРОГРАМАТА ЗА РАЗВИТИЕ НА СЕЛСКИТЕ РАЙОНИ ЗА ПЕРИОДА 2007-2013Г. Издадена от Министерството на земеделието и продоволствието Държавен вестник бр.39 от 15.04.2008г.
REGULATION № 107 FROM 23 AUGUST 2006 REGARDING THE CONDITIONS AND ORDER FOR SUBMITTING APPLICATIONS FOR THE SCHEMAS AND MEASURES FOR PER AREA SUPPORT State gazette 84 /17.10.2006	НАРЕДБА № 107 ОТ 23 АВГУСТ 2006 Г. ЗА УСЛОВИЯТА И РЕДА ЗА ПОДАВАНЕ НА ЗАЯВЛЕНИЯ ПО СХЕМИ И МЕРКИ ЗА ПОДПОМАГАНЕ НА ПЛОЩ Държавен вестник бр.84 от 17.10.2006г

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Abstract

This Technical Note 'Case Study – Bulgaria' is part of a series of case studies within the 'Sustainable Agriculture and Soil Conservation' (SoCo) project. Ten case studies were carried out in Belgium, Bulgaria, the Czech Republic, Denmark, France, Germany, Greece, Italy, Spain and the United Kingdom between spring and summer 2008. The selection of case study areas was designed to capture differences in soil degradation processes, soil types, climatic conditions, farm structures and farming practices, institutional settings and policy priorities. A harmonised methodological approach was pursued in order to gather insights from a range of contrasting conditions over a geographically diverse area. The case studies were carried out by local experts to reflect the specificities of the selected case studies.

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