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SPIN

Soil Protection Guidebook

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Soil Protection Guidebook

Zaječar, 2019

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Content

Project summary

Project title	Soil preservation initiative now - SPIN
Lead partner	RARIS - Regional Development Agency Eastern Serbia
Other partner/s	Municipality of Boynitsa /Bulgaria
Project objectives	General objective: To preserve and improve the quality of soils in Vidin and Zajecar districts across the border region. Specific objective: Enhanced capacity in Vidin and Zajecar districts to address jointly the preservation and improvement of the quality of soils exposed to pollution caused by human activities.
Project activities	1.Kick-off conference 2.Development of the Soil Protection Guidebook 3.Training on soil protection 4.Cross-border Soil Protection conference 5.Development of the Cross-Border Soil Protection Action Plan 6.Soil Protection Cross-Border Task Force 7.Development of the Web-based Soil Protection ToolBox 8.Final Project conference
Target Groups	• Regional and local public administrations and organisations from Vidin and Zajecar districts. • Civil Society Structures • Economic operators active in environment and agriculture. • Participants in capacity building activities.

Introduction

Wasting and destroying our natural resources, stripping and depleting the soil instead of increasing its usability - this will already significantly diminish the opportunities for our children to enjoy the pleasure we are obliged to give them - bigger and more developed.

(Theodore Roosevelt)

Man has done more harm to the Earth in the 20th century than in its entire history.

(Jacques Yves Cousteau)

Everything comes from the soil and everything returns to the soil.

*(*Xenophanes*)*

If you really think pollution is less important than economics, try not to breathe while counting money.

(Guy McPherson)

The pollution of the environment, air, water and soil is different throughout the epochs of humanity. Considering the degree of environmental degradation, there are three epochs in the development of human civilization:

- agricultural which lasted until the mid-nineteenth century,
- industrial through 1950 and
- technical-technological which spans the second half of the 20th century and continues to this day.

In the first epoch, degradation was minimal, almost negligible, but with the increase in population and increasing human activity in nature, the degree of degradation of natural ecosystems and the environment as a whole increased. The intensive development of industry at the end of the 19th and the first half of the 20th century and the production for profit, the use of fossil fuels as energy sources, havethreatened the environment on a larger scale, thus raising the question of the survival of life on planet Earth.

In modern society, 21st century society, environmental protection is one of the leading topics. We can easily encounter examples of pollution both in the territory of our state, city or municipality, as well as in countries all over the world. Consciousness about environment preservation was, unfortunately, developed only when the environment reached the point of extermination of animal species, ozone depletion, global warming, water, air, soil pollution. Only then did the question of preserving environment arise as well as what damage people are causing to the environment.. Only then did the question of preserving environment arise and people started to worry about damage that they are causing to the environment.

The UN Conference on Environment and Sustainable Development, held in Rio de Janeiro in 1992, adopted the Declaration on the Environment and Sustainable Development, which contained 27 basic environmental principles. The basic point of the Rio Declaration is that life and harmony with nature represent the basic purpose of human existence. The basic principles in the declaration, refers to sustainable development, preventiveness, recycling, publicity of environmental data, and there are principles - "polluter pays" and "user pays".

One of the most important principles is Principle 10, which states:

"Environmental problems are best addressed with the participation of all concerned citizens at the appropriate level. At the national level, each individual must have adequate access to environmental information held by public authorities, including information on hazardous substances and activities in their community, and the ability to participate in the decision-making process. States will support and foster public awareness and participation by ensuring widespread access to information."

How efficiently we manage an area today will directly determine if the values of the area are preserved for future generations or are destroyed.

The world went into **ecological debt** on July 29, 2019, which will say that by this date, we have spent more than planet Earth's ecosystems can recover in a year[11]. The Ecological Debt Day this year marks the earliest since measurements are taken. The Global Footprint Network calculates an overdraft day for each year. Last year, it went into debt on August 1st. We were within the "budget" of Earth's natural resources until about 1970, when Earth's Ecological Debt Day was December 23. In ten years, in 1980, the debt was entered into six weeks earlier, and in 1990 it was October 13. In 2000, the planet entered into debt on October 4, and in 2010, at the end of August, more precisely on the 28th day of the month. Now, nine years later, that record has been broken.

The purpose of the Soil Protection Guide:

- To be technical basis for all project capacity building activities;
- To provide relevant, accurate and timely information on the environment and land protection, especially in agriculture;
- To present examples of good soil protection practices in the EU;
- To support project replication and sustainability.

[1] BBCnews in Serbian: Ecological debt: One Earth is not enough for life to us - we currently need 1.75 planets, July 29, 2019.

1. Characteristics of the Project Region

The Soil Protection Initiative Now project is being realized on the territory of Zajecar and Vidin districts

1.1 Geographical characteristics of the Zajecar and Vidin districts

Zaječar is the center of the Zaječar Administrative District. It is located in the central part of Carpathian Serbia, in the center of the Timok region, in the Zaječar basin, at 43˚53 'north latitude and 20˚40' east longitude at 137m absolute height[2]. The city lies in the intersection of the two rivers, at the junction of the Black and White Timok. The Zaječar basin is located between two mountain ports, Carpathian and Balkan, situated between the Crnorecka's basin in the west and the Negotin's lowsoil/plain? in the north. The Zajecar Administrative District covers an area of 3,623 km2. Within the district, agricultural land covers over 123,000 hectares, and unfertilized(infertile perhaps?) land covers over 10,000 hectares. From the agricultural land, arable land and gardens cover about 76,000 hectares, orchards about 5,000 hectares, vineyards are based on about 3,500 hectares, while meadows and pastures cover more than 35,000 hectares. The forests cover about 118,000 hectares.

In Zajecar district, according to the latest census, there are about 120000[2] inhabitants, of which over 60000 are in the Zaječar area, and almost as many in the other municipalities such as Boljevac (13,000), Knjaževac (31,000) and Sokobanja (16,000).

The Vidin region is located in the far northwest of Bulgaria and occupies a territory of 3 022 km2, which represents 2.7% of the entire state territory of Bulgaria[3]. The region comprises 11 municipalities, with 142 settlements, the largest being Vidin, Boynitsa, Bregovo, Belogradchik, Gramada, Dimovo, Kula, Makresh, Novo selo, Ruzhinci, and Chuprene. The Vidin area is located in the southwestern periphery of the Vlach Plain, with a latitude of 43 ° 49 'north latitude and 22 ° 43' east longitude. The city is developed at the edge of the Danube, in the plains. The altitude of the city is about 40m. The relief of the region is diverse, changing from the Danube River to the Stara Planina Mountain and is rounding up in four natural-formed geographical zones: the Danube-coastal plain - Vidin and Arcar-Orsoja are the most fertile soil, the Danube Plateau; Pre-Balkan and Stara Planina. This relief provides opportunities for the development of agriculture and good infrastructure. Vidin area covers about 301 thousand hectares. Agricultural land, according to the census of 2017/2018, covers an area of 186,722 hectares and constitutes 61.6% of the total area, while under forests 85.970 hectares or 28.5% of the entire territory of the region[4]. Arable land accounts for 92% of agricultural land, vineyards 1.2%, and the rest is under the group of natural and artificial meadows and pastures.

[2] http://www.zajecar.info

[3] https://en.wikipedia.org/wiki/Vidin

[4] Republic of Serbia, Statistical Office of the Republic of Serbia: Census 2011

The whole area is characterized by a lower population number, so according to the data as of January 31, 2018, over 84 thousand inhabitants (over 43 thousand women and 41 thousand men) live in this area, of which about 55 thousand in the city and over 29 thousand in the countryside.

Map of the project area

1.2 Climatological characteristics of the Zaječar and Vidin areas

The continental climate of Zaječar with certain specificities is conditioned by the continental position of Zaječar and its openness to the Vlach-Pontic Basin. The climate is humid and temperate, with warm summers and moderately cold winters, with variable transitional seasons, from which autumn is warmer.

Summer has a more stable character due to the influence of the Azores anticyclone, while the winters are influenced by the cyclones of the Atlantic and Mediterranean, but also by the so-called Siberian anticyclone. Zaječar and its surroundings have a temperate continental climate. The average annual air temperature (1995-2014)[5] is 11.30C, the warmest month is July (22.80C), and the coldest January is (0.00C)[4]. The annual temperature amplitude is 22,8 ^{0}C. This, as well as the more gradual change from winter to summer than from summer to winter, shows the continental nature of the climate. The average number of frosty days in the year is 98.8, and in January there are up to 26 frosty days. The number of warm days in the city is about 100. Annual rainfall is 625.7 mm / m2. The months with the highest rainfall are May (65.5 mm / m2) and June (67.5 mm / m2), with the lowest rainfall being in January (35 mm / m2).

The Vidin area is located on the edge of the Vlach Plain in the area of temperate continental climate with somewhat sharper lines due to its openness to the north and northeast. Therefore, the summers are dry and warm and the winters harsh and humid. The average annual air temperature is 11.20C, with July being the warmest month with an average temperature of 23.10C and the coldest month is January with an average temperature of (-1.70C). Rainfall is relatively well distributed seasonally from 550 - 600 mm / m2 in the lower and about 750 mm / m2 in the higher terrains, ie the average annual rainfall is 581.6 mm / m2. The month with the highest rainfall during the year is June (75.4 mm / m2) and the lowest rainfall is in February, when it averages 31.5 mm / m2. During the winter, there are about 50 days with snowfall. Northwest winds are more prevalent during the year, with east and northeast winds more common in winter.

1.3 Soil and basic characteristics of soil types in the area of Zajecar and Vidin districts

Soil is formed by long-term processes of decomposition of the parent geological substrate in different climatic conditions and under the complex action of living organisms (microorganisms, fungus, plants, ...). The process of soil formation or pedogenesis goes through phases of physical decomposition of the parent geological substrate, mineralization (enrichment with mineral materials) and humification (extraction of organic matter).

The soil can be categorised as typical (developed) and atypical (undeveloped). Typical soils are created by long and complex natural processes in different geological, climatic, water and vegetation conditions.

Rendzine are soils of mountainous areas, formed on native rocks and dominated by soft limestones and flysch. They are characterized by water permeability and moderate humus richness.

Rankere are humus - silicate soils developed in mountainous areas where mixed and conifer forests grow and are mainly used as pastures and meadows.

Vertisol is a type of soil and is formed on native substrates with more than 30% clay, developed in climatic conditions that alternate between wet and dry periods. In the wet period, a high content of clay causes swelling and reduced soil drainage, and in the dry season, contractions occur when cracks collapse into the soil from the surface horizon.

Cambisol represents well drained and warm soils. Humus content of this type of soil is in the range of 2 to 5%, also this type of soil is neutral to poorly acidic chemical reactions/? and has a high adsorption

[5] Republic Hydrometeorological Institute of Serbia, Meteorological station Zajecar

capacity. The primary vegetation type on the soil is oak forests, but this type of soil is also suitable for crop, vegetable, fruit and viticulture production.

Red soil (Terra rossa) is a name for red soils especially widespread in the karst area of Eastern Serbia. The red soil is considered to be a type of relict? soil formed in warmer climates than today. The characteristic reddish color is derived from amorphous iron hydroxides.

Podzol is light soil, water-permeable, poor in phosphorus, calcium and nitrogen. This gray soil is of poor fertility due to the intense leaching of minerals and high acidity.

Stagnosol is a soil with unfavorable water, air and thermal characteristics. Water retention in surface horizons is due to the presence of a less permeable horizon or layer in the profile. More intensive use of stagnosol for plant production is possible with the use of complex ameliorative measures.

Atypical (undeveloped) soils are those in the initial stages of formation, after the operation of a certain erosive process. The atypical soils of Serbia include alluvial, eluvial, deluvial, aeolian and anthropogenic soils.

Alluvial soil (Fluviosol) is widespread along streams of large lowsoil rivers. The alternation of large waters (floodwaters) and low-water periods affect the character of alluvial soils. More specifically, these soils are characterized by a heterogeneous mechanical composition - sands, loam and clay, permeable to more permeable, mostly neutral, rarely poorly acidic chemical reactions. Although these soils belong to a group of potentially fertile solils, their intensive use mainly requires the application of ameliorative measures.

Eluvial and deluvial soils are created by the physical decomposition of the rock mass. During physical decomposition, a layer of loose material is formed on the surface of the rock mass. The thickness of this layer is variable and varies from centimeters to about ten meters. Decomposed material-eluvium, remains in place. Later, occasional surface currents, formed after the rainfall, lead to the transport of decomposed material down the slopes in relief.

Aeolian soils are formed by the Aeolian process, that is, they are generated by wind activity.

Anthropogenic soils are created by the long-lasting effects of man, which, by changing various mechanical and chemical processes and means, changes the natural characteristics of the soil.

The pedological cover in the project area is very diverse and complex due to its complicated biological structure. A large number of land types occur in smaller areas as well.

Zajecar district

The following developed soils are distinguished on the territory of Serbia: rendzine, rankere, chernozem, vertisol, cambisol, red, podzol, stagnosol, wetsoil, saline soil and others.

Alluvium is spread over 2000m wide on both sides of Black Timok and Timok. This "sludge" is very fertile. There is fertile and good soil at the bottom of the basin (Neogene clay, lake pebbles, loam, sandstones, sands and other lake sediments). The sandstone is located above the first river terrace, and above the second is sandstone with gravelly - rocky soil. There are very few podzols, and there are cambisols in the hilly parts of the river terraces. Corn and vegetables are most commonly grown on alluvial soils. Wheat is grown on the higher terraces, and other grains (barley, rye and oats) are grown on the even higher terraces. On terrains from 120 to 600m above sea level, in places sheltered from the wind, fruits, predominantly plum and cherry, are grown, and on terrains from 150 to 300m vineyards are grown.
The native vegetation is mainly composed of deciduous forests, which are mostly widespread in the foothills of Deli Jovan, Tupižnica and Stara planina.

An overview of agricultural land by usage on the territory of both districts is presented in the following tables.

Table 1. Structure of utilized agricultural land according to the latest agricultural census from 2012 for the municipalities of Zajecar district

Municipality	Number of settlemants	Number of agricultural households	Arable land and gardens (ha)	Orchards and vineyards (ha)	Meadows and pastures (ha)	Total agricultural area (ha)
Zaječar	41	6.124	21.225	1.348	7.852	30.425
Boljevac	19	2.990	10.678	1.992	9.089	21.759
Knjaževac	85	5.010	7.328	2.093	8.087	17.508
Sokobanja	25	2.521	9.597	501	5.801	15.899
Total	**170**	**16.645**	**48.828**	**5.934**	**30.829**	**85.591**

Vidin district

The distribution of soil types in the Vidin District is determined and correlates with the physical and geographical characteristics of the area. In the Danubian lowlands the soils are predominantly carbonate and typicaly chernozem, while in the upper, southern and eastern parts, as well as in the most western part of the Danube plain (west of Belogradchik), permeable and subzonal soils are developed south of the Chernozem zone. In the northern parts of the pre-Balkan region are developed dark gray soils and in the southern parts gray forest soils. In karst regions humus-carbonate soils (rendzina) are widespread. The river valleys are dominated by alluvial-meadow soils.

Table 2. Structure of utilized agricultural land according to the latest census of 2018 for the municipalities of the Vidin district

Municipality	Arable land, Under MRP** /ha/	Lands actually used - 2018 /ha/					Share of land actually used compared to the arable land
		Total area /ha/	Including:				
			Fields	Perennials		Meadows, Pastures and Grasslands	
				Vineyards	Other perennials		
Belogradchik	16923	6185	2175	49	129	3833	36.55%
Boynitsa	12124	5556	5485	26	5	40	45.83%
Bregovo	13002	9320	9251	1	68	0	71.68%
Vidin	35777	28230	27452	515	190	72	78.90%
Gramada	13110	8789	8700	1	19	69	67.04%
Dimovo	25815	16080	15819	3	42	215	62.29%
Kula	19543	11353	11251	17	23	63	58.09%
Makresh	13209	7400	7172	2	16	210	56.02%

Novo selo	8590	6941	6267	630	39	6	80.80%
Ruzhintsi	16293	9516	9138	1	15	362	58.41%
Chuprene	12337	2732	433	1	60	2239	22.15%
For the Region:	**186723**	112102	103142	1246	604	7109	**60.04%**

1.4 Agricultural production in the area of Zajecar and Vidin districts

Zaječar district

In the Zajecar district, agricultural production is divided into two main grups – cereal production and fruit growing. In both cases, the number of crops grown is narrowed, so that wheat and maize are dominate in cereal production, and dominant fruits are: sour cherries, plums and grapes. Other production, primarily vegetable production, is reduced to smaller areas and is oriented towards meeting the needs of municipal markets.

Tables 3. Physical indicators of agricultural production in the Zajecar district for 2018.

A

Cereal production	Total,ha	wheat	rye	barley	oats	maize	other
Zaječar	21225,2	5283,4	255,6	1278,3	760,1	5688,8	400,2
Boljevac	10678,2	2013,6	25,9	465,45	341,5	2556,5	134,9
Knjaževac	7328,3	1954,3	24,1	399,5	116,4	2239,6	23,5
Sokobanja	9597,0	2562,8	10,9	357,35	170,6	2772,9	33,8
Zaječar district	**48828,7**	**11814,07**	**316,6**	**2500,6**	**1388,7**	**13257,8**	**592,5**

Vegetables, ha	tomatoes	cabbage and kale	paprika	onion	garlic	cauliflower	carrot	pea	other
Zaječar	17,5	25,3	27,5	24,3	6,6	1,8	3,6	5,1	13,1
Boljevac	8,5	7,9	8,5	7,4	3,7	0,2	1,2	3,0	9,1
Knjaževac	9,3	12,1	21,3	6,2	2,8	0,4	1,2	2,6	9,6
Sokobanja	8,1	7,5	14,4	13,0	6,4	0,2	0,8	2,8	3,0
Zaječar district	**43,4**	**52,8**	**71,7**	**50,89**	**19,5**	**2,4**	**6,8**	**13,4**	**34,8**

C

Fruit, ha	total	apple	pear	apricot	sour cherry	plum	quince	nut	hazelnut	raspberries	blackberries
Zaječar	983,5	54,0	14,9	16,7	295,6	136,7	13,7	22,6	17,5	1,7	6,9
Boljevac	408,4	7,8	4,8	1,4	14,7	53,5	4,0	12,3	6,5	0,7	2,0

Knjaževac	1724,8	43,5	7,9	0,6	912,3	414,5	10,8	30,3	17,4	1,2	31,4
Sokobanja	487,2	2,5	1,2	0,0	2,4	27,2	1,9	4,7	1,8	0,1	1,3
Zaječar district	**3603,9**	**107,7**	**28,7**	**18,8**	**1225,0**	**631,8**	**30,4**	**69,9**	**43,2**	**3,8**	**41,6**

D

Vineyards, ha	**total**	**fertile**
Zaječar	463,23	446,23
Boljevac	62,22	60,35
Knjaževac	402,57	386,98
Sokobanja	57,55	52,75
Zaječarski okrug	985,57	946,31

As regards livestock production, in the area of Zajecar district, there is a tendency of declining production from year to year.

Table 4. Livestock production in the Zaječar district in 2018

Livestock production	**Cattle**	**Pig**	**Sheep**	**Poultry**
Zaječar	7804	37764	14180	102295
Boljevac	5551	8875	11045	46739
Knjaževac	2949	9549	13485	60406
Sokobanja	4756	11478	8986	35158
Zaječar district total	**21060**	**67666**	**47696**	**244598**

Vidin Region

The analysis of the plant growing shows that the area is typical with the production of wheat, barley, maize, sunflower, fruit, wine and vegetables. The most favorable soil and climate conditions for agriculture are in the Northern part of the flat area at the turn of the river Danube - Bregovo, Novo Selo and some municipalities of Vidin, Ruzhintsi and Dimovo.

Table 5. Physical indicators of agricultural production in the Vidin district for 2017-2018 agricultural year.

A

Production	**Sunflower**	**Wheat**	**Legumes (chickpeas, beans)**	**Barley**	**Feed peas**	**maize (ha)**	**Oilseed rape**
Vidin district	36594,5	36491	4743,6	2087,9	1234,5	15120,5	3726

Vegetable production in the district is relatively low in view of the suitable soil and climate conditions for the industry. Tomatoes, peppers, potatoes, cabbage, peas and beans are grown in small gardens and greenhouses.

Other crops

In the Vidin region, perennial essential oils were traditionally cultivated. In recent years, there has been an interest in this type of plantation and farmers are creating new plantings. In the municipality of Bregovo plantations have been created with a hub and an oil rose, which are planned to expand.
In Kula municipality, 150ha coriander were sown and harvested, in Bregovo municipality – 5.7 ha of sesame seeds, and in Belogradchik municipality – 3,7 ha of dill.

B

Crop	hectares (31.12.2018)
lavender	23,4
oilseed rose	3,5
and others essential oils of rose hips	10,4

Orchyards (ha)

C

Fruit	apple	pear	apricot	cherry	sour cherry	peach	plum	apple
Vidin District	58,1	4,4	4,33	15,67	3,95	2,8	120,1	6,1

Fruit	strawberries	raspberries	blackberries	Goji Berry	walnuts	Almonds	Hazelnut
Vidin District	14,5	7	7,8	7,96	259,9	8,4	40,4

Vineyards

The vineyards in the district occupy 16 57.7 hectares. The municipalities with the largest vine areas are Novo Selo and Vidin. Of the varietal composition predominate:

- from the reds - Cabernet Sauvignon, Gumza and Merlot
- from whites - Rkatsiteli and Muscat drowned.

Dessert vineyards occupy 1 68, 7 hectares.

The natural conditions of the Vidin district enable the breeding of any kind of livestock and define livestock as the second important segment of agriculture in the area. At the same time, relatively good conditions for the development of cereals' production and production of plants for feeding the livestock create conditions for the development of dairy cattle, pigs and poultry in this areas. On the other hand, numerous

high-quality pastures and meadows in the mountainous area create good conditions for the development of sheep and cattle.

Table 6. Number of available animals in Vidin District

Type	2018
Cattle - total	5181
Incl. cows	3730
Sheep - total	13500
Incl. Sheep mothers	12220
Goats- total	6413
Incl. goats mothers	5820
Pigs- total	4149
Incl. Pigs mothers	398
Equines (horses, donkeys, mules)	1394
Poultry - total	153392
Bee colonies	25257

2. Pollution factors, their sources and their impact on soil and agriculture

People are putting the planet Earth into great difficulties, with their irresponsible way of living. During the 20th century, the world increased its consumption of fossil fuels 12 times and used 34 times more material resources. According to futurists, demand for food, animal feed and fiber can increase by 70% by 2050. If we continue to use resources at the current rate of utilization, we will need more than two planets to sustain us. Soil is becoming increasingly polluted, because of rapid population growth and accelerated economic development,and is increasingly being exploited both for food production and as a source of basic raw materials. At the same time, a large part of the waste matter that is generated in numerous

human activities is deposited on the soil. All this affects the normal functioning of the soil and causes pollution and various forms of damage.

Contamination of the soil may result in its degradation, destruction, or temporary or permanent complete exclusion of the soil from function. Pollutants found on the soil surface in the inner layers can be the product of natural and human activities on Earth. Natural sources of pollution include: ore deposits, mineralization, rocks of specific composition, forest fires, volcanoes, earthquakes, storms and sandstorms, erosion, storm rains, floods. Anthropogenic sources of pollution include: mining, industry, agriculture, urbanization and communal activities, traffic and transport, forest fires caused by humans, floods, erosion. When pollutants reach the soil in any of these ways, their further fate depends on a number of physical, chemical and biological factors whose impacts are intertwined. As a consequence of various causes of pollution, the following processes can be distinguished:

- **biological contamination (infection)** means bringing into the soil various parasites, viruses, bacteria, fungi, etc., which reside in the soil and can directly or indirectly infect animals and humans through plants**;**
- **chemical contamination** means bringing into the soil, various harmful organic and inorganic substances in various forms (solid, liquid, gaseous), such as: heavy metals, organic pollutants, radionuclides, pesticides, mineral fertilizers, etc. The highest contamination usually occurs in the areas of industrial zones and in close proximity to roads and waste dumps.
- **anthropogenic degradation** represents damaging the soil when in regular use in a crop production. It arises as a result of irrational soil use, and is manifested through: damage to soil structure, compaction, reduction of physiological depth, occurrence of surface and furrow erosion, soilslides and reduction of soil fertility.

It is estimated, that 275 hectares of farmland in the European Union are "destroyed" every day.[6] Most of the world's land is in satisfactory, poor or extremely poor condition. For example, in EU countries, the situation is as follows: in Italy, about 45 percent of the coast is paved, and for Spain the particular problem is soil drainage. On the other hand, there is significant soil erosion in Eastern European countries, so about 35 percent of Podzol's soil is excessively acidic, and 40 percent of Lithuanian soil has a high concentration of heavy metals. Approximately 45% of the land in Europe has very low organic matter content (0 - 2% organic carbon)[7] and 45% of the land has a medium level (2 - 6%). The problem is particularly highlighted in the countries of southern Europe, but also in parts of France, Britain, Germany and Sweden.

In the first decade of the 21st century, the Ministry of Environment and Water of the Republic of Bulgaria implemented a program of monitoring of soil pollution that fully meets the requirements of the EC (European Commission) and EEA (European Environment Agency), with good practices in many European countries, as well as with national legislation. The monitoring program is organized in 3 levels:

- Level I refers to the assessment of soil conditions according to the following indicators: content of 9 heavy metals and metalloids, total nitrogen, phosphorus, organic carbon, active soil reaction (pH), electrical conductivity, nitric nitrogen, total carbon and persistent organic pollutants;
- Level II is oriented towards regional manifestations of degradation processes, such as acidification, salinization and erosion, soil compaction (Corine Soil Cover project);
- Level III is aimed at identifying and inventorying (listing) local soil pollution.

[6] www.agroklub.rs:EU lose 275 acres of farmland every day!?

[7] www. poljoprivreda.info: Karolić, R.: Plowing land (I): Agricultural soil degradation in the European Union.

The periodic monitoring and listing is different depending on the monitored processes. Tests of soil samples are carried out in 15 regional EEA accredited laboratories (Executive Environmental Agency).

In the project area, the impact of anthropogenic factor on soil pollution is particularly highlighted through irregular tillage, poor selection of agricultural crops and plantations, forcing crops that are cultivated on sloping terrain, deforestation and other factors that have led to erosive processes. Erosion destroys large areas of the most fertile land, decreases its productive capacity, and gradually degrades climatic conditions and threatens the environment.

2.1 Factors of environmental hazards that are affecting soil

Quality soil is essential for agriculture and the food production system, and it is vital for the future of food and agriculture. Any destruction of soil in any form threatens the future of food sources as well as humanity.

Soil degradation can occur in many forms as a result of intensification of various human activities, such as: *erosion,acidification,* compactness*, salinization, soil desertification.*

Erosion is the most widespread and most severe form of soil degradation. Wind or water, with their kinetic energy, move the surface particles of the earth from one place to another.

Erosion was once a natural process in which the amount of soil removed was equal to the amount of newly created soil and was used to rejuvenate the soil. In recent times, erosion has been accelerated due to intensive deforestation, vegetation destruction, uncontrolled grazing and inadequate tillage. The main reason why the area of arable soil is being lost and reduced is, first of all, erosion, due to which virtually 25,000 hectares are lost annually only in Serbia, while in the world it is considered that erosion consumes more than 50 million hectares annually. Combating erosion and torrential floods should be taken seriously, as they are very dangerous. Serbia is one of the countries that are very vulnerable to erosion.

Compactness of soil often occurs due to the misuse of various agricultural machines during the preparation of soil for plant cultivation.

The soil loses porosity, decreases the amount of water and air in it, compromises biodiversity and therefore the quality of the soil.

Salinization is the process of water passing across the soil over a long period of time with a high concentration of salt and it leads to its accumulation after evaporation of water.

High concentrations of soil salts adversely affect plant development.

Soil desertion is a consequence of the interaction of unpredictable climatic variations and inappropriate soil use, resulting in the disappearance or damage to the biological potential of the soil.

Over time, due to the irreversibility of the process, the soil is transformed into desert type of soil.

Acidification occurs as a result of overuse of nitrogen fertilizers in agriculture, soil drying and aerial pollution, and this natural process has been accelerated lately. Over time, acidification leads to a decrease in soil fertility and a change in its buffering capacity.

In recent years, the so-called **"acid rains"** have emerged as a very dangerous enemy of the soil. In recent years, it is estimated that over 10 million hectares have been drenched in Europe and North America. By definition, acid rain is an atmospheric acid precipitation in the form of rain. An even more accurate definition is that acidic rainfall is a rainfall that has a higher acidity (less pH) than normal rainfall in unpolluted regions of Earth. The term acidic precipitate covers all acidic precipitation which engulfs gases, particles as well as the liquid phase so that all acidic substances from the atmosphere are contained in the acidic precipitate. That is why the trivial name of "acid rain" is increasingly being replaced by a much more regular "atmospheric precipitate" that covers all acidic substances as well as any other pollutants found in the atmosphere.

Thus, for example, measurements of rainwater acidity in North America reached pH 3, and the lowest value for rainwater pH in the US ever measured was 2.1 in the northern parts of the United States in 1964. In Europe, the lowest value ever measured was pH 2.4 in Scotland in 1974.[8] In Serbia, the acidity of rain in Bor also reaches very low pH values between 2 and 3. By the way, unpolluted rain is also acidic, but its pH value is about 5.6.

2.2 Soil pollutants: causes and effects in the short, medium and long term

Unlike other environmental media (water, air), soil is static and has a high capacity to accept large amounts of pollutants that remain in it for many years so that the effects of pollution are long hidden and some trigger is needed to move pollutants from the soil to other environmental media. The largest sources of soil pollution today are industry, households and agricultural production.

Heavy metals are naturally found in soil, but lately their concentration in the soil have increased rapidly due to many different human activities. In the soil, metals are usually connected to mineral particles from which they are released under certain conditions (eg with acidification of the soil). They can be involved in the food chain and have toxic effects.

Pesticides, because of their intensive use in agriculture, make the soil heavily polluted. Pesticides are very resistant (persistent) and remain in the soil for a long time. Their presence in the soil adversely affects the flora and fauna of the soil, decreases soil fertility and leads to groundwater pollution.

[8] https://www.chem.bg.ac.rs: Gržetić, I.: Atmospheric precipitate and acid rains

Nitrates and phosphates, ie nitrogen (N) and phosphorus (P) are essential elements for plant growth, but their overuse in agriculture leads to soil pollution. Increased concentration in soil leads to pollution of groundwater and surface water. If phosphorus is used in large quantities, it may also be in the soil in an amount that is toxic to the plants. For example, in Serbia, 60-70% of the soil is poor in phosphorus. By increasing the phosphorus content, which should have about 20-30 mg in the soil, maximum yields are achieved. In Serbia we have over 2 million hectares where the phosphorus content is in the range of 2 or 5mg.

Radioactive contamination by origin and source of radiation can be natural and artificial. Most of the total radiation absorbed by man comes from natural sources such as cosmic radiation, terrestrial or /излишно(unnecessarily) radiation, and radiation from radioactive sources found in the tissues of living beings. Terrestrial radiation originates from natural radioactive elements found in soil, especially in clay substrates and rocks, and is different in different parts of the Earth, and is especially large above uranium ore deposits. These days, much is being said and written about the increase in radioactive radium, which goes into the soil by fertilizing with artificial fertilizers, especially phosphorus. Natural phosphorites imported by mineral fertilizer factories contain radioactive radium. Radioactive substances can accumulate in water, soil, sediments or air, but concentrations are generally higher in aquatic than in terrestrial ecosystems, since the flow is faster in water than in soil. On the other hand, widespread use of radioactivity, the use of nuclear energy, and more and more often incidental situations in recent times, alarmingly indicate serious environmental consequences for the environment and, consequently, a significant impact on the environment soil.

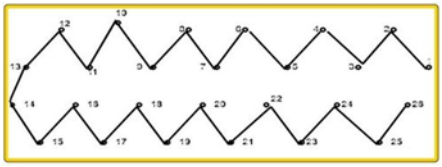
2.3 Examples of cause and effect analysis techniques applied in agriculture

The basic indicators of soil fertility are: total nitrogen, easily available phosphorus and potassium, humus and calcium carbonate content, pH in water and potassium chloride, all determined on the basis of soil analyzes. These fertility indicators are subject to change during the period of soil exploitation in the agricultural production process. Therefore, monitoring them is of great importance for proper soil management. Fertility checks must be carried out every four years.

In this fertility control process, the most responsible segment is certainly the soil sampling process. The soil sampling process consists of several stages: determination of sampling time, preparation for sampling, sampling, preparation and packaging of the soil sample.

The best time to collect samples from the soil is after the crop is harvested. The soil is flat at that moment, with undisturbed structures, and movement on such plots is significantly facilitated. Soil sampling can also be carried out during vegetation, and the most common cause are the deficiencies of certain nutrients on cultivated plants.

In the process of soil sampling, the goal is to form an average sample according to certain regulations and rules. The average soil sample is taken from a maximum area of 5 to 10 hectares depending on the homogeneity of the parcel.



The average soil sample from this area consists of 20 to 25 individual stitches and as many GPS coordinates. By returning to the parcel again, after 4-5 years, it is desirable to take soil samples from the same positions in order to detect a possible change in soil fertility.

After the sampling process is done, the soil must be well ground, mixed and placed in polythene or canvas bags and sent along with the label with all necessary information to an accredited laboratory for analysis.

In this way, preconditions are acquired for obtaining adequate results of soil analyzes. It is then possible to determine precisely the quantities of mineral fertilizers to be applied and to determine the fertility potential of each parcel.

Zajecar district

According to the land analysis data that the Center for Agricultural and Technological Research in Zajecar started to work from 1986 to 2010, it made more than 10,000 analyzes, as did the PSC Negotin (1990 to the present), in the whole territory of Eastern Serbia there is total change in soil fertility[9]. Constant decrease of humus, limestone and basic macro and micro elements as well as high acidification of soil is evident.

These changes are clearly seen in the following example. Land sampling was done at 11 sites, on parcels owned by the PD Zajecar (Example 1). As the majority of macro and microelements are adopted in the pH range 6 - 7, the results show that out of 11 samples, only 2 cases (samples 4 and 6), soil provides satisfactory conditions for growth and development of cultivated plants and positive plant response to supplementary care measures (nutrition and nutrition of plants with mineral and organic fertilizers).
Based on the results of chemical soil analysis, soil repair measures were carried out in the 2016/2017 season, and before the wheat and sunflower crops were planted. Soil repair was done by introducing 1,000 kg / ha of inorganic soil tiller "pH PLUS" (35% CaO + 13,5% MgO + 0,2% B) and 1,000 kg / ha of organic pelleted fertilizer "BioFert" (NPK 4: 3: 3). The analysis of land in the same locations, which was done during September (tables in Example 2), and after the removal of crops showed that the repair measures in the first year gave a certain shift and that the measures must be carried out regularly from 3 to 5 years.

Example 1.
Results of the chemical analysis of the soil done by PD “Zajecar” at 11 locations in 2016 before performing the repairing measures

Basic chemical properties of soil

[9] City of Zajecar (2012): Environmental program on the territory of the city of Zajecar for the period from 2012 to 2019, Zaječar

Lab. No	pH		$CaCO_3$	Humus %	Total N %	AL-P_2O_5 mg/100g	AL-K_2O mg/100g
	in KCl	in H_2O					
1	3,79	5,17	0,00	2,07	0,154	7,8	25,5
2	4,17	5,59	0,00	2,33	0,173	5,7	24,1
3	4,10	5,47	0,00	2,56	0,190	4,4	22,7
4	4,63	6,15	0,00	1,71	0,147	7,9	16,4
5	4,43	5,77	0,00	2,36	0,176	8,1	30,9
6	5,47	7,03	0,00	1,73	0,149	3,1	15,0
7	4,40	5,85	0,00	1,74	0,150	5,2	29,5
8	4,04	5,32	0,00	1,59	0,137	9,4	20,0
9	3,80	5,10	0,00	1,80	0,155	6,0	20,0
10	4,59	5,98	0,00	1,90	0,164	4,0	20,5
11	4,60	5,99	0,00	2,64	0,196	3,1	26,8

Content of Microelements (in EDTA)

Lab. No	Cu mg/kg	Zn mg/kg	Fe mg/kg	Mn mg/kg
1	19,3	1,2	195,9	128,2
2	21,8	1,1	157,7	134,1
3	19,6	2,7	180,6	136,9
4	18,5	1,5	111,6	80,9
5	22,2	2,3	193,7	137,5
6	16,0	5,0	119,8	195,2
7	20,3	1,9	166,7	191,7
8	13,9	10,0	114,1	123,8
9	15,2	0,8	212,5	158,7
10	17,9	0,6	146,9	239,2
11	6,3	0,8	141,2	226,5

Boron content (in hot water)

Lab. No	B mg/kg
1	nd
2	0,088
3	0,157
4	0,028
5	0,108
6	nd
7	nd

8	nd
9	nd
10	0,050
11	0,065

Results of chemical analysis of soil after repair measures have been performed (BioFert 4:3.3 1.000 kg/ha + pH Plus 1.000 kg/ha) during winter and spring 2017

Basic chemical properties of soil

Lab. No	pH		$CaCO_3$	Humus %	Total N %	AL-P_2O_5 mg/100g	AL-K_2O mg/100g
	in KCl	in H2O					
1	4,14	5,65	0,00	1,55	0,133	2,4	18,2
2	3,91	5,40	0,00	1,49	0,128	7,0	20,0
3	3,92	5,41	0,00	1,77	0,152	10,0	33,2
4	4,12	5,59	0,00	1,50	0,129	3,2	18,2
5	4,49	5,62	0,00	2,39	0,178	12,8	38,2
6	4,16	5,33	0,00	2,09	0,155	10,8	35,0
7	4,28	5,43	0,00	3,06	0,210	12,8	44,0
8	4,17	5,38	0,00	2,04	0,152	14,9	30,0
9	4,77	6,17	0,00	2,12	0,158	3,3	19,5
10	4,32	5,58	0,00	1,93	0,166	3,9	21,4
11	5,88	6,82	0,00	2,03	0,151	15,2	34,1

Content of Microelements (in EDTA)

Lab. No	Cu mg/kg	Zn mg/kg	Fe mg/kg	Mn mg/kg
1	20,18	2,01	201,3	100,8
2	20,67	3,42	217,3	129,7
3	23,19	1,97	456,9	173,0
4	21,69	5,32	185,5	118,2
5	25,48	2,28	390,5	200,6
6	26,56	3,62	266,3	183,2
7	31,78	13,50	249,9	210,7
8	22,15	4,10	202,8	136,8
9	25,69	4,04	179,1	211,1
10	26,04	1,67	208,8	247,4
11	12,38	2,04	163,5	207,8

Boron content (in hot water)

Lab. No	B mg/kg
1	0,5099
2	0,4281
3	0,5056
4	0,3563
5	0,5587
6	0,3821
7	0,5795
8	0,2911
9	0,3513
10	0,3374
11	0,4368

Vidin district

The problem is the valley along the Timok River due to pollution originating from the RTB Bor mine (Serbia), which led to chemical degradation of the soil in Bulgaria as well. The average copper content is particularly high in the area of Rakitnica and Bregovo villages (300-500 mg / kg), and the most polluted are the chernozem in these areas. Another area in this region with heavily contaminated soils is the Balei-Kudelin area, where the most polluted are the alluvial - carbonate soils. Some lead contamination is also present on the entrance highway of the city of Vidin. In total, there are about 800 hectares of contaminants, mostly heavy metals, in the area, of which about 600 hectares are copper contaminants.[10]

2.4 Applied analysis techniques for risk assessment and prevention of soil pollution

Only the analysis of soil fertility gives a true indication of whether there has been a disturbance of the physicochemical characteristics of the soil, disturbance of the pH value, humus content, excess or lack of an element. Deficiency is a problem, but excess is also dangerous. This problem has been noticed since the period when larger quantities of mineral fertilizers began to be applied, and less organic fertilizers. Soil acidity is characterized by having an impaired balance of cations, primarily calcium and magnesium in the soil, which leads to increased absorption (uptake) of aluminum. The accumulation of aluminum in the soil results in the plants adopting it, which causes rapid decay of the plants as it is

[10] Atanassova Irena, Zgorelec Zeljka, Simeonova Tsetska, Simeomova Cecka, Velichkova Nikolaya, Atanassova Dimitrova Irena (2018): Solubility and availability of copper, zinc lead and iron in technosols under the effect of increasing copper levels. International Journal of Hydrology, Volume 2 Issue 3.

extremely toxic. For example, according to the latest data of 3.5 million hectares of arable land in Serbia, almost 1.5 million hectares have risky, acidic land.[11]

Changes in humus content, as well as soil pH, have been occurring and are intensified since the beginning of intensive use of mineral fertilizers. As the humus began to break down microbiologically, the addition of the nutrients needed by the microorganisms began. Also, where the harvesting residues were plowed, as good agricultural practices suggest, there was no significant decrease in humus. Organic matter does not disappear immediately, but gradually. In countries like the Netherlands where there is a lot of livestock and manure, organic matter is completely preserved. Unfortunately, livestock stock is constantly decreasing in the territory of Serbia, which greatly influences the deposition of organic matter (manure) in agricultural land.According to experts, the level of humus in soil in Serbia is already below 3%, which is at the limit of optimum and certainly not a great result. Organic matter, before the beginning of intensive agriculture in the fields of Vojvodina in the second half of the 20th century, was more than 5%, and in the last twenty years it has decreased from 3.5% to 3%.[12]

2.5 The most common pollution factors in the cross-border area of Zajecar and Vidin

Zajecar district

RTB Bor. Copper production in Bor since 1903 has been an important source of environmental pollution. Dust, waste water and air pollutants affect the quality of soil, water and air. By the permanent spillage of pyrite tailings from the RTB Bor flotation tailings into the Bor River and from the Bor River at the point of its flow (Vrzogrnac) to Timok, the fertile agricultural land in the Timok Valley was destroyed. This process of soil pollution, but also of watercourses and groundwater in an area of over 2,000 hectares began in the 1950s with a drastic increase in the exploitation of copper ore and its further processing. The depth of the pyrite layer, which had been accumulating in the coastal area of Bor River and Timok for years, ranged from a tens of centimeters to one meter deep. Along with direct damages, indirect damages were also caused by the depletion of desiccated pyrite under the influence of wind on non-pyrite surfaces, which caused crop damage and environmental pollution over a large area. In the 1970s, a flotation tailings pond was built at RTB Bor and the further application of pyrite to the already destroyed land ceased, but the damage remained irreparable until today.

Chemical Industry Prahovo. IHP Prahovo was founded in 1960 as a factory of superphosphates, that is, as a chemical part of the metallurgical complex of the Bor Basin. Since then, IHP has expanded its capacity and product range. The first stage was the Superphosphate Factory (SF / PAF), then the Phosphoric Acid Factory 1 and 2, the Complex Fertilizer Factory (NKP), then the Sodium Tripolyphosphate Factory, the Cryolite Factory, the Monoammonium Phosphate Factory (MPF), the Aluminum Factory triluoride, phosphoric acid concentration and finally sulfuric acid factories. The soil is polluted by sedimentation of pollutants that are emitted into the air from the technological process, but much more by the spreading of the pyrite burn from the Prahovo soilfill as well as by the seepage of atmospheric water from the phosphogypsum landfill. Besides soils under landfills, the surrounding area

[11] https://poljoprivreda.info. Agricultural soil is constantly reducing

[12] Dnevnik (2018): No manure in the Serbian field will lead to infertile soil - Urgent increase in livestock needed, Novi Sad

is polluted as a result of the wind rose, primarily agricultural soil of the surrounding cadastral municipalities of Prahovo and Radujevac, and sometimes the pollution has a transboundary character as it is transferred by wind to the neighboring border area of Romania and Bulgaria. Previous studies have shown that most samples exceed the maximum allowable values for nickel, copper, arsenic and cadmium content.

Other soil pollutants. Local soil pollution is mostly prevalent in industrial zones where activities were carried out that could easily contaminate the soil.

The exploitation of mineral resources, which is intensive in the area of Zaječar, especially on surface mines, leads to complete degradation of the soil, not only at the site of exploitation, but in a much wider area around the exploitation field, including transport routes to the final destination of mineral resources. Such is the case with the coal mines "Vrška Čuka" Prlita (Zajecar), „Lubnica "(Zajecar)," Soko" Citluk (Sokobanja), the quarries "Rgotski Karst" near Rgotina and "Čokonjar"(Zajecar), as well as the exploitation of quartz sand in the area of Rgotina.

The eighties and nineties of the last century were marked by the Crystal Factory "Crystal“ Zaječar. It emitted a significant amount of harmful elements into the atmosphere (arsenic, mercury, cadmium ...) in certain zones of the then municipality of Zajecar, but also in other municipalities of our conutry, as well as in neighboring countries.

Inadequate waste disposal is certainly one of the main polluters of the soil. Much of the soil pollution comes from the wild landfills near towns and villages. Soil pollution is present in every rural settlement, especially in compacted settlements, due to unregulated wastewater from septic and manure pits.

Livestock farms were becoming major soil pollutants in the last two or three decades, primarily because of inadequate and uncontrolled disposal of solid and liquid waste on agricultural soil. Along with many so called home farms (20-50 cattles), in the district of Zajecar, there are two big capacity farms (over 2000 cattles), a „Halovo“ (Zajecar) pig fattening farm and an „Alapin“ (Zajecar) sheep fattening farm.

Vidin district

In 2017, a study was conducted using state-of-the-art monitoring networks to assess the physicochemical status of soil in the Vidin region and suggest optimal soil use practices. In the observed territory, the predominant soils are carbonate chernozem. Soil pH values are from neutral to slightly alkaline. Due to the rinsing process, the pH in the surface horizon is slightly acidic to neutral (6.0 - 6.6).

Environmental protection against pollution and damage (atmospheric air, water, soil, underground, soilscape, natural sites, mineral diversity, biodiversity and its elements) in the Vidin Region is performed by the Regional Inspectorate of Environment and Water - Montana (RIEV - Montana), which is a regional body of the Ministry of Environment and Water of the Republic of Bulgaria. Based on the results of the last analysis conducted between September 1 and October 15, 2018, no heavy metals were detected above the LC (lethal - lethal concentration).

The contamination is monitored in three groups of organic compounds: polycyclic aromatic hydrocarbons (PAH16), polychlorinated biphenyls (PCB6) and organochlorine pesticides. Testing shows that the content of persistent organic pollutants is below the maximum permissible concentrations (MPC). One of the main persistent organic pollutants is organochlorine pesticides, which were widely used in agriculture in the 1960s. Under the Bulgarian-Swiss Cooperation Program, the project "Environmentally friendly

disposal of unusable pesticides and other plant protection products" has been approved and is being implemented in 2019. Analysis of the available information shows that no PAH and PCB contaminated soil has been registered at this stage.

Erosion is defined as the most serious threat to soil degradation in Bulgaria. Much of the territory controlled by RIEV-Montana has a slope above 18-20%, which is a basic prerequisite for the development of erosion. However, there are no major problems with soil erosion in the observed area.

The soils under RIEV-Montana controll are in good ecological condition with respect to biogenic reserves / organic matter, heavy metal and metalloid content as well as persistent organic pollutants.

2.6 Agricultural production as a cause of soil pollution

Agricultural production is one of the oldest human activities. Man's constant need for food thousands of years ago led him to collect berries, seeds and green leaves, which is considered one of the primitive connections and forms of agriculture. With the development of civilizations in Mesopotamia, Egypt, India and China soil cultivation methods were also developed, all the way to the so-called the first "agrarian revolution" in the 18th century that led to radical changes. They began to cultivate the soil mechanically and feed more and more people. Today, modern agriculture is responding to more and more demanding requirements, both in food production and environmental protection, despite tremendous technological and manufacturing advances.

In the first half of the twentieth century, man introduced the use of pesticides, mineral fertilizers and high-yielding plant genotypes into agriculture, and starterd using heavy machinery to cultivate soil. The famine has decreased, but humanity has faced a serious environmental crisis. In addition to fossil fuel production, intensive agriculture is considered one of the most aggressive human impacts on nature.

The negative effects of intensive agricultural production on the environment are particularly evident in rural areas, since most of their territory is used for food production. According to a 1991 study by the United Nations, different soil management practices have led to the degradation of 38% of arable soil, and the cause-and-effect relationship between intensive agriculture and soil erosion was evident. The consequences of overexploitation of soil were manifested as early as the early 20th century, when eolian erosion occurred on large areas in the southern United States, after decades of intensive cultivation, and thousands of families had to leave flee.

It should be said that the focus of agricultural production towards the end of XX and the beginning of this century is moving towards the principles of organic agriculture, the protection of fertile soil, water and air, reducing the impact on climate change and adapting to these changes.

Due to the intensive agricultural production, arable soil is converted into desert at the rate of 2300 square kilometers per year. If temperatures increase, the processes of decomposition of organic matter are accelerated, especially on intensively cultivated soils, leading to rapid degradation, declining productive potential and structural collapse of the soil. As a result of excessive irrigation, the water mobilizes the salt deposits and brings them into the surface layers and creates a salty soil. As most plants do not tolerate high concentrations of salt, such soil becomes unusable for agricultural production. It is estimated that

the global losses caused by salinisation of agricultural soil amount to about 20% of the total irrigated area, or about forty-five million hectares of soil.

In agriculture, the most common pollutants are agrochemicals: pesticides, fertilizers and salts. Agricultural production uses fossil fuels to produce fertilizers and pesticides, for example, in the UK and the US, they account for about 2.4% of their total consumption. At the beginning of the twenty-first century, the annual value of pesticides on the world market was twenty-five billion dollars, about three billion of which were generated from sales in developing countries.

All this clearly shows that increasing agricultural productivity has a significant impact on environmental pollution. Only 10-15% of the applied pesticides reach the target pests, and the rest ends up in air, water and soil.

The most common pollutants, pesticides, have a long history. Historically, fungicides developed first, then insecticides, and last herbicides. Specifically, in 1755, arsenic and mercury sublimates were recommended and used for the treatment of wheat seeds, and copperarsulfate from 1761. Since 1824, the use of sulfur has been recommended and since then so-called "sulfur era," and in the mid-nineteenth century sulfur-lime broth was used to prevent grape moldiness. Copper and its compounds were finally recognised in the nineties of the nineteenth century (1885) through the action of a mixture of copper sulphate and lime so-called bordeaux mixture, in the suppressing of the causative agents of grapevine. This year is also being taken as the beginning of industrial production of pesticides and entering the "copper era". The so-called era Organic, synthetic fungicides began in the 1940s and last till today.

As for insecticides, a group of organochlorine non-systemic insecticides were developed in the 1930s, and among the first is hexachlorocyclohexane, better known as lindane (1942), and then aldrin, endrin, dieldrin and endosulfan are developed. Due to its toxicological characteristics, most of the insecticides from this group have been withdrawn entirely or partially from application, by the so-called Stockholm Convention of 2001, the insecticides aldrin, chlordane, dieldrin, endrin, heptachloride of this group, as well as DDT, mirex and toxafen from other groups, were put on the list of permanent organic pollutants whose production and use were prohibited. In the later period organo-phosphates, pyrethroids, neonicotinoids were created...

The first informations on the effects of some primarily inorganic compounds that destroy plants occurs at the end of the 19th century. Ferrosulfate, copper sulfate, sodium nitrate, sodium chlorate are used. The advancement of science encourages extensive research, so in the 1930s, chemical compounds that regulate the growth of plants, especially weeds, were tested. In the United Kingdom and the United States, 2,4D was discovered in 1942, one of the most widely used herbicides to date. Over the next fifty years, the production of herbicides has been increased twenty times or more, so in 1973, herbicides accounted for about 39% of the world's total pesticide production. One of the most significant, well-known and well-used groups of herbicides are the so-called soil herbicides from the Triazina group (amitrol 1954, simazin 1956, prometrin 1957, atrazine 1958 and terbutilazine 1966). As a consequence of the adverse effects on the living world, both in water and in the soil, at the end of the first decade of this century, most of these herbicides were banned from using. In the last two decades, sulfonyl urea groups and phenoxy groups are developed, etc.

Pesticides introduced into the soil may, depending on the dose and type of preparation used, alter the composition of the soil microflora. Soil fungicides and fumigants, usually, have a negative effect on soil microflora. A general indicator of the effect of pesticides on microflora is the biological activity of the soil or the intensity of the soil respiration (O2 sorption, CO2 release). Herbicides decompose relatively quickly

in soil and their application at recommended doses does not adversely affect soil microflora. When introduced into the soil in increased doses, a temporary regrouping of the microflora composition occurs. The nature and extent of the action on the fauna are conditioned by the properties of the preparation, their content in the soil, the composition of the fauna and the soil and climatic conditions.

At the same time, scientific research indicates that intensive agriculture has led to a very simplified structure of agroecosystems around the world, so that today, in all climatic zones, a total of 12 types of cereals, 23 types of vegetables and 35 types of fruits are grown. A total of 70 species on about one thousand four hundred and forty million hectares of arable soil in the world is a great contrast to the diversity in tropical rain forests, where one hectare can have a hundred species of only woody plants.

The agricultural dominance of five crops - wheat (200 million hectares), maize (140 million hectares), soybeans (100 million hectares), rice (92 million hectares) and barley (55) - also indicates that agricultural systems are designated as significant pollutants to the ecosystem, which is also considered to be a consequence of intensive agriculture. Today, these five crops occupy 38% of the total arable land. These monocultures have replaced the natural ecosystems that used to be the habitat for hundreds, even thousands of species of plants, insects, and many species of vertebrates. The disappearance of forests, which is most often caused by their deforestation and conversion to agricultural soil and the accumulation of greenhouse gases, especially carbon dioxide, are irreversible processes and the consequences will be felt for a period of hundreds of years.

2.7 Agricultural soil pollution in Europe

The environment of European countries faces serious global challenges that include a growing population both in EU countries and EU candidate countries, followed by a rise in the middle class with high consumption rates, rapid economic growth in developing economies, an ever-increasing need for energy and an increased global competing for resources. European Union countries have significant sources of information and technology, new methods of resource management, a well-established culture of precaution and prevention, a history of repairing damage at the source itself and ways to get polluters to pay. Environmental management can be made more efficient through greater commitment to environmental monitoring and up-to-date reporting of pollutants and waste, using the best available information and technologies.

Although certain agricultural technologies have significantly contributed to increasing the productivity of agricultural production, such as the use of pesticides and mineral fertilizers, they now threaten environmental sustainability of agriculture.

Damage estimates from soil degradation in Europe vary, with damages only from soil erosion going from € 0.7 to € 14 billion per year and from the loss of soil organic matter between € 3.4 and € 5.6 billion per year.[13] A total amount of estimated damage for 28 EU Member States from soil degradation is around €

[13] Jones, A., Panagos, P., Barcelo, S., Bouraoui, F., Bosco, C., Dewitte, O., Gardi, C., Erhard, M., Hervas de Diego, F., Hiederer, R., Jeffery, S., Lükewille, A., Marmo, L., Montanarella, L., Olazabal, C., Petersen, J., Penizek, V., Strassburger, T., Toth, G., Van

38 billion per year. However, there are also positive cases as well, so in Romania they have so-called "fresh soils", soils that are not very fertilized, where the humus content has remained at about 5-7% even today.

Soil degradation in the EU involves several aspects, the most important being: erosion, soil organic matter reduction, soil compacting or hardening, salinization.

Water-affected soil erosion covers an area of about 112 million hectares, or 12% of Europe's total soil, and 42 million hectares of soil is affected by wind erosion - 2% of which is severe erosion. In total, about 1/6 of the total EU soil area is affected by erosion processes.

Soil organic matter plays a major role in the carbon cycle of soil. At the same time, the soil is a greenhouse gas emitter (affecting climate change, such as carbon dioxide and methane), and is also the largest warehouse containing about 1500 gigatons of organic and inorganic carbon. Approximately 45% of the soil in Europe has a very low organic matter content (meaning 0-2% organic carbon) and 45% of the soil has a medium carbon level (meaning 2-6% organic carbon). The problem is particularly noticed in the countries of southern Europe but also in parts of France, Britain, Germany and Sweden.

Estimates of the total soil area that faces a risk of compacting vary. Some authors consider that about 36% of European soil is subject to a high or very high degree of compacting. Other authors consider that 32% of the soil is highly exposed to this process, and 18% of the soil will be moderately affected by compacting.

Salinization is the process of accumulation of soluble salts in the soil, mainly of sodium, magnesium and calcium, to which about 3.8 million hectares of soil in Europe are exposed.

The first part of the study on the social sustainability of alternative food systems (organic food production, organic farming) in the Baltic Sea region, to which Germany, Poland, Lithuania, Latvia, Estonia, Finland, Sweden and Denmark come out, provides a clear warning of the poor state of the environment in the Baltic Sea basin as well as proposed measures to improve the situation.[14] The environmental situation in the Baltic Sea region is the result of specialization in agricultural production, industrial pollution, improper waste management and unsustainable ways of living that are prevalent in countries around the Baltic Sea. Decreased use of energy from non-renewable resources, as well as decreased use of other natural resources and elimination of pesticides, would reduce air, water and soil pollution. Increased recycling of nutrients within agricultural systems through the integration of crop and livestock production on the farm would reduce the outflow of harmful substances from the field.

The ever increasing environmental degradation is leading to more active role of governmental and non-governmental sector in EU countries. Also, the soil now, more than ever, faces the risk of irreversible damage caused by wind and laminar erosion, pollution, salinisation, depletion of soil organic matter and reduction of biological diversity. All this, as well as the views of a number of non-governmental organizations (Greenpeace, Catholic development agencies…), which criticized the agricultural policies of the developed countries so far and considered it unsustainable in many respects, lead to the European Parliament adopting a resolution in 2009 on the deterioration of agricultural soil in the European Union. The resolution assumes that agriculture is an economic sector that is highly dependent on natural

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den Eeckhaut, M., Van Liedekerke, M., Verheijen, F., Viestova, E., Yigini, Y. (2012). The State of Soil in Europe. Publications Office of the European Union. JRC, Italy

[14] www.poljoprivreda.info (2010): Ekonomski efekti lokalizacije hrane (3)

phenomena but at the same time offers plenty of possibilities for intervention and the best means for preventing deterioration.

Along with the analysis of the current situation, measures have been proposed to improve the environmental situation:

- creating a well-designed strategy to sustain this activity,
- considering the role of European farmers in the fight against desertification, the key role of European producers is in the conservation of surface vegetation in areas affected by frequent drought and the particular benefits of permanent crops, meadows and forests in water harvesting,
- it is considered that the instructions and management methods of the Common Agricultural Policy (CAP) should clearly include the principles and instruments of climate protection (ie climate protection as well as mitigation of climate change) as well as reducing the damage caused by soil degradation,
- calling EU to implement information and training measures specifically targeting young farmers with the aim of promoting agricultural techniques that support soil conservation, especially in relation to the impact of climate change and the impact of agricultural production on the climate,
- calling the Council and the Commission to explore strategies for the restoration of damaged soil by using the incentive measures in order to limit the deterioration of the soil.

In response to the aforementioned requests, at the meeting of the Ministers of Agriculture of the industrialized countries, held in 2009, the so-called the G8 group, made up of the most industrialized and economically powerful countries in the world, the United States and Canada, Germany, the United Kingdom, France, Italy, Japan and Russia have committed to greater investment in sustainable agricultural production and rural development, with the aim of ensuring food security in the world.[15]

EU environment ministers adopted environmental development policies in June 2012, with aim of achieving an "ambitious vision for a green Europe 2050" in which economic growth will not disrupt the environment. However, they called for better enforcement of existing laws instead of passing new ones because the conclusions should provide guidance to the European Commission in preparing the next environmental strategy as the Sixth Environmental Action Program (EAP) expires[16]. Thereafter, European Commission in 2016[17] at the meeting of the G20 Agriculture Ministers, gives support to sustainable agriculture, and stresses its support for major global agreements, including the Sustainable Development Guidelines, the Paris Climate Agreement, and the WTO Nairobi agreement.

[15] Karolić, R. (2015): Plowing land (I): Agricultural soil degradation in the European Union,www.agroekonomija.rs

[16] EurActiv.rs (2012): EU prepare new environmetal strategy

[17] www.akademijaart.hr (2016): G20 agriculture ministers are committed to sustainable agriculture and the fight against antibiotic resistance.

3. Crop protection and management for sustainable development

3.1 Pesticide-based crop protection method

The main objective of classical agricultural production is to maximize the yield per unit of agricultural area. In order to achieve this goal, classical agriculture consumes enormous quantities of non-renewable natural resources and energy in its production process, as well as various types of agrochemicals - pesticides, mineral fertilizers.

Pesticides are chemical compounds or mixtures that are used to eliminate, control and destroy the plant pests and other pests. Unlike most pollutants that are introduced into the environment without a specific goal, pesticides are introduced with the intention of helping humans by increasing their nutritional yield, protection of the environment in the "fight" against harmful microorganisms and numerous pests. The impact of pesticides on biocenoses and the environment as a whole is very complex and diverse.

On the other hand, the rapid increase in population on planet Earth and the need for sufficient amounts of food still maintain the concept of conventional agriculture as a leader in agricultural production. It is very important that during the growing season and storage of the products and food produced that they are preserved, which means that the removal or control of harmful organisms is necessary. Damage to cultivated plants is caused by: insects, mites, nematodes, snails, rodents, some species of birds as well as pathogens: fungi, bacteria, viruses, phytoplasmas, rickettsia... Also, as a result of changes in climatic conditions, as well as approaches to weed control in recent decades (pre-em, post-em herbids), changes in the composition of the weed flora have been noticed in both ruderal habitats and arable soil. The dominant presence of close-knit thermophilic species and large-seeded broad-leaved weeds are recorded in the open ground. Drought tolerant weeds with deep roots and large seeds, then weed species that have developed resistant forms in some areas, such as perennial weeds are increasingly dominant, namely Sorghum halepense, Cirsium arvense, Convolvulus arvensis, Ambrosia artemisiifolia and others.

Extremely developed trade routes, agricultural trade, the introduction of new cultivated plants, often difficult to adapt in the new environment, have led to the introduction of many new pests, such as Diabrotica virgifera (corn rootworm), Tuta absoluta (South American tomato miner), Drosophilla suzukii (fruit fly), Pepino tomato virus, Scaphoides titanus (cicada, vector golden yellow grapevine), and others, and force the search for a pesticide application.

In the world of agriculture, according to the World Food Organization (FAO), losses from various pests in plant production are about 28%, which clearly indicates that the use of pesticides - plant protection products, is necessary in order to reduce losses and ensure safe production.[18] On the other hand, pesticides pose a certain risk to humans and the environment, so the aim is to minimize this risk in order to produce healthy food.

[18] Forgić, Gordana (2014): Proper application of pesticides as a basis for successful plant protection and environmental protection, PSSS „Sombor“ doo, Sombor

Proper application of pesticides is the basis for successful plant protection and environmental protection, which contributes to better pesticide efficiency as well as economically justified application. For this reason, proper application of pesticides, among other things, involves:

- Application in accordance with pesticide registration
- Application in accordance with the declared instructions for use
- Application in accordance with the principles of good agricultural practice and integral plant protection
- Used in a way that does not endanger human and animal health and unnecessarily increase their exposure to plant protection products
- Application in a way that will not end danger the environment.

Often a major contribution to the protection and conservation of the environment can be achieved by implementing appropriate measures in the protection of cultivated plants such as:

- Reducing environmental pollution through rationalization of pesticide use;
- Application of pesticides in accordance with the requirements of the GAP (Global Agricultural Practice) chemical application policy;
- Compliance with national and international legislation regarding the application of pesticides in the protection of cultivated plants and forests;

In order to protect and conserve the environment, alternative solutions will be used, within the possibilities, in the application of pesticides for the protection of cultivated plants or by combining the application of pesticides and other methods.

3.2 Impact of pesticides on soils and alternative methods

The term "fate of the pesticide in the environment" means all processes of movement and transformation, and the most significant are occurring in the soil, due to the potential duration and effects they can produce. Whether they reach the soil directly or indirectly, the fate of pesticides depend on the interplay of a number of complex physicochemical processes. The fate of pesticides in the environment is influenced by processes that can be grouped into three parts:

- adsorption (binding of pesticides to mineral and organic soil matter)
- degradation (chemical, photochemical and microbiological)
- transport (movement of pesticides in the environment - evaporation, flushing, rinsing and adoption by plants)

After application of the pesticide preparation, the molecules of the active substance remain in the place where they are applied for a while, and then under the influence of air or water they can be transported to the atmosphere (evaporation), to deeper layers of soil (flushing) or laterally to the surface of the soil (rinsing). Flushing is the most important process from the mentioned processes from the point of view of environmental protection, because it represents a potential danger of groundwater pollution. This process represents the vertical displacement of compounds by the soil profile. Rinsing is the horizontal movement of pesticide molecules across the soil surface.

Reducing the use of agrochemicals, especially plant protection products, pesticides, in order to achieve successful protection of cultivated plants come down to the application of preventive and repressive measures to prevent the emergence and suppress diseases, pests and weeds.
Preventive measures mean eliminating the conditions for the development of harmful organisms and ensuring the good vitality and resistance of the cultivated species. Among the preventive measures, the following can be distinguished: reionization of plant species, selection of tolerant and resistant genotypes of varieties and hybrids, use of healthy, declared seed and planting material, proper manipulation of seed and planting material, adequate fruiting, maintenance of favorable water regime of cultivated plants, preservation of biological diversity...

Mechanical measures include various procedures for the physical removal of harmful organisms, the setting of hunting and pheromone traps. These measures aim to preserve the the cultivated plants, with the aim of productive and profitable agricultural production.

Weed control is a measure that has the greatest impact on soil pollution and, indirectly, watercourses. For this reason, the reduction or complete absence of the application of herbicides, in order to protect crops and plantations, must be comprehensive through the combination of numerous measures. All weed control measures can be divided into indirect and direct. Among indirect measures, very important is proper treatment of various wastes and residues in agriculture, proper cultivation and use of manure and compost, destruction of weed plants on non-agricultural surfaces and maintenance of agricultural machinery, facilities and farm yards, sowing clean seed... Direct weed control measures include the application of agro-technical measures (land cultivation, stubble cultivation, pre-sowing soil preparation, fertilization, sowing and crop rotation...), biological measures (infecting weeds with some phytopathogenic organisms or multiplying insects and mites), physical measures (use of mulch, mechanical, pneumatic and thermal measures ie flame application) and chemical measures (application of herbicides and arboricides). All these measures create favorable conditions for faster development of the crop and make it more resistant to weeds.

3.3 Eco-friendly crop management methods

Mankind has been searching the answer to the question of how to integrate agriculture into overall economic development whilst protecting the environment? The answers, in recent decades, are in the development of so-called alternative production such as: integrated agriculture, organic agriculture, sustainable agriculture, sustainable soil agriculture, biodynamic agriculture, "Slash and Burn" agriculture, urban agriculture.

An integral type of agricultural production is an approach to production in which pesticides and mineral fertilizers are used more rationally and expertly. Although it is one step ahead of conventional agriculture, it still has harmful effects on the ecosystem, but on a much smaller scale, than conventional agriculture.

Organic farming is also known to many as organic production because it is based on the principles of protecting human health, soil quality and ecosystems. Its production methods rely on production inputs from biodiversity without the use of synthetic inputs, products and materials. Organic farming produces food without the use of mineral fertilizers, genetically modified (GMO) organisms, pesticides and other chemical products. The entire production system develops a sustainable agroecosystem based on the

natural sustainability of plants, animals and soilscapes. Both in the world and in our region, such agriculture is becoming more recognizable and economically more interesting to agriculturists and farmers.

Sustainable agriculture means the production of food, fiber or other plant or animal products using agricultural techniques that protect the environment, public health, the human community and respect the principles of animal welfare. This form of agriculture enables the production of healthy food without compromising production resources for future generations and leaves them with the opportunity to do the same. The concept of production, in crop and livestock production, is based on the non-use of toxic chemical preparations, synthetic fertilizers and (GMO) seeds. Soil, water or other natural resources are rationally used. Techniques are applied for crop rotation, soil or pasture conservation. So-called sustainable farms are being formed with the primary objective of protecting biodiversity. This form of production in the world is not yet at the level it should be. The main reason for this is poor economic profit.

Agricultural sustainable soil, as the name says, is production where the most important agricultural resource is soil. It is based on several principles that aim to exploit soil and preserve it's quality and environment in the long term. The first key principle concerns the minimum us of the mechanical tillage, stopping erosion and preventing the loss of necessary soil moisture. The second principle is similar to the first, but applies only to the surface layer of soil and the management of the so-called top soil, where an attempt is made to create a permanent organic cover that can allow the growth of organisms by decomposing organic matter in the soil structure, which is desirable for increasing the high level of organic matter, thus creating a fertilizer in the soil. And the third principle is based on the practice of crop rotation, with more than two types of cereals as rotary crops that act as natural insecticides and herbicides against pests and individual crops.

Biodynamic agricultural production is based on Steiner's thesis on the existence of a "livelihood" in agricultural crops and soil, and each estate or farm should be a complete system and a particular balanced organism. This form of agriculture completely eliminates cultivation in monoculture. Biodynamic farm uses all production methods as in organic production. This means that no pesticides, herbicides or other protective products are used. Grassing is accelerated, composting is done, plant compatibility is created, crops and livestock are integrated, and soil is plowed and cultivated with minimal use of mechanization. It involves different ways of preparing soil and compost and using the astrological calendar to determine the time of planting and harvesting. More specifically, the moon sowing calendar is used.

One brand new concept, that we are not interested in in our region is the so-called **"Slash and Burn"** production. There is, realistically, no need for it because the concept of "slash and burn" is characteristic of almost all tribes of the tropical zone and rain forests, where a smaller area in the forest is deforested, after which the destroyed vegetation is ignited and the ash that remains is fertile fertilizer, which increases pH of the soil for a maximum of 3 years at a time. Before artificial fertilizers were available, fire was one of the most widely used methods of improving soil characteristics**.**

The reduction of arable soil and the increased demand for food have led to this, for our conditions, a new concept of agricultural production, the so-called **urban agriculture**. On tops of buildings, abandoned buildings and halls, or in private gardens, every piece of soil is used to grow environmentally friendly fruits and vegetables. In developed countries, so-called commercial greenhouses are increasingly appearing in residential buildings owned by companies that are distributing these greenhouse products to a nearby market under the name *"fast and fresh".* The growing presence of architectural plans, which

pay great attention to the development of green vertical gardens in large urban regions, shows that such agriculture has a sustainable concept in the future.

One of the solutions to reduce environmental pollution (soil, water, air), and as part of its activities in agricultural production, lies in the application of Good Agricultural Practice (GAP). **Good agricultural practice** is based on the control of critical points and the quality of products given under World Health Organization regulations. Benefiting from the good agricultural practice are: small, medium and large producers, through the added value of all products and easier access to markets, consumers, through better quality and healthier food, like everyone else through a better environment**.** The concept of good agricultural practice means using the natural resources on sustainable principles to produce safe, health-safe food and other agricultural products, with economic viability and social stability.

The principles of good agricultural practice define the parameters and values that must be respected within the production system and periodically controlled by the supervision institutions. Good agricultural practice defines way of operation and production for each production system, always respecting the specifics of a given agro-ecosystem.

The basics of good agricultural practice include principles from eleven areas relevant to production: soil, water, agricultural production, crop protection, livestock farming, livestock health, livestock welfare, product harvesting, processing and storage on the farm, energy and waste management, welfare, health and human security, living world and landscape**.**

One of the most important areas of Good Agricultural Practice is the soil. That is because the physical-chemical properties and biological activity of the soil are key to maintaining agricultural productivity. Soil management enables minimization of loss of soil quality, then losses by erosion, runoff and drainage of surface and groundwater. The physical and chemical structure and biological activity of the soil determine its fertility and are important for maintaining soil productivity. Maintaining and enhancing soil fertility, among other things, is achieved by minimizing the loss of soil particles and nutrients through erosion, runoff and their infiltration into groundwater. Such losses represent inefficient and unsustainable soil management as a natural resource. Sustainable agricultural production tends to increase the biological activity of the soil and protect the surrounding flora and fauna. Good agricultural practice in terms of soil management implies:

- Production management within soil potential, while recording the inputs and outputs of each organizational unit;
- Maintenance and improvement of organic matter in the soil, using appropriate crop rotation and rational mechanical tillage;
- Maintenance of plant cover to reduce the harmful effects of erosion;
- Application of agrochemicals of organic and inorganic fertilizers in adequate quantities, expiry dates and methods that meet agro-technical requirements ensuring human health and healthy environment

One of the leading principles of Good Agricultural Practice, agricultural production must respect the correct selection of cultivated species and varieties with appropriate crop rotation in accordance with ecological conditions and market requirements, but with the preservation of soil fertility and implementation of all preventive and precautionary measures.

Also, one of the fundamental principles of Good Agricultural Practice is crop protection. Maintaining good crop health requires a long-term risk management strategy, using all biosecurity measures (sorts

resistant to pests and diseases, crop rotation, natural corridors for good insects and minimal use of pesticides and other chemicals) is the basis for environmental protection.

3.4 Overview of management of plant protection measures in the Zajecar and Vidin districts

Zajecar district

In the area of Zajecar's administrative district, more than 98% of the agricultural soil is cultivated by agricultural holdings, with the remaining being produced within three companies cultivating over 3000 hectares. Crop and fruit production takes place on the parcels of the Agricultural Property "Zaječar" operating within the Agromarket Group, arable, fruit and livestock production on the parcels "Delta Agrar" Zaječar, within the "Delta Holding", and crop production in the Agricultural Property "Salas" in Salas. These three companies employ over 10 agricultural experts of various specialties. In the observed area, three agricultural expert services are also active in their field of activity: PSS "Agroznanje", PSSS "Poljoservis" and PSSS "Negotin" with more than 15 advisers, specialists in crop production. In addition, more than 25 agricultural engineers, primarily plant protection specialists, are employed in more than 20 agricultural pharmacies. In the monitored territory, activities entrusted by the state are also fulfilled by the Public Health Institute "Timok" Zaječar. Also, health inspections of cultivated plants are also carried out by three inspectors of the Plant Protection Directorate of the Republic of Serbia Ministry of Agriculture.

Vidin district

In the monitored area, the authorized organization, Montana RIEV, controls and monitors the situation and takes measures to conserve the soil. The condition of the soil involves performing inspections to preserve, improve the structure and fertility of the soil. Among other things, soil protection includes enhanced control activities:

- storage and use of plant protection products;
- protection of soil from water and wind erosion;
- soil humus levels;
- recultivation of damaged soils

Based on the established situation, "RIEV" requires measures to be taken to limit soil pollution, among which, depending on the type of soil, may be:

- the use of bio-fertilizers to stop further degradation and increase soil fertility;
- recommendation for the use of pesticides (herbicides, soil insecticides ...) that do not have a negative impact on the soil;
- introduction of organic agriculture

Table 7. Conditions for maintaining the land in good agricultural and enviromental conditions:

NATIONAL STANDARDS	Measures, recommendations
1. For protection of soil from erosion:	

1.1. In agriculture with a unique identification number and arable areas with dimensions larger than the minimum under the support scheme (1 ha for Scheme for unified payment of acreage /UPA; 0.5 ha for others), it is obligatory to include in the collective joint sowing-turnover area - a minimum of 40% of the crops, with the merged surface, except areas for tobacco production.	• Anti-erosion crop rotations; • Compacted, with pre-cultured seeding rotations; • Appropriate treatments; *For permanent crops* • Grassing of the space between the rows of orchards; • Mulching and green fertilizing of orchards.
1.2. For the cultivation of agricultural crops, the uses of riparian acreages in a distance less than 5 m from the river are prohibited.	• Maintenance and restoration of riparian habitats; In response to climate changes: • Changing the overall technologies in agriculture (sowing dates, vegetation duration, fertilization norms, irrigation needs and regimes, etc.).
1.3. It is compulsory to preserve and maintain the existing permanent terraces in the agricultural block and/or in the agricultural parcel and to conclude agreements between the land-users of a given physical block.	During an inspection by the Technical Inspectorate of the State Fund Agriculture-Payment Agency for all blocks with existing permanent terraces, the submission of the concluded agreement will be required, which should cover at least the indicated period.
2. For preservation of the organic substance:	
2.1. On one agricultural plot, is prohibited the monoculture cultivation for more than two consecutive years of flax, sunflower, sugar beet, peas.	Sowing rotation
2.2. It is compulsory for the stubbles from field crops to be plowed into the soil for the creation of favorable conditions for transformation into organic substance and their burning is prohibited.	Soil processing; Use of post-harvest remains for fertilization; Cutting and spreading the straw over the acreages, followed by plowing.
3. Preserving the soil structure:	
3.1. It is prohibited to use agricultural machinery in parcels with overly moist soil.	• Proper soil processing; • Natural recovery; • Introduction of organic substances into the soil; • Sowing rotation - the inclusion in the sowing-turnover of alfalfa, clover and fodder grass improves soil structure; • Change the depth of plowing; • Selection of processing methods with limited or complete removal of plowing (minimum or zero soil processing); • Use of special agricultural machines: sub-soiler (deep) soil-looseners, para-plows; • Proper organization of the movement of equipment in the field.
4. Providing a minimum level of support for natural habitats:	

4.1: Farmers, using permanently grassed acreages (pastures and meadows) are required to maintain a minimum density of 0.15 animal units per hectare (AU/ha) or to carry out at least 1 mowing for the year in question - until 15th of July for the plain areas and up to 15th of August for mountain areas included in the coverage of the less-favored mountain areas.	• Rational and sparing use of meadows and pastures; • The height of the plants during grazing should be compliant to the type of pasture, species of animals, soil - climatic conditions and season; • Given acreage should be grazed for no more than: 4-6 days of cattle and 6-8 days of sheep; • To provide the necessary time for rest and growth of the grass, which is different for different seasons and depends on the type of grass and soil-climatic conditions; • The number of animals per unit area shall be consistent with the productive capacity of the pastures and the species of animals; • In the spring, grazing begins when the pastures are well dried; • In the fall, ceasing of the grazing for about a month before the onset of permanent cold weather in order for the grass to grow up and prepare for a successful wintering.; • Pasture care should not be episodic.
4.2. It is imperative that permanent pastures and meadows be cleared of unwanted shrubby vegetation. To be conducted combat against aggressive and persistent plant species such as eagle fern (Pteridium aquilinum), hellebore (Veratrum spp.), Aylant (Ailanthus altissima), amorpha (Amorpha fruticosa) and blackberry (Rubus fruticosus). For agricultural lands (grassland) of high natural value, the land falling within the Natura 2000 National Ecological Network and protected areas, depending on the welded position of the meadow or pasture, it is allowed to leave mosaically arranged single or clustered trees - shrubs and / or headlands up to 25% of the total grassland.	• Weed control and harmful vegetation; • Maintenance of semi-natural grass acreages through traditional agricultural practices (grazing and/or mowing); • Surface improvement of the terrain; • Improvement of natural meadows and pastures by optimizing mineral fertilization; • Organic fertilization of the natural meadows and pastures; • Sowing of degraded meadows and pastures;
4.3. It is obligatory to keep the existing field borders (headlands) in the block of the farm and/or the agricultural parcel.	• Conservation of the habitats of animal and plant species; • Maintaining the traditional appearance of the countryside.
4.4. It is obligatory to protect agricultural acreages near forests from the entry of tree and shrub vegetation into them.	• Control of the spread of shrubs and trees; • Lawn mowing to avoid the appearance of more aggressive grass species, shrubs, and trees.
5. For preservation and management of water use	
5.1. When using water for irrigation, the farmer must have the appropriate document for use right (permit, contract, etc.).	• Permitting regimes for water abstraction and use of water objects are regulated in the Water Act, Art. 52.

3.5 Good plant protection practice in the EU

EU has one of the most advanced chemicals legislation in the world called REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals). All chemical substances manufactured or imported into the EU must be registered with the European Chemicals Agency located in Helsinki. Otherwise, they can't be sold in the EU. Particularly strict regulations apply to the most dangerous products. Companies are responsible for assessing and managing all the risks of chemicals used or sold in the EU and for providing appropriate safety advice to customers for handling of chemicals.

Is the way of using pesticides an economic decision? Sometimes it is more economical to accept a smaller presence of pathogens, pests and weeds than to treat them. However, before that, a "pest limit" for each individual pest (pathogen, pest or weed species) should be established, that is, the number of specimens or damaged area that may endanger the production of a particular cultivated plant. The time when it is profitable to use pesticides is described as an ''economic cost limit''. It is only on the basis of these two parameters, as well as consultation with a plant protection specialist, that chemical protection measures for plant protection can be taken, based on the rules of good agricultural practice. This term, good plant protection practice (GPPP) covers:

- selection, dosage and timing of application of plant protection products (pesticides) to plants and plant products to ensure effective protection with the possibility of biological and agro-technical protection measures.
- each pesticide on the EU market must be approved for certain uses by regulatory authorities, both the EU itself, and each individual EU Member State, ie the Directorate for Food Safety, Veterinary and Phytosanitary Affairs, with dosing and instructions appropriate to the conditions in CG.
- the packaging or declaration must contain basic information about usage, risks and activities to be taken in an emergency (spillage, poisoning);
- each registered farm must have a qualified professional who will provide clarification on the use and precautions to be taken;
- a record keeping system is in place, according to which the supplier and user of the pesticide must keep records of which pesticide was used, where, when, for what and in what quantity;
- permanently organizing training programs to teach farmers how to use pesticides safely, effectively and in accordance with the law.

Compliance with the GPPP rules ensures that pesticides: act effectively and have harmless effect:

- to human and animal health,
- to direct or indirect environment,
- to plants or plant products and do not accumulate in soil and in the food chain,
- to surface water and groundwater,
- to non-targeted organisms and,
- to not cause unnecessary pests that suppress both biodiversity and the ecosystem.

Proper use of pesticides ensures prevention of:

- application to other cultivated crops or other non-targeted plants,
- the negative consequences of inadequate cleaning of the sprinklers between the two uses,
- applications at an inadequate stage of plant development,
- the application of inadequate water consumption,
- uncontrolled treatment at adequate temperatures,

- inadequate protection of plants or plant products against harmful organisms or their influence.

By following the GPPP rules, it is realized that the treatment prevents human, as well as domestic animals, exposure to pesticides and respect the time interval from use of pesticides to:

- sowing or planting a crop to be protected,
- sowing or planting the next crop in crop rotation,
- the period during which persons or animals are allowed to enter the treated area (work withdrawal period),
- picking, harvesting, mowing, harvesting and processing of stored agricultural products (withdrawal period),
- use or consumption of the product.

Good agricultural practice in crop protection prevents pesticide, during the treatment, from reaching:

- water sources, watercourses, wells, lakes, sea and other surface and groundwater,
- facilities for the supply of drinking water,
- to adjacent crops and other agricultural soil,
- facilities where people live,
- facilities where domestic animals are bred or wild animals kept or other non-targeted facilities.

By following the GPPP rules that are in force in the EU countries, it is realized that at least 48 hours before the pesticide treatment that is dangerous to bees, especially during the flowering of crops, the user should inform the public, and especially beekeepers about:

- date and estimated hour of treatment,
- pesticide trade name,
- the name of the pesticide user,
- place of treatment information,
- at the time of treatment with pesticides dangerous to bees, in perennial plantings if weed species are to blooming they must be cut or in some other way prevented from coming into contact with pesticides,
- at the time of flowering crops, no systematic pesticides dangerous to bees are applied. Contact pesticides hazardous to bees at the time of flowering crops are applied only during the night hours, starting from two hours after sunset to two hours before sunrise.

A separate chapter within the GPPP is dedicated to the protection of another, very significant resource, water. It is also prescribed that the application of pesticides and their preparation:

- should not be carried out near sources of water, watercourses, wells and other surface and groundwater as well as drinking water supply facilities, but according to warnings and notices on the label;
- pesticide solution residues do not flow into water, surface and groundwater sources. The water used to wash the pesticide application device should be sprayed on the treated surface or treated as hazardous waste in accordance with the law governing waste management;
- treatment shouldn’t be done in the vicinity of water protection zones in accordance with the law which regulates water protection according to the instructions for use and on the label;
- after use of pesticides, empty containers shall be handled in accordance with the instructions on the label;
- with packaging containing pesticide residues, pesticide contaminated waste, and pesticides which have expired warranty or expiry date shall be treated as hazardous waste in accordance with the law governing waste management.

4. Soil management and improvement planning

4.1 Monitoring

Monitoring is a system for monitoring and controlling the state and changes in the environment, that is, a system for monitoring environmental pollution.

Why is monitoring needed?

- to determine whether and to what extent nature and man are endangered by the emission of pollutants;
- to verify that 'potential pollutants' comply with the legally permitted levels of pollution;
- to provide relevant data about pollution level which is then made available to interested parties (the state and / or the public);
- to prevent and eliminate the unintended consequences of environmental pollution in a timely and effective manner.

The goals of the monitoring are:

- warnings and / or prevention of unintended consequences and environmental hazards;
- monitoring of changes already made to prevent further negative impact

One of the measures for the protection and conservation of soil is the implementation of monitoring, which is a permanent monitoring of the state of all changes in agricultural and non-agricultural soil, and in particular the monitoring of the content of dangerous and harmful substances. A very important indicator of soil fertility is the quantitative content of humus, as well as its quality. Soils rich in humus contain large reserves of biogenic elements that keep the humus from leaching and is,after mineralization, available to the plants. Soil, as a very complex ecosystem, is home to numerous and diverse microorganisms, which make up the most significant component of the biological phase of the soil. Soil should also be seen as a multifunctional system, not as a set of physical and chemical properties. In addition to being a source of food, water, it is a source of biodiversity and an environment for human beings. Therefore, regular monitoring of the soil condition is a necessary precondition for preserving the quality of life and the survival of the living world.

One of the safest methods of environmental pollution monitoring is biological monitoring, which involves the use of living organisms as bioindicators of environmental changes in space and time. This method monitors the accumulation of pollutants in the tissues and organs of living beings, but also all changes (biochemical, morphological, physiological) in individuals or in populations resulting from pollution.

When talking about types of bioindicators, plants should be singled out as indicators and hyperaccumulators of various pollutants (heavy metals, pesticides) in soil. One example is the Viola arsenic species, which is an indicator of arsenic-rich soils. Either species of Urtica dioica and Urtica urens, commonly known as nettles, indicate an increased concentration of nitrates and nitrites in the soil and usually inhabit nitrified habitats in urban and rural settings. Probably the most famous heavy metal hyperaccumulator is “Thlaspi caerulescens”. While the majority of plants show symptoms of toxicity at a

zinc (Zn) concentration of about 100 ppm, this plant accumulates at a concentration of 26,000 ppm without any damage.

Establishment of a systematic monitoring of soil quality is based on the experience of European countries in the application of methodology, method of site selection, fieldwork, sampling, list of parameters, methods and standards for physical, chemical and biological soil analysis, timeframe and dynamics of data collection with precise established sampling stations - sampling sites and standardized methods for sample collection and analysis.

The aim of establishing the Soil Monitoring Program is to establish continuous permanent monitoring of pedogenetic processes, endomorphological and ectomorphological changes, quality and condition of the soil. The European Commission and the European Environmental Agency (EEA) have made recommendations regarding the basic and specific parameters for the effective characterization of soil in the site.

4.2 Soil sanation, remediation and recultivation

The objective of the soil protection strategy is the protection and sustainable management of soil, based on the principles of preserving the role of soil, preventing degradation, mitigating the effects of degradation and repairing degraded soil.

Sanation or remediation is the process of taking measures to stop pollution and further environmental degradation to a level that is safe for future use of the site, including soilscaping, revitalization and reclamation. In this case, by definition a contaminated site is a site where the presence of dangerous and harmful substances, caused by human activity, is confirmed at such concentrations that can cause significant risk to human health and the environment.

Recultivation processes are processes of restoring soil to its original or other purpose, following anthropogenic processes that led to its degradation. However, its formation and regeneration is very slow, which obliges the soil user to manage it well, regardless of the soil's purpose. This management must be in line with the concept that soil has a many roles, which is enshrined in EU legal documents, where soil and its protection are given particular importance.

Recultivation is the process of closing down and remodeling an area after a production shutdown or disposal of waste. Recultivation is carried out on mines, surface mines, tailings pits, quarries, clays, landfills after the cessation of exploitation in order to repair degraded areas. The process includes prevention of further erosion, strengthening and stabilization of the soil ground, drainage, filling and covering of tailings, amelioration, greening and afforestation. After recultivation it is possible to grow crop and fruit crops.

Technical recultivation on surface mines is carried out in the process of exploitation and represents the planned design of the surface mine and soilfill, and includes the planning of the surface of the terrain, formation of recultivation surface, construction and mitigation of slopes of side slopes, construction of hydro-technical, soil reclamation and other facilities that accompany works on soil surfaces. Biological recultivation enables the use of soil prepared by technical reclamation. Biological recultivation is a complex and time-consuming process, which involves the implementation of a number of necessary

measures, which should facilitate and speed up pedological processes. The implementation of biological recultivation requires a preliminary analysis of the existing situation in the field and a phase-out, as well as a follow-up of the process and constant correction.

Biological measures are applied in the final stage of recultivation process. These measures include the application of agricultural and forest soil recultivation, which contribute to the stability and maintenance of the recultivated areas, but are much more significant from the aspect of space revitalization and the establishment of natural biocenoses. Biological recultivation involves the sowing of arable crops and the planting of fruit crops and afforestation. In order for the process to proceed at a faster pace, it is necessary to bring in large quantities of organic and mineral substances to make up for the lack of basic nutrients, especially nitrogen and phosphorus. Before biological recultivation or lawn sowing is started, the right choice must be made of perennial grasses, legumes or mixtures that are suitable for the given conditions, area, purpose or intended use.

4.3 Inspection supervision of soil protection entities

Zajecar district

Soil protection is executed in accordance with the Law on Soil Protection and within the framework of the legislation. Inspection supervision includes soil protection, systematic monitoring of the condition and quality of soil, sanation, remediation, recultivation, inspection control and other important issues for the protection and conservation of soil as a natural resource of national interest.

The control of the impelementation of the prescribed standards of ecological protection is executed by ecological inspection. Environmental inspections should contribute to the preventive protection of basic ecological values by preventing those activities that do not comply with the integrated permit that may cause environmental pollution.[19]Based on the authority deriving from the Environmental Protection Act, the inspector may order the elimination of irregularities in the implementation of environmental measures, prohibit and temporarily prohibit the further implementation of activities that harm the environment or are suspected of having a negative impact on the environment, order the development of an accident risk assessment and an accident protection plan, as well as order the implementation of emergency measures and procedures for responding to an accident, and undertaking remediation and prevention of the spreading of pollution. In addition, the inspector may initiate three types of proceedings: to file a report with the competent prosecutor's office for the committed criminal offense, to file a complaint with the competent prosecutor's office for the committed economic offense, and to submit a request to the misdemeanor court for instituting misdemeanor proceedings.

[19] Environmental Inspection Supervision Plan for 2018. Sector for Environmental Supervision and Precaution, Ministry of Environmental Protection of RS, Belgrade

Vidin district

The soil protection policy is implemented by the Ministry of the Environment, with the assistance of the Waste Management and Soil Conservation Directorate, in accordance with EU legislation and national legislation - the Law of Environmental Protection, the Soil Law, the Protection of Agricultural Soil Law and the Waste Management Law.

Also, by adhering to the provisions of the Law on Harmful Impact of Chemical Substances and Preparations and the Regulations on their Application, as well as from the Strategic Documents - National Action Program for Sustainable Soil Management and Suppression of Desertification in 2014-2020, regional and local protection strategies, plans and programs aim to keep the protection of the soil at a high level.

4.4 Soil protection planning at local and regional level

When it comes to environmental planning, it is widely reported that it all began in 1992, when the United Nations Conference on Environment and Sustainable Development was held in Rio de Janeiro. Then Agenda 21 was adopted, representing a global action plan for sustainable development for the 21st century.[20] The role of local and regional authorities is specifically defined in section 28 of this Agenda, which emphasizes the necessity for local authorities to engage in dialogue with their citizens, local organizations, entrepreneurs and other actors in the process of adopting local plans.

In the meantime, a large number of Central and Eastern European countries have achieved EU membership, and thus have adopted environmental commitments. The latest in a series of plans is the "Environmental Action Programme (EAP) until 2020".[21] This plan provides a long-term environmental strategy designed that is able to meet the challenges of the future and the increasingly systematic risks they carry. It provides a comprehensive approach to the environment and directs towards a green and competitive economy that will conserve our natural resources and health for this and future generations.

Zajecar district

Each local government in the Republic of Serbia adopts the Environmental Protection Program in its territory (State GaState Gazette of the Republic of Serbia). RS “No. 12/2010). The Local Environmental Action Plan (LEAP) delivers:

- improving understanding of local environmental issues,
- ranking of problems in relation to human health, eco - systems, quality of life in general,
- rationally using limited resources on priority problems,
- Designing a LEAP that fully integrates technical, policy and management solutions

[20] Đorđević, Slađana, Pejić Dušica, Milošević, S., Pavlović Slobodanka, Vujović, Zoran (2018): A participatory approach to design LEAP – case study City of Smederevo. Svarog, 16, 278-290.

[21] European Commission (2014): The European Union explained. Environment. Brussels

Integration of environmental issues into spatial and urban planning is enabled by Art. Of the Law on Environmental Protection and the Law on Strategic Environmental Impact Assessment ("State Gazette of the RS" no. 135/04 and 88/10) and given that they all represent the legal framework for assessing the impact of spatial and urban plans for the environment. General objectives are a prerequisite for the implementation of specific goals and form an integral part of environmental policy in economic and environmental sectors.

For the area of Zajecar, in February 2012, planning documents entitled "Environmental Program on the Territory of the City of Zajecar for the Period from 2012 to 2019" were adopted.[22] In the program, activities and time frames for the implementation of environmental policy objectives (waste, air, natural resources, degraded areas, noise, water, soil, non-ionizing radiation, etc.) have been specifically elaborated.

Vidin district

The protection of the banks and soils along the Danube from erosion and soilslides is of particular importance in order to prevent possible damage to the Vidin District. Financial support was provided under Operational Program "Regional Development" through activities under the project "Regional and Local Availability", and Operation 1.4 - "Improving the physical environment and preventing risk". In order to stop erosion processes, flood damage and soilslide activation, smaller infrastructural measures are being financed, such as the construction of dams, retaining walls, fortifications, ie the fight against coastal erosion.

Improper exploitation and increasing soil pollution gradually reduce its fertility and make it unsuitable for agricultural activities. As the soil, as a consequence of pollution, increases the content of toxic substances and changes its chemical composition and disrupts the natural environment of macro and microorganisms, measures are taken to repair it. The soil repair funds are secured under the Operational Program "Environment", ie the project "Improvement and Development of Waste Treatment Infrastructure". This project is aimed at improving the condition of soil and groundwater.

4.5 An example of applied planning techniques for solving soil pollution problems

Zajecar district

Many places in the Republic of Serbia are facing problems of soil pollution, which have arisen as a result of industrial development in the past, as well as other activities. According to the Waste Management Strategy, the amount of historical pollution in the Republic of Serbia is estimated at around 100,000 tons. In the Republic of Serbia, about 440 marked as "black" spots (contaminated sites) have been identified,[23] as a result of industrial activity.

[22] City of Zajecar (2012): "Environmental Program in the City of Zajecar for the Period from 2012 to 2019"

[23] Božić, V. (2014): Environmental projects - sanation and remediation. Ministry of Agriculture and Environmental Protection of the Republic of Serbia, Belgrade

In recent years, the following remediation projects for contaminated sites have been proposed, adopted and partially implemented:

- remediation in the Bor district;
- Velika Bačka's Channel - remediation;
- Sludge remediation (from Palic and Ludac lakes);
- Industrial wastewater channel Pancevo.

Projects have been launched in the Bor district, addressing urgent environmental and social problems arising from the restructuring of the mining sector. Key activities within the environmental management component are:

- design and execution of construction works on water purification from the lake formed above the tailings from the mine Veliki Krivelj,
- sanation of the tailings dam,
- surface remediation with mining waste and tailings,
- sanation of the collector Veliki Krivelj,
- environmental monitoring.

At the same time, the project "Feasibility Study for Remediation of Surface and Groundwater at Bor Copper Mine" envisages the following activities:

- analysis of surface and groundwater quality, as well as making recommendations for possible remediation measures and techniques adapted to the conditions in the Bor mine,
- identification of deficiencies in institutions (laws), as well as capacity building in the local community, to be able to solve environmental problems at Bor mine.

Based on the adopted strategic goals, as well as legal obligations, each local self-government in the territory of the Republic of Serbia is obliged to periodically adopt environmental plans on its territory. One such plan was adopted by the City of Zajecar, for the period 2012-2019. Within the framework of the implementation of the "Environmental Program on the Territory of the City of Zajecar for the Period from 2012 to 2019" short-term goals are:

- *launching organic production while reducing chemical agents*
  Contractors: agricultural producers and the Agency for Rural Development of the City of Zajecar;
- *development of a plan for the remediation of degraded areas in the Zajecar area*
  Contractors: local self-government;
- *initiating the implementation of sanation and remediation of contaminated sites from the priority list;*
  Contractors: Republic of Serbia and local self-government.

Vidin district

New approaches and directions for soil protection from anthropogenic pollution are currently being developed in the observed area, as a result of the achievements of science and practice, namely:

- selection of new technologies with reduced waste in public production, especially in industry and agriculture;
- reconstruction and construction of new drinking water treatment devices, air filters, etc.;
- optimization of sowing structure in agriculture with the aim of minimizing the need for mineral fertilizers and chemical protection of plants;
- optimization of fertilization and irrigation levels in line with the latest scientific developments;

- reduction of pesticides, due to the development of new biotechnological methods, production and introduction of new biological and hormonal plant protection products, which are environmentally friendly and harmless to humans and animals;

In addition, erosion protection measures are being implemented, covering the following activities:

- for farms with a unique identification number and arable soil whose dimensions are larger than the minimum, and within the support policy (1 hectare for consolidated area payments, 0.5 hectare for others), it is obligatory to include at least 40% of the crop in the collective joint sowing, except for the area for the production of tobacco;
- for the cultivation of agricultural crops, the use of coastal areas at a distance of less than 5 meters from the river is prohibited;
- It is obligatory to preserve and maintain the existing permanent terraces on terraced agricultural soil and, if necessary, to conclude agreements between the soil users and the soilowner;
- The introduction of harvest residues into the soil is a mandatory measure.

At the same time as protection measures, soil users are prohibited from:

- using agricultural machinery in parcels with excessively moist soil;
- burning of harvested and plant residues on agricultural soil and cultivation of flax, sunflower, sugar beet and peas on the same agricultural plot for more than two consecutive years

4.6 Role of regulatory authorities

Zajecar district

In the Republic of Serbia, environmental regulation is based on the highest legislative act, the Constitution of the Republic of Serbia. The provisions of Article 74 of the Constitution of the Republic of Serbia (Official Gazette of the RS, No. 98/06) define that everyone has the right to a healthy environment and to timely and complete informations of its condition, and that everyone is, especially the Republic of Serbia and an autonomous province, responsible for protecting the environment, as well as ensuring that everyone has a duty to protect and improve the environment.

It envisages the right of citizens to a healthy environment, but also their obligation to protect and promote the environment in accordance with the law. The Environmental legislation in the Republic of Serbia makes over 100 laws and other regulations.

Public participation in decision-making processes is a political principle or practice and can be considered as one of human rights. In recent years, public participation has been considered one of the key segments in addressing environmental issues and in stimulating sustainable development. Citizens are the main factors of both problems and solutions to environmental damage.

Internationally, one of the most advanced international environmental treaties, that defines the direction of sustainable development and strengthens basic democratic principles in EU countries, is the Aarhus Convention.[24] The Convention requires that environmental informations transparent that informations are made available to the civilian sector and representatives of all relevant stakeholders, and that they are allowed to participate in policy formulation and live in a healthy environment.

As an international environmental instrument, this Convention contains three sets of rules relating to:

1. The right of citizens to information availability;
2. The right of citizens to participate in environmental decision-making;
3. Rights to legal protection where the previous two rights have been violated.

Vidin district

Pursuant to the Soil Act, the national policy for the protection, sustainable use and restoration of soil at the national level is implemented by the line ministers, namely the Minister of Environment and Water, the Minister of Agriculture, Food and Forestry, the Minister of Health and the Minister of Regional Development and Public Works, and also other government officials and other stakeholders are assisting in line with their responsibilities.

At regional level, policies for soil conservation, sustainable use and restoration are implemented by regional governors, and at the local level by mayors of municipalities. The competent authorities shall ensure public participation in the decision-making and development of strategies, programs and plans for the conservation, sustainable use and restoration of soil.

In order to protect and sustainably use the soil and limit the processes that damage it, the Soil Act prohibits:

- destruction of erosion and irrigation facilities in cases where this causes damage to the soil;
- destruction of constructed structures and anti-soilslide fortifications;
- application of agricultural practices leading to salinisation, acidification and soil pollution by harmful substances;
- application of tillage technologies that lead to erosion, compaction and damage to its structure;
- destruction or impairment of the integrity of protective forest belts;
- irrigation with contaminated water containing harmful substances above the permitted standards;
- bringing of the sludge into the soil from a wastewater treatment plant that does not meet the requirements of the Rules on the order and manner of using wastewater treatment sludge for their use in agriculture (State Gazette of Bulgaria, No. 112 of 2004);
- introduction of fertilizers, compost and other improvers, biologically active substances and nutrients that do not meet the requirements laid down in the on Plant Protection Act;
- the use of plant protection products that do not meet the requirements of the Ordinance on the approval of plant protection products (State Gazette of Bulgaria No 81/2006; amended by No 62/2007);
- performing production activities that lead to increased salinization, acidification and pollution of soil by harmful substances;

[24] Komnenić Dušanka (2012): the Aarhus Convention. A new approach to environmental protection. LEGAL RECORD, III Year, no. 1 (2012) University Law School Union, 153-176

- burning or other forms of uncontrolled disposal, abandonment and unregulated disposal of waste on the soil surface, including agricultural waste, outside the scope of the Waste Management Act;
- burning of stover and other plant residues on the soil surface.

5. Legal measures and their importance for sustainable development

5.1 The role and importance of environmental education

Education has always been and will always be the most effective way to solve serious problems. The educational process about protection and improvement of the environment represents the conscious and planned development of man's knowledge about the environment. Environmental education should provide a very secure knowledge of the basic environmental issues of modern society, develop a critical attitude to the growing degradation of the environment and point to the need for rational use of natural resources. Environmental education and the formation of an ecological way of thinking begins at an early age, which is why the role of educational organizations at all levels of knowledge acquisition (primary, secondary, and higher education) is very important.

Zajecar district

The education system in Serbia is organized as follows:[25]

- *preparatory pre-school program* - getting to know the natural and social environment that incorporates environmental protection content;

- *young elementary schools* - environmental content is often permeated through almost all teaching subjects, and is most represented in the subjects World around us in first and second grades and Nature and Society in third and fourth grades, as and through elective course in the first cycle of elementary education "Keepers of Nature" through which awareness of the need and opportunities for personal engagement in environmental protection is developed, strengthens the adoption and application of the principles of sustainability, ethics and rights of future generations to the environment;

- *senior elementary school grades* - ecological contents are represented through the subjects of natural sciences: biology, geography, chemistry and physics;

- *secondary education* - as a separate subject, ecology is emerging for the first time at in some vocational secondary schools. In addition to this special subject, ecological content is also studied through general educational subjects;

- *Higher education* - environmental studies are present in almost all faculties, to a lesser or greater extent. Many faculties have study fields - departments that specialize in higher education in eco-safety and

[25] Šehović, S. (2012): The role of environmental education in protecting and improving the environment. Faculty of Pedagogy Belgrade

environmental protection (Faculty of Occupational Safety, Faculty of Physical Chemistry, Faculty of Biology, Faculty of Agriculture, ABHAO Military Academy, etc.).

A special form of education is to constantly raise the level of knowledge of farmers by organizing lectures, presentations, "winter schools", workshops and other forms of training to improve agricultural production, use of modern achievements in compliance with the rules of good agricultural practice in plant protection, waste management, etc. These activities are carried out by the Agricultural Advisory Expert Service (PSSS) in the territory of the Zajecar Administrative District, but also by NGOs, as well as Agro Services of leading companies involved in the sale of seeds, pesticides and fertilizers. Improper use of pesticides can cause adverse environmental effects, and therefore an education plan is in place, after which the farmer will receive a certificate on the proper application of plant protection products. By 2021, farmers will receive training, after which they will receive a certificate on the proper use of pesticides, as only then will they be able to buy and use pesticides on their properties without control.

Vidin district

In accordance with the ongoing processes of raising awareness and knowledge of environmental protection, from educational institutions to manufacturing companies, pupils, students and all employees are provided with appropriate training in environmental policy. The trainings include activities on environmental protection, soilscaping of the school and business environment, energy savings, as well as rules for the use of natural resources in an efficient and environmentally friendly manner. Also, within the activities described above, on the local level, emergency preparedness training is provided for various natural disasters, environmental emergencies and environmental pollution. Through the training, all contingency plans, actions and procedures have been elaborated, which ensure proper and timely intervention in order to eliminate the cause and prompt repair of the damaged environment.

Special attention is given to educating the school population. Environmental topics are present to varying degrees in curricula in all areas of education from primary to secondary school, as well as in higher education institutions in the Vidin district. In the region, specialized training in the field of natural sciences and agriculture is offered in 4 departments after the completion of the seventh grade, namely:

- High School "Tsar Simeon Veliki", Vidin, profile "Natural Sciences" - 1st grade;
- Hristo Botev High School, Archar Village - Grade 2 - Specialty "Flower Shop";
- High School „N. J. Vaptsarov ", Ruzhinci village - 1st grade - specialty" Mechanization of agriculture".

Also, as a part of higher education in Vidin, a branch of Angel Kunchev University in Ruse offers course in Agricultural Engineering and Technology.

5.2 The role and importance of implementing land protection regulations

Zajecar district

The so-called environmental legislation in the Republic of Serbia consists of over 100 laws and regulations. Basic legal norms for environmental protection in domestic law are regulated by the standards of the Environmental Protection Act, Soil Protection Act, Environmental Impact Assessment Act, Integrated Prevention and Control of Environmental Pollution Act, etc.

As in Art. 3 of the Soil Protection Act [25] says, the aim of this law is to preserve the areas and functions of soil as a natural resource and to prevent or eliminate harmful changes in soil that may result from:

- erosion processes;
- reduction of soil organic matter content;
- inappropriate agricultural and forestry production (inadequate and uncontrolled agricultural and ameliorative measures, deforestation, etc.);
- uncontrolled changes in soil use and management;
- unplanned urbanization, that is, unplanned construction and development of infrastructure;
- acidification, salinisation and alkalisation of soil;
- soil compaction, soilslides and rock slides; fires and chemical accidents;
- pollution (generated by waste management, wastewater discharge, emissions from point and diffuse sources, chemical pollution, etc.);
- exploitation of mineral and organic raw materials;
- exploitation of gravel, stone and sand;
- unauthorized archaeological excavations and researches, etc.

According to Art. 5 of the same Act, soil protection is based on the following principles:

- "conservation of the natural value of soil" means that the soil is used under the conditions and in a manner that ensures the conservation of its natural values in accordance with this and other laws;
- "Integrity of soil protection" means that the Republic of Serbia, bodies of the autonomous province and bodies of the local self-government unit provide integration of soil protection into all sectoral policies by implementing mutually agreed plans and programs and implementation of regulations through a system of permits, standards and norms, financing and other soil protection measures;
- "polluter pays" means anyone who causes pollution to the soil pays compensation in accordance with the law and bears the costs of preventive measures in reducing pollution, the cost of eliminating soil risks, and the cost of procedures compensation for damage to soil;
- "consumer pays" means the obligation of a soil user to pay a fee for his use in accordance with the law and, if necessary, bear the cost of sanation, that is remediation and recultivation;
- "subsidiary responsibilities" means systematically imposed soil protection obligations in relation to the hierarchy of state bodies, which, within the limits of their financial capacity, eliminate the consequences of damage, soil pollution and damage in cases where the pollutant is unknown, as well as when the damage arises from pollution of soil from sources outside the Republic;
- "information and public participation" means the right of the interested public to be informed of the condition of the soil and to participate in the decision-making process of the great social importance;
- "the protection of the right to preserve the natural values of soil" is the legal right to use soil in such a way as to preserve its natural values, and which citizens, groups of citizens or their associations, professional or other organizations exercise in accordance with these and other laws.

Vidin district

The main activities for the protection of soil are related to the harmonization of the domestic, Bulgarian legislation with the European regulation in the field of protection, sustainable use and restoration of soil. At the same time, participation in the preparation of documents at European level, the development of regulations, strategies, programs, evaluations and analyzes are indispensable. A very important segment is the coordination of commitments under the UN Convention to Combat Desertification, the National Strategy and the Action Plan to Combat Desertification and Soil Degradation and their Implementation measures.

All this leads to the implementation of preventive, ongoing and subsequent control over the implementation of the provisions of the Soil Act and by-law s.

5.3 The polluter pays principle

The polluter pays principle means that the costs of environmental protection are paid by whoever made them, that is, a pollutant[26]. The good application of this principle leads at the same time to the improvement of efficiency within the economic system, because it imposes the “optimal” level of pollution, which is the most economically efficient. For the adequate implementation of the polluter pays principle, it is first of all necessary to define the general policy of application of the principles, appropriate laws and regulations and institutional environment, determine the sources of pollution, ways of measuring pollution, define payers, calculation criteria, amount and method of calculation and payment of fees and other elements.

Economic instruments based on the polluter pays principle should stimulate investment in new, eco-friendly, non-polluting or less polluting technologies. The essence of economic environmental financing instruments is reflected in the fact that the polluter makes a decision on the amount of pollution based on lower costs: the cost of a fee / fee or the cost of acquiring new non-polluting technology. Therefore, an "optimal" level of pollution is required, which is the most economically efficient.

Revenues generated by pollutant taxation are often misused to compensate for work tax burdens or in the process of fiscal consolidation. Examples of such systems have been encountered in Italy since 2011. Similarly, in Hungary there is a special profit tax on energy suppliers, the so-called "Robin Hood" tax, which is used solely for generating additional revenue. To avoid this, dedicated funds are usually set up. Examples of this linking of expenditures with revenues can be seen in many countries.

In the Czech Republic, most air pollution funding is channeled into a national fund to finance air pollution abatement programs. In ?, similar practices apply to the use of plastic bags, while the rest is used for other environmental improvement purposes. Such systemic solutions exist in Latvia, Portugal and Cyprus as well, which has proven to be very beneficial for the environment and biodiversity. In some cases, tax instruments are designed to be tax neutral as the fully collected income is returned back to the economic system.

[26] Anonymous: (2018): Legal and economic aspects of the application of the polluter pays principle. Institute of Economic Sciences, Belgrade

Best practice examples indicate that local governments trying to build a circular economy model take care to foster sustainable development, through tax measures and influence economic operators to become more involved in environmental conservation. One example is the municipality of Aschaffenburg in Germany, where applying the 'pay as you throw' principle, which is a direct application of the 'polluter pays' principle, has significant benefits for the local community.

Croatia's environmental tax revenue remains one of the largest in the EU. Environmental taxes in 2017 accounted for 3.43% of GDP (EU-28 average: 2.40%). At the same time, energy taxes accounted for 2.59% of GDP, while the EU average was 1.84%. In the same year, environmental tax revenues amounted to 9.08% of total tax revenues (which is above the EU-28 average of 5.97%).[27]

Contrary to good practices, the sample of 125 municipalities in Spain in PuigVentosa showed a typical example of a lack of use of the polluter pays principle and of discouraging environmentally responsible entities. A survey on local soilfill fees conducted in 2015, covering about a third of the Spanish population, shows that the average fee is relatively low and cannot offset costs.[26] In addition, the fee structure is problematic because a large number of municipalities apply a fixed fee policy, while in those municipalities where variable fees exist, they are rarely correlated with the amount of waste generated.

6. Examples of good practices in soil conservation

[27] European Commission (2019): Review of environmental activities for Croatia 2019, Report for Croatia, Brussels

6.1 Goo practice in EU Member States - identifying short, medium and long-term effects

At European level, the Common Agricultural Policy use various instruments to promote sustainable soil use. These include green payments, which make up 30% of direct payments, requiring farmers to diversify crops, maintain a permanent lawn and devote 5% of arable land to "environmentally focused areas". These activities contribute to increasing soil resilience, conserving soil carbon and protecting biodiversity.

Land protection is also part of the rural development programs, funded by the European Agricultural Fund for Rural Development and managed by the Member States themselves. Promoting resource efficiency and restoration, preserving and enhancing ecosystems related to agriculture are two of the six key priority areas for rural development, and soil is a significant part of it.

In 2008, an updated EU Directive on Integrated Pollution Prevention and Control (IPPC) was adopted. It through "Best Agricultural Technic" (BAT)[28] promotes the most efficient and advanced phase in the development of activities and their methods of action. This Directive indicates the practical appropriateness of certain techniques for determining the baseline values of pollution restrictions with the aim of preventing or reducing pollution and the environmental impact as a whole.

These measures proved to be positive. Recent work, presented by the European Commission's Joint Research Center, concluded that between 2000 and 2010, soil erosion rates overall decreased by 9% and by 20% in arable land. As part of the new Horizon 2020 program[29] another € 100 million has been earmarked for the 2018-2020 programming period for research relating to land and its protection.

According to 2015 data[30], collected by monitoring the annual reduction of carbon (C) in the soil, intensive agricultural production of cereal in the United Kingdom lowers it by 1%, the addition of mineral fertilizers in Sweden lowers it by 0.5%. Reduced manure fertilization (5 tonnes / hectare) reduces carbon content in Sweden by 0.2% and straw intake (3 tonnes / hectare) in Denmark by 0.2%. However, soil management as a result of good agricultural practice has led to an increase in carbon content of 0.2% annually in France through the cultivation of cover crops, and straw intake of 12 tonnes / hectare in Denmark an increase by 0.3%. Also, the same study shows that the introduction of manure, 35 tonnes per hectare, in the UK increases carbon content by 0.4% and the cultivation of miscanthus giganteus by 4%.
The cultivation of cover crops for the repair of agricultural soil is particularly strong in Germany and France. Between the harvest of one crop and the sowing of another, since the soil must not be bare, cover crops are sown, among which the most widely spread oil radish (Raphanus sativus var. Oleifera). This type is most commonly used for green fertilization, which improves soil properties. At the same time, research has shown that this plant is very effective in controlling some types of nematodes such as turnip nematodes.

The practice of growing cover crops (red, white, sweet and incarnate clover, peas, 1 year old lupinus, hairy vetch, etc.) is one of the mandatory soil remediation measures in EU countries. Cover crops keep the soil covered during winter and other periods of time when crops are not growing, reducing the risk of erosion. Biomass produced from cover crops usually returns to the soil, increasing the level of organic matter. Species of cover crops containing mycorrhizal fungi can maintain and increase the population of

[28] http://eur-lex.europa.eu. 2008/1/EC-Integrated Pollution Prevention and Control Directive–new version
[29] https://ec.europa.eu/programmes/horizon2020
[30] European Commission: Best practices on Soil quality management, EXPO Milan, 6 July 2015.

these beneficial fungi. Crops that cover legumes can add nitrogen to the soil by fixing nitrogen. Cover crops can retain nitrates and other nutrients that are susceptible to flushing losses.

At the beginning of the 21st century, the principle of so-called Farmingscaping or the method of agricultural design became established in the leading EU countries as well as in the USA. This principle enhances, but also manages biodiversity with a view to increasing the presence of beneficial organisms. These organisms include the use of insect-attracting plants, woody plants, cover crops, and are cultivated to attract and support populations of beneficial organisms such as insects, spiders, amphibians, reptiles, bats and birds that parasitize or feed on harmful insects.

One of the methods widely used in protecting against soil erosion is the formation of horticultural oases. These oases are created by farmers in zones between production fields, steep ditches or places that are easily eroded as they give stability to the soil.

Farmers in the EU have a number of preventive and repressive measures in the field of conventional, integral and organic farming.

6.2 Good practices in Serbia

In the last decade, integrated and organic production has developed in Serbia, which respects the concept of protection and prevention of further environmental degradation. To this end, a number of preventive-repressive measures are being used.

One of the preventive measures affecting the rational (ecological-economic concept) behavior in agricultural production is the decision to grant state subventions in fruit production from 2020 on the basis of the document on reionization, ie on the basis of climate and land characteristics of certain areas in Serbia. The profession and science will determine which of the 18 fruit species can produce the highest yields and in which area. Based on this estimate, money for production will be given from the national budget. In practice, this will mean that if a producer grows crops where climatic conditions are not suitable for commercial production, he will not be able to receive state incentives either. The second segment is related to the activities of breeding houses, constantly working to improve the quality of their genetic material by identifying genes that contribute to increased tolerance to environmental stress. For leading crops (crops, corn, oilseeds, industrial plants), the selection goes towards plant cultivation with a well-developed root system that uses water and nutrients from the soil more efficiently, synchronized fertilization processes and better control of plant water losses. In the most common crop in Serbia, corn, this measure is reflected in the growing involvement of AquaMax (Pionner) and Artesian (Syngenta) hybrids, respectively.

Proper selection of seeds or planting material ensures a healthy starting plant material and thus reduces the possibility of infecting plants and soil with harmful organisms transmitted by seed or seedlings or grapevines. The existing laws on the circulation of seeds and planting material are allowed to further expand only the use of processed and declared seed and planting material.

Biological measures include the use of various biotechnical agents of living or inanimate nature in the fight against harmful organisms. Among living are biopesticides that include living agents, macrobiological (predators, parasites, parasitoids) and microbiological (fungi, bacteria, viruses), natural pesticides and metabolism products of some organisms. There are a large number of products on the Serbian market based on Bacillus thuringiensis (Lepinox Plus), Beauveria bassiana (Naturalis Biogard)

fungus, Carpovirusine EVO2. Biological measures have the greatest application in the control of pests and pathogens, especially fungi and bacteria.

Biotechnical agents, on the other hand, are inanimate in nature and are chemicals that adversely affect the behavior of pests in terms of attracting - attractants or repelling - repellents. Biotechnical agents also include agents that increase plant resistance and regulate insect development. Targeted protection of cultivated plants is precisely achieved by establishing a "threshold of harmfulness" of the cultivated species, and on the basis of eg. catches in pheromone traps, hunting traps, hunting belts, etc. Today's successful, eco-toxicological protection of apple from apple cider, cherry protection against cherry fly, or tomato from South American leaf miner cannot be done without the use of pheromone plates.

In recent years, in addition to the conventional method (use of herbicides), weed control has been achieved through a combination of agro-technical and physical measures. Physical measures include the use of flames. The first scientific research in Serbia on the application of flames in weed control in the row of crops was started in 2010 at the Scientific Institute of Field and Vegetable Crops in Novi Sad. Flame machine is made in Serbia of domestic components by modifying a four row cultivator. The result is a machine that flames suppressing weeds that are in the initial stages of development and are in the row of crops, and between the rows are suppressed by cultivation. This measure provides faster initial efficiency in weed control, the absence of residues in plants, soil and groundwater.

In order to raise the pH of the soil at the end of the XX and the beginning of the XXI century, the Ministry of Agriculture of Serbia conducted an action of lime distribution (CaCO3) to agricultural producers, based on the previously done soil analyzes. In recent years, the so-called soil breeders (pH Plus, BioFert Green, FF Humiflex, Slavol), all to prevent further degradation and repair of agricultural land.

The Ministry of Agriculture, Forestry and Water Management of the Republic of Serbia has started with the implementation of the project "Danube River Enterprise Pollution Reduction Project" (DREPR).[31] The preparation of this project was carried out by the Ministry of Science and Environment - Environmental Protection Directorate, and the entire project is being implemented with donations from the World Bank and the International Environmental Fund (GEF). $ 9 million was provided for the implementation of the project. Other donors include the $ 4 million from Swedish Development Agency (SIDA) and the European Agency for Reconstruction (EAR). The main objective of the project is, first of all, to reduce the pollution of the Danube watercourses and its tributaries with nutrients from livestock farms, especially from pigs and cattle farms, as well as to reduce the quantities of nutrients discharged from the slaughterhouse industry..

In addition to activities in EU countries, Serbia, as a candidate country for membership in the "European family", has achieved some results in the protection and remediation of soil. During the last decade of the 20th century, based on previous land analyzes in the Bor River, during 1994, 1995 and 1996. In the Center for Agricultural and Technological Research in Zajecar, and on the existing soil condition, oats and rye were produced in vegetation vessels using 104 chemical reclamation. In 1996 and 1997, rye was planted on an area of 5 acres, which ended the vegetation, ie it provided seeds for further reproduction. In connection with this, a Project for the financing of study and research works for the formation of an experimental field on an area of 1 hectare in the city settlement Vrazogrnac was done.[32]

[31] https://www.ekapija.com. With the help of DREPR, manure disposal facilities were built on 29 farms - a contract with 12 farmers is being prepared.

[32] City of Zajecar (2012): Environmental program on the territory of the city of Zajecar for the period from 2012 to 2019, Zajecar

Based on the above mentioned and later in-depth researching[33] more encouraging findings have emerged in attempts to quality recultivate contaminated land.

6.3 Good practices in Bulgaria

In the last ten years, the best practices in soil protection in the territory of Bulgaria, and in particular the Vidin district, are:

- Regional Waste Soilfill in Vidin Region;
- Covering terrain and agricultural soil;
- Ecologically acceptable disposal of obsolete pesticides and other plant protection products with expiry date;
- Introducing the „No-till“ technology.

On the territory of the village of Žheglica, a “Regional Soilfill for Municipal Waste in the Vidin Region” was built, which serves all 11 municipalities in the Vidin Region and creates conditions for the removal of unregulated soilfills and the closure of existing municipal soilfills. The new soilfill is located in the valley southwest of the existing soilfill and 1km west of the Danube River. It covers an area of about 221 hectares. The soilfill has two non-hazardous waste disposal facilities with a total volume of 516,000 tonnes, as well as a composting plant with a maximum annual capacity for receiving and treating about 10,000 tonnes of biodegradable waste. The operation of the soilfill was funded by OP "Environment".

As a result of the activities of the company „ Gypsum AD“ in the village of Koshava, 87.9 hectares of polluted soil have been identified as well as created sludge and filtered „cakes“ from production waste containing heavy metals, fluorine and radionuclides. In the last three years, as a result of the methods used, the company has emptied and delivered for disposal between 20 to 30 thousand tons of sludge and filtered „cake“, in parallel with biological recultivation of about 13 hectares of contaminated surface.

One of the leading problems, that has arisen is the storage and disposal of pesticides from the last decades of the twentieth century, especially from abandoned farms. At a site near the village of Žheglica in a harmless way for the environment and human health, about 130 m3 of banned pesticides and pesticides with expired date of use are stored. These pesticides are collected, sorted, the packaging separated, and grouped into "B-B cubes". In this way, the problem of pollution of agricultural and non-agricultural soil was finally solved, as well as the problem of the possibility of uncontrolled pollution of all ecosystems. The project “Environmentally friendly disposal of obsolete pesticides and other expired plant protection products” funded by the Bulgarian-Swiss Cooperation Program includes the construction of two storage facilities for the storage of organic pollutants (pesticides, hazardous waste and other expired plant protection products). Both warehouses are located in the area in question, Vidin district, namely "Warehouse 35" in Dimovo and "Warehouse 133" in Rakovica village.

According to the project, organic contaminants will be repackaged, transported and handed over for final disposal, and the warehouses will be cleaned and the visibly contaminated top soil in front of the warehouse replaced with clean soil or crushed stone.

[33] Maric M, Antonijevic M, Alagic S. (2013) The inves-tigation of the possibility for using some wild andcultivated plants as hyperaccumulators of heavymetals from contaminated soil, Environ Sci Poll Res20(2), 1181-88

As part of soil protection best practice, in recent years, particular attention has been paid to the introduction of the “No-till” technology in agricultural soil cultivation. Specifically, the main topic of the Seventh National Agricultural Seminar of the National Cereal Producers Association (NASGP), and in accordance with the guidelines of the World Food and Agriculture Organization (FAO), was the “No-Till” technology, aimed at protecting soil from further degradation. This technology involves managing agro and ecosystems in order to improve sustainable productivity, increase profitability and food security while maintaining and improving our resource base and environment.

7. Conclusion

In recent decades, humanity has faced increasing pollution of the environment and its elements. In addition to natural pollution through the processes taking place in the atmosphere, the lithosphere and the hydrosphere, since the mid-twentieth century, the increasing influence has been anthropogenic, ie human influence. The first signals of this worrying phenomenon were expressed through the reduction of biodiversity and climate change. And that were big signs of warning. Faced with this, the man decided to try to remedy the situation. How to do it? Simple, four very clear steps, observation, measurement, reflection, resolution.

The burning issue of halting further degradation and then of environmental protection rests on the need to identify the sources of pollution, that is, establish a monitoring system - monitoring of environmental pollution. Based on the results of monitoring, measures should be taken to stop further pollution, repair the devastated environment, and above all soil, and fight to stabilize the repaired soil and return it to the optimum medium. Along with direct measures, it is necessary to intensify to a greater extent develope awareness about the environment in which we live and which we will leave to our descendants through education and upbringing, from a pre-school institution to higher education. Also, the public is necessary in detecting problems and solving them as well as protecting "harassers", because everyone's interest is the same, a healthy environment in which we live and pursue our activities.

In short, in order to maintain or increase the level of soil organic matter, organic matter inputs must meet or exceed the decomposition of organic matter. At the same time, healthy crops can be a valuable source of organic matter, and crop residues should be returned to the soil as much as possible.

Combining the aforementioned preventive and repressive measures, such as compliance with legislation, among which is also the "polluter pays" principle, is achieving the goal, reducing pollution and and creates a healthier environment. All this is aimed at ensuring that today and in the coming decades, citizens of the entire planet Earth live in a safe and healthy environment that is managed in a way that respects environmental constraints and ensures environmental resilience. Vision for 2050 from the EU General Environmental Action Program: “In 2050, we are living well, within the ecological constraints of the planet. Our progress and healthy environment come from an innovative, circular economy where nothing is thrown away and where natural resources are managed in a sustainable way, and biodiversity is preserved, valued and restored in ways that strengthen the resilience of our society“

Let us protect the earth and nature on it, because we have not inherited them from our grandfathers and fathers, but have borrowed them from our descendants.

(Sitting Bull)

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