3.4.2 FARMING STRUCTURE

(1) Management Form of Farming Unit

In the Study Area, there are three types of management of farming unit, i.e., cooperative, enterprise and individual private farm (SHR). In addition, there are a lot of small gardens. People carry on their private farming activity on a small scale but they are distinguished from the registered farms such as SHR. Most of the cooperatives have been changed to commercial enterprises and individual farmers in the Study Area so far. There is one (1) agricultural cooperative, which is reported to be undergoing liquidation at the moment, eleven (11) private farmers and ten (10) commercial enterprises, which occupy 92% of the total agricultural land. It is peculiar that several large companies occupy most of the farmland: the top six commercial enterprises share as much as 77% of the entire arable land. Several individual farmers and gardening farmers are found in each town.

Farming Units and their Type, Size and Scale in Malacky District

Type of entity	Number of farming unit	Total agricultural land (ha)	Average size of land (ha)	note
Private farmers	10	847	106	Total area is result of 8 farmers
Commercial enterprises	11	22,995	2,300	Total area is result of 10 enterprises
Agricultural Cooperatives	1	(1,250)	(1,250)	in the liquidation process
Total	21(22)	25,092	1,141	

Source: farm unit survey (JICA 2001)

Land restitution has been carried out during the transition to capitalism. Through restitution, a lot of small-scale landowners were created. Most landowners decided not to use their land themselves but leased it to an enterprise which was developed from the cooperative farm or state farm. As a result, most agricultural lands are cultivated under lease agreement at the moment. A few people are using their own land for agriculture but it is only their hobby. Most landowners do not belong to the co-operative farms or enterprises, and many of them are retired pensioners or non-resident owners. Among the SHRs, some of them have small areas of land and

cultivate it themselves, but the percentage of leased land is high. According to the Farm Unit Survey (JICA 2001), the total area of arable land in each enterprise varies from 80 ha to 7,336 ha of which the average is 2,300 ha. The percentage of leased land in arable land reached 95% on average. On the other hand, the total cultivated area in each SHR varies from 9 ha to 315ha, with the average 106 ha. The percentage of leased land in arable land reached 61% on average. The ratio of leased land, as a weighted average is 99% for enterprise and 94% for SHR.

There are differences in farmland between the enterprise and SHR. 61% of the agricultural land of enterprise is poor sandy soil, while it is only 38% in SHR (according to Farm Unit Survey). The reason for such a difference could be the scale of management. Enterprises have a high ratio of livestock in their farm management and they tend to expand field size to meet the strong demand for low cost feed.

On average among the enterprises, the number of permanent employees is 67, seasonal employees is 190, and agronomist/engineers is 19. The average number of agronomist/engineers is 2.7 in agriculture, 1.7 in machinery, 1.6 in civil engineering, 2.4 in economy, and 2.6 in livestock. The percentage of agriculture and livestock sector is slightly high. The average age of the manager in enterprises is as young as 43 years old.

Number of enterprises according to employee

Employee	Enterprise
1~10	3
11~50	5
51~100	1
101~	2

Farm Unit Survey（JICA, 2001）

On the other hand, the average labour force for family farming is 3 for SHRs. Many of them are made up of family members and many have 10 years or more experience in agriculture. It could be said that the structure and technical level is stable in SHRs.

In the capital structure of enterprises, the majority has their own capital, even though most land is leased. 10 enterprises were investigated in the Farm Unit Survey, and seven of these were managed with 100% of their own capital, and only a few cases had outside shareholders. One company had more than half of its capital provided by another national company and another company had capital provided by a foreign company.

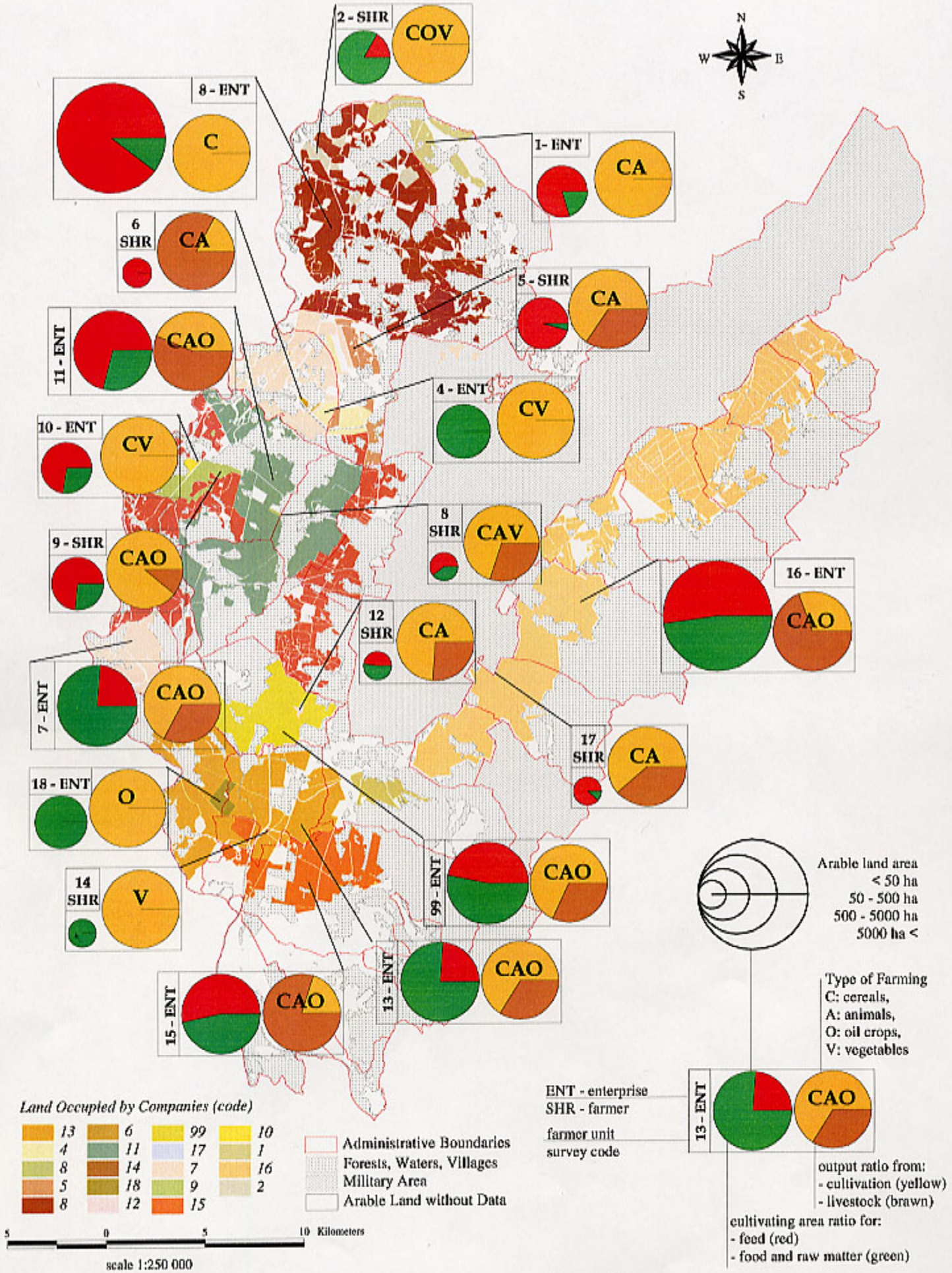


Figure 1.3 Farming Type and Farm Management

source: JICA Study Team
- Farmer Unit Survey

(2) Farm Management Category

Farm management in the Study Area is categorized into the following three types:

Distribution of Farming Type in Study Area

Farming Type	Number of Units
Mixed farming of cereal production with livestock farming	5
Mixed farming and other profitable crop production	7
Combination of cereals oil crops, vegetables, processing, etc.	6

Farming types of only 18 farming units studied by the Farming Unit Survey conducted by the Study Team (2001) are shown.

1) Mixed Farming of Cereal Production with Livestock Farming

This is a fundamental farming type of the Study Area as well as the whole country. In mixed farming, low profitability of crop production is compensated for livestock farming. Crop production functions to support livestock farming by providing self-supplied feed. Wheat, rye, barley, maize and a small proportion of soybean are cropped for concentrate, and silage maize and alfalfa are cropped for roughage. Milking is carried out mainly by the large-scale enterprises because of the large initial cost.

2) Mixed Farming and Other Profitable Crop Production

To stabilize mixed farming, profitable crops such as oil crops, i.e., rape and sunflower, and vegetables such as potato, cabbage, carrot and onion, etc. are added to the mixed cropping as supplementary production. In the comparison of land use of the enterprises with SHR, the percentage of oil crops and vegetables in SHR are higher than that in enterprises. The reason could be that SHR used comparatively small but fertile farmland, which is suitable for profitable crops, and it is easy for them to use intensive farming with their small-scale management.

3) Combination of Cereals, Oil Crops, Vegetables, Processing, etc.

Profitable crops such as oil crops, vegetables, fruits, etc. are also produced in various combinations without the mixed farming. Such combinations divide into 2 types according to their objectives. One aims to avoid animal production which requires a large amount of initial capital and is time consuming work, and the other aims to provide large amounts of self-supply raw material such as vegetables to private factories. The first one is seen as small scale SHR and the other can be found in enterprises which own processing factories. The combination of work depends on the size of the farming area, human labor and natural conditions such as soil fertility and availability of irrigation water.

(3) Income Structure of Mixed Farming with Cereal Production and Livestock Farming

The production cost of wheat was estimated in a trial to understand the profitability of feed production based on the Farm Unit Survey. In this estimate, direct cost is calculated at 11,115 SKK/ha, total cost including the management cost is 12,227 SKK/ha. The estimated gross income is 12,260 SKK/ha in this case. The profit is quite low or only compensates for the direct cost, the level of which relies on the governmental subsidy. Even feed is produced for self-consumption and not for sale. On the other hand, according to the data for cost structure of livestock farming prepared by the Ministry of Agriculture, feed is the most costly item, and it represents 34.9% of the total cost in milk production, 51.8% in cattle breeding, and 62.0% in hog raising. It can be understood that cereal production for use as feed cannot be a major income generator in farm management, and that the main function of it is to support the livestock sector, which generates most of the income. It is expected that a decrease in production costs of feed would contribute to improved farm management in the mixed farming of cereal production with livestock farming.

Estimation of Production Cost of Wheat

No.	Items	Cost (SKK/ha)
1	Land rental	500
2	Ploughing *	1,300
3	Manure *	900
4	Fertilizers	1,040
5	Fertilizer application *	500
6	Seeds	1,125
7	Seeding *	1,450
8	Agricultural chemicals	2,500
9	Agricultural chemicals application *	1,000
10	Harvesting *	1,700
<11>	Planting stock	
<12>	Fuels	
<13>	Agr. Machinery	
<14>	Others	
	Sub total	11,115
15	Management cost	1,112
	(10% of immediate cost)	
	Total cost	12,227
Gross income		
	unit price: 3,300 SKK/ton	10,560
	yield in the sample: 3.2 t/ha	
	Subsidies for wheat cropping	500
	Subsidy for disadvantage agricultural land	1,200
	Total	12,260

<Notes>*: Fee by contract including fuel and operator costs.
Sources: Farming unit survey (2001)

Composition of Production Cost of Animal Husbandry

Items	Composition of cost (%)		
	1999	2000	Average
Milking cow			
Feed	35.1	34.6	34.9
Labor	17.4	15.5	16.5
Facilities and equipment	14.8	13.6	14.2
Medicines	1.4	1.3	1.4
Others	31.3	35	33.2
Total cost	100	100	100
Cattle forf attening			
Feed	52.5	51.1	51.8
Labor	11.5	11.2	11.4
Facilities and equipment	13.5	13.2	13.4
Medicines	0.3	0.2	0.3
Others	22.2	24.3	23.3
Total cost	100	100	100
Pigs			
Feed	62.2	61.8	62.0
Labor	6.3	6.1	6.2
Facilities and equipment	11	11.2	11.1
Medicines	1.2	1.3	1.3
Others	19.3	19.6	19.5
Total cost	100	100	100

Source: MOA (2000 and 2001)

3.4.3 CULTIVATION AREA OF MAIN CROPS

The planted ratio (planted area / arable land) decreased slightly from 91% in 1997 to 87% in 2000. In Malacky district, it fell by 15 points from 92% to 78%.

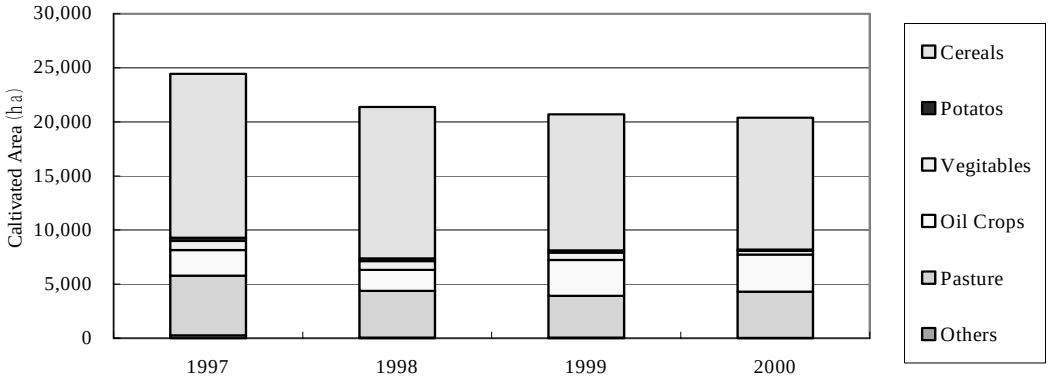
Movement of Cultivated Area and Cultivation Ratio （1997～2000）

	Unit	1997	1998	1999	2000	Average
Slovakia						
Planted Area	1000 ha	1,338	1,309	1,274	1,271	1,298
Cultivated Area	1000 ha	1,476	1,472	1,469	1,461	1,469
Cultivation Ratio	%	91	89	87	87	88
Malacky district						
Planted Area	ha	24,330	22,046	20,651	20,379	21,852
Cultivated Area	ha	26,782	26,624	26,169	26,090	26,416
Cultivation Ratio	%	91	83	79	78	83
Senica District						
Planted Area	ha	27,498	29,482	21,622	27,673	26,568
Cultivated Area	ha	33,178	33,174	33,162	32,946	33,115
Cultivation Ratio	%	83	89	65	84	80

Source：Slovakia Statistic Breau

The cultivation area of the main crops in the Malacky district, which represents the Study Area, is shown as follows. The cultivated areas of cereals decreased rapidly recently, accompanied by a decrease in the cultivated area. Both the cultivated area and cultivation ratio are increased only for the oil crops.

Cultivation Area of Malacky District

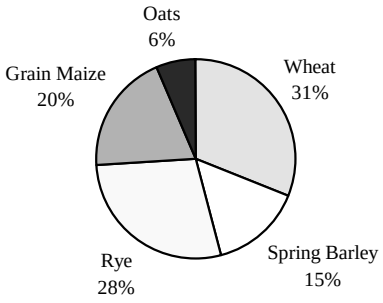


(Unit:ha, %)

Crops	1997		1998		1999		2000	
Cereals	15,158	62.3%	13,996	63.5%	12,571	60.9%	12,202	59.9%
Potatoes	303	1.2%	254	1.2%	222	1.1%	134	0.7%
Vegitables	842	3.5%	836	3.8%	670	3.2%	339	1.7%
Oil Crops	2,362	9.7%	1,918	8.7%	3,320	16.1%	3,441	16.9%
Feeds	5,538	22.8%	4,329	19.6%	3,868	18.7%	4,263	20.9%
Total(incl. Others)	24,330	100.0%	22,046	100.0%	20,651	100.0%	20,379	100.0%

Source: Slovakian Statistics Bureau

Share of Cultivated Area of Cereals in Malacky 2000



Source: Statistic Office of SR

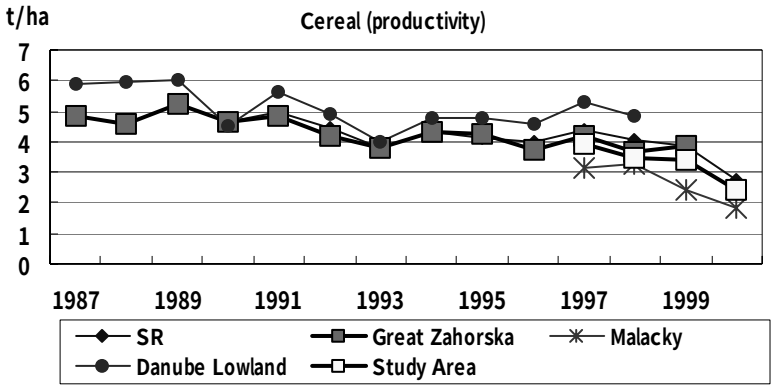
The cereals such as wheat, rye, and maize (including for feed) always account for around 60% of the cultivation area, and feed crops (silage maize and alfalfa) account for 20% in the Malacky district. Of these cereals, most of the wheat, rye, grain maize and oats are cropped for animal feeds, and only spring barley is cropped for raw material for malt. The proportion of the cultivation area of cereal crops is shown on the right side. 31.1% for wheat, 28.2% for rye. The share of oil crops like rape and sunflower has increased recently. Vegetables crops include cabbage, carrot, and onion.

3.4.4 PRODUCTIVITY OF MAIN CROPS

The unit yield of cereals reached a high level of about 6.0 ton/ha in 1989 as the average of the whole country. However, after the change in the social system, it became difficult to keep production with high inputs regardless of profit in the same way as before. Thus, as

a result of the decrease in irrigation and the amount of fertilizer and chemicals used, the unit yield has been deteriorating year by year and has become less than 4.0 ton/ha in recent years. In 2000, less than 3.0 ton/ha was recorded because of the unusual drought.

The unit yield of cereals in the Study Area has also decreased in line with country trend. Considering Bratislava Region, Senica, Skalica and Myjava Districts as a Great Zahorska area for the purpose of statistics productivity can also be estimated; at about 5.0 ton/ha before 1989, 4.0 ton/ha in recent years and 2.5 ton/ha in 2000.In the Malacky District, the value is also about 3.0 ton/ha in recent years and less than 2.0 ton/ha in 2000.



Source:Statistical yearbook of Slovak Republic

3.4.5 LIVESTOCK PRODUCTION

In terms of value of Slovakia, about one-third of the total production comes from crop products and the rest from animal products. In the Bratislava Region the ratio is 39% from crop products and 61% from animal products.

Production of Livestock Farming

(Unit: ton or klitr.)

District		1997	1998	1999	2000
Senica	Cow	2,739	2,361	2,231	1,904
	Pigs	5,339	4,927	3,909	4,136
	Milk	NA	NA	6,802	6,820
Malacky	Cow	1,865	1,532	1,340	842
	Pigs	1,394	1,201	935	987
	Milk	NA	NA	18,281	17,933
Bratislava	Cow	291	451	380	348
	Pigs	888	NA	1,021	1,031
	Milk	NA	NA	5,074	5,849
SR	Cow	94,048	87,125	77,223	67,752
	Pigs	183,484	169,319	170,105	164,863
	Milk	1,116,143	1,141,695	1,073,183	1,067,378

*: Weight of live animal sold to slaughter is applied for cow and pigs.

Source: Statistical Office of SR (2001).

The livestock farming in the Study Area is mainly composed of milk production and the breeding of cows and pigs, fully utilizing the advantage of location such as the suburb of the Capital Bratislava. However, meat production of cow and pig and fresh milk has been decreasing since 1997, especially in the case of both the meats which decreased rapidly. In 2000, pig meat production was increasing but cow meat is still decreasing. The current BSE problem has worsened the situation in cow fattening. Milk production has also slightly decreased but is stable. These data suggest that pig production, which has better-feed efficiency, and milk production, will revive and increase in the future.

Livestock Production

	Enterprise		SHR	
	Average	Range	Average	Range
Milk production				
Production ratio（lit./year/haed)	4958	4,156~6,855	-	-
Number of cattle（head/unit）	670	257~1,613	-	-
product amount（lit./ year）	3906	1,156~11,053	-	-
Slaughtered Cattle				
Production ratio（kg/year/head)	313	107~500	375	200~550
Number of Cattle（head/unit）	508	10~1,214	8	6~10
Product Amount（ton/year)	103	5~272	2.7	2.0~3.3
Slaughtered pig				
Production ratio（kg/year/head)	144	115~198	111	90~126
Number of Pig（Head/unit）	1707	1,048~3,004	37	13~95
Product Amount（ton/year)	227	128~345	4.4	1~12

Source: Farm Unit Survey（JICA, 2001)

Milk production is carried out by large-scale enterprises. The average number of milk cows in one enterprise is 670 and milking is not done by SHRs in the Study Area. The average annual milk yield per cow is about 4,500 liters, and is lower than the 8,000 to 9,000 liters yield in Austria and other Western Europe countries. A cattle breeding is carried out by both enterprise and SHR. The average number of holding cattle is about 500 in enterprise but is only 10 in SHR. Pig breeding is also carried out by enterprise and SHR. Annual production of pig breeding per farming unit is larger than for cattle.

3.4.6 MARKETING SYSTEM OF AGRICULTURAL PRODUCTS

The marketing system is starting to be prepared in Slovakia, but only for major commodities such as cereal and milk production. The wholesale market for vegetables and fruit does not exist yet. In the cereal market, the government fixes minimum supporting prices and 4 price categories according to its quality. There are a lot of cases where the large-scale traders procure the cereal directly from producers in the Study Area. Generally, oil crop and raw materials are cultivated by contract with a processing company. Usually, such a contract is valid for one year, and the purchase price is a little

lower than normal market price. However, this is an advantage for the farmer because it is easier to plan farm management when the customer is secured and the income is certain. In addition, the merit to farmer is expected that the contract farming helps farmers to prepare farming fund though the support of leasing equipment, providing soft loan to farmers, etc. Contract cultivation has started to extend to the vegetables market for processing at present. Because a wholesale market does not exist for vegetables and potato, farmers/enterprises sell their products to local traders or they are sold in the retail market by the farmers themselves.

3.4.7 AGRICULTURAL SUPPORT SERVICE

The Ministry of Agriculture prepares the support service to the registered agricultural enterprise and SHR (private farmer). The Scheme of the agriculture support service consists of 1) Subsidy, 2) Agricultural Information Service, and 3) Market Information.

(1) Actual Subsidy Expenditure in the Study Area

Under the jurisdiction of MoA Bratislava Regional Office, the total amount of expended subsidy in the agricultural sector was 448 million SKK and there were around 1,600 cases of which 240 recipients were farming units, in 2001. Of this amount, 136 million SKK was expended in Malacky district.

The subsidy system can be classified into assistance to disadvantaged agricultural areas and general assistance as explained previously in 2.3.3. 90% of the Study area is classified as disadvantaged agricultural area, and 27% of the total subsidy in the Malacky district has been paid out in this category in 2001.

Most of the qualified applicants received the subsidy in Malacky district in the year 2001. The subsidy request for the purchasing of irrigation equipment such as hose reel was also paid. However, the subsidy for modernization and support of restructuring, which was described in 2.3 (1), was obtained by only 40% of applicants in a given year. Because the budget is not enough to satisfy all the applications, the subsidy could not be obtained after the budget was spent even though the applicants

qualified. Many local farmers think the payment of subsidy is not assured. Most subsidies is provision for expenses already incurred by the farmer and the cost to the farmer becomes high when the expected subsidy is not obtained. It is pointed out that this causes farmers to be negative to investment in agriculture.

Actual Expenditure of Subsidy for Agriulture Sector Under MoA Bratislava Region Office

	Main subject	Amount (SKK)	(%)
1	Support to farmers operating on land in mountainous and other agriculturally disadvantaged areas	37,211,867	27.6
2	Support to the development of agriculture and food industry	98,642,281	73.3

Main	Sub Section	Amount (SKK)	(%)
1	The compensation of lower revenue rate on arable land	20,177,888	14.9
	Maintaining the quality of land in the country by grazing and mowing	13,634,170	10.1
	Other	3,399,809	3
2	The Cow breeding with milk production	23,012,598	17
	New or in-process construction, purchase of efficient mechanisms and technology,	18,581,370	13.7
	The Compensatory payments in cultivation production	18,253,598	13.5
	The use of irrigation	8,927,467	6.6
	The purchase of new/reconstruction irrigation technology	7,586,011	5.6
	The compensatory payments in crop farming	3,802,400	2.8
	Tthe reconstruction and planting of special crop(vineyards, orchards, etc.)	3,376,000	2.5
	The reconstruction, modernisation for the warehouses of fruits, vegetables	2,980,000	2.2
	The livestock breeding	2,658,400	2
	The payment of a part of interests on a loan	2,057,314	1.6
	The purchase of new technology for plant and animal production and agricultural services	2,050,000	1.6
	Other	5,357,123	4.2
	Total	135,854,148	100

Sorce: MoA Bratislava Region Office

(2) Agricultural Information Service

Farmers expect to be able to use suitable, practical agricultural techniques. However, the information which the regional office of MoA issues, is limited only to general information such as notices about the institution and system for the whole of Slovakia or notice of seminars. Because of this, farmers generally collect necessary

information from private dealers of seed, machines and equipment, etc. It was also observed that companies hired private agricultural consultants.

The agricultural extension service was formerly conducted through the technical guidance by the agrotechnician hired by an agricultural chamber to which the farmer belonged. The MoA changed this to the Technical Guidance System which operates by farming units hiring registered private advisers for which the government provides subsidies. It. In the Study area, it seems that this new system does not yet function well because it is not popular among farmers.

(3) Market Information

The wholesale market has not yet developed in Slovakia, but information about market prices and trends of the market for major commodities is collected, analyzed and announced once a week/month depending on the products by ATIS (the Agricultural Market Information Service). This information is useful when the production plan is long-term.

(4) Agricultural Credit

Agricultural loans are supplied by commercial banks because the public agricultural credit system does not exist in Slovakia. However, the government is assisting the farmers with interest payments for financing from commercial banks. The actual interest rate is between 11% and 12.8%, when assistance can be applied for. According to the Farm Unit Survey, 64% of the agricultural enterprises and 13% of SHR are using the loan in the Study area 91% of the companies reported difficulty in obtaining loans. Difficulty with collateral formation occurs, as pointed out in the Survey, because most land in enterprises is leased. In some cases, the food processing companies provide soft loans to the contracted farming enterprise.

3.4.8 PRESENT CONDITIONS OF IRRIGATION AND DRAINAGE

(1) Irrigation

In Zahorska Lowland, irrigation for crop growing started in the early 1970s, and the present irrigation facilities were completed by 1985. The present Study Area is equipped with 21 irrigation systems covering an area of 16,224 ha. 60% of the irrigation crop is grain such as wheat and barley, with the balance shared by sunflower, maize, potato, and vegetable. In the irrigation plan, the capacity of pump equipment and pipeline network including water permission are designed to cover 40% of the commanded area based on the crop rotation system for a combination of summer crops and winter crops. The irrigation area, however, continued to decrease after 1990 because of the trouble and loss of pump equipment caused by poor management, and during the period from 1994 to 2001, it dropped to an average of 1,740 ha, with the utilization ratio standing at 10.7%.

Actual Use of Irrigation inRecent Years

Item	1994	1995	1996	1997	1998	1999	2000	2001
Water Amount (1,000m^3)	2,486	1,620	557	412	829	273	2,031	1,556
Irrigation Area (ha)	3,290	2,695	924	685	1,376	620	1,376	2,978

The main reason could be that the farming body, which is developed from state farm or cooperative farm, should be implementing economic farm management as the result of the change of the economic system. There has been a remarkable reduction of irrigation for cereal production. Because the wheat for animal feed is cultivated as a winter crop, the profit resulting from using irrigation cannot be expected to be high due to the small increase of yield by 10 to 20% using irrigation. Therefore, irrigation is limited to drought years only to secure the necessary yield. The crops currently irrigated are only asparagus, potato, sunflower, vegetable and alfalfa for which effectiveness of irrigation is high. For asparagus, potato and vegetable, in particular, irrigation is indispensable to produce quality products acceptable for the market because of the low precipitation of 600 mm and sandy soil.

The trial estimate of the profitability of winter wheat with irrigation in sandy soil, according to the results of the farm unit survey, is shown in the following table. Wheat is classified into two categories, i.e., feed material and food material, of which price is different, in accordance with its protein contents. Without irrigation, the sales amount dose not cover the production cost by itself and only narrow profit is gained by the support of governmental subsidy. By applying combination of irrigation and improvement of cultivation practice including appropriate fertilizer application, it becomes possible to expect increase both of unit yield and selling price. The expected net return per hector will increase from 34 SKK without irrigation to 4,341 SKK with irrigation and improvement of cultivation practice, of which profit ratio increases from 0.3 to 25%. However, it should be pointed out that the farming cost will increase from 12,277 SKK to 17,098 SKK by 40% increment and farmers have to take a large amount of farming fund to receive above benefit.

Trial Estimate of Profitability of Winter Wheat with Irrigation in Sandy Soil

	Existing Condition			Irrigation + fertilized improvement		
Item	ısed amount/h	Unit Price	price	sed amount/h	Unit Price	price
Immediate Cost						
Land Rental			500			500
Ploughing*			1,300			1,500
Fertilizer（NPK)	90 kg	13 Sk/kg	1,040	135 kg	13 Sk/kg	1,755
Fertilizer Application*			500			500
Seeds	150 kg		1,125	150 kg		1,125
Seeding*			1,450			1,450
Agricultural chemicals	4 lit	600 sk/l	2,500	4 lit	600 sk/l	3,100
Agricultural Chemicals Appriction*			1,000			1,000
Harvesting*			1,700			1,870
Irrigation Cost（Facility cost, subsidy involved）				990 m3		2,744
Sub Total			11,115			15,544
Management Cost（10%of immediate cost）			1,112			1,554
Payment Total			12,227			17,099
Income						
Selling Income	3.2	3300Sk/t	10,560	4.7	4200Sk/t	19,740
Subsidy for production		500 SK/ha	500		800 SK/ha	500
Subsidy for disadvantage agricultural land		1200 SK/ha	1,200			1,200
	Yield 3.2t/ha Selling for feed			Yield 4.7t/ha Selling ofr food		
Income total			12,260			21,440
Net return/ratio		**34**	0.3%		**4,341**	25%

*: Application cost including the fuel, monpower
Source: Farm Unit Survey (JICA, 2001)

All systems are composed of a pump and pipeline system, and sprinkler irrigation with pressured water, using big reel-hoses, is widely used for field irrigation. The irrigation facilities are state assets from the water intake to the terminals (hydrants), and managed by the SWME-ID. Management of 13 their irrigation systems of is entrusted to private water supply companies. Field irrigation equipment beyond the

hydrants are provided and managed by farmers themselves. There are no irrigation systems which have a user's organization in the Area, even if two or more users use water in one irrigation system. Users negotiate for irrigation water supply with SWME-PD or water supply companies directly.

Pumping facilities are not well utilized due to damaged or lost parts. The evaluation of the irrigation systems according to the existing condition of pump facilities is shown in the following table. The irrigable area in category I, in which the irrigation systems are used or repaired easily, is 9,980 ha which corresponds to about 60% of whole irrigable area.

Evaluation of Existing Irrigation Systems

Category	Contents	Number of pump station	Irrigation Area (ha)
Category I	Pump station, which operates irrigation in 2001 or repairable easily.	8	9,980
Category II	Pump station which has the facility, but it has not been operated for 2-3 years.	3	3,319
Category III	Pump station, which has pump and motor, but a pressure tank, a switchboard, etc., are damaged and is not operated for 5 years or more.	4	1,179
Category IV	Pump station which cannot be operated because of loss or disappearance of parts	6	1,746

There are also problems caused by both management and technique. Irrigation equipment should be prepared by the irrigation user. However, introduction of new equipment or replacement of obsolete equipment is not carried out well. This shortage of facilities is one of the major constraints of irrigation use. Furthermore, 93% of the irrigation facilities are sprinkler systems with big reel-hoses. Most of them were designed for large scale farming during the socialist period, so it is suitable for cereal production, but cannot be used for vegetables and fruit due to the high hydraulic pressure. It is expected that small-scale irrigation or suitable irrigation systems for intensive farming will be required.

(2) Economics of Irrigation Farming

1) Necessity of Irrigation for Major Crops

The necessity of irrigation for major crops in the Study Area is summarized in the following table. “Target crop” is the recommended crop in the irrigable area, “occasional crop” means the crop which has the potential to be introduced into crop rotation with the mentioned “Object crop”

Necessity of Irrigation in major crop

Category	Crop	Purpose	Target crop	Occasional crop	Out of object
Oil Crop	Sunflower	Cash Crop	○		
	Rape	Cash Crop			○
Cereal	Winter Wheat	Food	○		
		Feed			○
	Spring Barley	Cash Crop	○		
	Rye	Feed			○
	Triticale	Feed			○
Maize	Grain Maize	Feed		○	
	Silage Maize	Feed			○
Legume	Soy Bean	Feed		○	
	Alfalfa	Feed		○	
Feed		Feed			○
Vegetable and Fruit		Food	○		

2) Assessment of Irrigation Farming

The results of economic assessment of existing cultivation according to the above crop selection reflect the actual situation. 1) Spring barley and sunflower which was cultivated in better soil areas made some profit, 2) balance of wheat production mostly even, but are used as feed in mixed farming of cereal production with livestock farming, 3) maize is widely cropped due to an advantage both in selling to market and consuming as a self-supply feed.

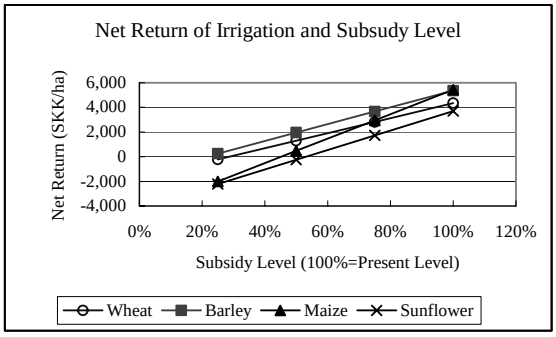
The economics (profitability) is improved with proper irrigation and fertilizing. A significant increase in profit may be expected for spring barley and sunflower, which

are already profitable use. Profit is related to soil condition and reduces in sandy soil. If wheat can be produced with food consuming quality so as to be sold as food, improvement of the profit structure is expected. Introduction of irrigation in maize production will contribute to reduce the cost of feed in mixed farming of cereal and livestock.

Item	Profit	Comment
Wheat	Without irrigation Net return: 34 SKK/ha Profit ratio: 0.3%	Wheat for feed is cropped in the better condition soil. It produces quite low profit, however, it contributes to the farming budget of the mixed farming though supplying feed.
	With irrigation Net return: 4,341 SKK/ha Profit ratio: 25%	It is expected that by the improvement of irrigation and fertilizing the increase of yield and quality will allow it to be sold at a good price as food wheat., 25% profit is given in sandy soil. However, it is precondition that products are sold as food. So security of a market connection is an essential item.
Spring Barley	Without irrigation Net return: 1,544 SKK/ha Profit ratio: 12%	Barley is cropped in the area where soil is better, now. Spring Barley is provided to the factory as raw material, so that the price is decided not only on the quality but also the stability of production. Due to that, it became a loss in sandy soil where it is a small area and in poor condition. Therefore, Spring barely is cropped in relatively large and better areas.
	With irrigation Net return: 5,362 SKK/ha Profit ratio: 32%	It is expected to give more than 30% profit even in sandy soil by the improvement of irrigation and fertilizing. It is enough profit to regard it as a cash crop in farm management.
Maize	Without irrigation Net return: 1,617 SKK/ha Profit ratio: 12%	Maize is cropped without selection of soil, now. Maize has an advantage both in selling and consuming as self-supply feed. Moreover, maize is cropped where there is environmental variation, because it can be used as silage when damaged by drought or inundation.
	With irrigation Net return: 5,427 SKK/ha Profit ratio: 28%	It is expected to give 28% profit even in sandy soil by the improvement of irrigation and fertilizing because a large increment of unit yield is expected by irrigation.
Sunflower	Without irrigation Net return: 917 SKK/ha Profit ratio: 6%	Sunflower is cropped without irrigation or with minimum supplemental irrigation. (400m^3/year). A 6% profit is expected in average condition of field without irrigation.
	With irrigation Net return: 3,696 SKK/ha Profit ratio: 19%	It is expected to give more than 20% profit even in sandy soil by the improvement of irrigation and fertilizing. It is enough profit to be regarded as a cash crop in farm management.

3) Sensitivity Analysis of Subsidy

In cultivation of "target crops", there are three types of subsidies: subsidy for cropping, subsidy for agriculturally disadvantaged area and subsidy for irrigation. In the economic balance of each crop, the income from subsidy occupies high ration in the gross income, which is from 28 to 40%. The subsidy for irrigation is more important than the one for cropping and disadvantage, because the irrigation cost accounts for about 16 to 23% of the total cost. It is difficult to make a profit without subsidy for irrigation. When the subsidy will be reduced to 23 to 53% of the present level, the economic balance of farming budget will fall into the break-even level.



Share of Irrigation Cost and Subsidy of Target Crops

Items	Wheat	Barley	Maize	Sunflower
Ratio of irrigation cost in the total farming cost	16.0%	18.4%	22.7%	18.0%
Ratio of subsidy in the gross income	28.4%	31.1.%	40.1%	34.7%

(3) Drainage

The bank of the Morava River, which provides the final drainage in the Study Area, is now being improved to cope with a 100-year frequency flood by 2003. Damage by flooding or inundation will thus be prevented in the Area. In the basin to the west of this area (17.56 km^2), which is a pumping drainage zone, surface water is drained to the Malolevarsky and the Zohorsky Canal, and the water is fed by a two pump station into the Morava River. A negative factor in this area is that the water level of the Morava River rises above the ground water level because of the concentration and run off from snow melting in the spring season from February to April and flood season in summer, and thus requires constant control and management by means of pump operation.

The natural drainage of the downstream basin of Malina, Rudava and Myjava is affected by the high water level of the Morava River during flooding. Although no areas suffer serious damage flooding and inundation occur every year. Small inundation fields were observed in depressions and/or poor drainage areas which suffer from high groundwater. Decreasing capabilities of the existing drainage canal and control facilities due to lack of budget became a problem in such areas, and strengthening and expansion of their maintenance is necessary.

In the areas where the groundwater level is high and drainage is bad, improvements of drainage are carried out by constructing underdrains and ditch canals in the field, and by repairing the existing natural canals. In the present study area, the area of drainage improved by means of underdrains is about 10,572 ha, which covers 34% of farmland. The percentage of areas where irrigation facilities have also been constructed is about 70%. The drainage facilities are not maintained and renewed well so it became superannuated and responsibility belongs to the landowner. 40% of them cannot function well according to SWME-PD, and it is said that the figure is increasing by about 4 to 5% annually.

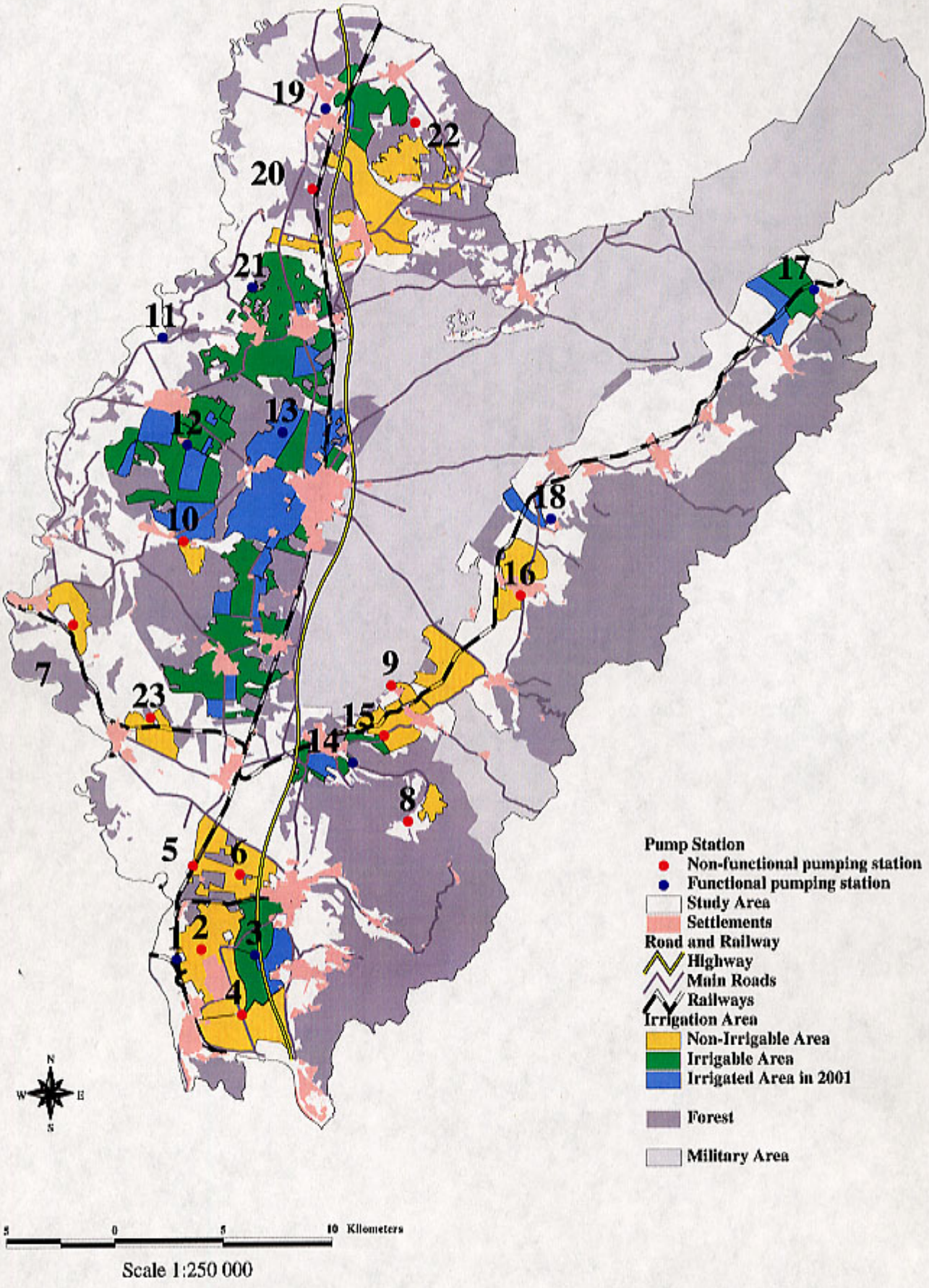


Figure 1.4 Location and State of Irrigation Systems

CHAPTER 4 POTENTIAL AND CONSTRAINTS

4.1 PROBLEMS OF AGRICULTURE IN THE ZAHORSKA LOWLAND

(1) Irrigation

Wide Distribution of Low Water Holding Capacity Sandy Soil

Poor soil, categorized as sandy soil and loamy sand, is dominant in the field in the Study Area. It has low water holding capacity and poor fertility, and it makes up around 60% of the total agricultural area. Hence, the yield in such soil depends on the amount of rainfall, even where rain fed cultivation is possible such as in cereal production. Irrigation is indispensable for most of the summer crops such as vegetables. Moreover, the amount of water usage and its frequency in irrigation becomes high, because of this low water holding capacity.

The Ratio of the Area with Installed Irrigation to the Total Agricultural Areas is high.

The large-scale irrigation system was developed in the 1970's and 1980's in the Study Area, and the total area of installed irrigation systems is about 16,000 ha. It is around 40% of the total agricultural area in the Study Area, and it is considerably higher than the national average of 13%. All irrigation systems still have the water permissions, regardless of actual use, and 74% of such permissions are given from the Morava River, which has a large and stable quantity of water. There is a high potential for irrigated agriculture in the Study Area regardless of the low ratio of irrigation in use mentioned below.

By Contrast, Low Ratio of Actual Use of Irrigation Facilities

The average area actually irrigated between 1996 and 2000 is about 1,700 ha, only 10.7% of the whole installed irrigation area. The reason for this low percentage, is malfunctioning of the system caused by superannuation of the facilities and low maintenance, and a decrease in the interest of the users in using irrigation. The poor condition of the facilities and the reduced usage combine to make the situation worse. Furthermore, instability and inflexibility of irrigation water supply make farmers less

likely to use irrigation. It is also relation to the reduction in the amount of recoverable water costs and the lack of a maintenance budget, resulting in the deterioration in the irrigation system. Another reason for the reduction of irrigation is that the farming style in the Study Area is not suited to irrigation agriculture in farm management under the market economy because cereal production is dominant.

(2) Drainage

Gravity drainage becomes difficult in spring because the water level of the Morava River rises above ground level.

Because of the increase in water run off from melting snow in the upper basin, the water level of the Morava River rises above surface level from February to April. It becomes difficult for the ground water to drain by gravity. Continuous pumping is necessary when the river discharge is high after rainfall or run off from melting water. Inundation happens in the fields by the side of the Morava River, and these fields are used as disadvantaged fields where there is a risk of inundation in spring season.

Serious flood damage is not expected if response facilities are operated and maintained well, such as the main drainage canal, its pump station and the embankment of the Morava River.

The main drainage canal system developed along the Morava River drains the surface water of the lowland, and it is necessary to continue pump drainage in the spring season due to the hydrological and geographical conditions mentioned. There are two pump stations that drain into the Morava River on the main drainage system. They were renewed in 1998 and 2001 respectively and function well. Moreover, the embankment of Morava River is being improved to cope with a 100-year frequency flood. It is expected that serious flood damage will not occur when these facilities are maintained and function well.

Continuous expenditure is required to maintain the drainage.

Pump drainage needs continuous expenditure for operating and maintenance of the system. The conditions of the area require permanent pump drainage in the spring

season. In addition, even if complex drainage networks are developed corresponding to the geography of the Study Area, small poorly drained areas remain, partially due to the collapse or malfunctioning of siphons or drainage canals. To maintain the proper functioning of a drainage system, consisting of the pump station and canals, a budget and manpower is required.

(3) Soil Conservation / Wind Erosion and Wind Damage

Risk potential of wind erosion is high due to strong wind in the spring and wide distribution of sandy soil.

There are some areas where the risk potential of wind erosion is high, especially in the fields for planting summer crops. The field surface is bare for seeding during the period of strong winds from March to May. In the Study Area, agricultural development has been carried out mainly for large-scale cereal farming with machinery and plot size was enlarged by removing the surrounding forest. It increased the risk potential of wind erosion because there are fewer barriers against the wind and the strong winds blow easily over the flat topography. The risk is very high in areas with wind blown sandy soil consisting of fine-grained sand.

Even where wind erosion or wind damage is serious, this is not always considered in the cropping system.

The damage to crops by wind and wind erosion is well recognized by farmers who cultivate in high-risk areas. It is said that the physical damage to crops by wind and blown sand is more serious than wind erosion damage. Two types of wind and wind erosion damage are described as follows. One is the water stress during the germination period for summer crops whereby evaporation and drying of the soil surface is increased by strong wind in the area not covered by crops. The other is physical damage to the crop in the juvenile period by the blown sand. Damage is especially marked in maize. Its seeding time is comparatively late, e.g. the middle of April, and its germination and juvenile period is during the season of strongest wind. According to the interview survey results, it decreases yield by about 20%. The necessity of considering soil coverage during the high-risk season of strong winds is

recognized by the farmers. However, it seems that the damage-prone maize was still cropped on a large scale in such an area because they could not choose other suitable crops. There are comparatively few crops suited to use crop rotation, and there is the need to provide feed for the livestock sector, which is the main sector in farm management.

(4) Soil Moisture Management and Field Drainage

Drainage conditions had been improved by installing a underdrain network, but malfunctioning of underdrains occurred as a result of wear.

In the Study Area, underdrains were installed into about 10,572 ha of poor drainage fields, which cover 34% of farmland. Drainage was improved by developing drainage canals and underdrains. This drainage improvement was started in the 1930's and half of them were constructed by the 1970's.According to SWME-PD's estimation, 40% of them have functional disorders and this increase by 4 to 5% per year. Because of such malfunctioning, partial inundation is observed locally after rain, even though underdrains are installed in the field. Land users have a responsibility for the maintenance of underdrains and SWME-PD takes care of the ditch canal. However these facilities are not maintained and renewed well. The reason is that they have finance problems and it was also mentioned that management of the drainage system became difficult when the network was divided among small landowners through land restitution.

Sandy soil fields become dry easily because of low water holding capacity and high evaporation from the soil surface. The yield is also unstable and varies widely depending on rainfall in rain fed cultivation.

Sandy soil, which covered 60% of total agricultural land in the Study Area, dries easily because of its low water holding capacity and high surface evaporation. Cereals such as wheat and rye are produced by rain fed cultivation in the area and the yield relies strongly on rainfall. Due to the large scale of the plots, it is difficult to provide countermeasures that would improve the water holding capacity or reduce the surface evaporation.

(5) Soil Fertility Management, Cropping System and Farm Management

Crop productivity is lower than other areas due to the wide distribution of sandy soils, which are poor in fertility and low in water holding capacity.

Cereals are the major crop in the Study Area, however yields are relatively low due to the wide distribution of sandy soil, which only has low fertility and low water holding capacity. The yield of cereals in the Area is only 80% of the national average in Slovakia, and the profit is low because a difference of 20% reduces profitability.

Decrease in agricultural inputs under the market economy induces yield reduction.

In the Study Area, high yield had been maintained during the socialist period using high inputs of chemical fertilizers and irrigation to achieve the target production and overcome the disadvantages of natural conditions. In the market economy, the fertilizer/chemicals became expensive in relation to the value of the agricultural products, thus the amount of fertilizer/chemicals and pesticide inputs have decreased, so the yield also decreased. The decrease in the amount of fertilizers in cereal production reduced the quality of products and the purchase price dropped accordingly.

Effective fertility improvement is difficult in sandy soil areas due to the less fertility in the basis and the less profitability that limits investment.

Small inputs of fertilizer do not work effectively for soil fertility improvement in low fertility sandy soils. Moreover, the profitability of such soils is originally relatively low, so that the fertility improvement created by a high input of soil additives cannot be supported under a market economy. Because of this, new improvement measures are required based on ideas other than the high input of chemical fertilizer used in the socialist period.

The planted area has been decreasing recently, especially in cereal cropping.

The planted ratio is gradually decreasing in the Study Area. It fell by about 15 points from 92% in 1997 to 78% in 2000. The reasons are not clear but are expected to be as follows. Not only suitable fields but also unsuitable fields for cultivation had been

developed in order to expand production through high input of material and manpower under the planned economy of the socialist period. After the economic system changed, use of such low productivity fields changed as a result of low input agriculture. It is also thought that some of the land not in use is in the process of changing land ownership caused by bankruptcy of agricultural cooperatives and companies. The reduction of planted area is most marked in cereal production, its area having decreased from 15,158 ha in 1997 to 12,202 ha in 2002 in Malacky.

(6) Effective Land Use

The land evaluation system is not used effectively for agricultural support and the regional agricultural development plan.

The land resource evaluation system, based on the soil condition database with considerations on climatic and other conditions, has been developed for the whole of Slovakia. This system can be said to be a synthetic evaluation system. The system is mainly used to provide the basic information to estimate land value (to estimate a land price and its tax value), and is not used effectively in planning agricultural support and regional development.

(7) Agricultural Support Service

There were some cases where an agricultural subsidy was not provided to qualifying applicants.

There were some cases when the subsidy was not paid because of insufficient resources, even though the applications satisfied the criteria. In addition, the subsidy is paid after the costs have been incurred, and the uncertainty of the subsidy was one of the main reasons that make the farmer less likely to invest.

The agricultural information service does not function well.

The agricultural extension service had been conducted through technical guidance by an agrotechnician belong to the agricultural chamber nearest to the farmer. The MoA changed it to the Technical Guidance System which consists of hiring privatized

agricultural advisers by farming units and the government provides a subsidy support. In the Study area, it seems that this new system is not yet functioning well because the new system is not popular among farmers. Furthermore, specialized cultivation methods and agricultural technologies are required in unique natural environments such as the sandy soils of the Zahorska lowland. Up to now, the research institute and farming body have not cooperated much. However, such institutes are registered as advisers to the new agricultural information service as are other agrotechnicians, because they is expected that cooperation between research laboratories and the production site will increase if this new system is to function in the future.

It is difficult to provide collateral for bank loans.

Most of the agricultural lands that enterprises use are accumulated through lease agreement. However, such leased land is not accepted as collateral by banks. When securing necessary collateral is difficult, it becomes hard to obtain a bank loan. This is a factor that reduces agricultural investment. Moreover, it is seen that some agricultural bodies are financed by large-scale distributors or processing companies and contract cultivation is carried out.

Insufficient market development and market information service

Quality grade is clearly regulated for cereals and contract cultivation is popular for raw material cultivation. Vegetable and fruit production has the problem that the quality of products or the production stability are not reflected in the price, due to the lack of a wholesale market system. This means that farmers do not consider quality improvement of products. Moreover, MoA announce the current market price, collected by interview survey as a market information service, but the shipping plan cannot be settled for vegetables and fruits that are difficult to store for a long time because of a delay in obtaining such information.

(8) Soil Pollution

There are no mines in the Study Area. Soils slightly polluted by cadmium (6 - 2.0 ppm Cd) were identified around the cement factory in Rohoznik, by using the potential map.

The above mentioned problems of agriculture in the Zahorska Lowland were classified into the following three topics at the workshop with participants such as C/P, officers and farmers: 1) problems caused by natural conditions, 2) caused by farmers/agricultural body and 3) caused by supporting systems or other external conditions, as shown in the table on the next page.

PROBLEMS OF AGRICULTURE IN ZAHORSKA LOWLAND

Sub-ject	Problems caused by natural conditions	Problems caused by farmers/agricultural body	Problems caused by supporting system or other external conditions
Irrigation	• Annual precipitation is low, but it is possible to cultivate wheat crops. The rainfall amount and distribution is unstable during April to May, in the season when water required for wheat crop is relatively high. Winter wheat can be grown without irrigation, but the yield depends on rain. • Usable amount of water in the area is enough for the demand of irrigation. • Frequent irrigation is required due to low moisture retention capacity of sandy soil.	• Irrigation is not (or in small amount) applied to wheat crops, that is the predominant production style in the area. • Farmers think the economical merit of irrigation is quite small (for wheat crops). • Facilities and equipment in field are not prepared or renewed because of lack of financial sources. • Number of non-operating systems increases due to the lack or low number of users. • The difference of interests between the land owner (doesn't want to develop since not user) and user (wants to develop but not owner) prevents the incentive to invest in irrigation • Low profitability of agriculture does not encourage people to invest in irrigation development.	• Insufficient maintenance and renewal of degraded facilities causes instability of irrigation water supply and/or a limitation of irrigable area. • Irrigation systems are not suitable to meet the requirements of farmers. (Many facilities were developed for large scale irrigation and do not have flexibility to meet small and diversified demand.) • It is difficult to establish appropriate rehabilitation plan because the users and the water demand are changing so often. • The irrigation facilities are not counted into the property value of land
Drainage	• Operation of pumping drainage is indispensable during a) snow melting period in spring (from the end of February to the end of April) and b) the high precipitation period in summer because the high water level of the recipient (Morava River) prevents gravitational flow from drainage canals. • It is difficult to drain gravitational water from some of the downstream area of the tributaries of Morava river (Myjava, Rudava, Marina rivers)	• Inundation caused damages of agricultural production occurs mainly in the flood hazardous areas, such as flood plains. Despite understanding its risk farmers use these lands for farming	• It is very important to maintain the drainage pumping stations to ensure the proper functioning of the main drainage network. • Many of the areas accompanied by poor drainage capacity are part of the environmental conservation area and have some limitations to develop.

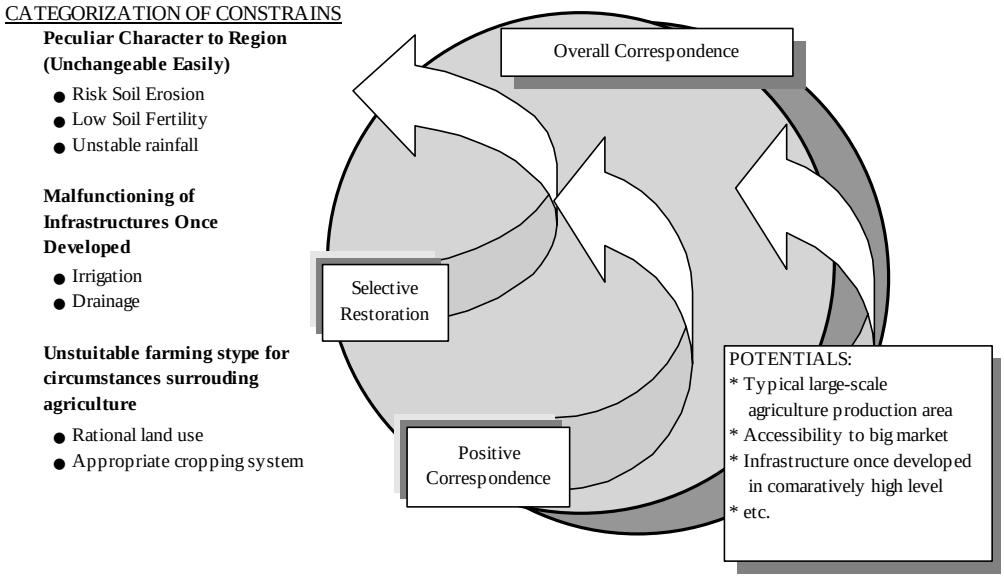
Sub-ject	Problems caused by natural conditions	Problems caused by farmers/agricultural body	Problems caused by supporting system or other external conditions
Soil erosion	• Water erosion does not occur easily because the area is generally flat. • Strong wind occurs during early spring (February and March) • Sandy soil with dried surface.	• Expansion of agricultural land by removal of boundary forest and/or windbreak forest. • Lack of knowledge on the importance and necessity of covering soil surface in cropping and farming.	• Lack of activities for plantation of wind break/ boundary forests. • Social and economic environment/conditions that makes it difficult to have incentive for land investment. (Land ownership)
Soil moisture management and ordinal drainage in the field	• Stagnant waters are found in some area because of some depression. • In some part of the area the groundwater level is high • Sandy soil is easily dried out due to high evaporation at soil surface caused by low moisture retention capacity.	• Farmers have a responsibility to maintain underdrain in their fields. However, it is difficult for them to judge technically the degree of degradation or malfunction of underdrains. • Underdrains in the field are not maintained sufficiently. • Investment for equipment, including repair and renewal, is limited due to the lack of funds and subsides. • Benefits of underdrain are not well-known or well-understood by farmers. • Large scale farming causes difficulty to introduce measures such as mulching by cultivation residues or sand.	• Insufficient relationship between the river management and drainage management causes difficulty of appropriate soil water management in field. • Insufficient coordination between the management of main drainage system and field drainage exists due to the separated responsibility of management. • Insufficient maintenance of collecting canals. • Divided drainage network through the land re-distribution causes difficulty of management.
Soil fertility management	• Most of the area is covered by sandy soils, which have low nutrient retention capacity. • Low ability of soil to respond to fertilizer supply.	• Decrease of soil fertility has resulted from the decrease of fertilizer input. • Harvest residues on the field and animal waste are recycled in field insufficiently. • Soil dressing with sticky gray clay soil (eluvium of limestone) is observed in some part of the area, but it is limited or restricted.	

Sub-ject	Problems caused by natural conditions	Problems caused by farmers/agricultural body	Problems caused by supporting system or other external conditions
Cropping system	• Low/varying precipitation • Sandy soil with low retention capacity of moisture and fertility is predominant. • Late frost damage occurs frequently due to the relatively low temperature. • Organic material content is deficient, and it causes low soil fertility. • Low potential of productivity • Only a small group of suitable crops can be found due to a number of natural limitations.	• Amount of applied fertilizer decreases to half or quarter of past. (60～70kg of N, P_2O_5, K_2O/ha) • Amount of applied agricultural chemicals decreases. • Unit yield of grain crops decreases as a result of terminating irrigation. • Cropping system has not been diversified yet. • Insufficient maintenance of agricultural machinery. Sometimes farmers cannot renew their machinery even though it is necessary. • Insufficient establishment of gathering and transporting /delivering system of agricultural products.	• Purchase price of fertilizer went extremely high. • Selling price of agricultural products is staying low. • Formulating production centers and/or joint work processes are not developed in production and selling stage as well, because fruits and vegetables are being produced individually. • Sometimes, irrigation water cannot be supplied in the right time at the right place.
Farm management	• Low potential of productivity • Only small number of suitable crops is found due to the several natural limitations.	• Incentive for investment in agriculture is decreasing. • Location advantage is not made the best use of. • There are many farmers who can not respond to market economy.	• Lack of soft loans for farmer/farming body. • Lack of support system for small scale independent farmers.
Land use evaluation and			• The existing land evaluation system is mainly used to provide the basic information to determine land value (price for taxation), and not to support farming plans or regional agricultural developments.

Sub-ject	Problems caused by natural conditions	Problems caused by farmers/agricultural body	Problems caused by supporting system or other external conditions
Agricultural support	• (Specific techniques of cropping system are required due to the particular soil condition.)	• It is difficult to secure the collateral to obtain the bank loan..	• There are some cases where an agricultural subsidy is not provided to a proper application • The agricultural information service does not function well because it is not known well. • The advantage of quality and production stability is not reflected in its price because the wholesale market is not prepared for the vegetable and fruit market.
Soil pollution	• (There are no mines in the Study Area.) • (It is understood that the cadmium observed was brought to the area by local air pollution from the cement factory.)	• Farmers/farming bodies lack understanding of pollution, and they use lands as usual.	• Detailed standards of permissible levels is set up for food, drinking water, etc. in Slovakia based on the international standards. • However, the analysis of the relation between soil pollution and pollution of agricultural products is not sufficient, and the standard of permissible level of soil pollution is much higher than international standards.

4.2 POTENTIAL AND CONSTRAINTS

The constrains recognized in the Study Area are categorized into the following three groups: (a) peculiar character, not easily changed, such as natural conditions, (b) malfunctioning of the infrastructures previously developed, (c) farming style unsuited to present circumstances and without consideration of rational land use and appropriate cropping systems.



Categorization of Constrains and Countermeasure with Full Use of Potentials

A large number of irrigation and drainage (including underdrains) systems were previously developed to cope with severe natural conditions mentioned in (a), to increase agricultural productivity. After the transition to the economic system, the efficiency of these facilities has largely decreased over the past ten years. However, they are facilities that can easily and economically be recovered and immediately contribute to increase or stabilize the agricultural production if restored. In addition, constraints categorized in (c) have become more important due to the change of circumstances surrounding agriculture in recent years. On the other hand, the Zahorska Lowland is one of the typical large-scale agricultural areas in Slovakia, and it has potential as represented by the previously developed irrigation facilities. These factors should be considered for the sustainable development of the regional agriculture.

PART 2	*GUIDELINES*

PART-2 GUIDELINES

CHAPTER 1 CONCEPT OF GUIDELINES

1.1 BASIC CONCEPT OF GUIDELINES

(1) Historical Understanding of Regional Agriculture

Before the Agricultural Revolution in the 18th century, European agriculture had been ruled by the fact that grain cultivation causes an inevitable decline in soil fertility and continuous grain cultivation results in a decrease in productivity. The three-field system (or four-field system) using the combination of fallow land, grassland for pasturing and grain field had been introduced as a countermeasure to the yield reduction in the field.

This system enabled European agriculture to barely maintain crop yield for more than 100 years until the 1930's. A rapid rise in the unit yield of cereals was achieved by the introduction of ammonia fertilizer in the latter half of the 1930's, and the rotation system collapsed. This corresponds to the time when the farmland development of the Zahorska Lowland through drainage improvement and flood control of the Morava River was promoted, and the Lowland was recognized as one of the agricultural centers of Slovakia.

The mechanization of agriculture (introduction of large-scale machinery, large-scale irrigation development) and the use of chemicals in agriculture (large applications of chemical fertilizer and agricultural chemicals) were strongly promoted during the 1960's to 1970's under the socialist regime in order to stabilize food supply in socialist nations. In the Zahorska Lowland, where a low fertility sandy soil was predominant and the productivity was originally low, an expansion of farmland and an increase of agricultural production were promoted by the introduction of a large-scale irrigation and drainage development with a large amount of fertilizer application in the 1970's. The irrigation area of the Zahorska Lowland was developed

to the present level during the 1970's to 1980's. During this period achievement of the production target was considered more important than economic efficiency, under the policy of increased food production. Due to the change in the political system, agriculture in the area was required to respond to the market economy in the 1990's. To prepare for affiliation to the European Union, where the agricultural trend is overproduction, it is urgently required to establish a profitable agriculture taking into account protection of the natural environment.

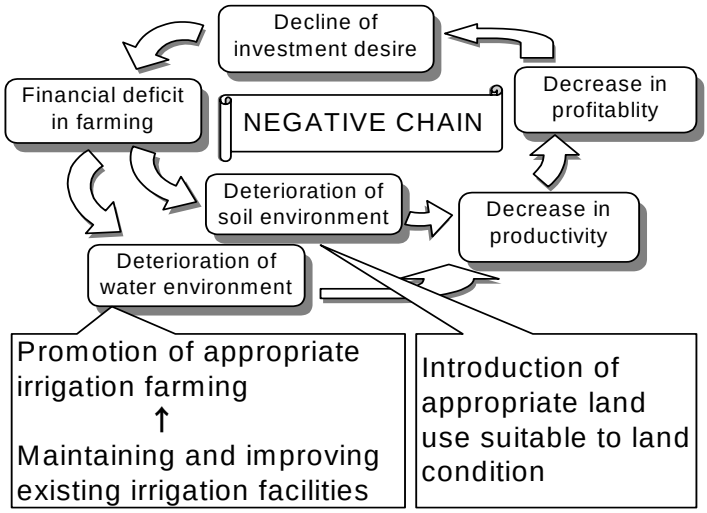
(2) Current Situation of Regional Agriculture

Agriculture in the Zahorska Lowland is struggling with stagnation/devastation, which is a complex combination of the decrease of irrigation and fertilizer/chemicals application, the decrease of agricultural production and unit yield, the deterioration of the profitability of farmers/agricultural body as well as the selection of farmers/agricultural body who cannot respond to the changes in the economic system. The stagnation/devastation of agriculture in the Zahorska Lowland can be said to be caught in a negative chain; the deterioration of profitability, which has originated from low productivity and low prices for domestic agricultural products, has caused a reduction in the investment incentives of farmers, and it causes further decrease of productivity by reduction of irrigation and fertilizer application as a result of farmers' low incentives for investment. As a result of the principles of the production targets promoted in the socialist regime, a mismatch of regional agriculture and land use occurred. In the present situation, under the market economy, economic efficiency strengthens the negative chain.

This stagnation/devastation of regional agriculture can be seen as the result of confusion in the process of change to the economic system. However, if the current situation is left in such confusion without taking any measures, it may lead to the excessive decline of regional agriculture, the destruction of the natural environment and the permanent dismantlement of a rural society. The recovery from this decline may be impossible in the future.

(3) Where to Break-in on the Negative Chain

This negative chain can be solved by the process of realizing efficient farm management taking into account the natural and social environment. The approaches shown below are proposed to break in on the negative chain.



Where to Break in on Negative Chain

(4) Purpose of Guidelines

The purpose of the Guidelines is to help to promote and to improve the regional agriculture quantitatively and qualitatively. The Guidelines are prepared to provide technical countermeasures as an optimal package for the soil and water management program of the Zahorska Lowland. They would target a regional agriculture that is "realizing agriculture to cope with both the stability and sustainability of farm management and the sustainable development of the natural environment and rural society, based on rational land use".

(5) Target Area of Guidelines

There is more than one geographical definition of the Zahorska Lowland in Slovakia. Popularly the Zahorska Lowland is defined as the Slovakian Territory of the Lower Morava River Basin. In its broad sense this includes the Chvojnicka Hill, which is the part of the right bank of the Myjava River. In the Guidelines, the Zahorska Lowland is defined, in the narrow sense, as the target area limited to the left bank of the Myjava River excluding the military area.

Even though the Guidelines target the Zahorska Lowland in the narrow sense, it is expected that they will be also used in the remaining area because there are a lot of common issues and applicable Guidelines.

(6) Users of Guidelines

The users of the Guidelines are expected to be composed of the following three groups:

- Officers in charge of planning the regional agriculture or controlling the agricultural infrastructures such as irrigation and drainage system,
- Technical advisers belonging to the Agricultural Chamber or registered in the Agricultural Advisory System, who connect enterprises/farmers to the technical support system,
- Managers and agricultural engineers of enterprises and individual farms, who are in charge of planning the farming and farm management.

(7) Scope of Guidelines

The agriculture in the Zahorska Lowland is basically composed of mixed farming consisting of cereal production with animal husbandry. The animal husbandry generates the major part of profits in the farm management in general. The major part of the cereal production is for supplying feed for animals and supports the animal husbandry. Even though the animal husbandry sector is important and indispensable

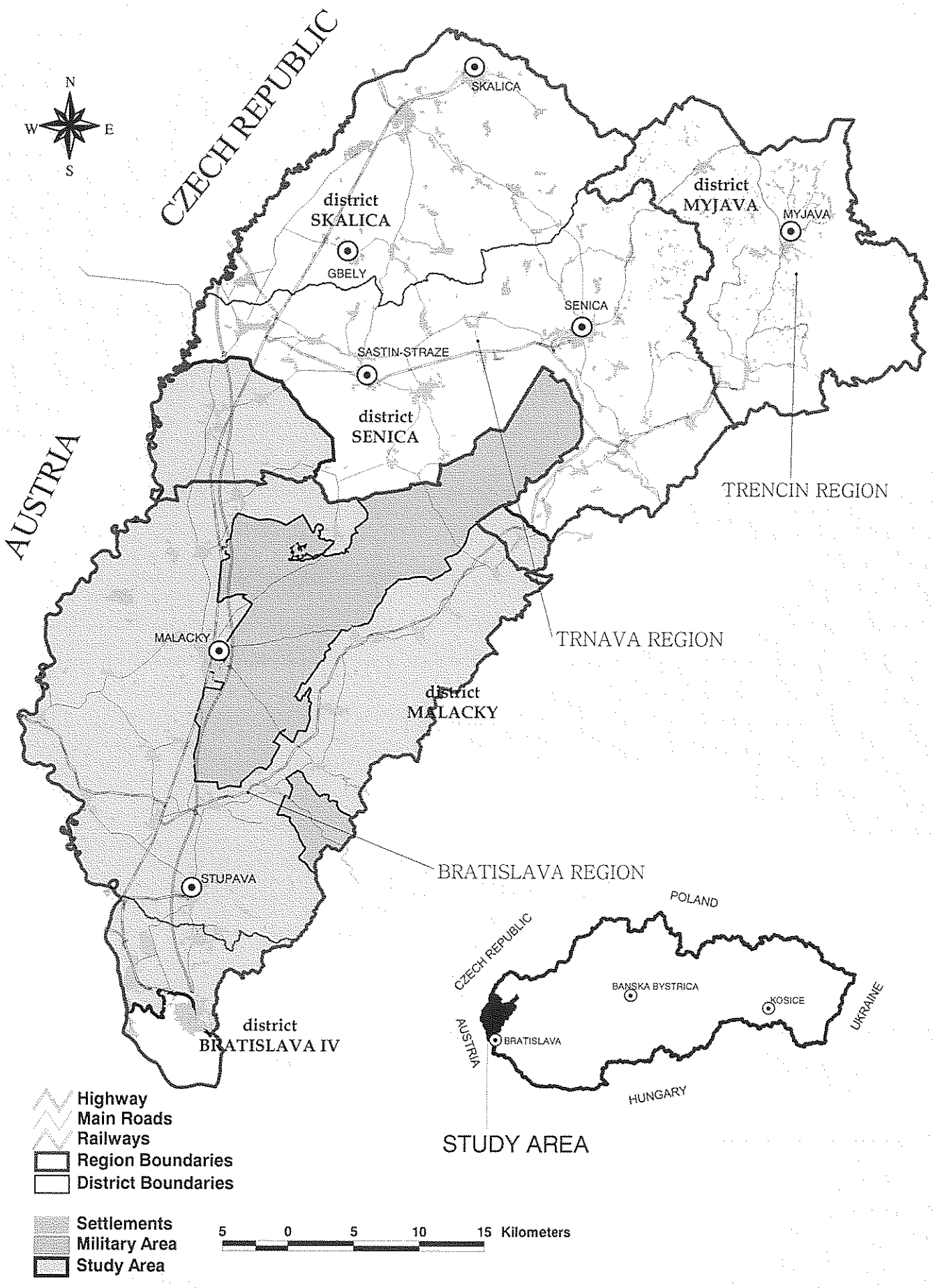


Figure 2.1 Target Area of Guidelines

to the promotion of regional agriculture, the Guidelines concentrate its objectives on the improvement of crop cultivation in quality and quantity and do not treat directly the technical matter of animal husbandry itself. However, the Guidelines include a contribution to the animal husbandry sector through realizing in its guidance for cost reduction and qualitative improvement of feed production. In addition, coordination of crop cultivation and animal husbandry is discussed in the Guidelines from the aspect of improving crop cultivation, such as organic recycling to fields using manure and compost, maintaining grazing and improving the fertility of farmland.

The effective use of the existing irrigation systems, which had been developed with great effort, is considered as fundamental to the future of agriculture in the region. It is pointed out that farmers cannot prepare the field irrigation equipment by themselves and the increasing farming fund for irrigation farming due to financial difficulty. This is one of the biggest constraints to the promotion of agriculture. The financial difficulty of farmers is also a problem for most of the technical measures proposed in the Guidelines. Thus the enhancement of agricultural financing system and subsidy by the government is indispensable for the improvement and promotion of agriculture in the region. However the Guidelines will not deal with those issues because institutional issues cannot be solved only in the Zahorska Lowland and they are difficult to discuss in the technical guidelines.

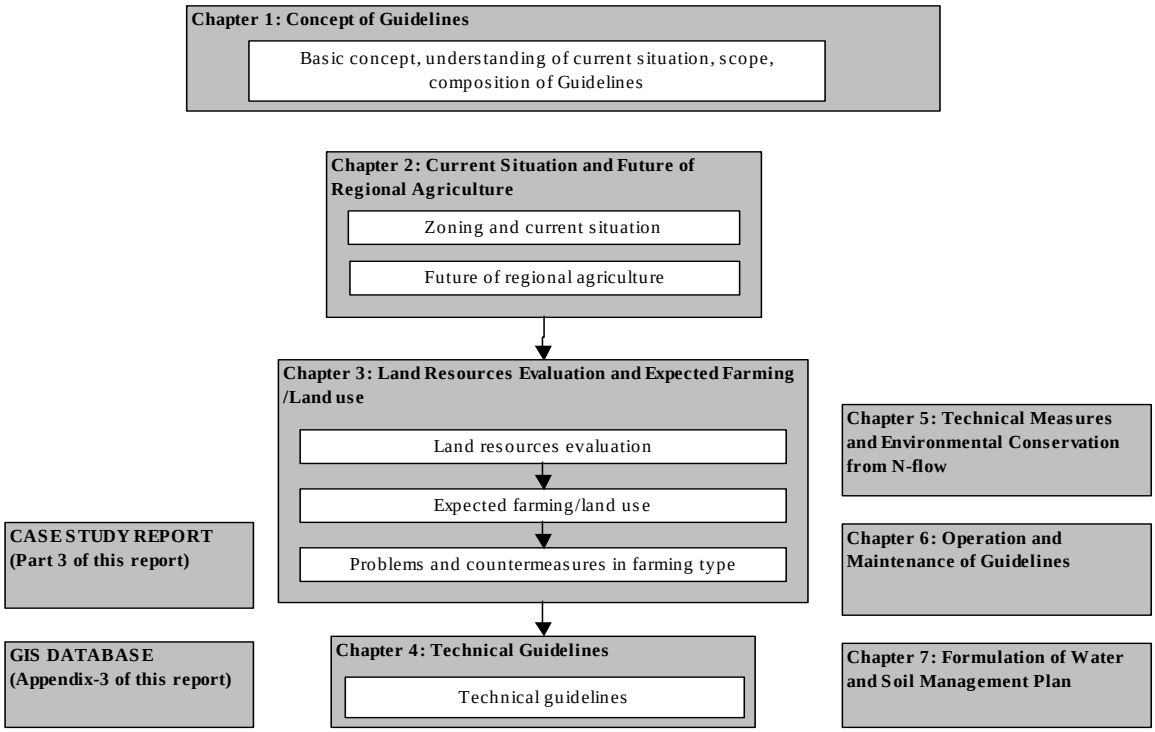
In Slovakia, the main agricultural issue is the alteration of administrative institutions and legislation to allow accession to the EU; it is expected to proceed with assistance from programmes conducted by the EU such as SAPARD (Special Accession Program for Agriculture and Rural Development) and PHARE (Poland Hungary Aid for the Reconstruction of Economy). The direction of change is considered when discussing the future of agriculture and appropriate technical countermeasures in the study area.

1.2 COMPOSITION OF GUIDELINES

The Guidelines aim to provide necessary technical materials and information for planners to formulate water and soil management plans or for farmers or enterprises to prepare

appropriate farming plans as mentioned above. The Guidelines composes of 1) Guidelines (Part 2 of this report), 2) Case Study Report describing the concrete sample of the Guidelines in the Case Study Site, and 3) GIS database constructed in the Study. The composition of the Guidelines is as follows:

The components of the Guidelines are strongly related to the expected agricultural types proposed in the former chapter as a "future of agriculture in the region", i.e., cultivation of highly profitable crops using or without irrigation, cultivation of crops considering protection of natural environments, cultivation of crops considering maintenance of soil fertility, cultivation of crops considering land conservation, and intensive cultivation of vegetables/fruits using irrigation. The Guidelines will provide the information necessary for promoting these expected agricultural types in appropriate areas. In addition, they include the application of appropriate land resource evaluation methods and the optimal package of techniques based on the evaluation. Ideas on compiling countermeasures into the water and soil management plan based on the land resources evaluation are also introduced in the Guidelines.



Composition of Guidelines

Chapter 1: Concept of Guideline

The basic ideas of the Guidelines are introduced in Chapter 1. In the Zahorska Lowland, agricultural production was largely based on irrigation and large amounts of chemical application during the socialist era. It became impossible to maintain such agriculture under the economic transformation and the agriculture there is struggling with stagnation/devastation. The Guidelines aim to provide technical guidelines develop and maintain the farm management and natural/social environment through realizing appropriate water and soil management. This chapter gives the basic information on the Guidelines such as target, scope, users, composition, etc.

Chapter 2: Current Situation and Future of Regional Agriculture

The current situation of the regional agriculture is reviewed by zoning and the future and approach to it are examined. The area was categorized into 4 zones based on geographical conditions, natural conditions, conditions of infrastructure, socio-economic conditions, farming conditions, etc. The potential and constraints of agriculture in each zone are examined. The future of the regional agriculture was examined from the concept of "*Realizing agriculture to cope with both the stability and sustainability of farm management and the sustainable development of the natural environment and rural society, based on rational land use*". Five cultivation types are proposed as an approach to the future of agriculture in the region.

Chapter 3: Land Resources Evaluation and Expected Cultivation Type/Land Use

Promotion of proper farming based on proper land resources evaluation is required to realize rational land use and effective use of resources concerning agriculture. In this chapter, land resources evaluation in the Zahorska Lowland is proposed and the expected cultivation type/land use corresponding to the land conditions and necessary technical countermeasures were examined based on the evaluation. The land resources evaluation proposes to use the existing evaluation system as a basis. It is proposed that the possibility of irrigation use and the condition of soil moisture, which are considered to be the most important factors for crop production in the area, should be added as evaluation factors. The requirement of agricultural conservation or

restrictions from socio-economic conditions are also proposed as considerations As a result of evaluation considering the character of each zone, the expected cultivation type/land uses were examined and some ideas are proposed (3.5). Problems to be solved in order to realize proper cultivation type/land use are examined and countermeasures to them are proposed (3.6).

Chapter 4: Technical Guidelines

Countermeasures for problems to be solved to realize the expected farming type/land use are described in this chapter as technical guidelines. The Guidelines compose of following nine (9) subjects.

Subject-1: Land Resources Evaluation and Appropriate Land Use
Subject-2: Irrigation
Subject-3: Drainage
Subject-4: Soil Conservation
Subject-5: Soil Moisture Management
Subject-6: Soil Fertility Management
Subject-7: Crop Cultivation Techniques
Subject-8: Farm Management
Subject-9: Other Recommended Measures

Chapter 5: Technical Measures and Environmental Conservation from N-flow

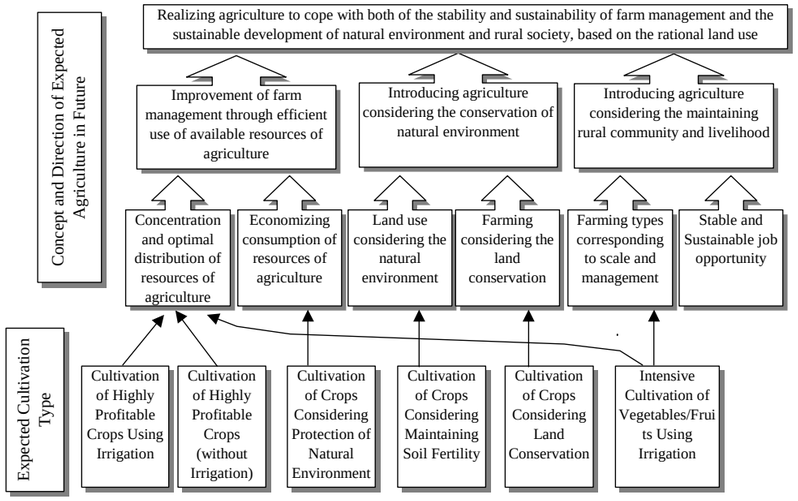
Proposed individual technical measures are reviewed from the viewpoint of environmental conservation by idea of N-flow of agricultural activities.

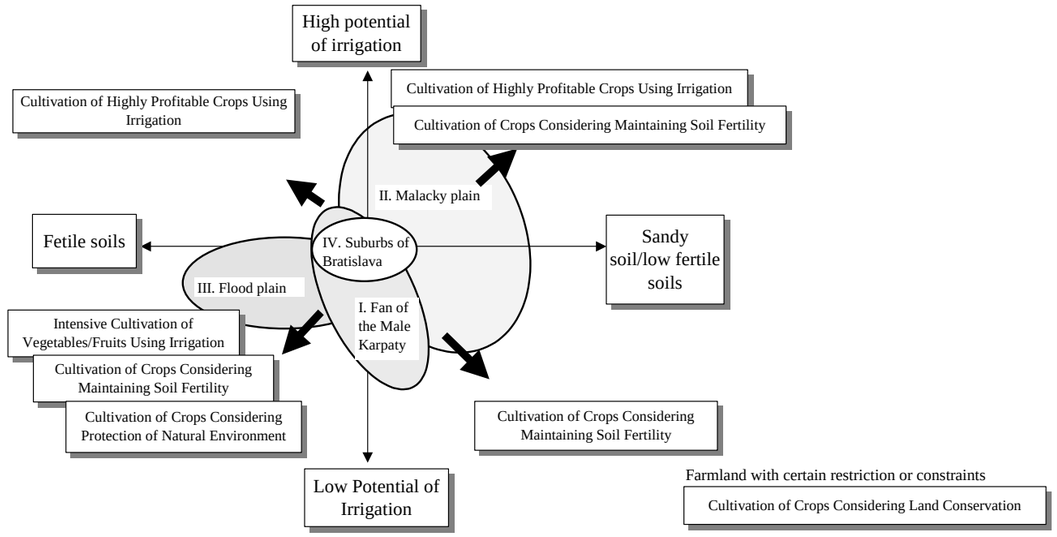
Chapter 6: Operation and Maintenance of Guidelines

The operation and maintenance plan of the Guidelines is proposed from viewpoints of; 1) flow of information, 2) role allotment of concerning organizations/personnel, and 3) establishment of organization for operation and maintenance of the Guidelines.

Chapter 7: Formulation of Water and Soil Management Program

This chapter shows the procedure for formulating water and soil management programs in certain areas by compiling countermeasures proposed in Chapter 3. The Guidelines give various technical measures which have various approaches for implementation or application. They are categorized into two levels and five technical groups due to their character in the formulation of the water and soil management program. The regional level of the program will be composed of measures requiring action at the regional level and are difficult/impossible to be carried out by individual farmer/enterprise. The field level of the program will combine the countermeasures to be carried out in the field and try to find the optimum combination.





TECHNICAL MEASURES

LAND RESOURCES EVALUATION

Soil moisture conditions

Water condition	Irrigation	Soil moisture condition
Irrigation (1)	Available	
Abundant (2)	Not available	Abundant soil moisture condition
Poor (3)		Relatively poor soil moisture condition

Soil conditions

Soil condition	Major soil type	Existing land productivity category
Good (A)	Loamy clay to sandy loam	A1~A3
Medium (B)	Loamy clay to sandy loam	A4~A6
	Sand and sandy loam	A2~A4
Low (C)	Sand and sandy loam	A6~A7
	All type	A7, AG, G

Other restrictions

Necessity of conservation activities	Socio-economic conditions
Restriction due to wind erosion	Land use regulation in natural reserve areas
Restriction due to inundation	Competition with other sectors and restriction of enlargement of farming scale in Bratislava suburb area
Restriction in the area equipped with underdrains	

EXPECTED CULTIVATION TYPE AND LAND USE

ZONE I. Fan of the Male Karpaty

Characteristics of the zone

Farming type usually found is dairy farming, which is highly dependent on self-supplied feeds. The crop diversification will also be important in the future. The crop diversification will also be important in the future.

Expected cultivation type

Water conditions / Soil conditions	Irrigation available (1)	Irrigation not available: Abundant soil moisture (2)	Irrigation not available: Poor soil moisture (3)
Good (A)	Cultivation of highly profitable crops using irrigation. Possible combination of highly profitable crops.	Cultivation of highly profitable crops (without irrigation). Possible combination of [illegible]	
Medium (B)	Cultivation of highly profitable crops using irrigation. Possible combination of highly profitable crops and soil resting crops.	Cultivation of crops considering maintenance of soil fertility. Possible combination of feed crops and soil resting crops.	Cultivation of crops considering maintenance of soil fertility. Possible combination of winter feed crops.
Low (C)	Cultivation of highly profitable crops using irrigation. Possible combination of highly profitable crops and soil resting crops.	Cultivation of crops considering maintenance of soil fertility. Possible combination of feed crops and soil resting crops.	Marginal areas for cropping.

Constraints in farmland protection

Cultivation type	Soil conditions	Matters to be considered or possible measures
Cultivation of crops considering land conservation	Susceptible to wind erosion.	Secure ground cover in early spring
	Area of underdrains	Maintain and renew old underground drainage facilities.

SUBJECTS AND COUNTERMEASURES

Type-1-(1)-(A)

Cultivation Type : Cultivation of Highly Profitable Crops Using Irrigation
Condition :Irrigation : available (1) Soil condition : good (A)

Expected farming

Highly profitable farming with various cropping technologies is possible owing to the irrigation water and fertile soil conditions. Highly profitable cash crops are planted to cover high input cost.

Crop selection and cropping pattern

[Sunflower] + [Spring barley / food quality wheat]

Subject	Problem of agriculture and farming	Necessary countermeasures
Irrigation/drainage and water management	1. Increasing actual irrigation area	2.4 Improvement / increase of existing functions of irrigation facilities
	2. Sustainable irrigation water supply	2.2 Rehabilitation of facilities 2.3 Strengthening operation and maintenance 2.5 Improvement of irrigation water management
	3. Promotion of preparing field irrigation	2.6 Provision of irrigation equipment adaptable to farming 2.7 Improvement of on-farm irrigation system to cope with intensive farming
	4. Improvement of function and O/M of underdrains	5.1.3 Improvement of O/M of underdrains 5.1.4 Improvement of field drainage 5.1.5 Improvement of field drainage management
Soil management	1. Prevention of disease and pest	7.3 Improvement of crop management
	2. Fertilizing with low input	6.1 Practical use of cropping residues and livestock wastes
	3. Prevention of plow sol compaction	6.6 Prevention of plow sol compaction
Cropping system / farm management	1. Establishing rotation system	7.5 Development and extension of intensive irrigation of summer crops and leafy crops 7.3 Improvement of crop management
	2. High quality production	7.4 Appropriate fertilizer application technology
	3. Crop protection and weed control	7.8 Prevention of damage by weeds

Figure 2.2 Composition of Guidelines

CHAPTER 2 CURRENT SITUATION AND FUTURE OF REGIONAL AGRICULTURE

2.1 ZONATION AND CURRENT SITUATION

To help understand the character of the Study Area, zones from several aspects were constructed and combined into a regional zonation. The geographic features, soil fertility, possibility of irrigation, and distribution of farm management and farming types were mainly considered to establish the regional zonation. Of the geographic features, the accessibility to the main road network and Bratislava Town from each part of the Study Area was examined. The possible soil fertility was examined mainly by soil texture and divided into the fertile soils along the Morava River and the low fertility light soils. Irrigation systems were evaluated for their present effectiveness and possibility of repair. Also, the distribution of farm management and farming types was one of the major aspects used to characterize zones.

As a result of analysis, the following four (4) zones were established as shown below.

Zone-I Fan of the Male Karpaty

This Zone is specified to be the area between the foothill of the Male Karpaty Mountains and the forest of the Central Plateau.

Zone-II Malacky Plain

The Malacky Plain is defined to be between the boundary of the Protected Landscape Area along the Morava River and the forest of the Central Plateau. The northern end reaches to the river course of the Myjava River and the Stupava Town is the southern end of the Zone.

Zone-III Flood Plain

The Flood Plain is the area inside the Protected Landscape Area along the Morava River including the flood basin of the River.

Zone-IV Suburbs of Bratislava Town

The Suburbs of Bratislava Town are in the southern part of the Study Area close to Bratislava Town. This Zone comprises villages/towns of the Bratislava IV District and the Protection Landscape Area along the Morava River is included in Zone III.

The military area spreads onto the central plateau of Malacky and is distinguished as a zone which has a peculiar character in soil conditions and land use. However, this area is excluded from the Study Area because there is no agricultural use.

The characteristics of each zone, including aspects of natural conditions, status of infrastructure development, socio-economic conditions and conditions of agriculture, are summarized in the table following.

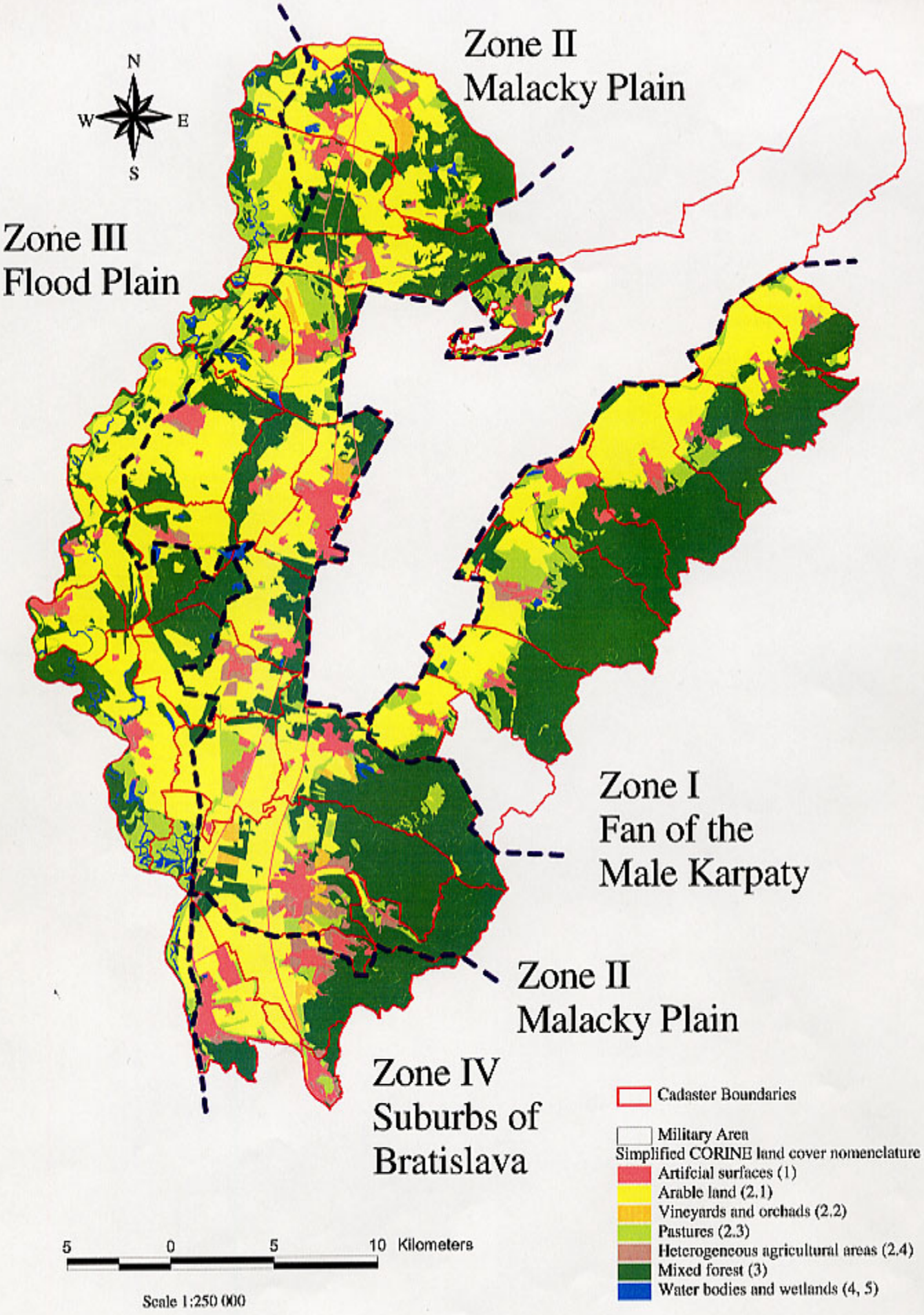


Figure 2.3 Zonation Map

Character of Zones

Items \ Zones		I Fan of the Male Karpaty	II Malacky Plain	III Flood Plain	IV Suburbs of Bratislava Town
Natural Conditions	Precipitation	Annual Precipitation: 562~648mm (Average of 1981-2000) Precipitation during vegetation period (from April to September): 346~394mm			
	Geomorphology	Transition between mountains and lowlands. Alternation of plain and hilly land along foothill of the Male Karpaty.	Low small articulated hilly land in the northern part (in Senica District). Relatively lower and flat to moderate undulated area in the central part.	A little-articulated strip, moderately undulated lowland along the Morava River.	Intermediate character of Fan of the Male Karpaty and the Malacky Plain.
	Soil Conditions	Low fertile sandy soils and Loamy sand spread widely. High fertile loamy soils, suitable for cultivation spread along foothill fans. Northern half is rather fertile and southern one is less fertile and rather gravely in general.	Low fertile sandy soils and loamy sand are predominant. Among sand and sandy soils, rather fertile soils composed by Regosol group and less fertile soils composed by Fluvic Phaeozem group are intermingled.	High fertile soils of sandy loam, loam and loamy clay cover the zone. Sand and loamy sand is observed in the central part spottily. In small area, heavy clay that causes problem for agriculture exists.	A mixture of high fertility soils and low fertility soils characterizes this zone. The ratio of land with loam and sandy loam, which is relatively higher fertility soil in the Zahorska Lowland, is higher than the Zone II or III.
Condition of Infrastructures	Irrigation	Small areas possible to be irrigated are scattered. Middle to large-scale irrigation systems had been developed in the southern part but half of them do not function at moment.	Mainstream of the irrigation development of the Zahorska Lowland. Large-scale irrigation systems cover large area, which still function.	No irrigation systems had been developed (though small exception exists).	Large-scale irrigation systems had been developed in the southern part but most of them do not function at moment. Only small part is functioning.
	Geographic Features	A little disadvantage on access to Bratislava comparing other zones.	The Motor Highway D2 provides a good traffic access to the Bratislava.	In some part, less accessibility to main road network.	Very close to the capital town Bratislava. Extreme advantage to access to big market.

Items \ Zones		I Fan of the Male Karpaty	II Malacky Plain	III Flood Plain	IV Suburbs of Bratislava Town
Socio-economic Conditions	Socio-economic Conditions		.	Covered by the Protected Landscape Area	Including urban and industrial area in the Zone. This causes competition in land occupation between agricultural sector and other sectors.
Condition of Agriculture	Type of Agricultural Body and Farm Management	Most of the Zone is occupied by one extremely large enterprise. Large-scale extensive farming is predominant.	There are large varieties of types of agricultural body and farm management. Small to large scale individual farmers exist in parallel to mid and large scale enterprises. Extensive farming and rather intensive farming with irrigation are intermingled.	Agricultural land in the Zone is developed and used by the enterprises based on the Malacky Plain under the process of expansion of farmland.	Similar to the Malacky Plain. The agricultural lands occupied Large-scale enterprises are not predominant.
	Farming Type	Combination of cereal crops and animal husbandry / dairy farming is predominant. Roughage such as alfalfa occupies a large part of farmland. Extensive crops such as wheat and oil crops are cultivated also.	Large variety of farming type formulates the character of agriculture of the Zone. Combination of cereal and animal is a basic type. Semi-intensive farming with irrigation such as oil crops and/or vegetables are combined to the basic farming type. Farms specialized into cultivation also observed.	Using an abundant natural condition such as soil fertility and soil moisture, value added crops like oil crops and vegetables in addition to wheat are cultivated without irrigation. Eco-farming is also conducted Inundation damages crop production frequently.	This zone is characterized as intermediate between zones of Malacky Plain and Fan of the Male Karpaty. Vegetable specialized farm exists.

Items \ Zones		I Fan of the Male Karpaty	II Malacky Plain	III Flood Plain	IV Suburbs of Bratislava Town
Potential and constraints of agriculture	Potential	Relatively high fertility soils are distributed in the northern part of the zone. Irrigation systems functioning in the limited beneficiary area.· High groundwater development potential.	Advantaged traffic access to a large market. Irrigation systems keep working and possible to use. Irrigation systems are corrupted but it is easy or economic to repair. Developed drainage infrastructures.	Fertile soil conditions. Abundant soil moisture condition for crops. High value added to organic farming productions.	Advantaged traffic access to a large market Existing relatively fertile soils in some parts. Irrigation systems functioning in the limited beneficiary area.
	Constraints	Irrigation system is corrupted and it is difficult or very costly to repair. Low fertility sandy soil area is predominant. Gravely soils unsuitable or disadvantaged for cultivation are distributed in the southern part. High potential of wind erosion is expected partly.	Low fertility sandy soils are predominant in general. Extremely high potential of wind erosion in some parts. Inundation occurs partly. Superannuated and malfunctioned irrigation systems. Conflict on water management between agriculture sector and the proposed industrial park is a worry in future.	Limited land use within Protection Landscape Area. Frequent damage by weed. Inundation in flood basins of rivers and part of flood plain. Heavy soils inconvenient to cultivating scattered in specific area.	Irrigation systems are corrupted and difficult or very costly to repair. Competition between sectors for land, human and other resources. High potential of wind erosion is expected in parts.

2.2 FUTURE OF REGIONAL AGRICUTLURE

(1) Direction of Future Regional Agriculture

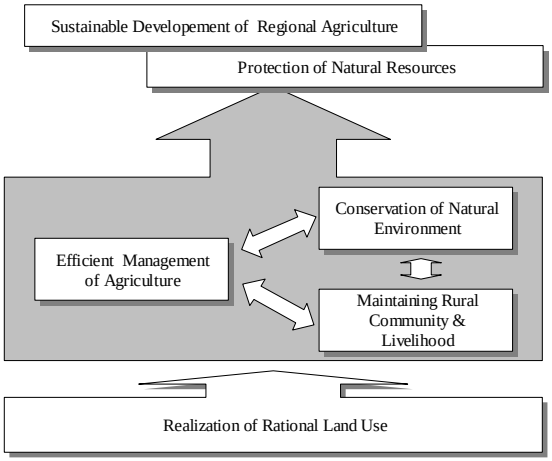
A picture of regional agriculture in the future was examined on the basis of the following premises.

- It is impossible to go backward to the agriculture in the socialist regime, when the amount of production was set as a prior target, and it was supported by an inefficient large-scale development and too much subsidy.
- The agricultural policies of EU have been shifted from producers to consumers, from agricultural development to rural development, and from price policy to income policy. It is necessary to consider such circumstances during examining the future of the regional agriculture.
- Sustainability and profitability of agricultural management are principal considerations in the market economy.
- From the viewpoint of environmental preservation and the maintenance of rural community, state support to agriculture is considered to be necessary but it should only be complementary. In addition, such kind of state support should be limited within the range acceptable for neighbouring countries, especially for the EU.

In Slovakia, ten years have passed since land restitution began in 1991. Meanwhile, the number of private farmers has not increased for complex reasons. The dynamic evolution of enterprises has been the most typical feature of the restructuring process in agriculture. It is thought that business companies will continue to lead regional agriculture in the future.

The regional agriculture of the Area can be characterized as extensive agriculture carried out by large-scale enterprises, which occupy the major part of the agricultural land. Because of this, farm management, natural environment and the rural society are closely connected to each other. Aiming at the sustainable development and

conservation of natural resources, it is indispensable to deal with both achieving the stability and sustainability of farm management and the sustainable development of the natural environment and rural society. Furthermore, during the shift of principles from the production target under the planned economy to profitability under the market economy, realizing effective and efficient agriculture based on rational land use application is required. Considering these points, the concept of regional agriculture was examined and set as;



Conceptual Figures for Regional Agriculture in Future

"Realizing agriculture to cope with both the stability and sustainability of farm management and the sustainable development of natural environment and rural society, based on rational land use".

To achieve this, the following directions for regional agriculture are proposed:

- Improvement of farm management through efficient use of available resources of agriculture, such as farmland, fund, infrastructures, agricultural input, etc.
  - Concentration and optimal distribution of resources of agriculture.
    - Effective use of existing infrastructures represented by irrigation systems.
    - Maintaining/increase productivity by applying appropriate irrigation and fertilizing on appropriate land.
    - Abandonment of unreasonable agriculture on unsuitable land and change to reasonable and sustainable land use.
  - Economizing the consumption of resources of agriculture.
    - Promotion and intensification of organic matter recycling in agriculture.
    - Optimization of cultivation technology and water management technology.

- Introducing agriculture which takes into account conservation of the natural environment.
  - Land use appropriate to the natural environment.
  - Farming appropriate to land conservation.

- Introducing agriculture which takes into account the need to maintain rural community and livelihood (that is to say agriculture having low negative impact to rural community and livelihood).
  - Development of farming types corresponding to each scale and management of farm, especially for small and extra-small farmers.
  - Stable and sustainable management of agricultural enterprises contributes to maintaining rural livelihood by providing job opportunity.

(2) Expected Regional Agriculture in Future

The typical farming type in the Study Area at present is understood to be a combination of livestock farming and cereal cultivation that supports livestock farming though feed supply. Cultivation of oil crops or other raw material crops (and vegetables in some cases) is also combined on appropriate land.

Typical composition of farming type: [Cereal cultivation]+[Livestock farming]+[Oil crops or other raw material crops (and vegetables in some cases)]

In the farm types represented, the combinations of crops and the proportions of crops vary depending on the scale and type of farm. The trend of combinations is summarized below:

- Livestock Farming
  - Most of profits on a farm unit is generated by livestock farming generally.
  - Large-scale farms carry out milking and small-scale farms tend towards stock breeding in general, due to the difference in required investment.

- Cultivation Farming
  - The cultivated crops are similar from small to large farms, except for vegetables that are mainly cultivated by small farms.
  - The proportion of land use has different trends due to farm scale. The proportion of crops for sale is greater in large-scale farms and that for self-consuming fodder is greater in small farms.
  - In the land suitable for intensive crops, large-scale farms tend to cultivate relatively intensive crops such as oil crops or raw materials while small farms tends to introduce intensive crops like vegetables within the capability of human resources.

The farming types mentioned above were recognized as logical in view of the natural and socio-economic conditions surrounding the regional agriculture. The typical farming types of the regional agriculture in future is expected to be basically the same as the present ones.

Three aspects are pointed out as important subjects in examining the future of agriculture in the area, i.e., 1) livestock farming is the major income generator of the faming unit, 2) cereal cultivation supports livestock farming by supplying feed, and 3) cash crop production. The Guidelines deal with mainly the technical issues in crop production and they are expected to contribute to the improvement of livestock farming though improving crop production. That is to say, the future of crop production should be discussed from two different view points; the improvement of crop production itself and the contribution it makes to livestock farming.

The direction of future development of livestock farming is examined separately in dairy farming (milking) and animal husbandry (fattening for meet). The contribution of crop production to livestock farming is also discussed from the above two aspects. The improvement of productivity through improving quality of feed is considered one of the most fundamental strategies in milking. On the other hand, cost reduction

through improving efficiency of feed production is required for animal husbandry. The following ideas are introduced as examples of ways of improving crop production in line with the contribution to livestock farming: 1) introducing and expanding the application of high protein roughage such as alfalfa with high purity to milking cows and 2) the cost-efficient feed production using a proper rotation system with a soil resting crop or an appropriate farming input.

In deciding on the planting crop or production volume in the farming plan, farming units consider the necessity of feed in livestock farming in their farm management principally, and cash crops are planted in the remaining farmland after securing necessary feed production. Each farmer or agricultural body is required to seek the optimal combination and proportion considering their conditions of management type, scale, available farmland, available resources, etc.

As regards farming type and combination of crops, the following developments are recommended :

- Promotion of oil crops and raw materials cultivation in appropriate land for large-scale farms.
- For small farms, promotion of intensive crops like vegetables in appropriate land within the capacity of the labor force, in addition to promotion of oil crops and raw material cultivation in appropriate land.
- Small-scale farm specialized in intensive vegetable cultivation.
- Raw materials cultivation with specified destination or self-consumption.

Furthermore, the different objectives of efficiency improvement are emphasized depending on the type and scale of farm:

- For large-scale corporate management,
  - Efficiency improvement of farm management by reducing farming cost and increasing productivity in the extensive agriculture.
- For small-scale individual management,

- Positive improvement of land profitability through introduction of intensive farming,
- For vegetable production, an enhancement of bargaining power through establishing producing locality and development of marketing system.

As regards farming technology, the effective use of agricultural resources is expected to be realized though the following approach.

- Conversion of unsuitable land for crop cultivation to grass land and pasturing.
- Promotion of profitable agriculture in the land with high suitability for cultivation in terms of irrigation, soil and other natural conditions.
  - Promotion of crops for semi-intensive farming, such as oil crops, raw materials, potatoes, etc. in large scale farm.
  - Promotion of crops for intensive farming, such as potatoes, vegetables, etc. in small scale farm.
  - Promotion of intensive and semi-intensive farming in the areas where irrigation is available.
  - Introduction of small-scale groundwater irrigation for vegetable production where existing irrigation is not available.
- Improvement of the efficiency of cereal production by promoting and intensifying organic matter recycling in the combination of cultivation and livestock farming.
- Applying cultivation technology, taking into account farmland conservation, to land that is marginal for cultivation, i.e., introduction of a proper rotation system including pasturing, etc.
- Improvement of the efficiency of crop production by improving soil management and water management technology.

Productivity of crop cultivation in future regional agriculture is discussed from the following two viewpoints.

- Highly profitable crop production achieving both high productivity and high quality by using the combination of irrigation and proper fertilizer application. This is sought in the production of oil crops such as sunflower, raw material crops such as malt barley and food wheat and vegetable cultivation.
- Efficient and low cost production, without adhering to improving unit yield, is sought in the production of animal feed such as wheat, rye, maize, etc. In the production plan of animal feed, the main aim is to meet the demand for self-consumption feed in the mixed farm management of crop and livestock. The selection of crops, required quality of products, and necessary production amount are based on the business policy of the farming unit. Considering the demand as a precondition, the target productivity level, which allows maximum economic efficiency under the soils and other conditions, is to be sought. To be considered at that time are the distribution of resources of farm management such as agricultural land, financial sources, labour force, machinery, etc. to feed production.

(3) Approach to Expected Figures from Crop Production

In the process of realizing the rational agriculture and land use appropriate to the land conditions, the agriculture corresponding to the characteristics of the area should be promoted. In consideration of the natural and socio-economic conditions, the status of infrastructures and the condition of present agriculture in the area, the following cultivation types are proposed. They are expected to be applied to areas by the appropriate combination of them.

- **Cultivation of Highly Profitable Crops Using Irrigation**:
  Highly profitable cultivation is enabled by proper irrigation and fertilizing. This type will be carried out in areas with functioning irrigation systems or the possibility to repair them economically, even if malfunctioning at moment, in order to use existing facilities effectively.

- **Cultivation of Highly Profitable Crops (without Irrigation)**:
  Highly profitable cultivation with proper fertilizing in suitable areas where there is abundant soil moisture and fertile soils. The management of soil fertility and moisture is important in this type.

- **Cultivation of Crops Considering Protection of Natural Environments**:
  Even in the Protected Landscape Area along the Morava River, there are private farms and farming on the fertile soil. Low environmental stress agriculture using the natural condition as it is, needs to be promoted in this area.

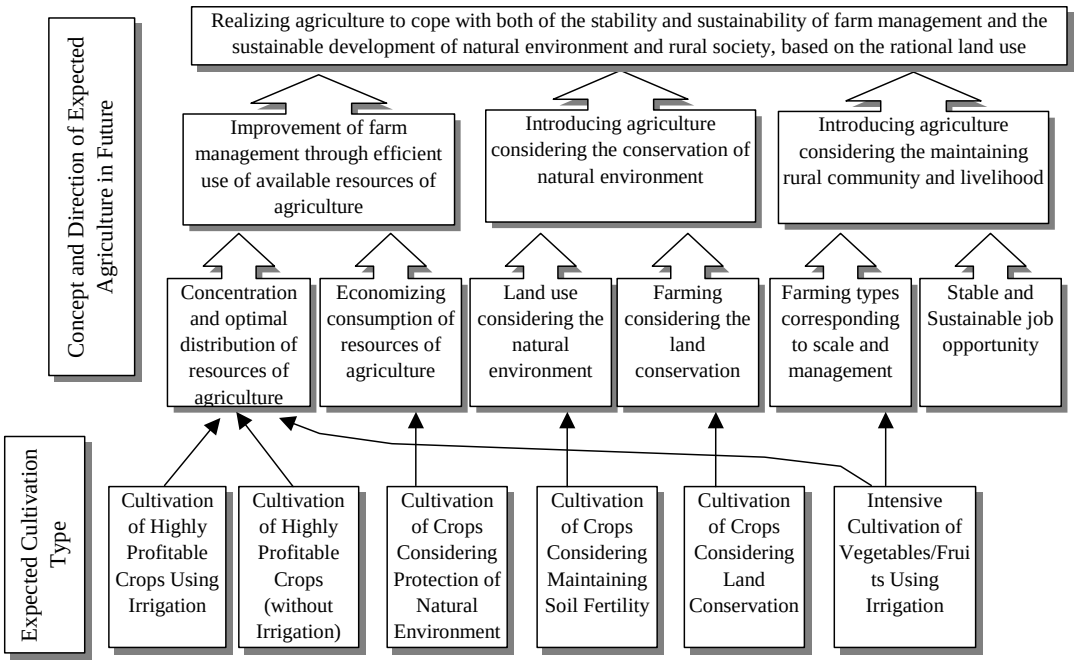
- **Cultivation of Crops Considering Maintenance of Soil Fertility**:
  This type is aimed at low cost production of feed for animals by improving efficiency of cultivation. Proper soil fertility management techniques such as organic matter recycling or proper field rotation using soil-resting crops will be applied based on the combination of crop production and livestock farming. Techniques and countermeasures proposed for this type also apply to other types as a component of effective soil management.

- **Cultivation of Crops Considering Land Conservation**:
  Cultivation types need to take into account the fragility of the farmland, the necessity of protection from natural damage such as wind and water erosion, and maintaining the function of existing field drainage. The techniques and countermeasures proposed apply in fields where a risk of damage or other constraint is expected.

- **Intensive Cultivation of Vegetables/Fruits Using Irrigation**:
  Vegetables and fruits cultivation using irrigation in the appropriate farmland. This type requires intensive cultivation. Vegetable/fruit cultivation is contributes to the diversification of farm management on the large-scale farms. On the other hand, small-scale farms are able to seek high profitability by concentrating on intensive vegetable cultivation.

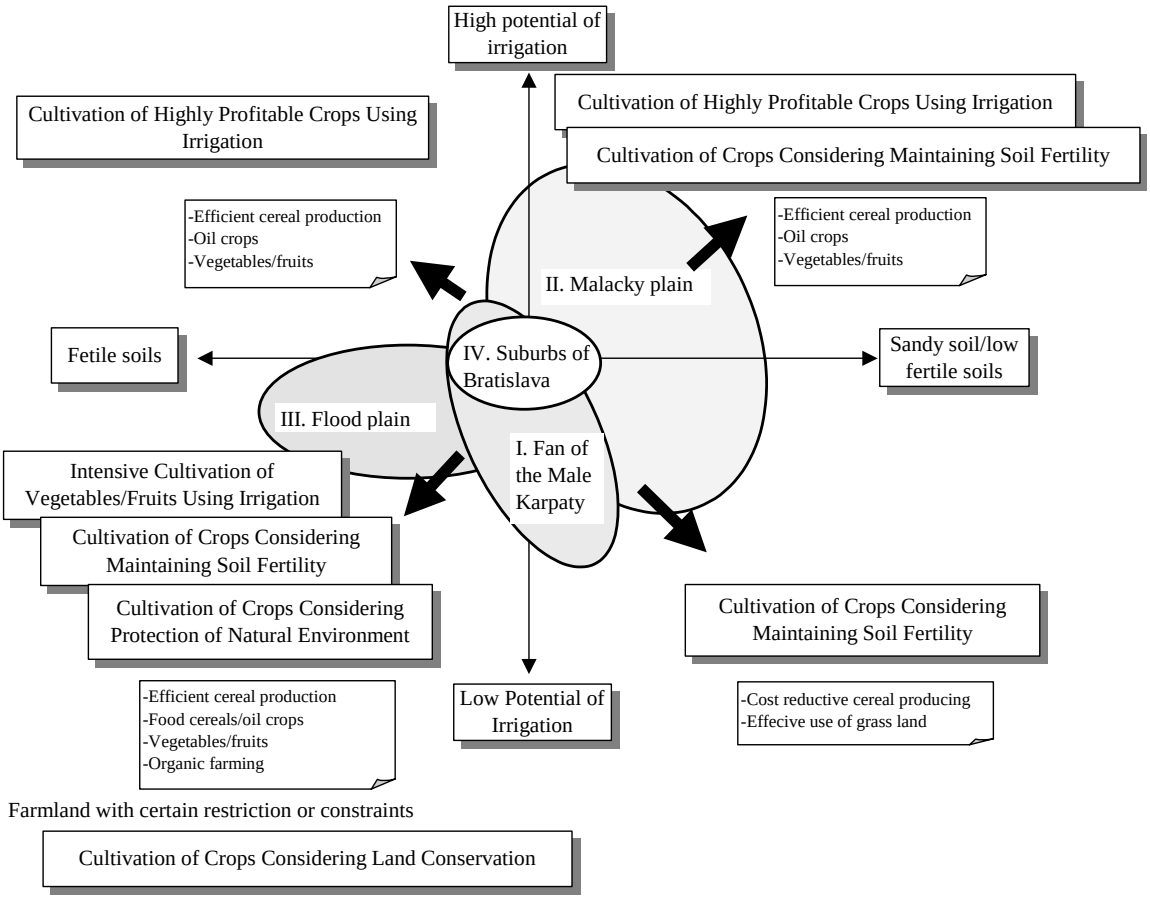
The relation between the direction or future of regional agriculture and the expected cultivation types proposed above is summarized below:

The cultivation types expected to be introduced into the zones categorized in the former chapter are summarized below. Based on the cultivation types shown below, appropriate selection and combination of farming types that correspond to the land and other conditions is required for each zone.



Direction/Future of Regional Agriculture and Expected Cultivation Types

Zone	Major cultivation types expected to be introduced	Farmland with certain restriction or constraints
I - Fan of the Male Karpaty	Cultivation of Crops Considering Maintenance of Soil Fertility Cultivation of Highly Profitable Crops (with Irrigation)	Cultivation of Crops Considering Land Conservation
II - Malacky Plain	Cultivation of Highly Profitable Crops Using Irrigation Cultivation of Crops Considering Maintenance of Soil Fertility Cultivation of Highly Profitable Crops (without Irrigation) Intensive Cultivation of Vegetables/Fruits Using Irrigation	
III - Flood Plain	Cultivation of Crops Considering Protection of Natural Environment	
IV - Suburbs of Bratislava Town	Intensive Cultivation of Vegetables/Fruits Using Irrigation Cultivation of Highly Profitable Crops (with Irrigation)	



Conceptural Figure on Potential and Expected Farming of Zones

The zone of the suburbs of Bratislava Town is characterized as an intermediate zone between the fan of the Male Karpaty and the Malacky plain. In addition, the Zone has high land prices or land renting prices which obstruct the improvement in efficiency of farm management and expansion of farmland for farmers and enterprises operating there. The scale of management is expected to stay small even in the future while they have the geographical advantage of being suburbs of a big town. To cope with this situation, small-scale intensive irrigation farming specialized in vegetables and fruits, that can make full use of the advantage of its location in the suburbs, is expected in this Zone.

To promote profit-seeking farming, applying irrigation in the appropriate land while maintaining and improving existing facilities is extremely important for its effective use as an agricultural resource. It is undesirable to abandon the irrigation facilities

that do not currently function from the viewpoint of efficient use of current investment and regional property. However, aiming for the restoration of all facilities is not reasonable considering the age and, damage to the facilities and the land conditions. It is necessary to evaluate the restoration of the facilities from the viewpoint of economic efficiency, and restoration is prioritized for facilities that can be recovered efficiently.

On the other hand, it is pointed out that the farmer cannot prepare the in-field irrigation equipment and that it is difficult to cope with the increase of fund of irrigation farming. It is a major constraint that the irrigation facilities are not used. It is stated that farmers/agricultural bodies are not positive or have a financial difficulty with the investment needed to update and to procure the equipment. The creation of circumstances in which farmers can confidently invest and obtain funding is requested.

To promote profit-seeking farming applying irrigation, it is considered indispensable to prepare agricultural credit systems and subsidy systems to support farmers' financial investment in on-farm irrigation equipment. However, this matter will be discussed in the recommendations instead of the technical guidelines due to the character of credit and subsidy.