Slovak Environmental Agency
Banská Bystrica

Agriculture and its Impact on the Environment in the Slovak Republic 2009

Indicator Report

2010

Ing. Radoslava Kanianska, CSc.

Content

Foreword

Report **Agriculture and its Impact on the Environment in the Slovak Republic 2009** is one of task outcomes listed in main task program of the Slovak Environmental Agency and Ministry of Environment of the Slovak Republic that is titled as *Assess Effects of Selected Sectors in Economic Activities on Environment and Implementation of Environmental Aspects into Sectoral Policies.* This has been already the third report.

Within the task in 2005, sets of indicators and indicative sectors 'reports were completed for agriculture, forestry, transportation, energy, industry, and tourism. The reports, in full, assess a correlation between economical sector and environment through environmental indicators and are focused on key questions and issues. Document was submitted for comments within relevant resort, other resorts, and at routine daily meeting of Ministry of the Environment. Further work procedure was approved and adopted at the daily routine meeting. The Slovak Environmental Agency was instructed to proceed in the assessment through updating of indicators database in a year interval and summary sectoral reports in two-year intervals. At the same time, an obligation to publicize the indicators and reports on the webpage was laid. www.enviroportal.sk/sektor/.

Summary

What is current status and future directions of agriculture in the Slovak Republic?

The current status and future directions of agriculture are influenced the most by the processes of intensification, specialisation as well as marginalisation. As regards the nature conservation, important is the development of ecological agriculture in Slovakia.

Trends in Agricultural Production

- **INTENSIFICATION –** In the 1990s, after the political and economical conditions changed, the trend of intensification in Slovakia turned to have a downward curve. Owing to this, the load of the environment connected with emissions into air from agriculture, contamination of water and soil fell down. Although gradual improvement of economic situation in agriculture is expected, the pressure of the Common Agricultural Policy creates an assumption of keeping extensive forms of farming as well as other trends acceptable to the environment.
- Since 1990 we have observed continuous decline of the agricultural land area (including the arable land) usually in favour of the built-up areas.
  (Indicator Changes in land utilization, Structure of agricultural land utilization, Arable land per capita)
- During 1990 – 2009, the number of beef cattle dropped by 69.8%, the number of pigs fell by 70.6%, the number of sheep and goats dropped by 38.3% and poultry fell by 17.6%.
  (Indicator Amounts of livestock)
- After 1990, several plant commodities faced decline in production; if we compare the time period from 1990 to 2009, legumes fell by 84.5%, potatoes by 72.3%, annual fodder crops by 66.0%, perennial fodder crops on arable land by 58.0%, sugar beet fell by 43.2%, cereals by 7.9%. Significant growth was observed only in case of oil plants, these grew by 321.4%.
  (Indicator Vegetable and livestock production)
- During 1990 – 2009, the consumption of nitrogen fertilizers dropped by 20.4%, phosphate fertilizers by 55.1% and potash fertilizers fell by 67.8%.
  (Indicator Consumption of commercial fertilizers)
- During the 1990s, the consumption of manure was falling with some deviations and this trend continued up to 2009.
  (Indicator Consumption of manure)
- As regards individual groups of pesticides, the comparison of the years of 1991 – 2009 revealed decline in the consumption of herbicides by 39.2%, fungicides by 41.8% and insecticides by 35.9%.
  (Indicator Consumption of pesticides)
- From 1995 to 2009, total final consumption of fuels and energies in agriculture had a downward tendency.
  (Indicator Final consumption of fuels and energy in agriculture)
- During 1993 – 2009, the area of watered areas in the Slovak Republic dropped by 93.2%.
  (Indicator Irrigated areas)
- **SPECIALISATION –** Based on the 2007 Farm Structure Surveys, vegetable and livestock production (37.9%) slightly predominates in the group of registered natural persons in Slovakia. The group of registered legal entities specialises rather in livestock production (34.0%).
- **MARGINALISATION** – In Slovakia the main factors of marginalisation is lower rentability of agricultural production in mountain and submontane areas, growing number of farmers in senior age. In 2008, the unused agricultural land extended on 337 410 ha.
- **ECOLOGICAL AGRICULTURE** – From 1990 till present, ecological agriculture has been gradually growing. In 2009, 458 entities were registered in the system of ecological agriculture and these were farming on 146 762 ha, this being 7.6% of the agricultural land fund.
  (Indicator Agricultural land area in the ecological agriculture)

Influence of Agriculture on the Environment in the Slovak Republic

Changes in political and economic conditions after 1989 caused decline of intensification factors in agriculture, which brought about improvement of the components of the environment. The model of multifunctional agriculture the Slovak Republic professes guarantees support of agro-environmental measures. This should ensure prospective improvement of the agriculture's impact on the environment.

Water

Utilization of Water in Agriculture

- During 1990 – 2009, surface water take-off for the purposes of agriculture slumped by 95%, the groundwater take-off fell by 75%.
  (Indicator Agriculture water withdrawals)

- During 1994 – 2009, the participation of agriculture in utilization of surface water fell from 14% to 4.4%. The participation of agriculture in utilization of groundwater in 2009 was 3%, this representing decrease of 1% compared to 1994.
  (Indicator Share of agriculture in water utilization)

- Considering the documented utilisable volume of groundwater in Slovakia, the actual as well as expected water demand is guaranteed to a large extent.
  (Indicator Groundwater level from the agricultural point of view)

Quality of Water and Agriculture

- The quality of surface water and, consequently, the groundwater is affected to a great degree by technological processes, intensification of livestock and vegetable production. However, when measuring the quality of water it is difficult to isolate the influence of agriculture on this indicator. Therefore, the evaluations provided herein are only indicative.

  - In the first half of the 1990s, the nitrogen regimens in soils of Slovakia were balanced. Later, the content of nitrogen in soil became deficient as a result of reduced fertilization. From 2007 to 2009, positive balance of nitrogen was observed in soils.
    (Indicator Balance of nitrogen)

  - Although the share of sludge suitable for the application into soil in Slovakia is more than 95% of the total sludge production, during 2007 – 2009 almost no sludge whatsoever was applied to soil.
    (Indicator Application of treatment plant sludge into soil)

  - In 2008, 878 probable environmental loads (124 of these from agricultural activities), 257 environmental loads (3 of these from agricultural activities) and 684 reclaimed localities (6 of these from agricultural activities) were entered in the Slovak Environmental Loads Register.
    (Indicator Environmental loads)

  - Total generation of wastes from agriculture is variable from 1995. In 2009, 476 392 t of wastes (other and hazardous wastes together) were generated by agriculture.
    (Indicator Wastes from agriculture)

  - Discharge of waste waters is variable and due to changes in the evaluation methods it is not possible to evaluate long-term trend. In 2009, 286 thousand m3 of waste water from agriculture was discharged.
    (Indicator Wastewaters from agriculture)

- At present, the system of water status evaluation is being implemented according to the Framework Directive on water 2000/60/EC. Pursuant to the evaluation under STN, after 2000 gradual increase in the percentage of sampling points was observed for nutrients at the level of IV. and V. quality class. This means that the quality of water as regards this indicator was getting worse. As regards the microbiological indicators, their curve was fluctuating but still maintaining the leading position among all parameters monitored. After 2008, the most excesses were observed for the indicator of nitrite nitrogen. Out of the microbiological indicators, the most excesses were observed for the indicator of thermotolerant coliform bacteria and intestinal enterococci.
  (Indicator Surface water quality from the agricultural point of view)

- The lowest degree of pollution of groundwater is observed in mountain and submontane areas. The percentage of the allowed concentration of nitrates excesses in groundwater in the monitored areas during 1998 – 2006 was of variable character and it ranged between 8 and 11%. In 2008, the character of agricultural utilization of the country projected onto the increased contents of oxidized and reduced forms of nitrogen, of which the ions NH_4^+ and NO_3^- took part in exceeding the limits.

  (Indicator Groundwater quality from the agricultural point of view)

- After 2000, the percentage of sampling points at the level of IV. and V. quality class for the indicator of nutrients was, under the STN valid at that time, gradually growing, this meaning that the quality of water was getting worse and the eutrophication of water was rising. During 2004 – 2007, the content of nitrates in groundwater was measured in 560 monitored sites. The limit value (50 mg/l) was overrun by

8.75% of the total number of the sites. As regards surface water, annual concentration of nitrates was ranging from 2 – 9.99 mg/l in the majority of samples (74%). According to chlorophyll "a", majority of the samples monitored (46.9%) was classed as mesotrophic.
(Indicator Eutrophication of waters from the viewpoint of agriculture)

Soil

- As regards agricultural country, after 1990 the biggest change in ground cover was observed in the expanded area of the mosaic of fields, meadows and perennial plantations (by 165,49 km^2), mainly at the expense of arable land and meadows. Significant decrease in meadows was connected particularly with their abandonment and subsequent growth of shrubbery through self-seeding.
(Indicator Land cover changes)

- In the Slovak Republic 39.7% (959 919 ha) of agricultural land was exposed to potential danger of water erosion (of various intensity) in 2009. Soil drifting is not a serious problem in the Slovak Republic, in 2009 6.5% (132 986 ha) of agricultural land was endangered by it.
(Indicator Soil erosion)

- Slovakia registers up to 5 000 ha of alkali (salsodic) soils, this representing 0.2% of the total agricultural land area in Slovakia. Waterlogged lands take ca 187 000 ha, this being approximately 7.6% of the total agricultural land area in Slovakia.
(Indicator Alkali and waterlogged areas)

- Results of the Partial Monitoring System – Soil revealed the following for the period from 1993 to 2002:

  - After mild decrease in the content of organic coal in soils in 1997 its content got higher in some soil types in 2002, thus approaching the initial values measured in 1993.
  (Indicator Organic carbon in soil)

  - The content of the majority of dangerous substances was under the limit and changes in individual cycles were, except for the chrome, mostly insignificant. In 2002, increased content was observed for cadmium (fluvial soils, rendzinas) and lead (fluvial soils).
  (Indicator Soil contamination)

  - During 1993 – 1997, the situation as regards the soil acidification got stable and even slightly better. On the contrary, the 2002 results revealed moderate acidification trend particularly in acid soils and substrates.
  (Indicator Soil acidification)

  - Certain tendency towards reduced compaction of the topsoil of heavy and medium soils was observed.
  (Indicator Soil compaction)

- At present, desertification is not a serious problem in Slovakia. The climactic changes, however, may lead to the increase of average soil temperature by 1^{o} C and the average values of soil humidity at the time of vegetative period should fall by around 10%.

Air

- During 1990–2008, a sharp decline in emissions from agriculture was observed, in particular:

  - decline in the emission of greenhouse gases (methane and nitrogen monoxide) by 56%,
  (Indicator Greenhouse gases emissions from agriculture)
  - decline in the emission of ammonia by 60%.
  (Indicator Ammonia emissions from agriculture)

- The quality of air measured by the level of regional air pollution by 5 monitoring stations was gradually getting better after 1992; the level of concentration of sulphur dioxide as well as nitrogen oxide were, with small deviations, falling down and never exceeded the limit values stipulated to protect ecosystems.
(Indicator Air quality from the agricultural point of view).

- The share of agriculture in the emissions of greenhouse gases during 1990 – 2008 dropped by 3.2%. As regards emissions, agriculture's largest share is in the emissions of ammonia; in 2008 it was 96.4%.
(Indicator Share of agriculture in emissions of greenhouse gases and ammonia)

- Agriculture as well, especially by the emission f methane and nitrogen monoxide, adds to the processes of greenhouse effect intensification.
(Indicator Climactic changes from the viewpoint of agriculture)

- Purposeful growing of biomass for energy purposes is actually insufficient in Slovakia. In Slovakia, only 6 facilities producing biogas from manure and silage maize were in operation in 2009.
  (Indicator Renewable energy resources from agriculture)

Biota

In terms of space, agriculture is the most spread human activity in our territory having therefore a significant impact on biodiversity.

- Decrease in biodiversity in the agricultural country struck the most the area of lowlands and hilly areas, especially as a result of intensive utilization. Today, a majority of indigenous semi-natural biotopes of this area is almost destroyed or changed to a great extent.
(*Indicator Biodiversity of the agricultural countryside*)

- In mountain and submontane areas, one may find preserved rare territories with high biological and country diversity with traditional farming preserved. Compared to the lowlands, the processes of land becoming neglected are more intensive in mountain areas.

- In 2001, only 323 000 ha of grass cover was considered natural. The area of natural grass covers makes around 60% of permanent grass stands registered according to LPIS. From 1990, abandonment of land is a significant factor conditioning degradation of natural covers on the area of about 300 000 ha.
(Indicator High natural value territories)

- Genetic diversity of cultivated species of plants grown in agriculture rose. In 1990 – 2009, the number of strains gradually rose for a majority of the crops grown. The numbers of breeds got higher for beef cattle and sheep.
(Indicator Genetic diversity of crops and breeds)

- To protect biodiversity, protective measures are adopted and farming in protected areas is restricted:

  - Pursuant to the act No. 543/2002 on protection of nature and countryside, including the protection zones, the protected areas cover around 1 200 000 ha, this being approximately 22.8% of Slovakia and out of this 250 000 ha is used for agricultural production.

  - Total area of bird areas takes 1 154 111 ha, this being 23.5% of the Slovak territory, 30% of which is the agricultural land.

  - National list of the proposed Sites of Community Importance covers the area of 573 690 ha, this being 11.7% of the Slovak territory. 10% of this area is the agricultural land.

  (Indicator Agricultural lands in protected areas)

- In the programming period of the Rural Development Programme of the Slovak Republic 2004 – 2006 the expenses under the measure of Agri-environment and living conditions of animals totalled 134 726 thousand euro. For the period of 2007 – 2013 it was 71 236 thousand euro and under the measure of NATURA 2000 and the Water Directive it was 42 thousand euro.
(Indicator Area with agri-environmental support)

Is the Environmental Efficiency of the Slovak Agriculture Rising?

Environmental efficiency in agriculture is, after 2000 particularly, characterised by a positive trend in relation to consumption of fuels, heat, electricity, greenhouse gases emission and water utilization. Positive trend for production of wastes and discharge of waters was observed during 2007 – 2009.

(Indicator Environmental efficiency of agriculture with regard to the consumption of fuels, heat, and electricity in agriculture,
Indicator Environmental efficiency of agriculture with regard to the greenhouse gases emissions from agriculture,
Indicator Environmental efficiency of agriculture with regard to utilization of water in agriculture,
Indicator Environmental efficiency of agriculture with regard to the quantity of wastes generated from agriculture,
Indicator Environmental efficiency of agriculture with regard to total volume of discharged waste waters from agricultural activities).

1. Introduction

Sector Indicators Report **Agriculture and its Impact on the Environment in the Slovak Republic 2009** is a third report and it is focusing on evaluation of environmental impact of the energy as one of the most important economic sectors in Slovakia, and environmental aspects, which are in the process of being implemented in the agricultural policy.

Integration of environmental policy into sectoral policies commenced at the European Council Summit in Cardiff. It represents an all-European process, in which environmental policy purposes and goals are reflected in the sectoral policies and which aims to provide a permanently sustainable development.

Indicators sets – measurable indicators that are evaluated through **sectoral reports** are an effective tool to assess integration of the environmental aspects into the energy policy.

Assessment of the impact of the energy sector on the environment respects a creating and evaluating process of the indicators, which is ensured by activities of European Environment Agency (EEA), Organization for Economic Co-operation and Development (OECD), and Statistical Office of the European Commission (EURO STAT) and development of sectoral reports at the European level.

A purpose of such formulated report for a sector of energy in Slovakia is to gain:

- Basic document to identify the impact of the power engineering on the environment;
- Grounds to assess effectiveness of environmental measures application into the energy policy;
- An initial document at implementation of Cardiff process and Lisbon process under conditions of the Slovak Republic;
- An effective tool to assess strategic objectives or long-term priorities of National Sustainable Development Strategy.

In the first place, the report focuses on evaluation of the interrelation between agriculture and the environment. Some of the economical and social factors having significant indirect influence on the environment are handled only marginally. It expresses the approaches of experts in the field of environment and, at the same time, it equally accepts the opinions of experts from the agricultural resort.

The report is to serve mainly politicians as an appropriate tool for decision making process, experts and pedagogues from the environment field and power engineering, and finally to students and public engaged in environment matters.

2. Methodology

The sector indicators report is based on a methodology implemented by the European Environmental Agency, established in Copenhagen (EEA). It is a process; in which implementation of the environmental aspects into economic activities sectors and sector's impact on the environment is assessed through the indicators analyses. The evaluation process is focused on two stages:

1. Stage: Preparation and processing of a list of aggregated and individual indicators by D-P-S-I-R model;
2. Stage: Writing the indicators sector report.

Chain of causal indicator links according to the DPSIR model is a methodological tool for integrated assessment of the environment. Within individual chain links, the aggregated and individual indicators are defined as following:

- **Driving forces** (**D**) – they are starting mechanisms of processes in a society and they initiate
- **Pressure** (**P**) with an negative impact on the environment (contamination, depletion of mineral sources) or a positive impact, which is an immediate cause of changes in the
- **State of the environment (S**). Deterioration of the environment's state - its elements usually cause a negative
- **impact** (**I**) to human health, biodiversity, functions of eco-systems, and it logically leads to formulating of measures and tools concentrated on elimination or remedy of environmental damages in the last chain link- and it is
- **Response (**R**)**

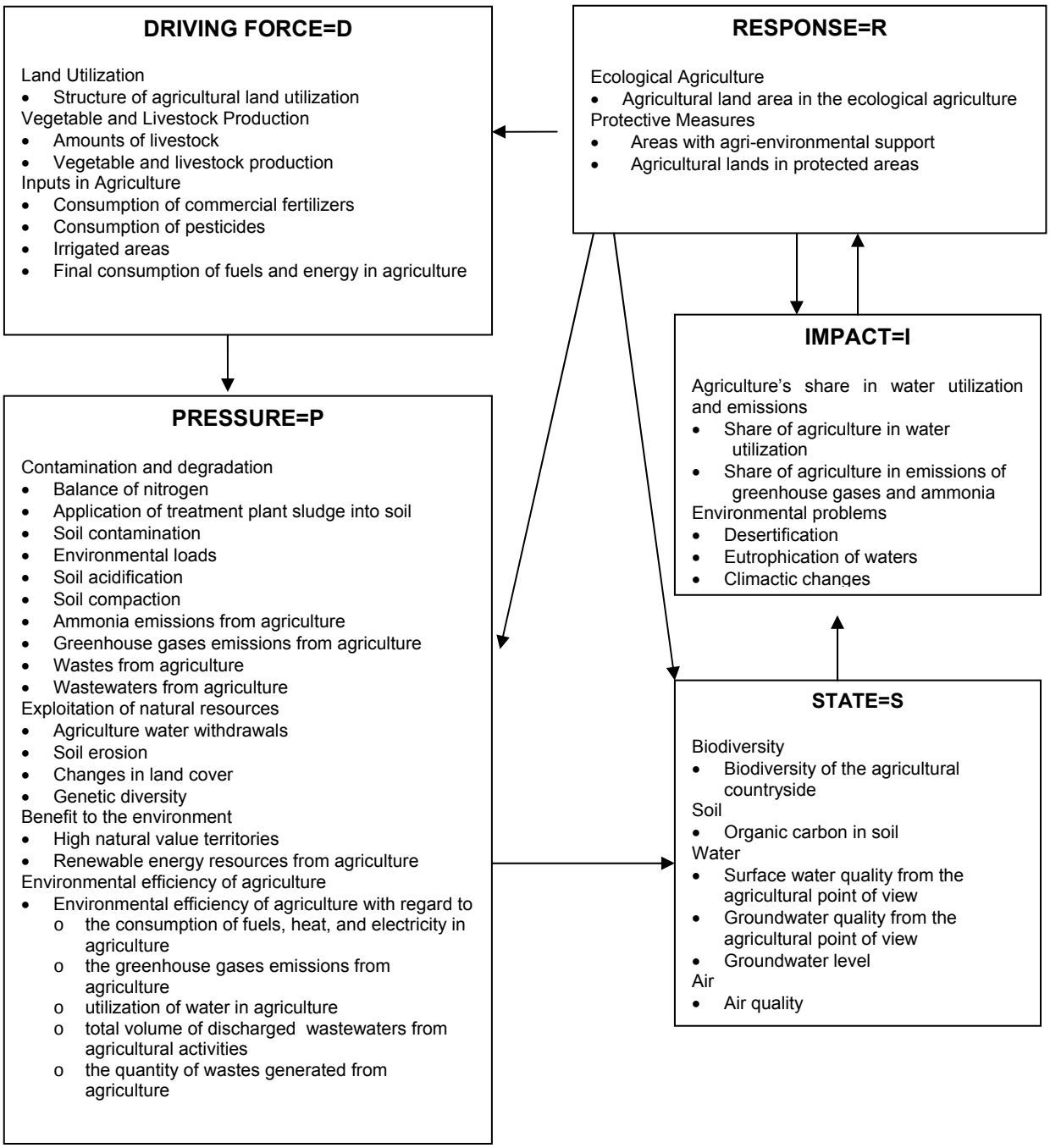
The analyzed individual agro-environmental indicators of the Slovak Republic in the D-P-S-I-R structure are in detail available at the web page www.enviroportal.sk/indikatory/. It includes description of the indicator, trend assessment, and identified political objectives in relation to indicator, international comparison, and reference to topics.

The set of environmental indicators, arranged by D-P-S-I-R model, serves as a theoretical base for preparation of **indicators sector report.** The main priority of the report is to understand **causal-consequential correlations** between an activity of human being and state of the environment by means of D-P-S-I-R causal chain link and in such way to offer an innovative view of the state and trend in the environment through the integrated assessment.

The indicators sector report is focused to answer **four key political questions**:

1. What is current status and trend of agricultural in the Slovak Republic?
2. What impact does agricultural have on environment in the Slovak Republic?
3. Does environmental effectiveness of the agricultural in the Slovak Republic increase?
4. Do actual legislative and financial mechanisms support the implementation of environmental measures into agricultural in the Slovak Republic?

Causal chain of agri-environmental indicators in Slovakia according to the D-P-S-I-R model in the agricultural sector



List of aggregated and individual agri-environmental indicators in Slovakia according to the D-P-S-I-R model with the option of direct selection of individual indicator

Position in DPSIR structure	Aggregated indicator	No.	Individual indicator
Driving force	Land Utilization	1.	Changes in land utilization
		2.	Structure of agricultural land utilization
		3.	Arable land per capita
	Vegetable and Livestock Production	4.	Amounts of livestock
		5.	Vegetable and livestock production
	Inputs in Agriculture	6.	Consumption of commercial fertilizers
		7.	Consumption of manure
		8.	Consumption of pesticides
		9.	Final consumption of fuels and energy in agriculture
		10.	Watered areas
Pressure	Contamination and degradation	11.	Balance of nitrogen
		12.	Application of treatment plant sludge into soil
		13.	Soil contamination
		14.	Environmental loads
		15.	Soil acidification
		16.	Soil compaction
		17.	Alkali and waterlogged areas
		18.	Ammonia emissions from agriculture
		19.	Greenhouse gases emissions from agriculture
		20.	Wastes from agriculture
		21.	Wastewaters from agriculture
	Exploitation of natural resources	22.	Agriculture water withdrawals
		23.	Soil erosion
		24.	Changes in land cover
		25.	Genetic diversity of crops and breeds
	Benefit to the environment	26.	High natural value territories
		27.	Renewable energy resources from agriculture
	Environmental efficiency of agriculture	28.	Environmental efficiency of agriculture with regard to the consumption of fuels, heat, and electricity in agriculture
		29.	Environmental efficiency of agriculture with regard to the greenhouse gases emissions from agriculture
		30.	Environmental efficiency of agriculture with regard to utilization of water in agriculture
		31.	Environmental efficiency of agriculture with regard to total volume of discharged wastewaters from agricultural activities
		32.	Environmental efficiency of agriculture with regard to the quantity of wastes generated from agriculture
State	Biodiversity	33.	Biodiversity of the agricultural countryside
	Soil	34.	Organic carbon in soil
	Water	35.	Surface water quality from the agricultural point of view
		36.	Groundwater quality from the agricultural point of view
		37.	Groundwater level from the agricultural point of view
	Air	38.	Air quality from the agricultural point of view
Impact	Agriculture's share in water utilization and emissions	39.	Share of agriculture in water utilization
		40.	Share of agriculture in emissions of greenhouse gases and ammonia
	Environmental problems	41.	Desertification
		42.	Eutrophication of waters from the viewpoint of soil and agriculture
		43.	Climactic changes from the viewpoint of soil and agriculture
Response	Ecological Agriculture	44.	Agricultural land area in the ecological agriculture
	Protective Measures	45.	Agricultural lands in protected areas
		46.	Areas with agri-environmental support
		47.	Legislative regulations connected with the environment for the sector of agriculture

3. Implementation of Environmental Policy into Agriculture

Implementation of environmental policy into agriculture progresses at the European as well as national level. Upon Slovakia's joining the EU Slovakia adopted the objective of building a European model of multifunctional agriculture as adopted by the European Union.

3.1. Political framework of implementation of the environmental policy into agriculture in the European Union

Common Agricultural Policy (CAP) arisen in the 1950s and 1960s was resistant to any changes for many years. In 1985 the document called **Green Book** was adopted, this document covering the reform of the Common Agricultural Policy, including the implementation of environmental measures into agriculture.

In 1992 **MacSharry Reform of Common Agricultural Policy** was adopted. In addition to price reduction of some of the agricultural products and establishment of compensation payments, also the policy in relation to the environment changed. (Josling, Babinard, 2000)

In 1998, the **EU Biodiversity Strategy** (COM(98) 42) was adopted aiming at preventing further losses in biodiversity, including the agri-ecosystem biodiversity. In the same year, the **Cardiff European Council meeting** launched the process of integration of environmental aspects into all sector policies. The meeting posed the request for elaboration for individual sectors (agriculture, transport, power engineering) of **the strategies and evaluation reports covering also implementation of environmental aspects and sustainable development** (CEC, 2004).

The **European Council Vienna meeting** in December 1998 accepted the reports assessing the implementation of environmental measures into sector policies and called for continuation of the process by way of indicators.

The **European Council Helsinki meeting** in December 1999 presented strategies for each sector, including the proposed particular measures to attain the set strategic targets as well as measurable indicators. For the agriculture, the strategy titled **Towards Sustainable Agriculture** (COM(1999) 22), was submitted and this strategy set the main environmental topics for agriculture.

The goals of monitoring of environmental aspects integration into agriculture and the set of agri-environmental indicators were published in the Communication of the Commission titled **Indicators of Implementation of Environmental Aspects into Common Agricultural Policy** (COM(2000) 20)**.** The evaluation concept for indicators and potential sources of data are included in the Communication of the Commission **Statistical Information Required to the Indicator Evaluation of the Environmental Aspects Implementation into Common Agricultural Policy** (COM(2001) 144)**.**

The principles of **Agenda 2000** were adopted by the Ministers of Agriculture of the Member States in 1999 at the **European Council meeting in Berlin**.

In 2000, the **Council Regulation 1257/99 on support of rural development** from the European Agricultural Guidance and Guarantee Fund brought about implementation of the **Principles of Good Farming Practice** (EC,1999) into agricultural practice.

Upon adoption of the **Biodiversity Action Plan** COM(2001) 0162 (03)) in 2001, the emphasis on asserting the agri-environmental measures in agriculture rose.

In 2002, the communication **Towards Thematic Strategy for Soil Protection** (COM(2002) 179**)** and **Towards Thematic Strategy on the Sustainable Use of Pesticides** (COM(2002) 349) was issued.

In 2003, the reform of Common Agricultural Policy of the EU countries was adopted in Luxembourg. Its keynote sets forth separation of the amount of direct payments from the

volume of production and current support of implementation of environmental measures into practice. In this context, CAP identified three main priorities:

- biodiversity, protection and support of natural forms of farming on soil and in forestry, as well as of traditional agricultural countryside;
- utilization of water and water management;
- climactic changes.

In 2004, the **Action Plan for Organic Food and Farming** (COM (2004) 415) was adopted as a significant milestone in enforcing the agri-environmental measures. These are further covered in the programming period 2007 – 2013 within the rural development policy and are based on four axes, namely:

- improving competitiveness of farm and forestry sectors,
- **improving the environment** and the countryside,
- quality of life in rural areas and diversification of the rural economy
- Leader

3.2. Political Framework of Implementation of the Environmental Policy into Agriculture in the Slovak Republic

In Slovakia, environmental aspects were implemented into agricultural policy as early as in the conceptual and strategic materials after 1989. After Slovakia joined EU, the **Rural Development Plan of the Slovak Republic 2004 – 2006** (Ministry of Agriculture of the Slovak Republic, 2004) was elaborated in cooperation with the **Sectoral Operational Programme Agriculture and Rural Development of the Slovak Republic 2004 – 2006** (Ministry of Agriculture of the Slovak Republic, 2003) for the programming period of 2004 – 2006.

For the programming period of 2007 – 2013, the **Concept of Development of Agriculture for 2007 – 2013** and the **Rural Development Programme of the Slovak Republic 2007 – 2013** (Ministry of Agriculture of the Slovak Republic, 2007) were elaborated. The **global objective** of the programme is to increase competitiveness of agriculture, food industry and forestry and improve the environment through implementation of appropriate agricultural and forestry processes and improve the quality of rural life with the emphasis on sustainable development. From the viewpoint of implementation of the environmental policy into agriculture the most important is the **axis 2 Improvement of the environment and countryside** aiming at creating multifunctional agricultural and forestry systems with positive impact on the environment, nature and countryside.

In compliance with implementation of the environmental policy, also the **Codes of Good Farming Practice** – soil protection, principles of correct use of fertilizers, protection of waters against pollution by nitrates from agricultural sources (Bielek, 1996; Bujnovský, 2000; VÚPOP a VÚVH, 2001) were elaborated based on the Council Recommendation No. R (92) 8.

Ecologization of the agricultural production as a substantial manifestation of implementation of environmental aspects into agriculture is covered also by the Act **No. 189/2009 Coll. on ecological agricultural production** and by the **Action Plan for Ecological Agriculture Development in SR until 2010** (Ministry of Agriculture of SR, 2005). Support of ecological agriculture results also from the **National Biodiversity Strategy in Slovakia** (Ministry of the Environment of SR, 1997) that was prepared as a response to the Article 6 of the Convention on Biological Diversity.

4. What is current status and future directions of Agriculture in the Slovak Republic?

Agriculture forms an important part of the state's national economy. It is carried out on nearly half of the Slovakia's territory on the area of 2 418 thousand ha. In terms of space, it is the most widespread human activity in our territory. In 2009, agriculture was in the red for the first time since Slovakia joined EU. The consequences of the global financial and the subsequent economic crisis helped this development to a great extent. The gross domestic product in agriculture in 2009 reached 1 698 mil. EUR in current prices. Also the number of workers in this sector fell to 64.3 thousand.

Situation in the Slovak agriculture is significantly influenced by progress in science and technology as well as by the political and economic situation in the country. Employing individual indicators characterising the main trends in agriculture makes description of the status and development of agriculture in Slovakia from 1990 possible.

List of Individual Agri-Environmental Indicators Relevant to the Description of Main Trends in Agriculture

Position v D-P-S-I-R structure	Individual indicator
Driving force	Changes in land utilization
	Structure of agricultural land utilization
	Arable land per capita
	Amounts of livestock
	Vegetable and livestock production
	Consumption of commercial fertilizers
	Consumption of manure
	Consumption of pesticides
	Final consumption of fuels and energy in agriculture
	Irrigated areas
Response	Area under organic farming

4.1. Trends in Agricultural Production

The strategy **Towards Sustainable Agriculture** (COM(1999) 22) specifies as the main trends in agriculture **intensification, specialisation, marginalisation and development of ecological agriculture**. They are significant also from the point of view of agriculture's influence on the environment.

4.1.1. Intensification

Intensification is a dominant feature of Slovak agriculture as of the 1950s. **After 1989, alleviation of intensification** was observed as a consequence of a change in political and economic conditions. In this era, the vegetable and livestock production fell down, the inputs applied into soil (including agri-chemicals, energy, water) dropped significantly, the numbers of livestock fell, which brought about lesser load of the environment connected with emissions into air from agriculture, contamination of water, soil. Although gradual improvement of economic situation in agriculture is expected the pressure of the Common Agricultural Policy on promoting more extensive forms of farming on soil, environmental measures, which is implemented also into the Slovak legislation, **creates a presupposition of keeping (or even further improvement) of environmentally acceptable trends.**

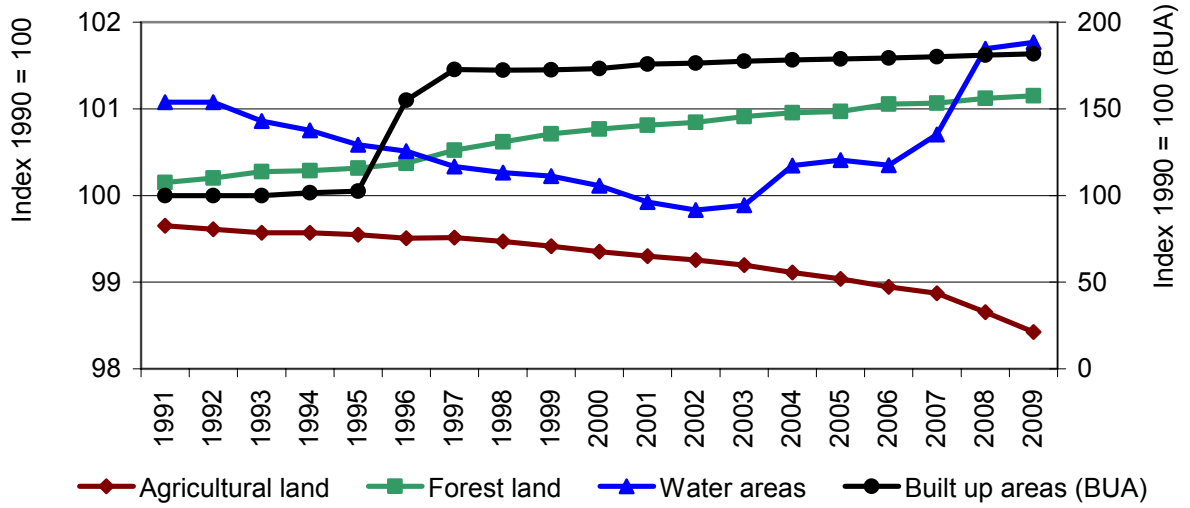
Intensification can be characterised by utilization of land, numbers of livestock, agricultural production, as well as utilization of agricultural inputs.

4.1.1.1. Land Utilization

In 2009, the agricultural land took according to the land register 49.31% of the total land area in Slovakia; forest lands extending on 40.97% ensued. The largest share of the agricultural land took the arable land (58.64%), then permanent grasslands (36.33%), gardens (3.17%), vineyards (1.12%), orchards (0.71%) and hop fields (0.02%).

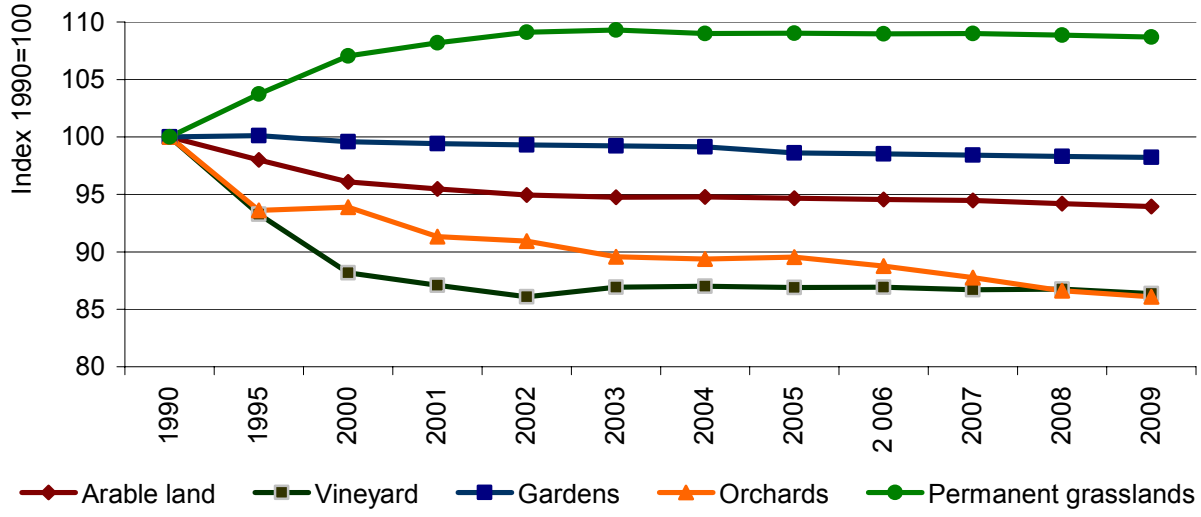
After 1990, changes in utilization of land brought about continuous decrease in the area of agricultural land, often in favour of built-up areas. The structure of agricultural land reveals continuous decline in the arable land area, this being reflected also in decrease in this area per capita. From 1990 to 2009 the arable land area per capita thus fell by 231 m^2 (*Indicator Arable land per capita*). Gradual growth was observed in case of the areas of permanent grasslands.

Changes in land utilization



Source: GCCA SR; Processed by SEA
Indicator Changes in land utilization

Structure of agricultural land utilization



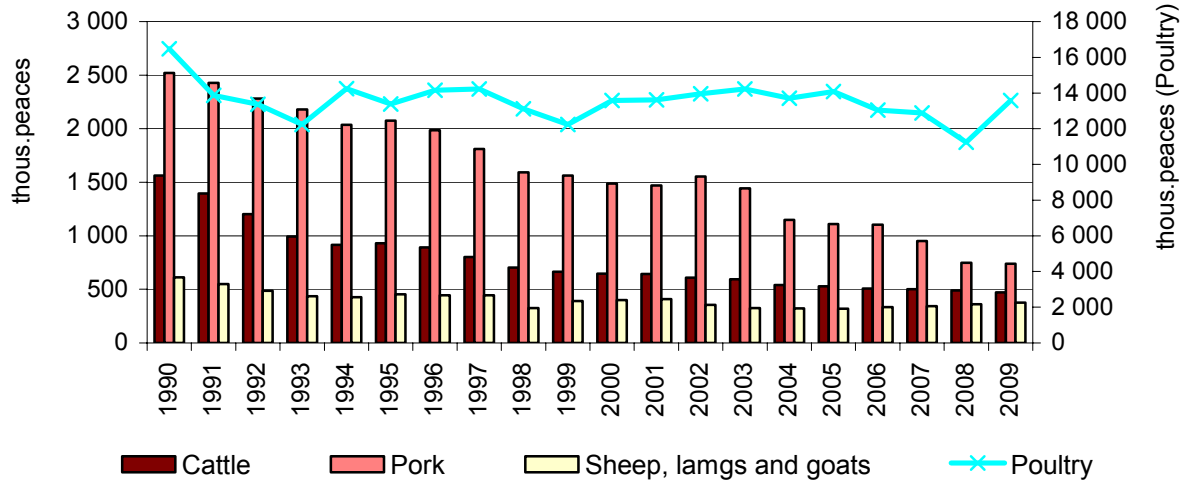
Source: GCCA SR; Processed by SEA
Indicator Structure of agricultural land utilization

4.1.1.2. Vegetable and Livestock Production

The numbers of livestock animals have **dropped in all categories** since 1990. During 1990 – 2009, the number of cattle fell by 69.8 % (-1 091 000 paces), the number of pork fell by 70.6 % (-1 780 000 paces), sheep and goats dropped by 38.3 % (-234 000 paces) and poultry by 17.6 % (-2 895 000 paces).

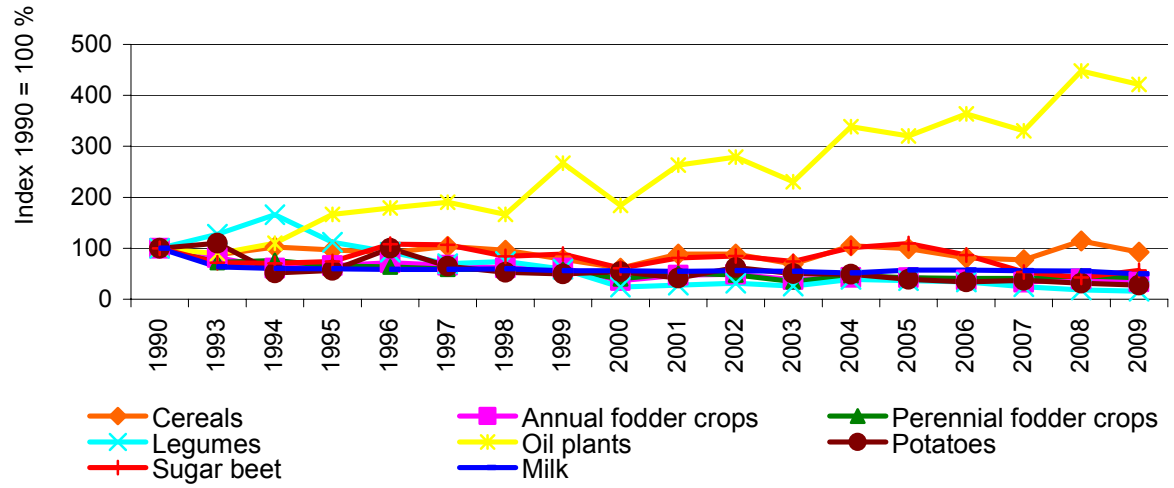
After 1990, several plant commodities dropped in production, the comparison of 1990 to 2009 revealed decrease in legumes by 84.5 % (-81 500 t), potatoes by 72.3 % (-562 000 t),, annual fodder crops by 66.0 % (-4 044 000 t), perennial fodder crops on arable land by 58.0 % (-888 800 t), sugar beet by 43.2 % (-683 400 t), cereals by 7.9 % (-287 200 t). **Significant growth was observed only for oil plants**, these grew by 321.4 % (+454 400 t). In relation to land and the environment, decrease in growing annual and perennial fodder crops on arable land is considered to be negative. As regards the production of milk, the comparison of the period from 1990 to 2009 revealed a drop by 50.2% (-962 900 t).

Number of livestock in Slovakia (thousand peaces)



Source: SO SR, MP SR; Processed by SEA
Indicator Number of livestock

Vegetable and livestock production



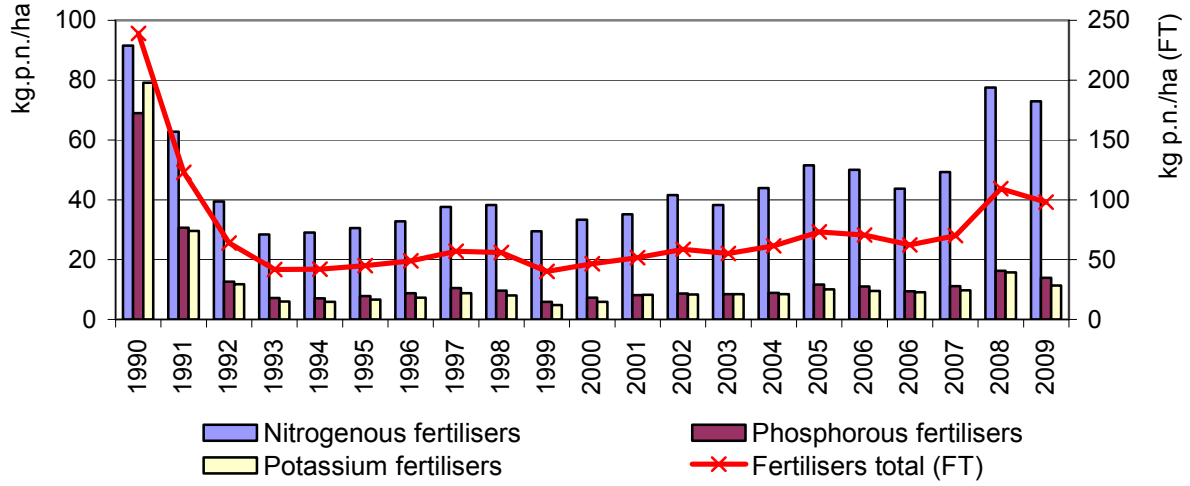
Source: SO SR; Processed by SEA
Indicator Vegetable and livestock production

4.1.1.3. Inputs in Agriculture

The 1990s are typical by reduction of inputs applied to agriculture. After 2000, this trend stopped in most cases or, eventually, there was an increase in some of the indicators.

During 1990 – 2009, the consumption of nitrogen fertilizers dropped by 20.4% (-18.7 kg of pure nutrient/ha), the consumption of **phosphate fertilizers** fell during this period by 55.1% (-79.9 kg of pure nutrient/ha) and the potash **fertilizers** fell by 67.8% (- 85.7 kg of pure nutrient/ha).

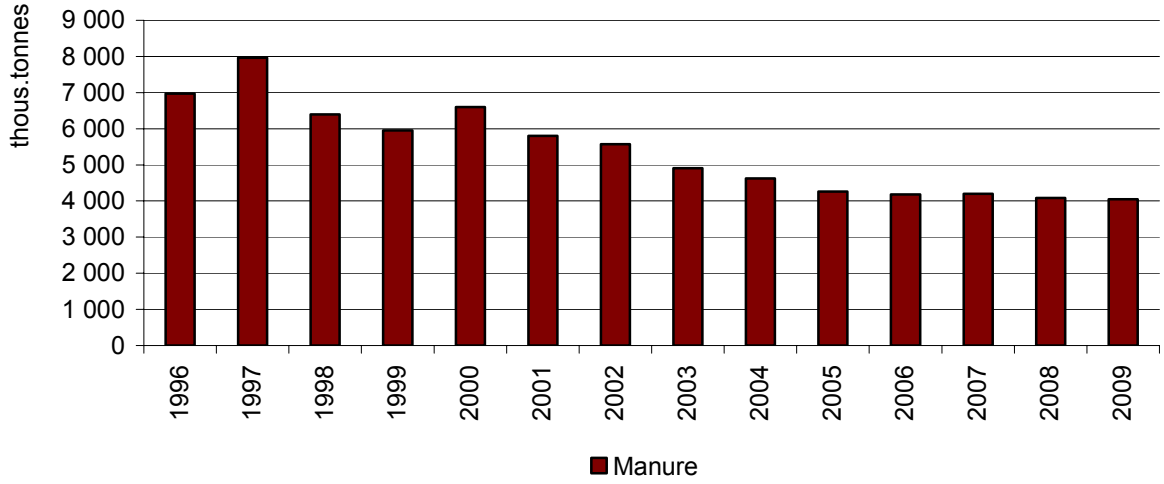
Fertilisers consumption in Slovakia (kg pure nutrient/ha)



Source: CCTIA ; Processed by SEA
Indicator Consumption of fertilizers

The consumption of manure in the 1990s **was falling** with some deviations and this trend **continued also after 2000.** This situation is a consequence of a slump in the numbers of livestock animals, including the cattle, after 1990. From the environmental point of view, this trend is negative.

Consumption of manure (thousand tonnes)

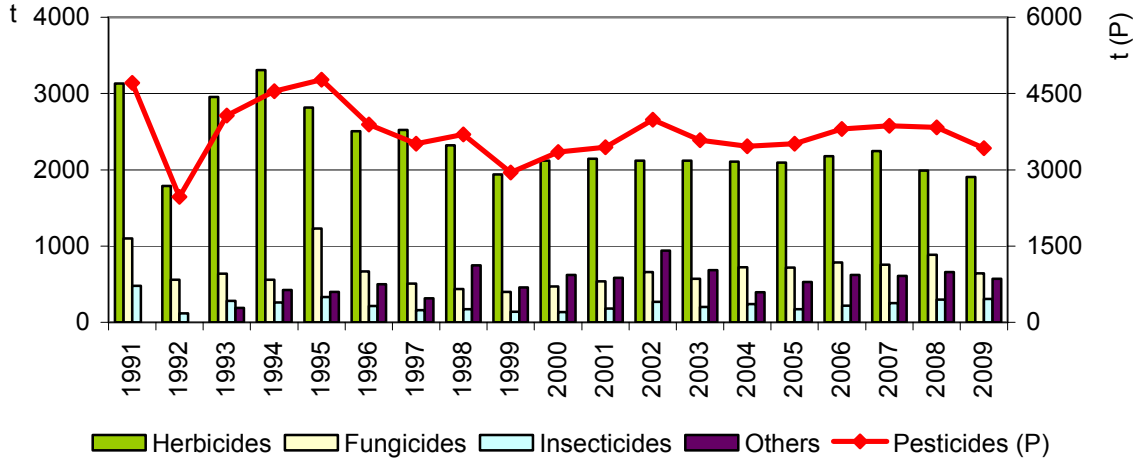


Source: CCTIA; Processed by SEA
Indicator Consumption of manure

Total consumption of pesticides was falling in the 1990s with some deviations. After 2000, the downward trend stopped and it had a relatively stable development. **In individual groups of pesticides we encountered, comparing the period from 1991 to 2009, the**

decline in consumption of herbicides by 39.2% (-1 226.9 t), fungicides by 41.8% (-460.7 t), insecticides by 35.9% (-171.1 t). Consumption of other pesticides rose.

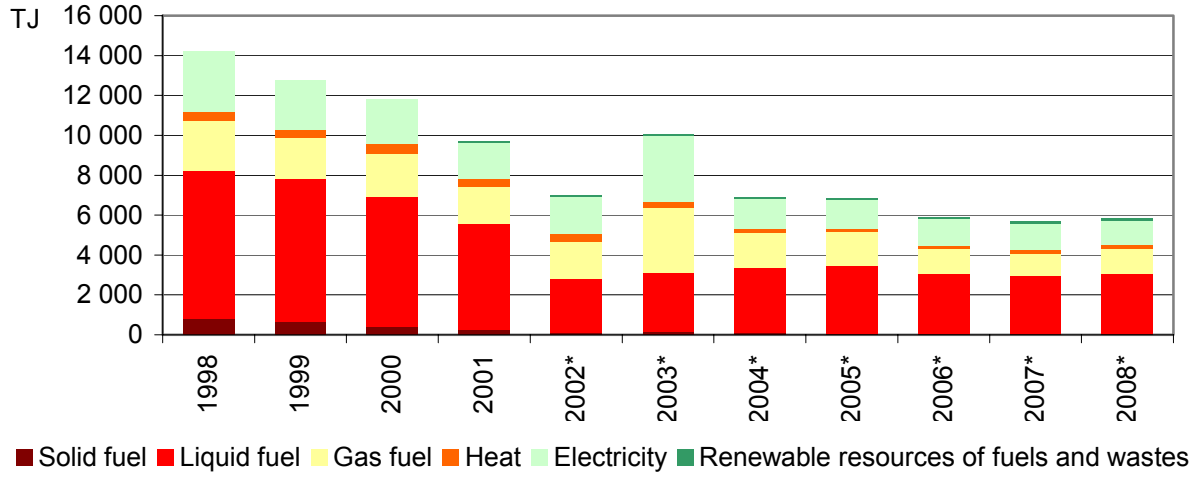
Total consumption of pesticides (t)



Source: CCTIA; Processed by SEA
Indicator *Consumption of pesticides*

During the 1990s, total final consumption of fuels and energy in agriculture (which includes the agricultural as well as forestry sectors) was characterised by **falling tendency** continuing with some deviations until now. As regards liquid fuels, biggest consumption was observed for diesel fuel; as regards gaseous fuels, the most consumed was the natural gas and propane-butane. As regards solid fuels, the most consumed was brown coal and lignite even though its consumption was falling down. Consumption of renewable resources and wastes was not significant until 2009.

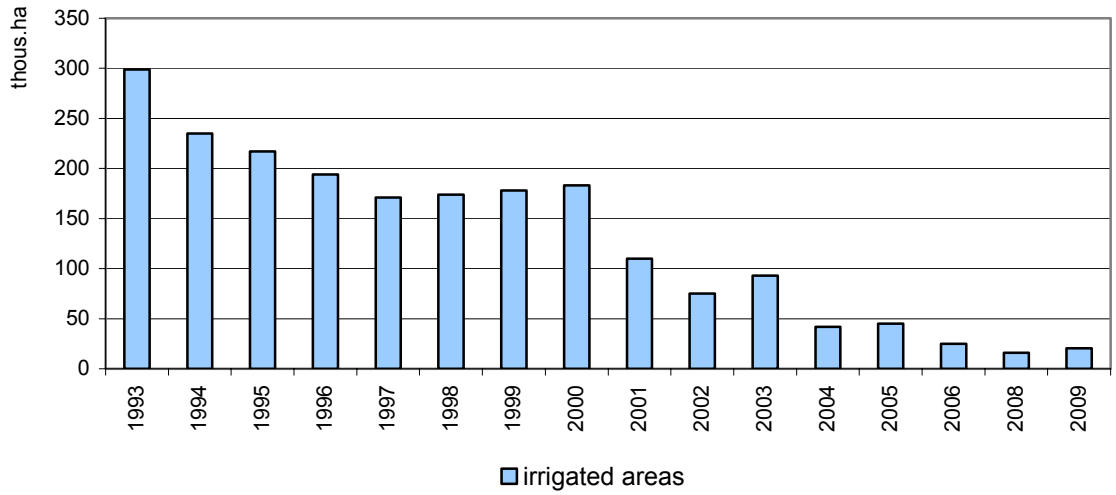
Final consumption of fuels and energy in agriculture



Source: SO SR; Processed by SEA
Note: * Change in the methodology of the SO SR
Indicator *Final consumption of fuels and energy in agriculture*

Although irrigation systems on the agricultural land of SR can be found on the area of 321 000 ha, after 1989 they were gradually abandoned and became outdated. **During 1993 – 2009 the area of watered territories in SR thus dropped** by 93.2% (-279 000 ha).

Irrigated area (thousand tonnes)



Source: SO SR; Processed by SEA
Indicator Irrigated areas

4.1.2. Specialisation

Specialisation of agriculture leads to higher economic activity; however, it may bring about negative consequences for the environment. **Homogenous, specialised farming systems lead to decrease in diversity** of agricultural biotopes, variety of crops and animal breeds. Nevertheless, **some specialised farming systems have a positive impact on ecosystems and countryside**. For example, specialised extensive breeding of livestock animals in mountain areas directly influences maintenance of semi-natural grass stands and high natural value territories.

According to the Farm Structure Surveys in 2007 (SO SR, 2007), combined vegetable and livestock production (38.9% of farms) slightly predominated in the group of registered natural persons in Slovakia; this was followed by specialisation in vegetable production (37.9%), livestock production (19.5%) and services in agriculture (3.7%). As regards the group of registered legal entities, the specialisation in livestock production (34.0% of farms) predominated in it slightly and this was followed by specialisation in vegetable production (33.5%), combined vegetable and livestock production (28.4%) and services in agriculture (4.1%).

Diversification is an opposite process of specialisation. Diversification of farms is demonstrated through extension in agriculturally and non-agriculturally oriented activities at farms, it relates to income of farmers from agricultural and non-agricultural activities as the main and subsidiary occupation. **Diversification** of farms does not have a direct impact on the environment. Despite of that, it **stabilizes income of farmers and prevents abandonment of land** that is, from the environmental point of view, undesirable. Support to utilization of renewable energy resources in agriculture should help diversification of farms in future. At present we do not have enough data to evaluate diversification of farms.

4.1.3. Marginalisation

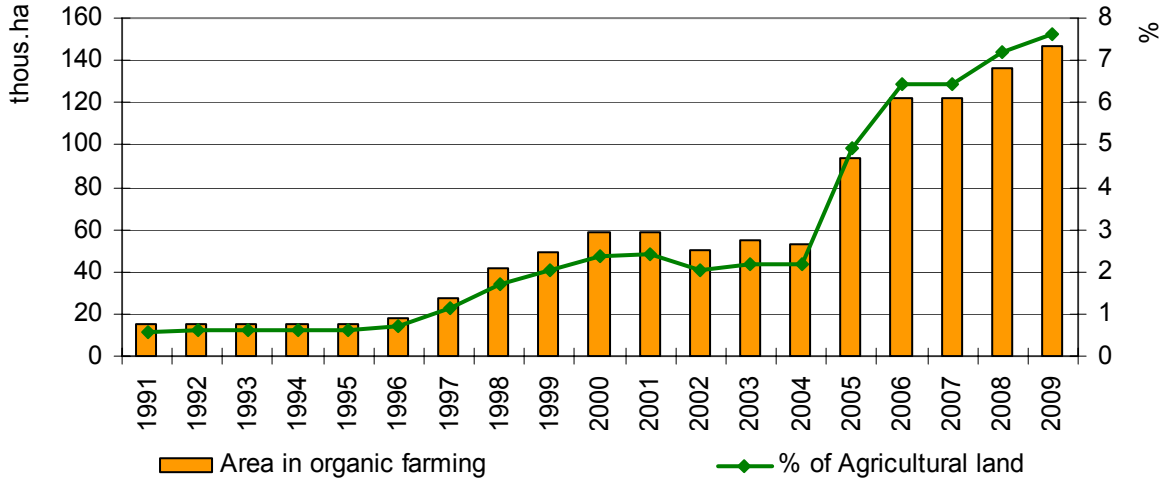
Marginalisation is caused by low profitability of agriculture, which is often conditioned by worsened natural and climactic conditions and other socio-economic trends. **A negative consequence of marginalization is also abandonment of land** which brings about decrease in biodiversity and preservation of cultural heritage. In Slovakia, the main factors of marginalization is lower rentability of agricultural production in mountain and submontane areas, rising number of farmers in senior age, especially at unregistered farms, with farming males aged 60 to 65 years being dominant.

In 2008, according to the comparison of land register data and the LPIS (Land Parcels Identification System) data, the unused area of agricultural land in Slovakia extended on 337 410 ha. This difference is especially noticeable in case of permanent grass stands with the unused area (in 2008) of not less than 38.1% of the total permanent grass stands according to Geodesy, Cartography and Land Register Authority of SR. The unused area of the arable land reached 1.7% of the total area of arable land according to the Geodesy, Cartography and Land Register Authority of SR.

4.1.4. Ecological Agriculture

From 1990 until now ecological agriculture in Slovakia has been gradually growing. **In 2009 458 entities were registered in the ecological agriculture system,** with 145 of them being natural persons and 313 legal entities. In 2009, ecological agriculture was applied **on the area of 146 762 ha of agricultural land, this being 7.6% of the Slovakia's agricultural land fund.**

Trend in the organic farming area (thous. ha, %)



Source: CCTIA; Processed by SEA
Indicator *Area under organic farming*

5. What is influence of Agriculture on the Environment in the Slovak Republic?

The processes of intensification and specialisation of agriculture significantly contribute to the acceleration of environmental issues. Although farmers realize the need of good quality of components of the environment for healthy and effective growing of crops and successful breeding of livestock, **agriculture exerts negative pressure on the components of the environment,** and participates in degradation of their quality.

The following chapters deal with the influence of agriculture on the environment, particularly on its components: water, soil, air and biota.

5.1. Water

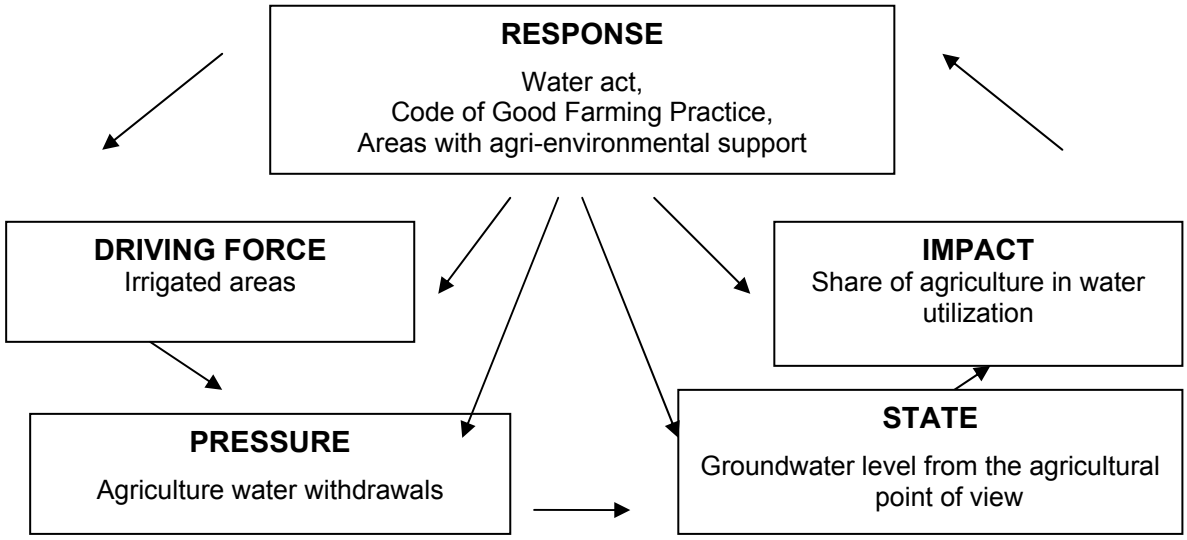
Water is one of the most important production factors of agriculture. Agriculture plays a significant role in relation to water reserves, especially in connection with the production processes using irrigation as an acceleration factor. Agriculture is a significant, yet not the only one, actual as well as potential cause of water resources pollution.

5.1.1. Utilization of Water in Agriculture

Globally as well as locally for Slovakia, rational management of water is, considering the sustentation of population and the prognosticated climactic changes, needful.

Water resource for the agricultural production (in addition to precipitation) is predominantly the **surface water** (ca 80%) and **groundwater** (ca 20%).

Use of Water in Agriculture according to the D-P-S-I-R model



List of individual agri-environmental indicators relevant to description of water utilization in agriculture

Position v D-P-S-I-R structure	Individual indicator
Driving force	Irrigated areas
Pressure	Agriculture water withdrawals
State	Groundwater level from the agricultural point of view
Impact	Share of agriculture in water utilization
Response	Water act
	Code of Good Farming Practice
	Areas with agri-environmental support

5.1.1.1. Driving Forces in Agriculture

The indicator of the driving force in relation to water utilization – Irrigated areas is contained in Chapter 4.

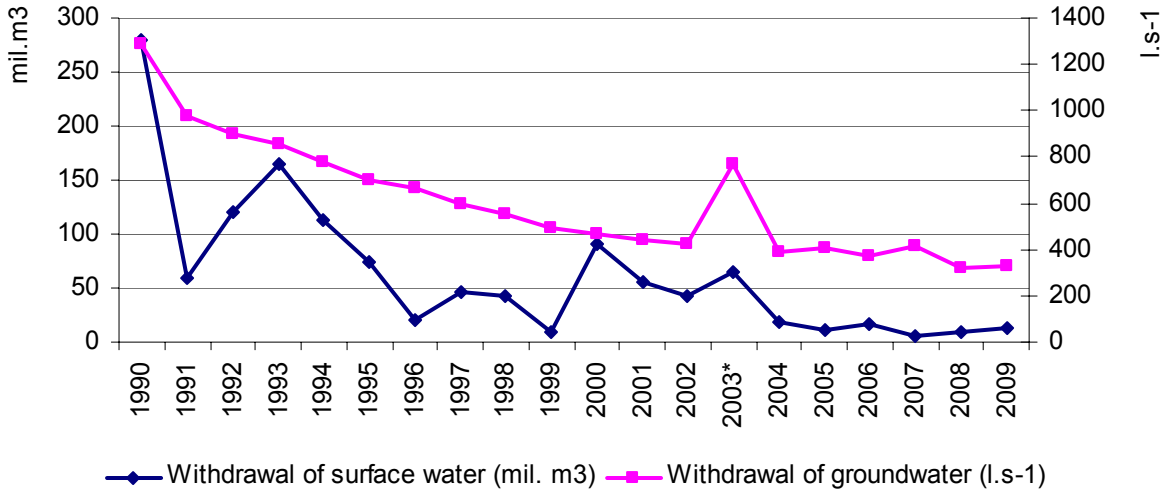
5.1.1.2. Pressure of Agriculture on Water Resources

Pressure of agriculture on water resources may be seen especially in water withdrawal for agricultural purposes. Concerned are predominantly the withdrawals of surface water forming a greater portion but also the withdrawals of groundwater.

5.1.1.2.1. Agriculture water withdrawals

The decrease in the area of irrigated areas and the slump in livestock production during the 1990s brought about also the decrease in utilization and thus even withdrawals of groundwater and surface water for the purposes of vegetable and livestock production. As of 1990, we experience obvious slump (with occasional deviations) in withdrawal of water for agriculture. **During 1990 – 2009, the take-off of surface water fell by 95%** (-262 mil. m^3), **groundwater by 75%** (-959 $l.s^{-1}$).

Agriculture water withdrawals (mil. m^3, $l.s^{-1}$)



Source: SHMI, *2003 change in the method for groundwater withdrawal; Processed by SEA
Indicator Agriculture water withdrawals

5.1.1.3. State

Condition of the components of the environment in relation to water utilization in agriculture is characterised by the indicator – Groundwater level.

5.1.1.3.1. Groundwater level from the agricultural point of view

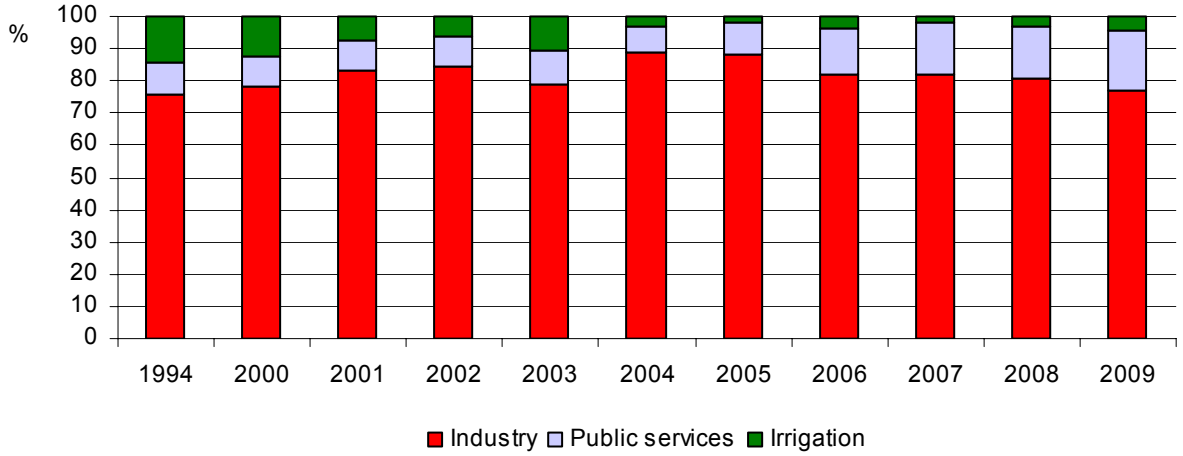
Despite favourable hydrological and hydrogeological conditions for generation, circulation and accumulation of groundwater in SR its uneven location is a disadvantage. The most significant quantities of groundwater are in the Bratislava and Trnava region (46%) and the smallest quantity of groundwater is in the Prešov and Nitra region. **Considering the documented usable quantities of groundwater in SR, actual as well as expected need for water is safeguarded to a great extent.** Nevertheless, in some locations the need for water rises and the deficit of water resources grows, this being enhanced by the fact that natural reserves and resources grow smaller not only because of negative global climactic changes but also due to degradation in quality and inappropriate and excessive use of water resources. *(Indicator Groundwater level from the agricultural point of view).*

5.1.1.4. Impact

5.1.1.4.1. Agriculture's Share in Water Utilization

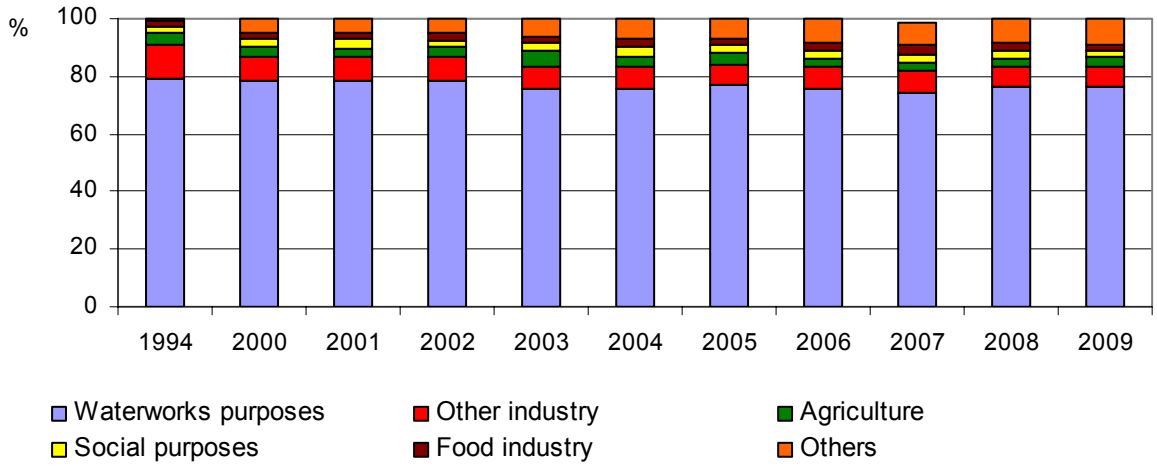
During **1994 – 2009 the share of agriculture in surface water utilization fell from 14 to 4.4%.** The biggest consumption of water is noticed in the sector of industry. **The share of agriculture in groundwater utilization in 2009 totalled 3%**, this representing a decrease by 1 % compared to 1994. Most groundwater is used for waterworks purposes.

Sectoral share in surface water utilization (%)



Source: SHMI; Processed by SEA

Sectoral share in groundwater utilization (%)



Source: SHMI; Processed by SEA
Indicator Share of agriculture in water utilization

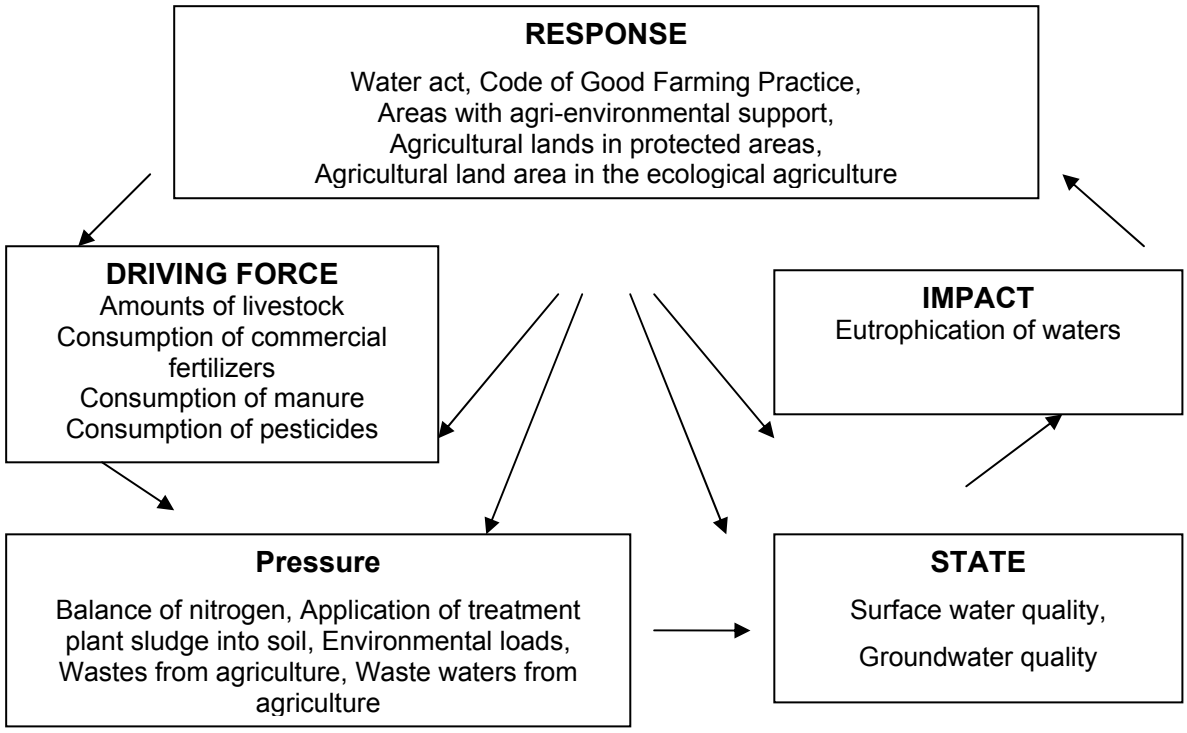
5.1.1.5. Response

A response to the current status, pressure and consequences of water resources utilization is expressed through the adopted legislation and other non-legislation measures. **The Act No. 364/2004 Coll. on water** regulates the rights and obligations of natural persons and legal entities to water in respect of its protection. **The Code** of Good Farming Practice with focus on improvement in use of the irrigation systems **was not elaborated** separately for the Slovak conditions. The **Rural Development Programme 2007 – 2013** does not directly include particular measures connected with water utilization.

5.1.2. Quality of Water and Agriculture

Agricultural activities are carried out on a half of Slovakia, owing to which they are considered the larges possible blanket sources of hazard to water quality. High **concentration of agricultural activities may be the point as well as blanket source of water resources pollution.**

Quality of water in relation to agriculture according to the D-P-S-I-R model



List of aggregated agri-environmental indicators relevant to description of water quality in relation to agriculture

Position v D-P-S-I-R structure	Individual indicator
Driving force	Amounts of livestock
	Consumption of commercial fertilizers
	Consumption of manure
	Consumption of pesticides
Pressure	Balance of nitrogen
	Application of treatment plant sludge into soil
	Environmental loads
	Wastes from agriculture
	Waste waters from agriculture
State	Surface water quality from the agricultural point of view
	Groundwater quality from the agricultural point of view
Impact	Eutrophication of waters from the viewpoint of soil and agriculture
Response	Water act
	Code of Good Farming Practice
	Areas with agri-environmental support
	Agricultural lands in protected areas
	Agricultural land area in the ecological agriculture

5.1.2.1. Driving forces in agriculture

Indicators of driving forces in relation to water quality - Amounts of livestock, Consumption of commercial fertilizers, Consumption of manure, Consumption of pesticides are covered in the Chapter 4.

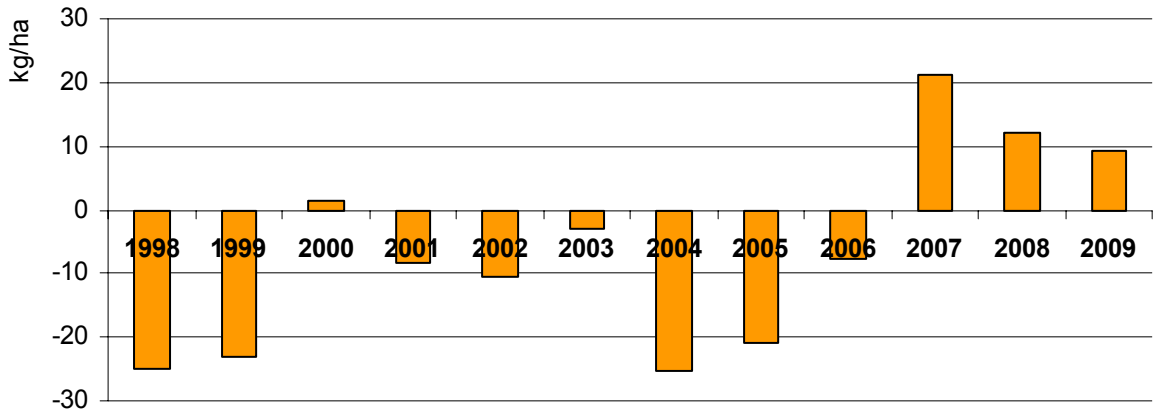
5.1.2.2. Pressure of Agriculture on Water Quality

Indicators of pressure comprise risks created by agricultural activities in respect of water quality. Nitrogen balance, Application of treatment plant sludge into soil, Environmental loads, Wastes and Waste waters from agriculture belong among these indicators.

5.1.2.2.1. Balance of nitrogen

In the first half of the 1990s, nitrogen regimes in the soils of Slovakia were balanced. Average annual nitrogen turnover in 1 ha of our agricultural lands was at the level of 90 – 140 kg $N.ha^{-1}$ (nitrogen inputs) in relation to 102 – 130 kg $N.ha^{-1}$ (nitrogen outputs). At that time, **around 10% deficit in nitrogen balance was observed through lower level of nitrogen turnover in soils**, which may be manifested by worse yields or gradual exhaustion of nitrogen reserves in soil (Bielek, 1998). Later on, as a consequence of decrease in application of organic and commercial fertilizers to soil and simultaneous intensive growing of crops, the **content of nitrogen in soil became deficient.** From 2007 to 2009, positive nitrogen balance was observed in soils.

Total nitrogen balance in agricultural lands (kg/ha)

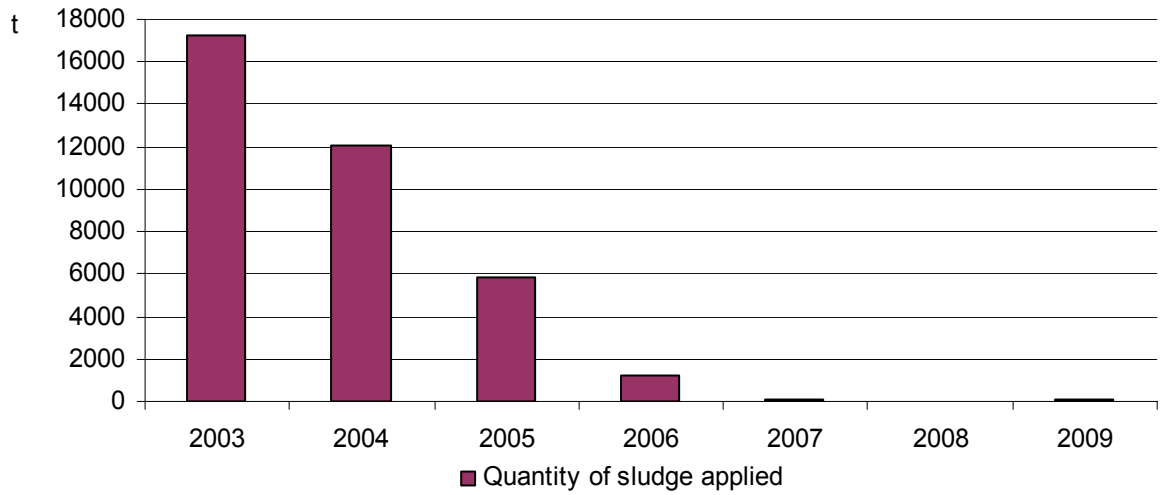


Source: CCTIA; Processed by SEA
Indicator *Balance of nitrogen*

5.1.2.2.2. Application of treatment plant sludge into soil

As a consequence of recession in industry and the measures taken, the contamination of cleaning plant sludge has significantly dropped during the last ten years. The share of sludge suitable for application into soil in Slovakia reaches more than 95 % of the total sludge production. However, **its utilization in agriculture is accompanied by a downward tendency.** During 2007 – 2009, almost no sludge was applied into soil in compliance with the Act No. 188/2003 on application of cleaning plant sludge and bottom sediments into soil.

Quantity of the cleaning plant sludge applied directly into soils of Slovakia (t)

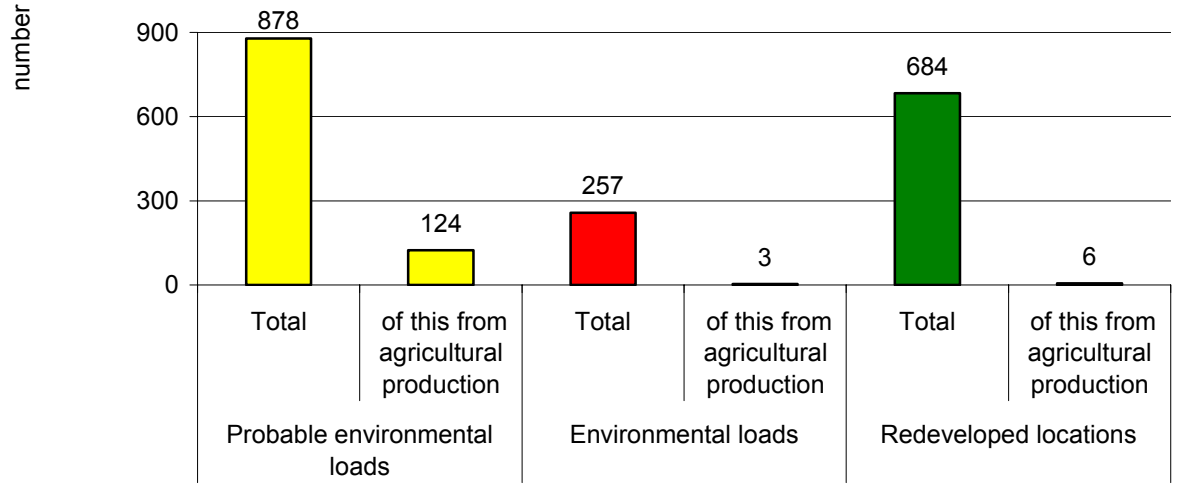


Source: WRI, SSCRI; Processed by SEA
Indicator *Application of treatment plant sludge into soil*

5.1.2.2.3. Environmental loads

In 2008, **878 probable environmental loads (124** of these **from agricultural activities), 257 environmental loads (3** of these **from agricultural activities)** and **684 reclaimed localities (6** of these **from agricultural activities)** were entered in the Slovak Environmental Loads Register. Probable environmental loads from agricultural activities are the second most widespread (with the number of 124) after the waste dumps (with the number of 491) (Palúchová et al., 2008).

Environmental loads in 2008



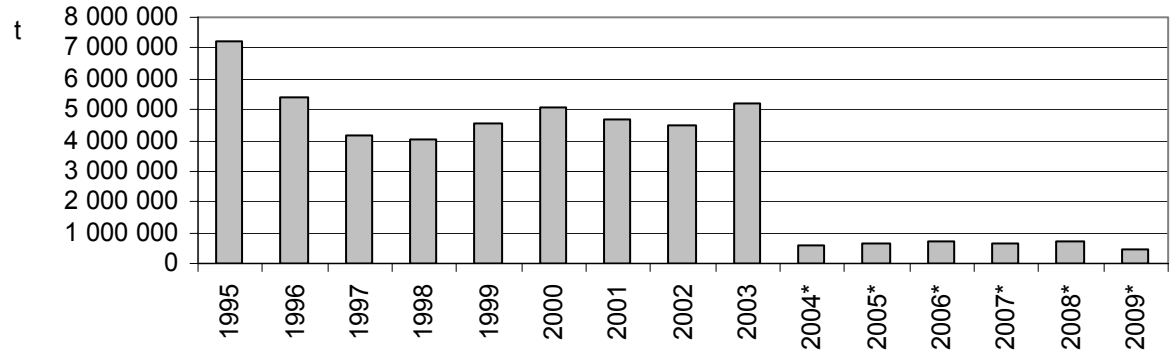
Source: SEA
Indicator *Environmental loads*

5.1.2.2.4. Wastes from agriculture

Total, of this from agricultural production, Probable environmental loads, Redeveloped locations

Total production of other and hazardous wastes from agriculture, whether assessed for the agriculture as an independent sector or within soil management, has been **fluctuating** since 1995. In 2009, 476 391 t of other and hazardous wastes were produced from agriculture.

Wastes from Agricultural Soil Management (Agriculture together with Forestry Management)(t)

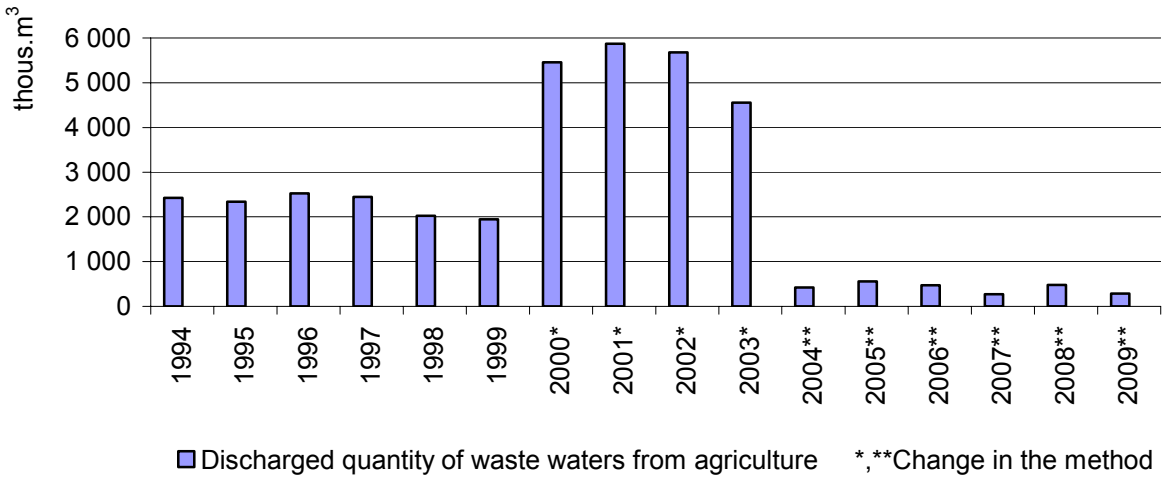


Source: SEA
Indicator *Wastes from agriculture*

5.1.2.2.5. Waste waters from agriculture

Considering the changes in the methodology of evaluation of the quantity of waste waters discharged from agriculture, a long-term trend cannot be assessed in an objective manner. After 2004, the trend has been fluctuating. In 2009, 286 thousand m^3 of waste waters related to the agricultural activities were discharged.

Total Volume of Discharged Waters from Agricultural Activities



Source: SHMI; Processed by SEA
Indicator *Wastewaters from agriculture*

5.1.2.3. State

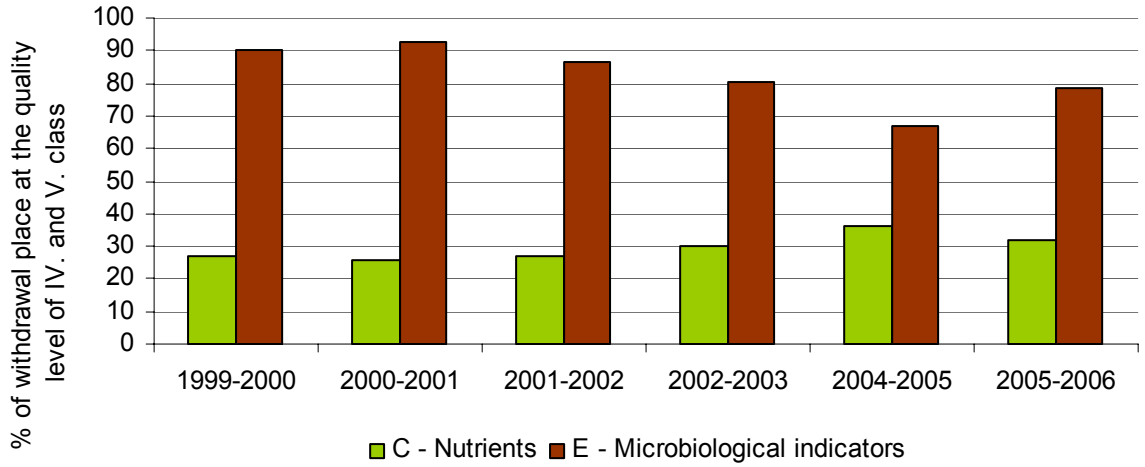
The condition of water as a component of the environment is characterised by the indicator Surface water quality, Groundwater quality.

5.1.2.3.1. Surface water quality from the agricultural point of view

From the point of view of possible pollution of waters from agricultural sources, especially such indicators are important as nutrients (NH_4, $N\text{-}NO_3$, $N\text{-}NO_2$, $N_{org.}$, N_{total}, P_{total}) and microbiological indicators (coliform bacteria, thermotolerant coliform bacteria, fecal streptococci, psychrofil bacteria).

At present, new evaluation system of surface water condition is being implemented in Slovakia as well as in other EU countries according to the requirements of the Framework Directive on water 2000/60/EC. Therefore it is not possible to follow in the evaluation of trends up to 2007 that was based on STN 75 7221 "Water Quality. Surface Water Quality Classification" that was annulled on 1 March 2007. According to the evaluation, after 2000 the percentage of withdrawal places at the IV. and V. level of quality class (I. class – very pure water up to V. class very strongly polluted water, with the water quality levels I., II., and III. being considered to be favourable water quality) gradually rose, this meaning that water quality as regards this indicator got gradually worse and worse. **In case of microbiological indicators, the development was fluctuating** but still maintaining leading position among all parameters monitored.

Nutrients and microbiological indicators in surface waters (% of withdrawal places)



Source: SHMI; Processed by SEA
Indicator Surface water quality from the agricultural point of view

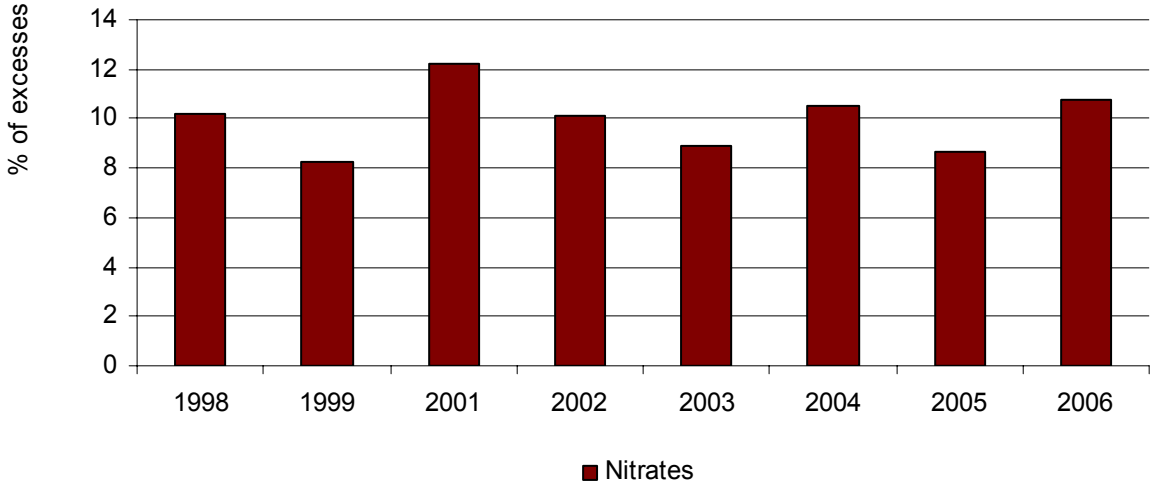
From 2008, indicators have been monitored according to the Slovak Government Regulation No. 269/2010 Coll. Within this evaluation, **most excesses** of quality requirements for surface water were **in the indicator of nitrite nitrogen.** As regards the microbiological indicators, most excesses were observed in the indicator of **termotolerant coliform bacteria and intestinal enterococci** (Ministry of the Environment of SR, Slovak Environmental Agency, 2009, 2010). As regards the said indicators, we may suppose that their source may be, in addition to municipal uncleaned waters, also the agricultural production, namely the incorrect agritechnical procedures in vegetable production and incorrect technique of livestock breeding.

5.1.2.3.2. Groundwater quality from the agricultural point of view

Just like in case of surface waters evaluation of quality is changed also in case of groundwater in compliance with the Framework Water Directive 2000/60/EC. Therefore it is not possible to follow in evaluation of trends until 2006. Until 2006, monitoring objects were divided to 26 significant monitoring areas. Urbanized and agricultural nature of land utilization

projected onto increased contents of oxidised and reduced forms of nitrogen in waters. The lowest extent of pollution of groundwater was observed in mountain and submontane areas. The evaluation is only approximate, since it evaluates the groundwater quality on the whole without direct delimitation of agriculture's share. **The percentage of excesses of allowable nitrates concentration** in groundwater in monitored areas according to the Slovak Ministry of Health Regulation No. 151/2004 Coll. on requirements for drinking water and control of drinking water quality was **during 1998 – 2006 fluctuating and ranged between 8 and 11%.**

Exceeding the allowable nitrate concentration in groundwater according to the Slovak Ministry of Health Regulation No. 151/2004 Coll. on requirements for drinking water and control of drinking water quality (%)



Source: SHMI; Processed by SEA
Indicator *Groundwater quality from the agricultural point of view*

From 2007, the division of groundwater areas is made based on demarcation of formations of groundwater and monitoring is divided to basic and operating. The results of analyses are evaluated according to the Slovak Government Regulation No. 354/2006 Coll. stipulating the requirements for water meant for consumption by humans and control of water quality meant for consumption by humans. **In 2008, the character of agricultural utilization of the country projected onto increased contents of oxidised and reduced nitrogen forms** in groundwaters, of which ammonium iones NH_4^+ (82-times) and NO_3^- (66-times) contributed the most to exceeding the limits (Ministry of the Environment SR, Slovak Environmental Agency, 2009).

5.1.2.4. Impact

Unfavourable water quality results in negative environmental problem, namely to eutrophication of waters.

5.1.2.4.1. Eutrophication of waters from the viewpoint of soil and agriculture

Among the indicators that characterise water eutrophication belong chlorophyll "a", $N\text{-}NH_4$, $N\text{-}NO_3$, $N\text{-}NO_2$, $N_{org.}$, N_{total}, P_{total}. These substances come from agricultural activity (excessive application of NPK fertilizers into soil, discharge of waste substances from livestock breeding), discharge of sink and some industrial waste waters.

General **requirements** for quality of surface water are set forth **in the Regulation of the Government 269/2010 Annex No. 1** using the recommended values for total nitrogen (9.0 mg/l), total phosphor (0.4 mg/l) and chlorophyll a (50.0 µg/l).

After 2000, according to the then valid STN, the percentage of withdrawal places at the quality level of IV. and V. class (I. class – very pure water up to V. class – strongly polluted water, with the water quality levels I., II., and III. being considered to be favourable water quality) **for the nutrient indicator** has been gradually growing, i.e. water quality under this indicator got worse and worse, with the water eutrophication getting higher therefore.

During 2004 – 2007, **content of nitrates in groundwaters** was evaluated in 560 monitored objects. **In 49 objects the limit value (50 mg/l) was overrun**, this being 8.75% of the total number of monitoring objects.

Contamination of Groundwaters by Nitrates in Vulnerable Areas

Depth of groundwater level (m)	Total number of monitoring objects	Number of objects with the exceeded concentration of nitrates	%
0–5	54	0	0
5–15	206	30	14.5
5–30	132	13	9.8
> 30	168	6	3.6

Source: SHMI, WRI

Indicator Eutrophication of waters from the viewpoint of soil and agriculture

In case of surface water in sensitive and vulnerable areas, **nitrates** were monitored in 224 withdrawal places and chlorophyll "a" in 49 locations within the entire Slovakia. During 2004 – 2007, **annual concentration of nitrates in a majority of samples (74%) ranged between 2 and 9.99 mg/l** and thus fell under 2nd class: 2-9.99 mg/l NO_3, 3rd class: 10-24.99 mg/l NO_3, 4th class: 25-39.99 mg/l NO_3, 5th class: 40-50 mg/l NO_3, 6th class: above 50 mg/l NO_3). The places of occurrence of maximum concentrations of nitrates in surface waters revealed that in vulnerable areas wherein intensive agricultural production is concentrated a majority of withdrawal places was classified into third and fourth quality class. There was not a single withdrawal place with the first quality class. In addition to pollution from agricultural production, especially municipal waste waters contributed to water pollution.

According to chlorophyll "a", a majority of the samples observed (46.9%) was classified as mesotrophic, 18.4% of samples were classified as eutrophic. Not a single withdrawal place was in hypertrophic state.

5.1.2.5. Response

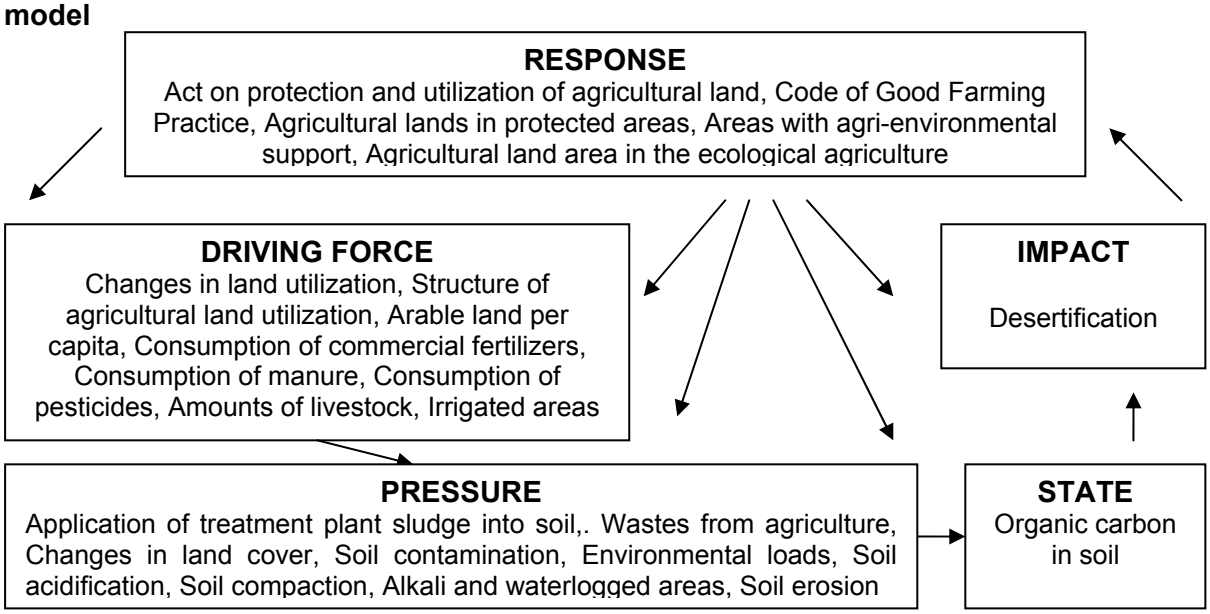
Important legislation tool for water protection in EU is the **Framework Water Directive (2000/60/EC) and the Directive concerning protection of water against pollution by nitrates from agricultural sources (91/676 EEC)**. At the national level, the rights and obligations of natural persons and legal entities in respect of waters are regulated by the **Act No. 364/2004 coll. on waters.** From the viewpoint of water protection, also the **act No. 199/2003 coll. on application of cleaning plant sludge and bottom sediments into soil** is important. Elaborated were the **codes of Good Farming Practice – protection of waters against pollution by nitrates from agricultural sources, principles of correct use of fertilizers** and **soil protection**.

In the **Rural Development Programme of SR 2007 – 2013**, the axis 2 Improvement of the Environment and Countryside includes the priority 2 Maintaining and improving the quality of ground and surface waters. Water quality is indirectly influenced also by another measure – Agri-environmental payments, that contains 10 sub-measures, including the Ecological agriculture.

5.2. Soil

Soil, a non-renewable natural resource, is an indispensable precondition of agriculture functioning. Among crucial functions of soil belong the biomass production, filtration, neutralisation, transport and metabolism of substances.

Utilization of land and its quality in relation to agriculture according to the DPSIR model



List of individual agri-environmental indicators relevant to the description of utilization of land and its quality in relation to agriculture

Position v D-P-S-I-R structure	Individual indicator
Driving force	Changes in land utilization
	Structure of agricultural land utilization
	Arable land per capita
	Amounts of livestock
	Vegetable and livestock production
	Consumption of commercial fertilizers
	Consumption of manure
	Consumption of pesticides
	Irrigated areas
Pressure	Application of treatment plant sludge into soil
	Wastes from agriculture
	Changes in land cover
	Soil contamination
	Environmental loads
	Soil acidification
	Soil compaction
	Alkali and waterlogged areas
	Soil erosion
State	Organic carbon in soil
Impact	Desertification
Response	Act on protection and utilization of agricultural land
	Code of Good Farming Practice
	Areas with agri-environmental support
	Agricultural lands in protected areas
	Agricultural land area in the ecological agriculture

5.2.1. Driving forces in agriculture

Indicators of the driving force in relation to utilization of land and to its quality - Changes in land utilization, Structure of agricultural land utilization, Arable land per capita, Amounts of livestock, Consumption of commercial fertilizers, Consumption of manure, Consumption of pesticides, Irrigated areas are covered in the chapter No. 4.

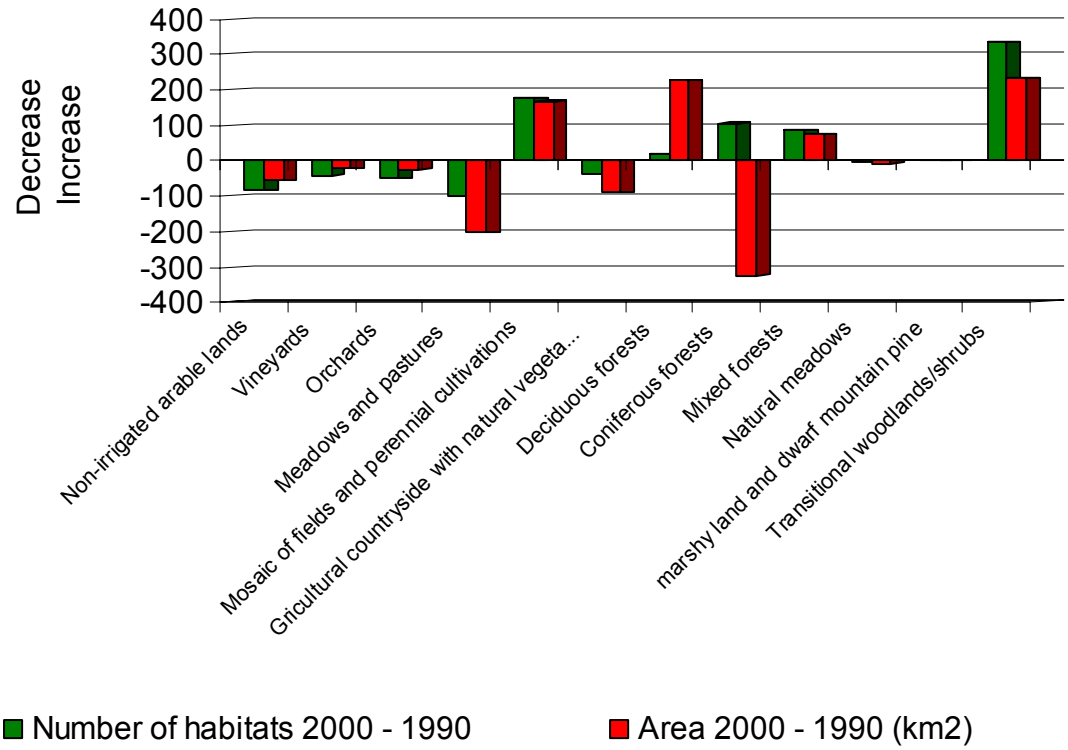
5.2.2. Agricultural Pressure on Land

The indicators of pressure are represented by the risks created by agricultural activities and reflected in the soil quality. Among these indicators belongs the Application of cleaning plant sludge into soil (in conflict with the law on the application thereof), Wastes from agricultural soil management (Evaluated in the chapter No. 4), Changes in land cover, Soil contamination, Soil acidification, Soil compaction, Alkali and waterlogged areas, Soil erosion.

5.2.2.1. Land cover changes

The results of the project CORINE1990, I&CLC2000 and GMES-Land2006 comparing the years of 1990, 2000 and 2006 revealed that **the area of the mosaic of fields, meadows and perennial cultivations got larger** in the agricultural countryside. Increase in the heterogeneity of the agricultural countryside is a positive phenomenon in relation to protection of agricultural land against soil drifting and water erosion as well as in relation to biodiversity protection. The observed **decline in meadows and pastures** (by 201.53 km^2 in 2000 compared to 1990) was connected particularly with their abandonment and the subsequent succession which resulted in the increase of areas with transitional woodlands/shrub. This is a negative phenomenon that contributes to biodiversity decreasing. Another observed negative phenomenon was the decrease in agricultural land, including the arable one, at the expense of transport infrastructure and industrial parks.

Land cover changes in 1990 – 2000



Source: SEA
Indicator Land cover changes

5.2.2.2. Soil contamination

In the I. cycle of the 1993 Partial Monitoring System – Soil (PMS-S), pursuant to the then valid categorization, 69.5% of agricultural lands of SR was not contaminated, 28.7% of agricultural lands belonged among risk ones, 1.4% of agricultural lands belonged in the category of contaminated lands with the B limit exceeded and 0.4% with the C limit exceeded (Linkeš et al., 1997). The results of the II. monitoring cycle of PMS-S with samples taken in 1997 revealed that, compared to the I. cycle, **the hygienic condition of agricultural soils got slightly better.** Observed was provable vertical migration of risk elements in the soil profile (Kobza et al., 2002). The measured concentration values of the monitored risk elements in the III. cycle of PMS-S were, compared to 1993, predominantly statistically insignificant, save for chrome particularly in regosol soils. Increased content was observed in case of cadmium (fluvisol, rendzinas) and lead (fluvisol).

Average concentrations of risk elements in agricultural lands of Slovakia in the III. cycle of PMS-S (mg.kg^{-1})

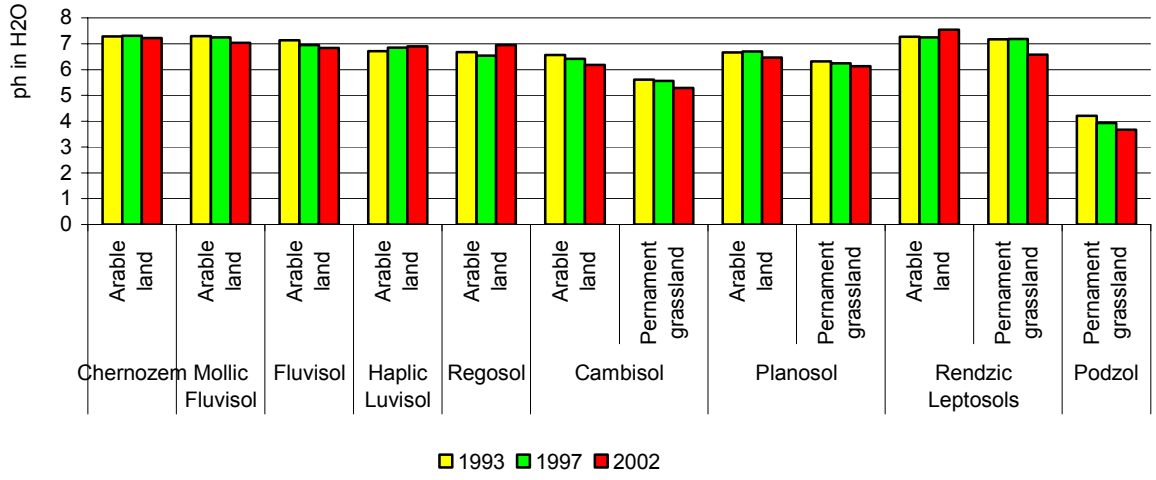
Soils	Risk elements in the tincture of 2 mol.dm^{-3} HNO_3						
	As*	Cd	Cr	Cu	Ni	Pb	Zn
Chernozems	1.05	0.15	2.41	10.99	7.38	11.82	9.33
Haplic Luvisols	1.10	0.13	2.35	9.58	4.82	11.53	9.19
Luvisols and pseudogleys	1.77	0.17	2.89	6.26	2.65	16.32	10.29
Fluvisols	3.11	**0.45**	5.03	17.47	6.93	**41.96**	33.98
Mollic Fluvisols	1.51	0.22	3.60	13.13	5.93	15.81	15.60
Cambisols	2.03	0.29	3.40	11.42	3.06	18.98	12.62
Rendzic Leptosols	0.72	**0.40**	3.48	9.48	6.45	22.93	22.43
Regosols	0.65	0.18	3.32	8.39	1.86	5.32	9.35

Source: Kobza et al., 2010, * in the tincture of 2M HCl
Indicator Soil contamination

5.2.2.3. Soil acidification

The results of the II. cycle of PMS-S showed that during 1993 – 1997 the situation as regards soil acidification got stable and even slightly better. However, the results of the III. monitoring cycle with the samples taken in 2002 revealed slight acidification trend mainly on acid soils and substrates.(Kobza et al., 2010).

Development of Slovak soil acidification according to the soil reaction in selected soil types (pH in H_2O)



Source: SSCRI; Processed by SEA
Indicator Soil acidification

5.2.2.4. Soil compaction

Compaction of Slovak agricultural lands involves a relatively large area. In fact, around 192 thousand ha of agricultural lands is compacted. The compaction processes are potentially in progress on further 457 thousand ha of agricultural lands.

The results of the Partial Monitoring System – Soil showed for the period of 1993 – 2002 **certain moderation in compaction of arable land** of heavy as well as medium soils. In case of **subsoil larger portion of compacted locations was observed.** Within soil types, heavy soils as to the grain size showed higher degree of compaction in the entire soil profile. *(Indicator Soil compaction)*

5.2.2.5. Alkali and waterlogged areas

In SR, there is up to **5 000 ha of alkali (salsodic) soils, this being 0.2%** of the total agricultural land area in Slovakia. They can be found in the southern parts of Danubian and Eastern Slovak Lowlands. The expanding trend of these soils has not been observed for now. Within the alcali soils, the processes of salinization as well as sodification take place at the same time, with the sodification process being dominant. (Kobza et al., 2010)

Waterlogged soils occupy around **187 000 ha**, this being approximately **7.6%** of the total agricultural land area in Slovakia. *(Indicator Alkali and waterlogged areas)*

5.2.2.6. Soil erosion

Signs of water erosion dominate Slovakia; 39.7% (959 9191 ha) of agricultural land is endangered by it. Areas least endangered by water erosion are located in dryer regions in Danubian and Eastern Slovak Lowlands. Agricultural lands of these regions located on gentle slopes are endangered by water erosion in medium extent. Strongly endangered are the areas of agricultural lands situated on slopes in cooler and damper regions, particularly in the Banská Bystrica, Trenčín and Košice regions. Soils extremely endangered by water erosion are mainly the soils on steep slopes, in cool and damp climactic regions of the Prešov, Banská Bystrica and Žilina regions.

Soil drifting is not a serious problem in Slovakia compared to water erosion; 6.5% (132 986 ha) of agricultural lands are endangered by it. The areas with light soils situated in Borská, Danubian and Eastern Slovak Lowlands in the Bratislava, Trnava, Nitra and Košice regions are endangered by soil drifting. (SSCRI, 2000). (*Indicator Soil erosion*)

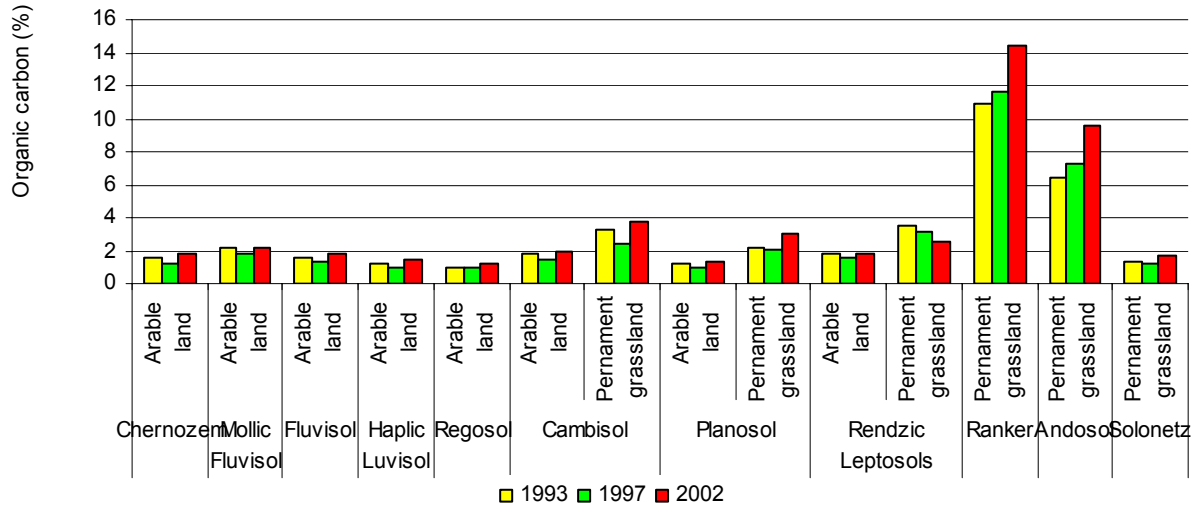
5.2.3. State

Although there are many indicators that can express soil quality, the European Commission chose the content of organic carbon in soil as a typical indicator for the sector of agriculture.

5.2.3.1. Organic carbon in soil

The results of the Partial Monitoring System – Soil (ČMS-P) revealed that the average values of organic carbon in arable lands range between 1 and 2%. The highest content of organic carbon was observed in permanent grass stands (TTP), podzols and rankers in higher mountain locations. Rendzinas, pseudogleys and cambisols on TTP belong among strongly humic soils. Comparison of the average values of organic carbon content in the topsoil horizon in selected arable lands of Slovakia **of 1997 and 1993 revealed its slight decrease.** In permanent grass stands, just like in the 35-45 cm depth, no significant changes were measured. The results of average values of **the organic carbon content in the topsoil horizon taken in 2002 revealed repeated increase** in the organic carbon content in the evaluated soils compared to 1997. Excess values approached the initial values of the organic carbon content measured in 1993.

Development of the organic carbon content in Slovak lands in selected soil types (%)



Source: SSCRI; Processed by SEA
Indicator *Organic carbon in soil*

5.2.4. Impact

Agriculture contributes to the production of greenhouse gases and thus to intensification of the greenhouse effect, which is indirectly reflected in the land desertification.

5.2.4.1. Desertification

At present, desertification is not a serious problem in Slovakia. As a result of climactic changes, however, the average land temperature should rise by 1°C and the average land dampness will fall down during the vegetative period by approximately 10%. Due to the abovementioned changes higher intensity of mineralisation of the soil organic matter and its degradation is presupposed, particularly in the area up to 400 m above sea level where evaporation water regime with negative water balance should predominate. Expected is moderate up to medium growth of salinization and alkalinization of soils (Sobocká et al., 2005).

5.2.5. Response

The Act No. 220/2004 Coll. on protection and utilization of agricultural land stipulates the protection of properties and functions of agricultural land and ensurance of its sustainable use. From the viewpoint of land protection, the **Act No. 188/2003 Coll. on application of cleaning plant sludge and bottom sediments into soil** is important as well.

Restricted farming of land is guaranteed in the protected areas declared **in compliance with the Act No. 543/2002 on protection of nature and countryside, as well as in the NATURA 2000 areas**.

The Ministry of Agriculture issued the **Code of Good Farming Practice – protection of soil, principles of correct use of fertilizers** and **protection of waters against pollution by nitrates from agricultural sources**.

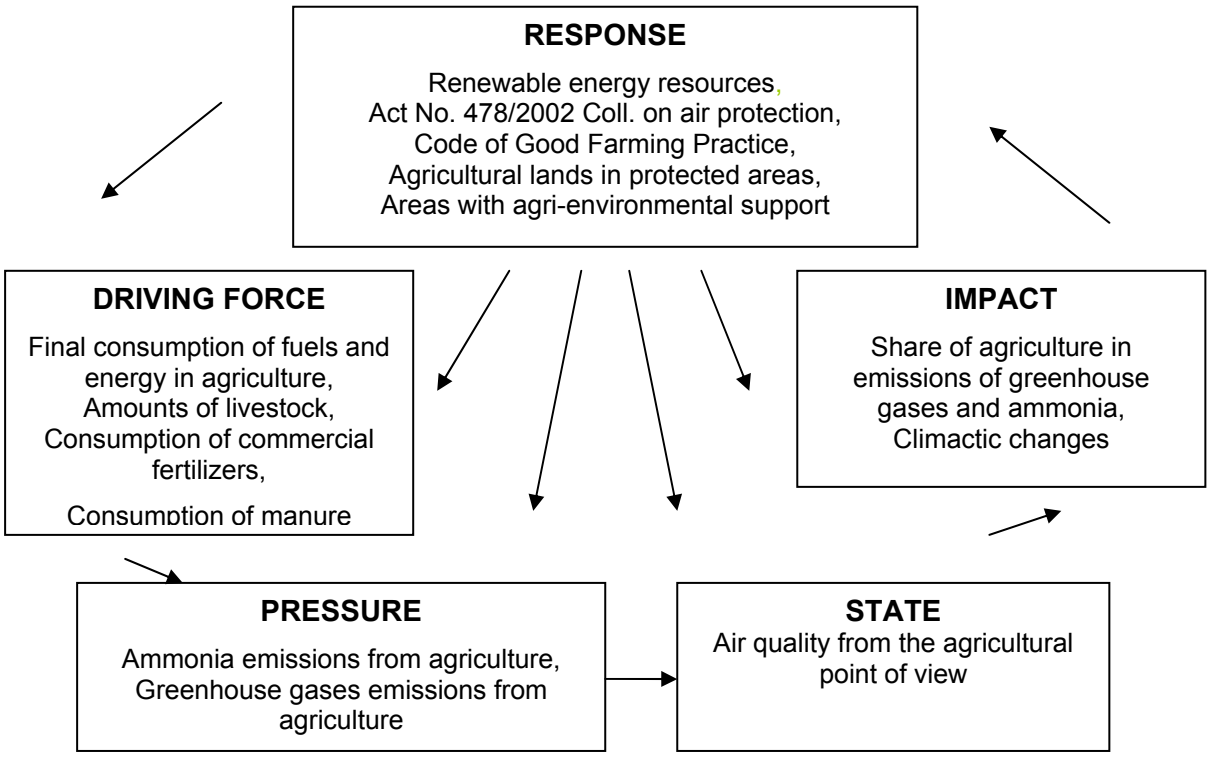
In the **Rural Development Programme of the Slovak Republic 2007 – 2013,** the axis 2 Improvement of the Environment and Countryside includes the priority 3. Keeping and improving the quality of agricultural and forest land. The quality of soils is indirectly influenced also by other measures from the group of Agri-environmental payments, particularly the Ecological agriculture and Payments within the NATURA 2000 system on agricultural land.

5.3. Air

Agriculture contributes to pollution of air and thus also to the actual climactic change. It is the biggest producer of ammonia (more than 96%). It adds to the production of greenhouse gases, especially methane, nitrogen monoxide, and carbon dioxide, halogenated hydrocarbon in smaller extent.

On the other side, agriculture takes part in capturing CO_2 and its subsequent deposition in form of organic carbon in soil.

Air, its quality and climactic change in relation to agriculture according to the DPSIR model



List of individual agri-environmental indicators relevant to the description of air in relation to agriculture

Position v D-P-S-I-R structure	Individual indicator
Driving force	Final consumption of fuels and energy in agriculture
	Amounts of livestock
	Consumption of commercial fertilizers
	Consumption of manure
Pressure	Ammonia emissions from agriculture
	Greenhouse gases emissions from agriculture
State	Air quality from the agricultural point of view
Impact	Share of agriculture in emissions of greenhouse gases and ammonia
	Climactic changes from the viewpoint of soil and agriculture
Response	Renewable energy resources from agriculture
	Code of Good Farming Practice
	Agricultural lands in protected areas
	Areas with agri-environmental support

5.3.1. Driving forces in agriculture

Indicators of the driving force in relation to air quality and climactic change - Final consumption of fuels and energy in agriculture, Amounts of livestock, Consumption of commercial fertilizers, Consumption of manure are covered in the Chapter 4.

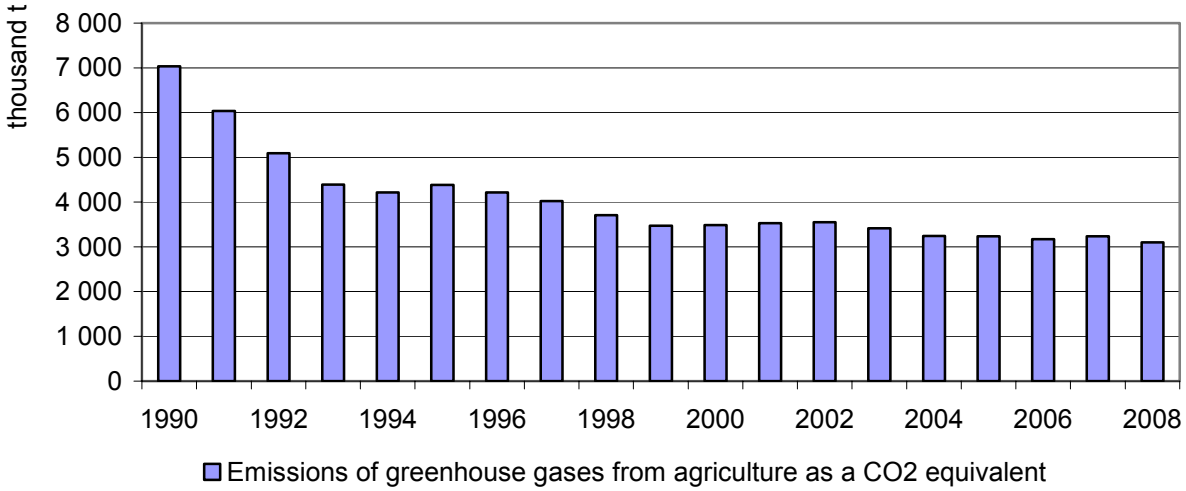
5.3.2. Agricultural pressure on air quality and climactic change

Agriculture partakes in the emissions of greenhouse gases, methane (CH_4), nitrogen monoxide (N_2O), carbon dioxide (CO_2) and is a significant producer of ammonia (NH_3).

5.3.2.1. Greenhouse gases emissions from agriculture

From 1990, the emissions of greenhouse gases from agriculture dropped, this being a consequence mainly of the decrease in the numbers of livestock and reduced use of commercial fertilizers. During **1990 – 2008, the emissions of greenhouse gases** as expressed through the CO_2 equivalent **dropped by 56%.** Since 1990, the emissions of methane dropped by 63.34 Gg and nitrogen monoxide fell by 8.42 Gg.

Emissions of greenhouse gases from agriculture as a CO_2 equivalent (thousand tonnes)

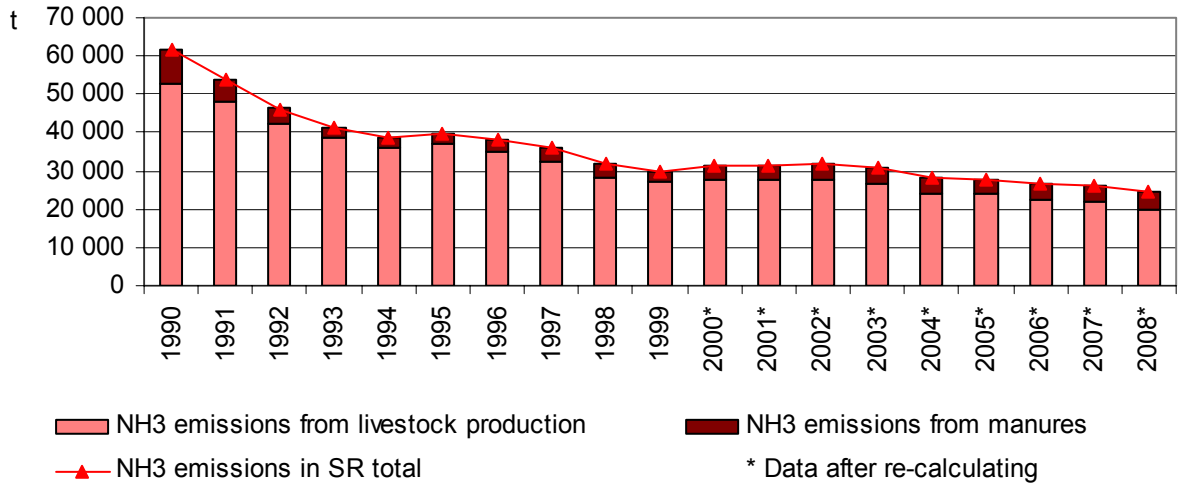


Source: SHMI; Processed by SEA
Indicator *Greenhouse gases emissions from agriculture*

5.3.2.2. Ammonia emissions from agriculture

After 1990, the emissions of ammonia from agriculture fell down; this was the result mainly of the decrease in the number of livestock. During **1990 – 2008, total ammonia emissions from agriculture slumped by ca 60%.** In 2008, it was 24 422 t.

Trend in ammonia emissions from agriculture



Source: SHMI; Processed by SEA
Indicator Ammonia emissions from agriculture

5.3.3. State

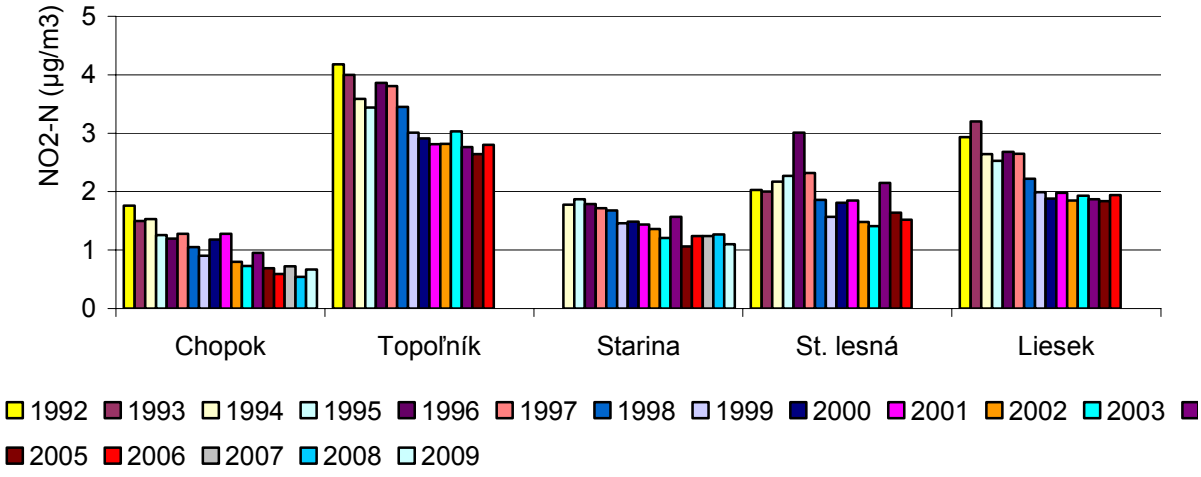
Condition of air as components of the environment are characterised by the indicator Air quality.

5.3.3.1. Air quality from the agricultural point of view

Air quality is evaluated pursuant to the Slovak Ministry of the Environment Ordinance No. 705/2002 Coll. on air quality that implements the Act No. 478/2002 Coll. on air protection.

Air quality evaluated by the level of regional air pollution at 5 or 4 monitoring stations **has gradually got better after 1992**; the level of concentrations of sulphur dioxide as well as nitrogen oxides had, with small deviations, downward tendency and never exceeded the limit values of protection of ecosystems.

Average annual concentrations of NO_2-N (µg/m^3)



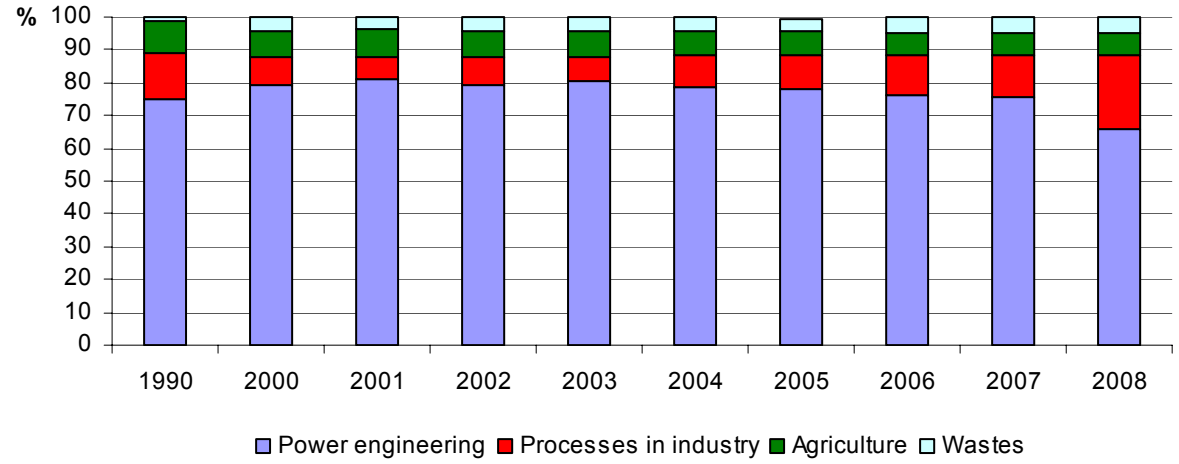
Source: SHMI; Processed by SEA
Indicator Air quality from the agricultural point of view,
http://enviroportal.sk/indikatory/detail.php?kategoria=124&id_indikator=1061

5.3.4. Impact

5.3.4.1. Share of agriculture in emissions of greenhouse gases and ammonia

Agriculture's share in emissions of greenhouse gases during 1990 – 2008 fell by 3.2%. The largest share in emissions of greenhouse gases comes from the power engineering.

Share of sectors in emissions of greenhouse gases



Source: SHMI; Processed by SEA
Indicator *Share of agriculture in emissions of greenhouse gases and ammonia*

The agriculture contributes by largest percentage to the emissions of ammonia. Agriculture's share maintains a balanced tendency in ammonia emissions as of 1990. In 2008, agriculture added to the emissions of ammonia by 96.4%.

Sectorial share in ammonia emissions (%)

Source: SHMI; Processed by SEA
Indicator *Share of agriculture in emissions of greenhouse gases and ammonia*

5.3.4.2. Climactic changes from the viewpoint of agriculture

The processes of intensification of the greenhouse effect are assisted also by the agriculture, particularly through the emissions of methane and nitrogen monoxide. Throughout the past 100 years, Slovakia observed a growing trend in the average annual air temperature by 1.1°C and a decrease in annual precipitation depth by 5.6% on average. During the last 7 years, we have faced **significant growth of extreme daily precipitation depth,** this

resulting in a considerable **increase of the risk of local floods** in various areas of Slovakia. On the other side, during 1989 – 2002 **local or nation-wide drought** took place more often than before, which was caused predominantly by long periods of relatively warm weather. Special devastating effect had the drought in 1990 – 1994, 2000 and 2002. The scenarios of climactic change still presuppose extension of the vegetative period, increase of the sum of daily average temperatures, sums of active radiation and increase in precipitation depth. *(Indicator Climactic changes from the viewpoint of soil and agriculture).*

5.3.5. Response

Important for the air protection is the **Framework Convention on Climate Change** and within it the conference of the parties to the Framework Convention on Climate Change in Kyoto. Another important protocol is the **Gothenburg** protocol on reduction of acidification, eutrophication and ground-level ozone adopted in 1999. Slovakia committed to reduce the ammonia emissions by 37%by 2010.

At the national level, the **Act No. 478/2002 Coll. on air protection** plays an important role. Among the pollution sources defined by the act belong also the sources from the agricultural production. Air pollution by ammonia emissions is financially penalized in Slovakia from 1 Jan 2000. The legislation in force applicable to the air protection sets forth fee obligation of SKK 2,000.00 t/year for produced ammonia emissions.

Code of Good Farming Practice – principles of correct use of fertilizers was adopted also in relation to air protection (Bujnovský, 2000).

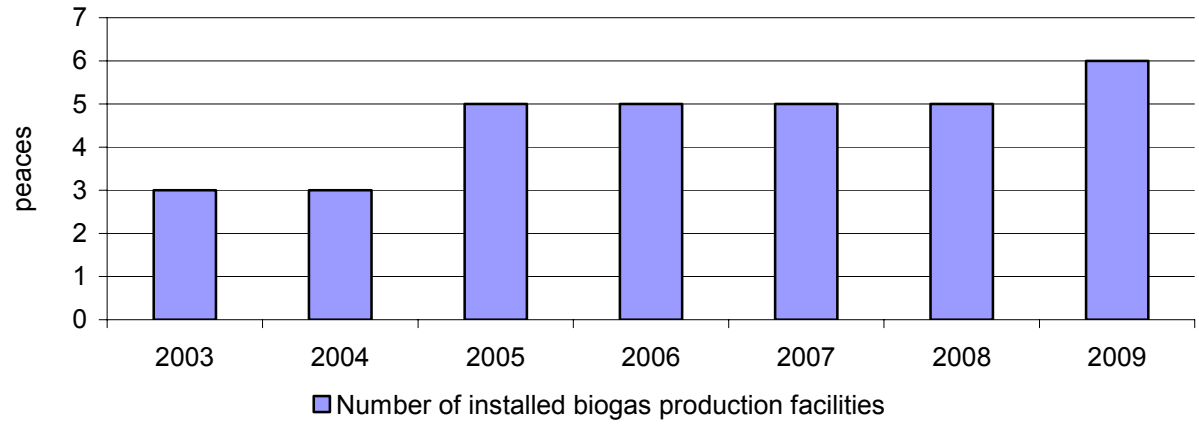
In the **Rural Development Programme of SR 2007 – 2013,** the axis 2 Improvement of the Environment and Countryside covers the priority 4. Mitigation of the consequences of climactic changes.

5.3.5.1. Renewable energy resources

The main source of CO_2, emissions that significantly add to the climactic changes is the fossil fuel combustion. Biofuels gained from renewable resources may substitute use of fossil fuels and thus may significantly contribute to reduction of the climactic changes effect.

At present, most of the agricultural land is used for growing bioenergetic crops meant for production of biofuels. Biomass really used for production of heat is not known to us. **Purposeful growing of biomass for energy purposes is actually insufficient in Slovakia.** Important, but yet not much used energy resource in agriculture, is the **biogas.** In Slovakia 6 facilities for biogas production from manure and corn ensilage was in operation up to 2009.

Number of biogas stations (pcs)

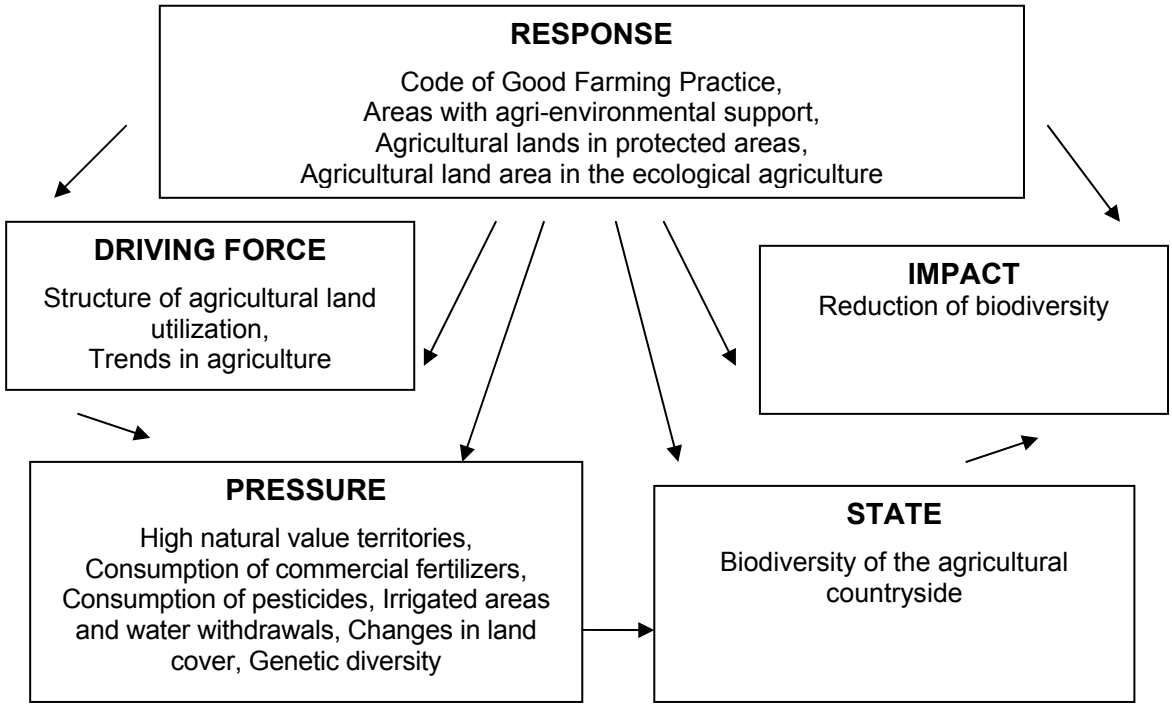


Source: APRC; Processed by SEA
Indicator *Renewable energy resources from agriculture*

5.4. Biota

Agriculture, since it is spatially most extensive human activity in our territory, has a significant influence on the condition of biota, especially on its biodiversity. The years of intensification in agriculture contributed to its reduction in many aspects. On the contrary, extensive and traditional farming forms support it considerably. The territories of valuable biotopes are located mainly in mountain areas and in extensively farmed areas. After 1989, there emerged another negative phenomenon in relation to biodiversity, namely the land abandonment.

Biodiversity and country in relation to agriculture according to the DPSIR model



List of individual agri-environmental indicators relevant to the description of biodiversity and country in relation to agriculture

Position v D-P-S-I-R structure	Individual indicator
Driving force	Changes in land utilization
	Structure of agricultural land utilization
	Trends in agriculture
Pressure	High natural value territories
	Genetic diversity
	Consumption of commercial fertilizers
	Consumption of pesticides
	Irrigated areas and water withdrawals
	Changes in land cover
State	Biodiversity of the agricultural countryside
Impact	Reduction of biodiversity
Response	Code of Good Farming Practice
	Agricultural lands in protected areas
	Areas with agri-environmental support
	Agricultural land area in the ecological agriculture

5.4.1. Driving forces in agriculture

Indicators of the driving force in relation to biodiversity, Changes in land utilization, Agricultural land utilization structure, and current trends in agriculture, Intensification, Extensification, Specialisation, Diversification and Marginalisation are covered in the Chapter No. 4.

5.4.2. Agricultural pressure on biodiversity

Indicators of pressure in relation to biodiversity, Consumption of commercial fertilizers, Consumption of pesticides, Irrigated areas are covered in the Chapter No. 4. The indicator Water withdrawal is contained in the Chapter No. 5.1 and the indicator Changes in land cover in the Chapter No. 5.2.

5.4.2.1. High natural value territories

Semi-natural and natural grass stands form the so-called high natural value territories. Owing to the geological, geo-morphological and climactic conditions, Slovakia is rich in species diversity of grass stands that significantly contribute to the biodiversity of entire Slovakia. A lot of endangered and endemic species grow on semi-natural and natural grass stands. Out of the total territory of Slovakia, 17% is covered by grass stands in which 77% of all endemic species is located (around 232 endemic species of plants can be found in Slovakia). Small-area species diversity (maximum 75 vascular plants per m^2 and 106 species per 25 m^2) is typical of these territories.

In 2001, 323 000 ha of grass stands considered to be natural was mapped. In 2002, 74% of grass stands were farmed in Slovakia, 13% was not farmed at all and in respect of the remaining 13% there were no data available (Šeffer et al., 2002). The area of natural grass stands reaches around 60% of TTP as recorded by LPIS.

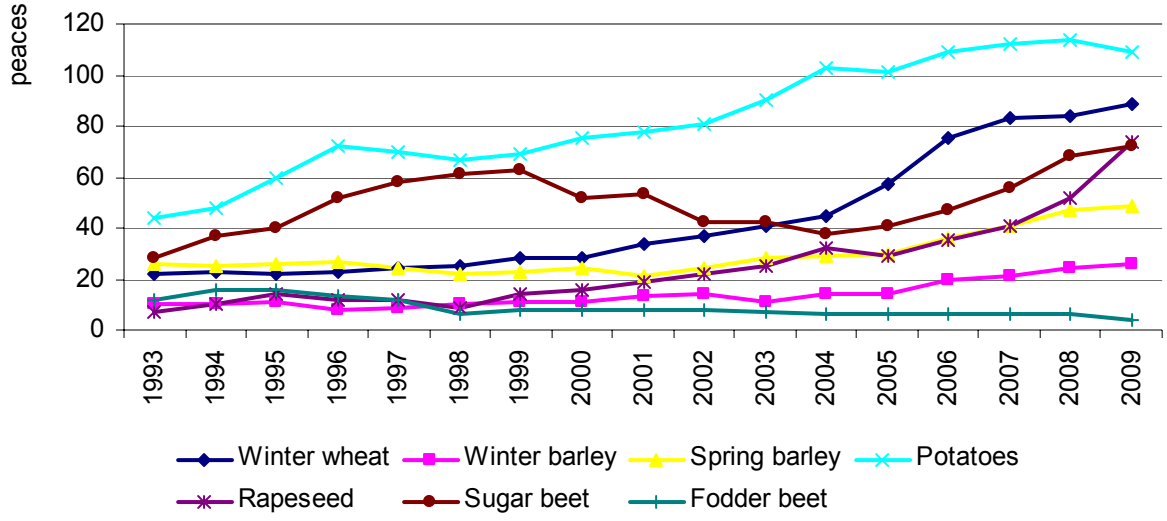
In a majority of natural grass stands, there occurred degradation, secondary succession and development of ruderal and undesirable societies of plants. In past, such status was assisted by such factors as intensive use of grass stands – use of hybrid types of seed and excessive fertilization. On the other hand, the most noticeable factor conditioning degradation of natural stands on the area of around 300 000 ha during the last decade is land abandonment. *(Indicator High natural value territories).*

5.4.2.2. Genetic diversity

During 1990 – 2009 the number of strains of winter wheat, winter and spring barley, potatoes, oilseed rape and sugar beet was gradually rising. Decrease was observed only in case of fodder beet.

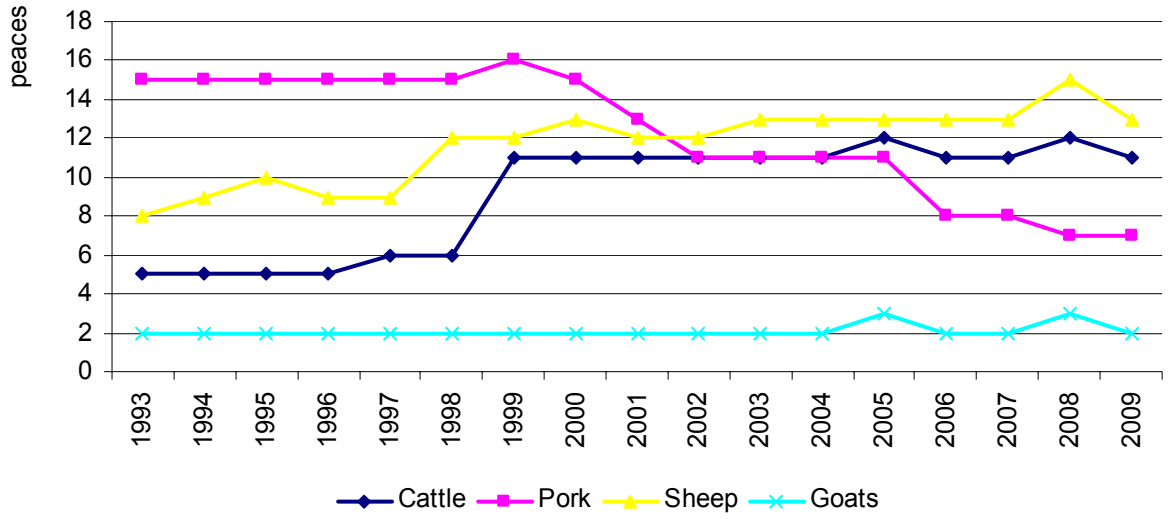
As regards **breeds, increase in beef cattle and sheep was observed.** As regards pigs and poultry, these fell down and the number of goats was balanced.

Number of agriculture plant's varieties in the SR



Source: RIPP
Indicator Genetic diversity of crops and breeds

Number of livestock breed in the SR



Source: RIAP
Indicator *Genetic diversity of crops and breeds*

5.4.3. State / Impact

Biodiversity in Slovakia may be roughly characterised by the numbers of species described so far. In Slovakia, around 11 270 of plant strains (algae including) and more than 26 700 animal species (including the invertebrates and 1000 protozoa) were described. Estimates are, however, higher; e.g. the number of animal species is estimated to reach 40 000. Due to development concentrated on intensive use of natural resources, many plant strains and animal species became extinct, some became rare, and others endangered.

Of the total amount of 3 352 of higher plants, 1 270 is on the Red List of Ferns and Flowering Plants of Slovakia. Of the total number of 551 feral vertebrates, 267 is endangered (48.5%). Also 121 species of birds and 68 species of mammals belong among them.

Since 1940, also agriculture has intervened in the natural ecosystem in a considerable extent, which resulted in biodiversity reduction. **Decrease in biodiversity in the agricultural countryside has struck the most the area of lowlands and heights,** this particularly as a result of intensive use and farming of the country, ploughing grass stands wetland drainage and degradation of xerothermic stands. Today, a majority of the originally semi-natural biotopes of this area is almost totally destroyed or strongly modified. Many species of birds died; Great Bastard for example belonging among critically endangered.

Mountain and submontane areas are in a better condition; here the valuable territories with high biological and country diversity were preserved. Among these belong mainly the areas with solitary settlements with preserved traditional farming methods and submontane areas that are a part of the protected areas. The biodiversity of the remaining territory is reduced owing to similar processes as mentioned for lowlands. Compared to lowlands in mountain areas, more intensive are the processes of dilapidation of the agricultural land. (Kováč et al., 1999), *(Indicator Biodiversity of the agricultural countryside).*

5.4.4. Response

In May 1992, **Convention on Biological Diversity** was signed in Rio de Janeiro. Based on this Convention, the government passed the **National Biodiversity Strategy** in 1997 that is followed up by the first **Action Plan** for 1998 – 2010. In 1998, Biodiversity Protection National Report was elaborated. In 2007, Slovakia delivered to the European Commission the first report concerning the condition of territories, biotopes and species in Slovakia during 2004 – 2006.

Biodiversity is influenced also by compliance with the principles of good farming practice, **Codes of Good Farming Practice and ecological agriculture.**
In the **Rural Development Programme of the Slovak Republic 2007 – 2013,** the axis 2 Improvement of the Environment and Countryside includes also the priority 1 Preservation of rural biodiversity and of agricultural and forestry systems with high natural value.

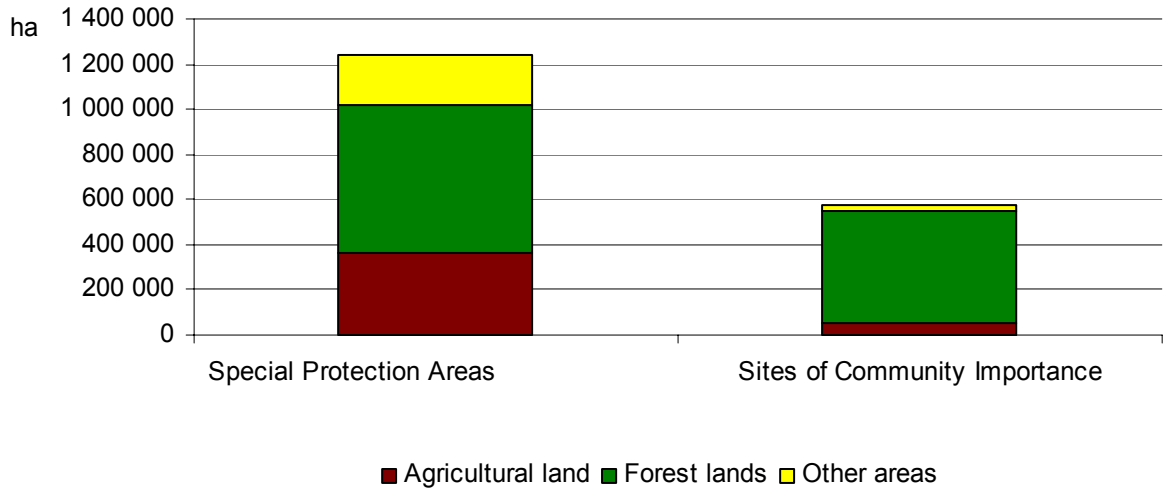
5.4.4.1. Lands in protected areas

Protected areas pursuant to Act No. 543/2002 on protection of nature and country, including the protection zones, occupy around **1 200 000 ha, which is approximately 22.8% of the Slovak territory. Of this area, 250 000 ha is used for agricultural production.**

Main factors influencing further directions of nature protection include implementation of the NATURA 2000 principles in the interest of creating a European network of specially protected areas. National list contains **38 special protection areas (SPA) occupying the area of 1 154 111 ha, which is 23.5% of the Slovak territory.** It overlaps the actual network of protected areas in the extent of 55%. **Of this area, 30% is the agricultural land** and 53% the forest land.

National list of Sites of Community Importance (SCI) contains **382 territories with the area of 573 690 ha, which is 11.7% of Slovakia**. It overlaps the actual network of protected areas in the extent of 86%. **Of the total area of SCI, 10% is the agricultural land,** 86% the forest land, 2% the water areas and 2% other areas.

Lands in protected areas (ha)



Source: ŠNC SR; Processed by SEA
Indicator. Agricultural lands in protected areas

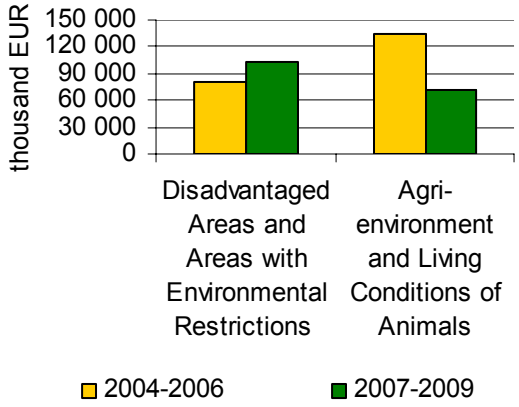
5.4.4.2. Area with agri-environmental support

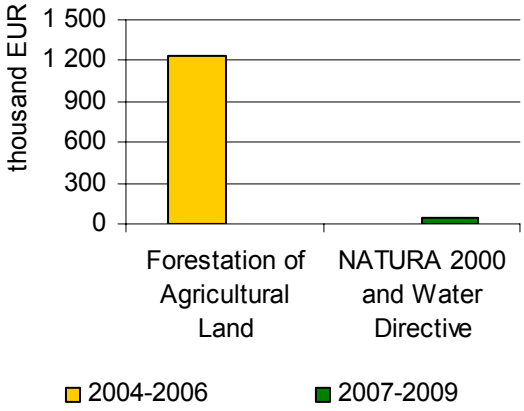
In the programming period of the Rural Development Plan of the Slovak Republic 2004 – 2006, the expenditure under the measure **Disadvantaged Areas and Areas with Environmental Restrictions** totalled 81 252 thousand Euro, under the measure **Agri-environment and Living Conditions of Animals** it was 134 726 thousand Euro, under the measure Forestation of Agricultural Land it reached 1 237 thousand Euro (Ministry of Agriculture of SR, 2007).

In the programming period of the Rural Development Programme of the Slovak Republic 2007 – 2013, the expenditure up to 2009 totalled 102 487 thousand Euro under the measure

Disadvantaged Areas, 71 236 thousand Euro under the measure **Agri-environment and Living Conditions of Animals,** 6 thousand Euro under the measure Forestation of Agricultural Land. In this programming period, a new **measure NATURA 2000 and Water Directive** was added and up to 2009, 42 thousand Euro was used for it (Ministry of Agriculture of SR, 2010).

Territories with agri-environmental support funded within the Rural Development Programme of SR 2004 – 2006 and 2007 - 2013 (thousands of Euro)





Source: MP SR, 2007, 2010; Processed by SEA
Indicator Area with agri-environmental support

6. Is the Environmental Efficiency of the Slovak Agriculture Rising?

The success rate of the environmental policy implementation into economic sectors may be described using correlation between economic indicators of the relevant sector (expressed by indicators of GDP – gross domestic product, or GVA – gross value added) and environmental indicators with negative effects on the environment (e.g. development of pollutant emissions into air, water, exploitation of natural resources of raw materials, energy etc.).

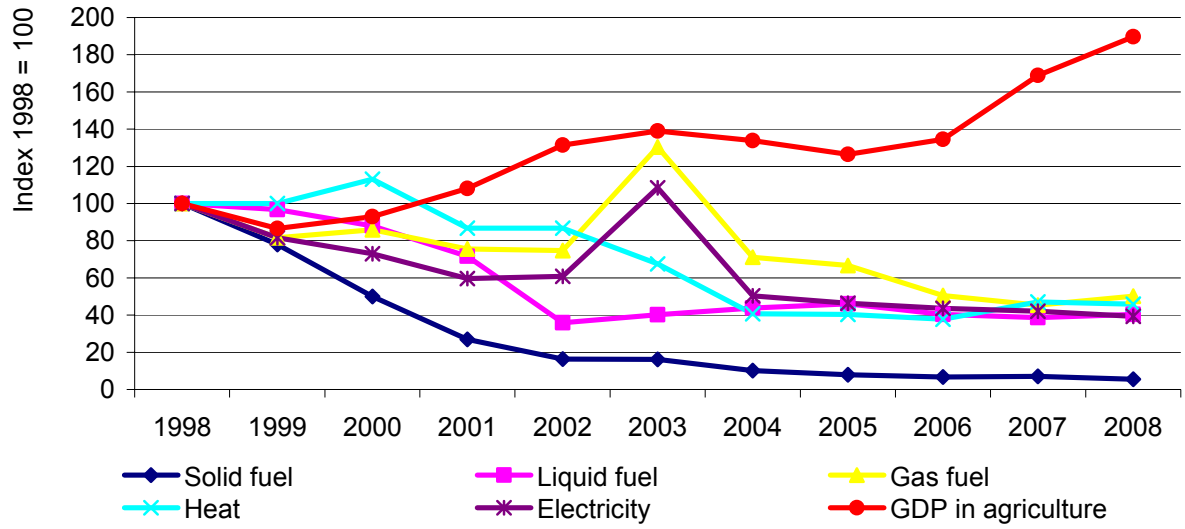
The relevant sector of economic activity becomes environmentally efficient if there is economic growth within such sector with its negative environmental consequences on the environment minimized.

Indicators of environmental efficiency belong into the group of pressure indicators.

6.1. Environmental Efficiency of Agriculture with regard to consumption of fuels, heat, and electricity in agriculture

After 2001, we have witnessed a positive trend of environmental efficiency with regard to consumption of fuels and energy, with one deviation in 2003 in the group of gaseous fuels and electricity.

Environmental efficiency of agriculture with regard to consumption of fuels, heat, and electricity in agriculture (1998 index)

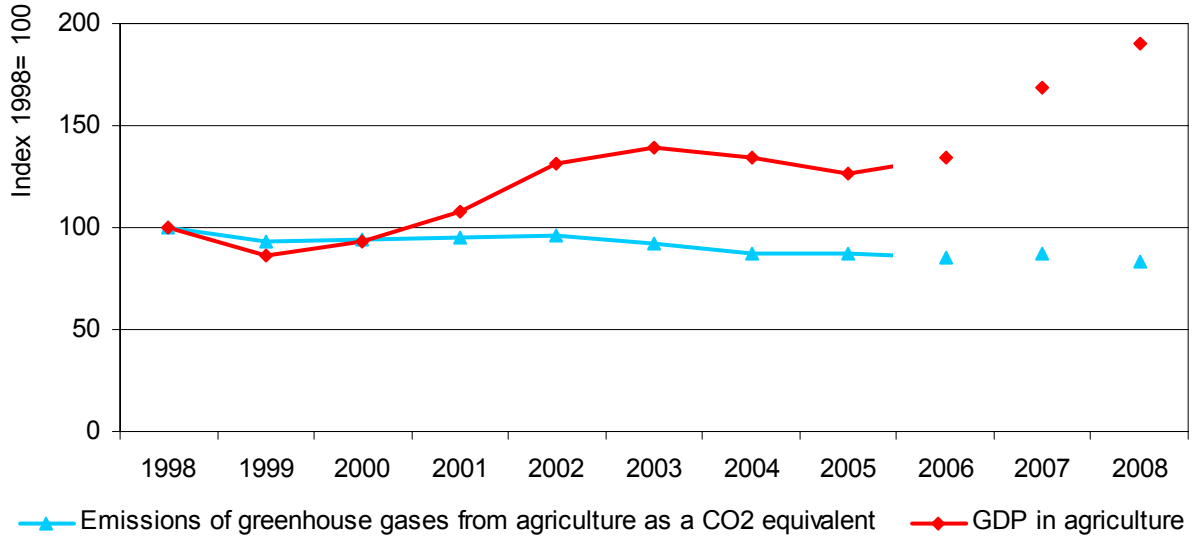


Source: SO SR; Processed by SEA
Indicator *Environmental efficiency of agriculture with regard to the consumption of fuels, heat, and electricity in agriculture*

6.2. Environmental efficiency of agriculture with regard to the greenhouse gases emissions from agriculture

Since 2001 we may speak of a **positive development of environmental efficiency of agriculture with regard to greenhouse gasses emissions.** This positive effect caused by decline in emissions from agriculture results especially from decrease in the number of livestock animals and the extent of using commercial fertilisers and the simultaneous improvement of GDP.

Environmental efficiency of agriculture with regard to the greenhouse gases emissions from agriculture (1998 Index)

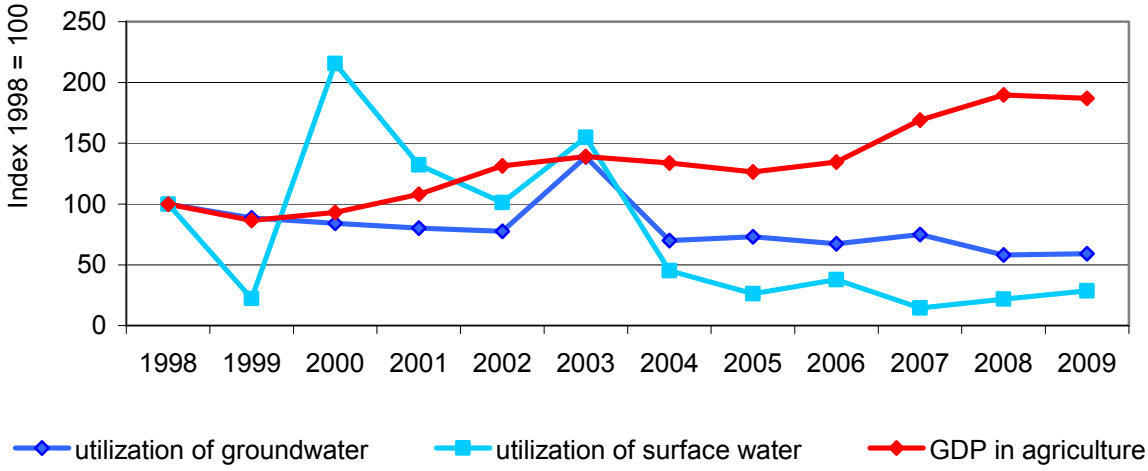


Source: SO SR, SHMI; Processed by SEA
Indicator *Environmental efficiency of agriculture with regard to the greenhouse gases emissions from agriculture*

6.3. Environmental efficiency of agriculture with regard to utilization of water in agriculture

Environmental efficiency of agriculture with regard to **use of groundwater has had a positive trend since 1998, with a deviation in 2003.** Environmental efficiency of agriculture with regard to utilization of **surface water had a negative trend during 1998 - 2003**. Since 2004, environmental efficiency is positive even for this indicator.

Environmental efficiency of agriculture with regard to utilization of water in agriculture (1998 Index)

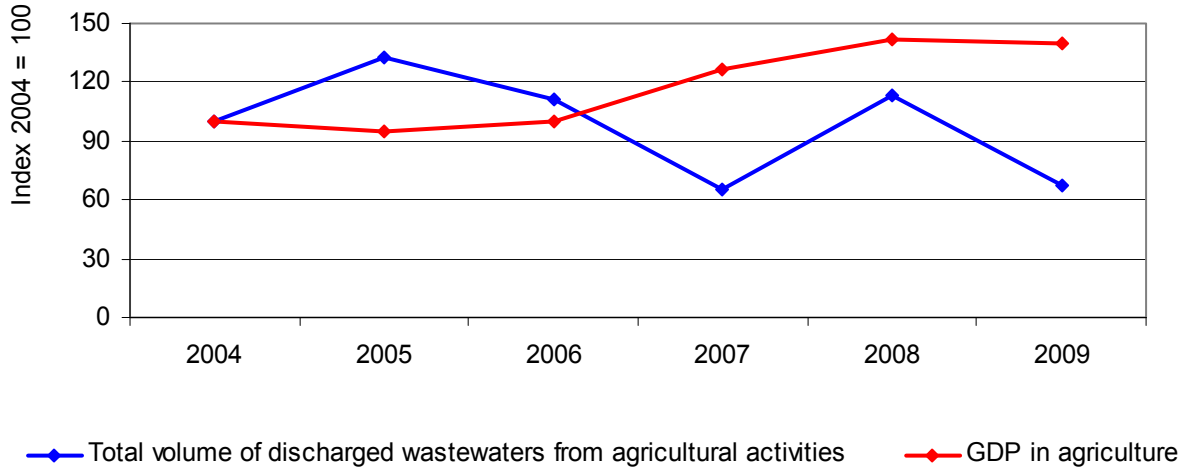


Source: SO SR, SHMI; Processed by SEA
Indicator *Environmental efficiency of agriculture with regard to utilization of water in agriculture*

6.4. Environmental efficiency of agriculture with regard to total volume of discharged wastewaters from agricultural activities

During 2004 – 2006, the environmental efficiency of agriculture with regard to the entire volume of discharged wastewaters from agricultural activities had a negative trend. **Positive trend has been observed since 2007.**

Environmental efficiency of agriculture with regard to total volume of discharged wastewaters from agricultural activities (2004 Index)

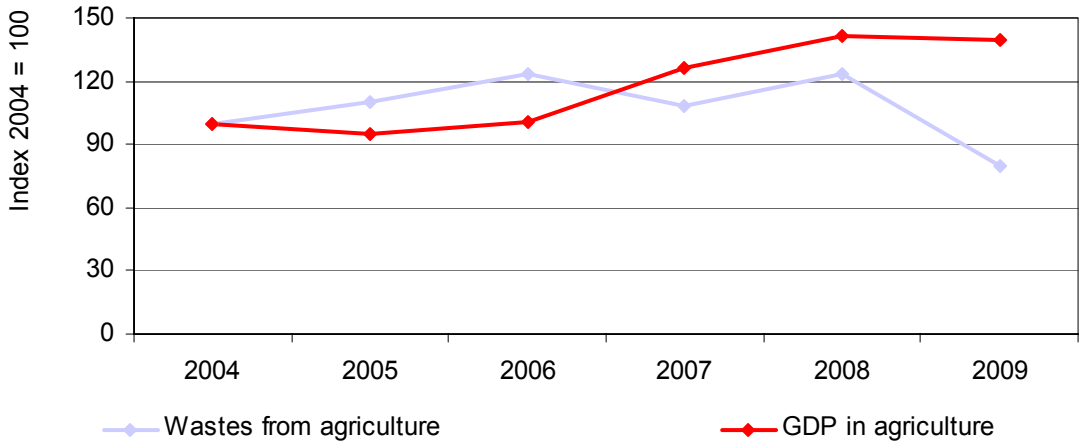


Source: SO SR, SHMI; Processed by SEA
Indicator *Environmental efficiency of agriculture with regard to total volume of discharged wastewaters from agricultural activities*

6.5. Environmental efficiency of agriculture with regard to the quantity of wastes generated from agriculture

During 2004 – 2006, the environmental efficiency of agriculture with regard to the volume of produced wastes had a negative trend. **Positive trend has been observed since 2007.**

Environmental efficiency of agriculture with regard to the quantity of wastes generated from agriculture (2004 Index)



Source: SEA
Indicator *Environmental efficiency of agriculture with regard to the quantity of wastes generated from agriculture*

References

1. BIELEK, P. 1996. *Ochrana pôdy: Kódex správnej poľnohospodárskej praxe v SR.* Bratislava: Ministerstvo pôdohospodárstva SR a Výskumný ústav pôdnej úrodnosti, 1996, 54 s.
2. BIELEK, P. 1998. *Dusík v poľnohospodárskych pôdach Slovenska.* Bratislava: Výskumný ústav pôdnej úrodnosti, 1998, 256 s.
3. BUJNOVSKÝ, R. 2000. *Zásady správneho používania hnojív: Kódex správnej poľnohospodárskej praxe v SR*. Bratislava: Ministerstvo pôdohospodárstva SR a Výskumný ústav pôdoznalectva a ochrany pôdy, 2000, 34 s.
4. COMMIMISSION OF THE EUROPEAN COMMUNITIES. 1998. *Communication of the Commission to the Council and the Parliament on a European Community Biodiversity Strategy*. COM(98) 42 final, Brussels, 1998, 21 p.
5. COMMIMISSION OF THE EUROPEAN COMMUNITIES. 1999. *Communication from the Commission to the Council and the European Parliament, the Economic and Social Committee and the Committee of the Regions. Direction Towards Sustainable Agriculture*. COM(1999) 22 final, Brussels, 1999, 30 p.
6. COMMIMISSION OF THE EUROPEAN COMMUNITIES. 2000. *Communication from the Commission to the Council and the European Parliament, the Economic and Social Committee and the Committee of the Regions. Indicators for the Integration of Environmental Concerns into the Common Agricultural Policy*. COM(2000) 20 final, Brussels, 2000, 26 p.
7. COMMIMISSION OF THE EUROPEAN COMMUNITIES. 2001. *Communication from the Commission to the Council and the European Parliament, the Economic and Social Committee and the Committee of the Regions. Statistical Information for Indicators to monitor the Integration of Environmental concerns into the Common Agricultural Policy*. COM(2001) 144 final, Brussels, 2001, 21 p.
8. COMMIMISSION OF THE EUROPEAN COMMUNITIES. 2002. *Communication from the Commission to the Council and the European Parliament, the Economic and Social Committee and the Committee of the Regions. Towards a Thematic Strategy for Soil Protection*. COM(2002) 179 final, Brussels, 2002, 35 p.
9. COMMIMISSION OF THE EUROPEAN COMMUNITIES. 2002. *Communication from the Commission to the Council and the European Parliament, the Economic and Social Committee and the Committee of the Regions. Towards a Thematic Strategy on the Sustainable Use of Pesticides*. COM(2002) 349 final, Brussels, 2002, 35 p.
10. COMMIMISSION OF THE EUROPEAN COMMUNITIES. 2004. *Commission working document. Integrating environmental considerations into other policy areas- a stocktaking of the Cardiff process.* Brussels, 2004, 38 p.
11. COMMIMISSION OF THE EUROPEAN COMMUNITIES. 2004. *Communication from the Commission to the Council and the European Parliament. European Action Plan for Organic Food and Farming.* COM(2004) 415 final, Brussels, 2004, 7 p.
12. DIRECTORATE-GENERAL FOR AGRICULTURE – EUROPEAN COMMISSION. 2000. *Agenda 2000, CAP reform decisions – impact analyses*. Brussels, 2000, 104 p.
13. EUROPEAN ENVIRONMENT AGENCY. 2005. Agriculture and environment in EU-15 – the IRENA indicator report. Copenhagen, 2005, 128 p.
14. EUROPEAN COMMUNITIES. 1999. *Council regulation 1257/1999 on support for rural development from the European Agricultural Guidance and Guarantee Fund*. Official Journal of the European Communities. 1999
15. EUROSTAT, (http://epp.eurostat.cec.eu.int)
16. JOSLING, T., BABINARD, J. 2000. *The Future of the CAP and Prospects for Change. the Policy Environment for Agri-food Competitiveness.* Institute for International Studies. Stnaford University, 2000, 41 p.
17. KOBZA, J a kol. 2002. *Monitoring pôd Slovenskej republiky. Súčasný stav monitorovaných vlastností pôd.* 1997 – 2001. Bratislava: Výskumný ústav pôdoznalectva a ochrany pôdy, 2002, 178 s.

18. KOBZA, J a kol. 2010. *Monitoring pôd Slovenska (venované 50. výročiu založenia ústavu).* Výskumný ústav pôdoznalectva a ochrany pôdy, Bratislava, 39 s.
19. KOVÁČ, K., SABO, P. a kol. 1999. *Agroenvironmentálne programy pre Slovensko: Programy ochrany a obnovy poľnohospodárskej krajiny.* Piešťany: Občianske združenie Živá planéta, 1999. 44 s.
20. LINKEŠ V. a kol. 1997. *Monitoring pôd Slovenskej republiky. Súčasný stav monitorovaných vlastností pôd.* 1992 – 1996. Bratislava: Výskumný ústav pôdoznalectva a ochrany pôdy, 1997, 128 s.
21. MINISTERSTVO PÔDOHOSPODÁRSTVA SR. 2003. *Sektorový operačný program Poľnohospodárstvo a rozvoj vidieka Slovenskej republiky 2004 - 2006.* Bratislava: Ministerstvo pôdohospodárstva SR, 2003, 121 s.
22. MINISTERSTVO PÔDOHOSPODÁRSTVA SR. 2004. *Plán rozvoja vidieka Slovenskej republiky 2004 – 2006..* Bratislava: Ministerstvo pôdohospodárstva SR, 2004, 216 s.
23. MINISTERSTVO PÔDOHOSPODÁRSTVA SR. 2005. *Akčný plán rozvoja ekologického poľnohospodárstva v Slovenskej republike do roku 2010.* Bratislava: Ministerstvo pôdohospodárstva SR, 2005, 13 s.
24. MINISTERSTVO PÔDOHOSPODÁRSTVA SR. 2007. *Koncepcia rozvoja pôdohospodárstva na roky 2007 – 2013.* Bratislava: Ministerstvo pôdohospodárstva SR, 2007.
25. MINISTERSTVO PÔDOHOSPODÁRSTVA SR. 2010. *Správa o poľnohospodárstve a potravinárstve v SR za rok 2009 (Zelená správa).* Bratislava: Ministerstvo pôdohospodárstva SR, 2010, 235 s.
26. MINISTERSTVO ŽIVOTNÉHO PROSTREDIA SR, SLOVENSKÁ AGENTÚRA ŽIVOTNÉHO PROSTREDIA. 2009, 2010. *Správa o stave životného prostredia SR v roku 2008.*, 306 s.
27. MINISTERSTVO ŽIVOTNÉHO PROSTREDIA SR, VÝSKUMNÝ ÚSTAV VODNÉHO HOPSODÁRSTVA. 2005. *Správa o vodnom hospodárstve v SR v roku 2004.* Bratislava: Ministerstvo životného prostredia SR, 2005, 147 s.
28. ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT. 2001. *Environmental Indicators for Agriculture.* Methods and results. Paris: OECD, 2001, 53 p.
29. ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT. 2004. *OECD Environmental data: Compendium 2004. Agriculture.* Paris: OECD, 2004, 27 p.
30. PLOEG, J.D. 2004. *Rural development and the mobilisation of local actors.* European Conference in Salzburg. Wageningen, Netherland, 2004, 15 p.
31. SOBOCKÁ, J., ŠURINA, B., TORMA, S., DODOK, R. 2005. *Klimatická zmena a jej možné dopady na pôdny fond Slovenska.* Bratislava: Výskumný ústav pôdoznalectva a ochrany pôdy, 2005, 48 s.
32. SVIČEK, M. 2009. Expertný systém identifikácie zanedbaných pôd prostredníctvom vlastníckych a užívateľských vzťahov. In: Pustnutie krajiny – ochrana pôdy – krajinná ekológia: Zborník z vedeckého seminára pri príležitosti životného jubilea – 70. výročia narodenia prof. Ing. Rudolfa Midriaka, DrSc., 2009, ISBN 978-80-8083-923-9.
33. ŠEFFER, J.,LASÁK, R., GALVÁNEK, D. AND STANOVÁ, V. 2002. *Grasslands of Slovakia. Final report on National Grassland Inventory 1998 – 2002*. Institute of Applied Ecology, Bratislava
34. ŠTATISTICKÝ ÚRAD SR. 2007. *Štrukturálne zisťovanie fariem 2007 – komplexné výsledky.* ŠÚ SR Bratislava:, 2007
35. VÝSKUMNÝ ÚSTAV PÔDOZNALECTVA A OCHRANY PÔDY. 2000. *Jubilejná správa o pôde Slovenskej republiky a činnosti VÚPOP v Bratislave.* Bratislava: Výskumný ústav pôdoznalectva a ochrany pôdy, 2000, 123 s.
36. VÝSKUMNÝ ÚSTAV PÔDOZNALECTVA A OCHRANY PÔDY - VÝSKUMNÝ ÚSTAV VODNÉHO HOPOSDÁRSTVA. 2001. *Ochrana vôd pred znečistením dusičnanmi z poľnohospodárskych zdrojov: Kódex správnej poľnohospodárskej praxe v SR.* Bratislava: Ministerstvo pôdohospodárstva SR, 2001, 21 s.

Abbreviations

EEA	European Environment Agency
EUROSTAT	Statistical Office of the European Communities
EU	European Union
CLC	Corine Land Cover
RIPP	Research Institute of Plant Production
RIAP	Research Institute of Animal Production
PMS	Partial Monitoring System
PMS -S	Partial Monitoring System - Soil
DPSIR	D - driving force, P – pressure, S – state, I – impact, R – response
GDP	Gross Domestic Product
IRENA	Indicator Reporting on Integration of Environmental Concerns into Agriculture Policy
LPIS	Land Parcels Identification System
MP SR	Ministry of Agriculture of the SR
MoE SR	Ministry of the Environment of the SR
OECD	Organisation for Economic Co-operation and Development
AL	Arable Land
RDP SR	Rural Development Plan of the Slovak Republic
SEA	Slovak Environmental Agency
SHMI	Slovak Hydrometeorological Institute
SNC SR	State Nature Conservancy of the Slovak Republic
CAP	Common Agricultural Policy
SO SR	Statistical Office of the Slovak Republic
GCCA SR	Geodesy Cartography and Cadastre Authority of the Slovak Republic
CCTIA	Central Controlling and Testing Institute in Agriculture
SSCRI	Soil Science and Conservation Research Institute
WRI	Water Research Institute