ANNEX C	*ECONOMY AND DEVELOPMENT – SUPPLEMENTARY INFORMATION*

ANNEX C ECONOMY AND DEVELOPMENT – SUPPLEMENTARY INFORMATION

C.1 OVERVIEW OF NATIONAL ECONOMY

C.1.1 GDP AND PER CAPITA INCOME

The Slovak economy is highly diversified with market services (trade, transport, financial intermediation etc.) as the largest productive sector accounting for about 42% of GDP followed by market goods (manufacturing, mining, quarrying etc.) at 36% and non-market services at about 13% (refer to Table C.1.1). The share of agriculture in total GDP shows rather declining trend. In 1996, the agriculture sector contributed 4.1% to the total GDP that declined to 3.6% in 1999.

In 1999, the GDP of Slovak Republic reached at 815,330 million SKK or 8.6% more than in the corresponding period of the preceding year at current prices. As shown in Table C.1.1, from 1996 to 1999 GDP growth was between 11.0% and 8.6% in current prices and between 6.0% and 1.9% in 1995 constant prices. The main reason of low growth rate during 1999 in the comparison to previous years was a reduction of domestic demand that was partly compensated for by a growth in external demand (MoA, Agricultural and Rural Development Plan of the Slovak Republic for the Period of 2000-2006 p. 22). The per capita GDP in constant 1995 prices increased from 107,808 SKK in 1996 to 121,004 SKK in 1999.

The share of Regional GDP in the whole country is shown in Table C.1.2. The share of Bratislava is about 23% followed by Kosice Region more than 13% and Banska Bystrica Region about 12% respectively.

C.1.2 ECONOMICALLY ACTIVE POPULATION AND OCCUPATION

(1) Economically Active Population and Employment

Economically active population increased from 2,509 thousand in 1996 to 2,573 thousand in 1999. As shown in Table C.1.3 between 1996 and 1999 the rate of unemployment increased from 11.3% to 16.2%. The rate is more than 19% for productive age. The growth of unemployment rate is higher than the growth of economically active population. It is estimated that large number of unemployed population have been out of job for more than a year and the majority of unemployed have low education level. The high rate of unemployment was mainly connected with the on going downsizing in agriculture and industry (MoA, Agriculture and Rural Development Plan of the Slovak Republic for the Period of 2000-2006, p23).

Concerning the Regional level, the rate of unemployment was highest at 26% in the Regions of Presov and Kosice Regions followed by Banska Bystrica region at 23.1%. The Regions with high rate of unemployment are located in eastern and southern part of the country (refer to Table C.1.4). On the other hand it was lowest at 7.2 % in the Region of Bratislava region.

(2) Occupation

As shown in the Table C.1.5, the manufacturing sector is the largest source of employment and accounts for about 26% of the work force followed by whole-sale, retail trade (12.2%), and construction (8.9%). The percentage of economically active population engaged in agriculture is 7.4% and is in declining trend. Before transition the agriculture sector, specially, collective farms were over staffed and after the transition (1991, 1992) one third of the staffs were reduced. New opportunities in other industries is absorbing skilled managerial staffs from the farming sector.

Low demand of farm labor have resulted the low level per capita wages. As shown in Table C.1.5 the average wage of farm labors is only 78% of the national average.

Table C.1.6 shows the rate of employment in agriculture by Regions. In the Region of Nitra region, more than 12% of employees worked in agriculture followed by Trnava (11.7%), Presov (9.2%) and Banska Bystrica 8.8% respectively. In the Region of Bratislava it was only 1.9% of people, which worked in agriculture.

C.1.3 FOREIGN TRADE

During the last 3 years (1997-99), both imports and exports have been increasing, while the balance shows slight improvement (refer to Table C1.7 (a)). As shown in the Table, in 1998 total import amount was 460,737 million SKK that increased to 468,893 million SKK (an increment of 1.8%) in 1999. During the same period export amount increased from 377,808 million SKK to 423,650 million SKK (an increment of 12.8%). The main imported commodities were machinery transport equipment (37.7%) followed by intermediate manufactured products (18.3%) fuels and related products (12.9%) etc. On the other hand the main exported commodities are also from the same commodity group or machinery and transport equipment (39.4%) followed by intermediate manufactured products (27.5%), and miscellaneous manufactured articles etc.

The share of food and live animals is 5.1% for imports and 3% for exports. It means the country is a net importer of foods. As shown in the Table C.1.7 (a) imports of food and live animals have about twice the value of exports. The overall value of food and animal imports and exports is raising, its relative share of all trade is declining. The main imported agro-food commodities were those commodities that cannot be produced in Slovakia, i.e., tropical fruits and other commodities which can compete with domestic products as meat, cereals, sugar and bakery. Exports were based on live animals, diary products etc. The most important trade partners for both import and exports were European countries with a share of more than 90% (refer to Table C.1.8). Czech Republic is the most important trading partner among European countries.

C.1.4 DEVELOPMENT OF CONSUMERS' PRICES

Consumers' Price Index (CPI) and the rate of inflation between 1995 and 1999 are illustrated in Table C.1.9. Inflation remains relatively low. Inflation increased from 5.8% in 1996 to 10.6% in 1999. The adjustments of some remaining administered prices, indirect taxes and reintroduction of a surcharge on imports pushed inflation up at 10.6% as described before. Furthermore, the development of the prices was influenced by the higher prices of electricity, heating for households (that increased by 29.7%) and supply of water.

C.2 POSITION OF AGRICULTURE AND FOOD SECTOR IN THE SLOVAK ECONOMY

Slovakia has an industrialized economy and the share of agriculture in total GDP is in decreasing trend contributing only by 3.6% in 1999 as described in the previous Chapter. This reflects the industry and service oriented character of the economy, however agriculture plays a significant role in the maintenance of social equilibrium. As shown in Table C.2.1, the share of expenditure on food stuffs and non alcoholic beverages in total consumption expenditure is high at about 35% for the households of pensioners without working members, 29% for the households of self employees, 28% for farm households, 26% for employees and 27.6% for the total households respectively.

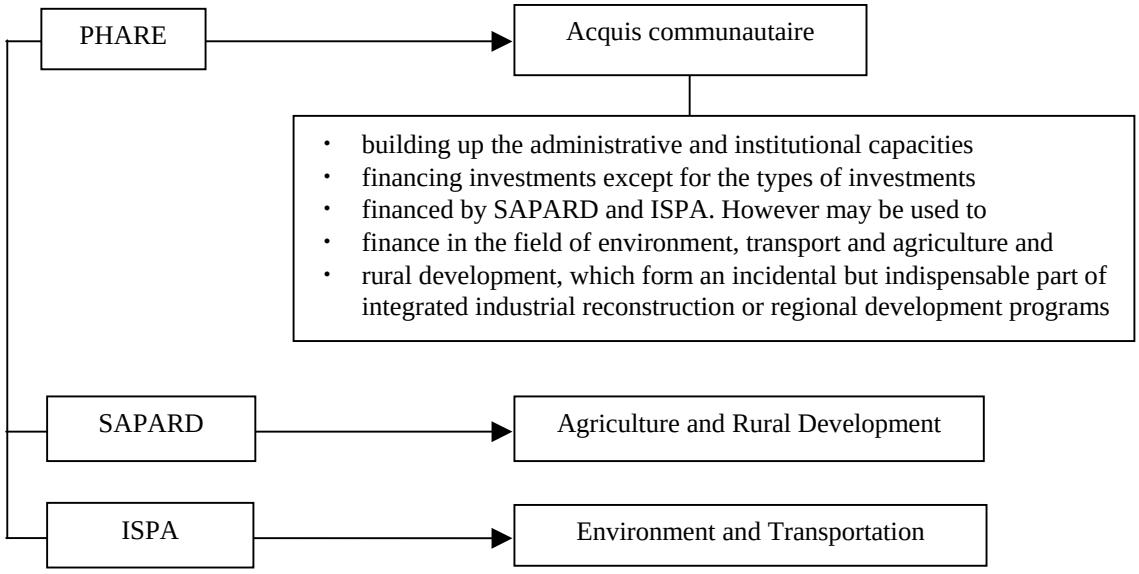
About 7.4% of the economically active population is engaged in agriculture sector. As described before, the share of food and live animals in foreign trade is 5.1% for imports and 3% for exports. The balance of grains, i.e. wheat, barley, rye, oats, maize and other grains for the years 1998/99 and 1999/2000 are illustrated in Table C.2.2. The major exported cereal in 1999/2000 was maize, followed by wheat and barley and the major imported items were also from the same commodities (wheat, barley and maize). In total during the year 1999/2000 Slovakia imported 42.6 thousand tones of grains and exported 317.7 thousand tones. There was a stock of 269.2 thousand tones.

The Slovak policy objectives for agriculture are mainly to target self-sufficiency and one of the main long-term objectives is to maintain the country's food security or to keep the domestic supply at 90% that for cereals, meat and milk (EC, DG VI, Working Document, Agricultural Situation and Prospects in the Central European Countries, June 1998, p42). However the disparity of prices of agricultural products and inputs, inadequate credit, inadequate market etc have a negative impact on production.

C.3 CO-OPERATION BY OTHER DONORS

C.3.1 COOPERATION BY EU

European Union (EU) is the main donor for Slovakia and it assists for financing projects through three pre-accession instruments i.e. PHARE, ISPA and SAPARD as illustrated below.



According to the Green Report 1999, the international economic co-operation is determined by the contractual basis created by the EU, CEFTA, WTO/GATT and the Custom Union Agreement with the Czech Republic.

As shown in the above Figure, agriculture and rural development programs fall under SAPARD. In Slovak Republic, approximately 48% of population lives in rural areas, 40% in semi urban regions and 12% in urban regions respectively (Agricultural Situation and Prospects in the Central European Countries EC DG VI June 1998, p.11). So the development programs uplifting the living standard of the rural area have great importance. During 1990-1997, various activities were undertaken by the individual sectors but there was no effective cooperation and integration. In 1993, after the foundation of the Slovak Republic, to avoid decline in production and for food security, agricultural policies were fixed in a long-term program. In 1998, MoA prepared a " Rural Development Concept of the Slovak Republic". The concept defines rural areas based on political, economic and demographic analysis. Based on the analysis principles and priorities for the development are set and are reflected in the National Agricultural and Rural Development Plan, which serves as a basis for the implementation of SAPARD program 2000-2006.

Table C.3.1 shows the economic assistance provided by EU under PHARE program between 1994 and 1999 for the social and economic development of the Slovak Republic. The assistance was provided for the development of agriculture sector, preparation for EU CAP implementation, harmonization of internal market legislation etc. The amount allocated to the Slovak Republic was about 20 million in 1994 and increased to 40 million ECU in 1999. SAPARD financial plan for the years of 2000-2006 according to the individual priorities and measures are shown in Table C.3.2. The priorities are set as first priority: improvement of agricultural production sector including the food industry, second priority: sustainable rural development and third priority: development of human resources and technical assistance. The amount allocated is about 192 million, 94 million and 8 million EUR for the first, second and third priorities respectively.

C.3.2 COOPERATION BY INTERNATIONAL ORGANIZATIONS

The co-operation provided by FAO is also significant. FAO assisted projects such as planning of strategy for animal breeding development, harmonization of legislation and strategy for development of the forestry sector, fish marketing and information system and training projects at sub-regional level on the application of the HACCP system and cooperation in the AGRIS/CARIS information system. The OECD had worked for Slovakia under the Partners in Transition in a number of areas including industrial restructuring, privatization, accounting and income tax compliance. Now as a regular member Slovakia participates in several programs. IBRD and the European Investment Bank (EIB) also are assisting the Slovak economy. IAEA assisted a plan to prepare " Feasibility study for the construction and operation of mass rearing insect facility" in Slovakia.

C.3.3 BILATERAL COOPERATION

There are several bilateral cooperation programs in Slovakia. German provided technical assistance for the program of " Further development of politically oriented information system for Slovak agriculture and Trainees program for specializing in horticulture and support to agricultural economics of Slovakia. Netherlands supported demonstration project of potato growing, strengthening the marketing function of the vegetable sector in the Komarno area, improving the dairy sector in eastern Slovakia. France was active as a Twinning partner and the USA provided several fellowship programs.

C.4 CONDITION OF EU AFFILIATION PROCESS OF SLOVAKIA

The reference date for the accession to the European Union has been set as 1st of January 2004 for Slovakia and the country is going to assume the community law by the end of 2002 at the latest. Every kind of laws, from taxation to custom formalities, from company laws to the judicial systems as a whole are in process of reforms. Concerning the agriculture sector, the Slovak updated version of the National Program for the Adoption of Acquis Communautaire was officially released in 1999 (Acquis Communautaire is the entire body of legislation of the European Community. Countries wishing to join the European Union must adopt and implement the entire acquis upon accession. The European Council has ruled out any partial adoption of the acquis). The short term and medium term priorities for the adjustment of Slovakia's regulatory frame work to the requirements of the Acquis, are outlined in Chapter- 7 Agriculture (Criteria for Membership). The short term and medium term priorities are illustrated in the following Chapters.

C.4.1 SHORT TERM PRIORITIES;
(SHORT-TERM AS WELL AS MEDIUM-TERM PRIORITIES ARE QUOTED FROM NATIONAL PROGRAM FOR THE ADOPTION OF THE ACQUIS 2001, PP.143-144)

- Adopt an act on the organization of markets in selected commodities. It will address the transformation of the State Fund for Market Regulation into an intervention agency.

- Make functional the Slovak Agrarian Marketing Organization (SAMO) focused on the support of the sale and marketing of agricultural commodities in line with the act on the organization of markets in selected commodities under preparation.
- Prepare the Integrated Administration and Control System (IACS) for selected support schemes of direct payments.
- Set up a payment agency for the provision of subsidies in agriculture

C.4.2 MEDIUM TERM PRIORITIES

- In relation to the IACS strategy, secure finance and start to set up the IACS. The finance will be partially secured through twinning projects. Co-financing from state budget is expected.
- Gradually build the IACS for the implementation of the common Agricultural Policy.
- Build a functional system for the administration of export and import measures.
- FADN-classify legal and physical persons on the basis of the results of the structural census of farms
- Gradually create conditions for the interconnection of the sectors' information system with information system in the EU.
- Gradually rebuild the system of structural policy instruments according to the system applied in the EU

Several programs under the EU assisted Phare program such as CBC, ISPA, SAPARD, Twinning were implemented during 2000 and 2001. The Phare program was a significant financial instrument for the implementation of Slovakia's pre-accession strategy. Some important reforms have already taken place such as the provision of subsidies for the use of land in less favored production areas through the compensation of low income. ATIS started to issue the news bulletin " Agrarian Market in the EU and the World" in 2000. ATIS monitors the price developments for the important agricultural commodities. Reform measures are also taken on veterinary and phyto-sanitary areas. Veterinary care act and foodstuffs act are under review. The amendment removes the incompatibility in the labeling of foodstuffs and harmonizes the official inspections.

Table C.1.1 Gross Domestic Activities by Economic Activities (1996-1999) (Unit: Million SKK at Current Prices)

Economic Activities	1996	Percent to total	1997	Percent to total	1998	Percent to total	1999	Percent to total
1 Market Goods	**251,272**	**41.5**	**263,407**	38.4	**271,024**	36.1	**291,194**	35.7
of which								
-Agriculture, Hunting, Forestry and Fishing	29,062	4.8	31,643	4.6	31,591	4.2	33,200	4.1
of which								
Agriculture	24,996	**4.1**	27,377	**4.0**	27,481	**3.7**	29,179	**3.6**
-Industry in total	178,888	29.5	184,110	26.8	191,255	25.5	215,597	26.4
of which								
-Mining and Quarrying	5,645	0.9	6,093	0.9	6,258	0.8	7,523	0.9
-Manufacturing	146,947	24.2	154,553	22.5	166,713	22.2	178,063	21.8
of which								
-Manufacture of food products;	20,336	3.4	20,121	2.9	24,933	3.3	27,435	3.4
-Manufacture of petroleum; coke; manufacture of chemical Products; manufacture of rubber and plastic	28,762	4.7	27,873	4.1	30,531	4.1	29,051	3.6
-Manufacture of metal products	25,362	4.2	26,544	3.9	26,706	3.6	27,601	3.4
-Manufacture of machinery n.e.c; manufacture of electrical equipment manufacture of transport equipment	33,454	5.5	36,576	5.3	40,461	5.4	47,815	5.9
-Electricity; gas and water supply	26,296	4.3	23,464	3.4	18,284	2.4	30,011	3.7
-Construction	43,322	7.1	47,654	6.9	48,178	6.4	42,397	5.2
2 Market Services	**230,297**	**38.0**	**275,470**	40.2	**308,118**	41.0	**343,276**	42.1
of which								
-Trade; hotel and restaurants	76,485	12.6	85,536	12.5	102,751	13.7	114,132	14.0
-Transport and storage	46,725	7.7	48,510	7.1	53,585	7.1	57,817	7.1
-Post and telecommunications	13,931	2.3	17,197	2.5	20,532	2.7	23,637	2.9
-Financial intermediation, other businesses, activities; research; public administration and defense; education; health; social work; other community services activities	93,156	15.4	124,227	18.1	131,250	17.5	147,690	18.1
3 Non-Market Services	**74,157**	**12.2**	**93,984**	13.7	**101,215**	13.5	**101,732**	12.5
4 Others	**50,368**	**8.3**	**53,226**	7.8	**70,404**	9.4	**79,128**	9.7
5 Total	**606,094**	**100.0**	**686,087**	**100.0**	**750,761**	**100.0**	**815,330**	100.0
6 GDP Growth Rate (%)	11.0		13.1		9.4		8.6	
7 GDP at Constant Prices (1995=100)	579,900		615,900		641,100		653,300	
8 GDP Growth Rate (%) (Constant Prices)	6.0		6.2		4.1		1.9	
9 GDP Per Capita (SKK)								
at Current Prices	112,678		127,336		139,210		151,015	
at Constant 1995 Prices	107,808		114,310		118,876		121,004	

Source: Statistical Year Book 2000, Statistical Office of the Slovak Republic, pp. 59-67; Social Trends in the Slovak Republic, p.14

Note: 1) The estimated population in the Slovak Republic is as follows;

1996 5379 Thousand Persons
1997 5388 "
1998 5393 "
1999 5399 "

Table C1.2 Gross Domestic Product by Region

Unit: Million SKK at Current Prices

Gross Output						
Region	1997	Percent to Total	1998	Percent to Total	1999	Percent to Total
Bratislava	375,706	22.6	403,354	22.4	430,217	22.9
Trnava	173,453	10.4	182,770	10.1	188,868	10.1
Trencin	178,635	10.7	186,005	10.3	191,380	10.2
Nitra	172,704	10.4	189,150	10.5	197,559	10.5
Zilina	182,932	11.0	198,691	11.0	203,139	10.8
Banska Bystrica	196,834	11.8	211,249	11.7	222,125	11.8
Presov	159,802	9.6	171,953	9.5	181,266	9.7
Kosice	221,819	13.3	259,554	14.4	261,715	13.9
Total	1,661,885	100.0	1,802,726	100.0	1,876,269	100.0

Intermediate Consumption						
Region	1997	Percent to Total	1998	Percent to Total	1999	Percent to Total
Bratislava	233,369	22.2	247,930	21.9	257,385	22.5
Trnava	107,223	10.2	112,077	9.9	112,705	9.9
Trencin	114,582	10.9	116,606	10.3	116,681	10.2
Nitra	106,172	10.1	115,473	10.2	115,537	10.1
Zilina	117,735	11.2	126,794	11.2	126,976	11.1
Banska Bystrica	128,247	12.2	136,983	12.1	140,103	12.2
Presov	101,967	9.7	108,681	9.6	110,961	9.7
Kosice	141,913	13.5	167,550	14.8	163,582	14.3
Total	1,051,208	100.0	1,132,094	100.0	1,143,930	100.0

Value Added						
Region	1997	Percent to Total	1998	Percent to Total	1999	Percent to Total
Bratislava	142,337	23.3	155,424	23.2	172,832	23.6
Trnava	66,230	10.8	70,693	10.5	76,163	10.4
Trencin	64,053	10.5	69,399	10.3	74,699	10.2
Nitra	66,532	10.9	73,677	11.0	82,022	11.2
Zilina	65,197	10.7	71,897	10.7	76,163	10.4
Banska Bystrica	68,587	11.2	74,266	11.1	82,022	11.2
Presov	57,835	9.5	63,272	9.4	70,305	9.6
Kosice	79,906	13.1	92,004	13.7	98,133	13.4
Total	610,677	100.0	670,632	100.0	732,339	100.0

Source: Statistical Year Book, 2000, Statistical Office, p 569

Table C.1.3 Economically Active Population and Employment in Slovak Republic

(Unit: 1,000 Persons)

	1996	1997	1998	1999
Economically Active Population				
Productive age	2,460.2	2,479.1	2,498.8	2,525.8
Post productive age	48.9	42.8	45.9	47.2
Total	2,509.1	2,521.9	2,544.7	2,573.0
Employed				
Productive age	2,203.0	2,186.8	2,176.0	2,112.1
Post productive age	45.1	39.5	41.9	43.8
Total	2,248.1	2,226.3	2,217.9	2,155.9
Unemployed				
Productive age	280.4	294.2	313.0	413.5
Post productive age	3.8	3.3	4.0	3.4
Total	284.2	297.5	317.0	416.9
Rate of Unemployment (%)				
Productive age	**12.7**	**13.5**	**14.4**	**19.6**
Post productive age	8.4	8.4	9.5	7.8
Rate of Unemployment for the whole Economically Active Population (%)	**11.3**	**11.8**	**12.5**	**16.2**

Source: Statistical Year Book, 2000, Statistical Office

Note: 1) Economically active population: persons aged 15 and over who are civilian employed, unemployed or members of the arm forces.

2) Employed by LFS: all persons aged 15 and above who are working at least one hour for pay or profit (full time or part time job, permanent, temporary, casual or seasonal job) in the reference week, as well as contributing (unpaid) family workers, professionals in military service, person in substitute civil service and persons working abroad.

3) Productive age: men aged 15-59, women aged 15-54

4) Post productive age: men aged 60 and more, women aged 55 and more

Table C.1.4 Registered Unemployment and Unemployment Rate by Region

(Unit: Persons)

	Registered Unemployed Total	of Which Women	Disposable number of registered unemployed	Unemployment Rate (%)
Bratislava	25,122	12,818	23,668	7.2
Trnava	45,935	21,541	43,644	16.3
Trencin	44,437	18,607	41,887	13.5
Nitra	78,078	36,038	74,882	21.5
Zilina	64,637	27,362	61,539	17.7
Banska Bystrica	79,567	36,007	76,098	23.1
Presov	100,084	41,389	95,860	26.0
Kosice	97,351	42,355	93,151	26.0
Total	535,211	236,117	510,729	19.2

Source: Statistical Year Book, 2000, P. 573

Note: 1) Unemployment rate is calculated as the ratio of disposable number of the unemployed in the number of economically active people for 1998

Table C.1.6 Employment by Selected Branches
(Dec. 31, 1999 at present)

Unit Persons

Regions	Employees Total	In Agriculture	Percent to Total
Bratislava	223,040	4,292	1.9
Trnava	125,177	14,697	11.7
Trencin	154,276	9,349	6.1
Nitra	159,177	19,463	12.2
Zilina	160,327	10,274	6.4
Banska Bystrica	161,515	14,231	8.8
Presov	153,820	14,129	9.2
Kosice	179,018	10,779	6.0
Total	1,316,350	97,214	7.4

Source: Statistical Year Book, 2000 p. 573

Note: 1) For companies with 20 and more employees
without employees whose working place is located abroad

Table C.1.5 Employed by Economic Activities-NACE (from labour force survey)

(Unit: 1000 persons, %)

Economic Activities		Employed Persons and Share to Total				Average Gross Monthly Per Capita Wages			
		1998	Share (%)	1999	Share (%)	1998 SKK		1999 SKK	
Agriculture, hunting, forestry and fishing		181.4	8.3	157.2	7.4	7,781	77.8	8,380	78.1
Industry	Mining and quarrying	35.6	1.6	29.9	1.4	11,006	110.0	11,988	111.7
	Manufacturing	573.7	26.1	547.5	25.7	9,980	99.8	10,758	100.3
	Electricity, gas and water supply	53.2	2.4	52.9	2.5	13,325	133.2	14,349	133.8
Construction		204.5	9.3	189.7	8.9	9,976	99.7	9,899	92.3
Wholesale and retail trade; repair of motor vehicles, motorcycles, and personal and household goods		262.3	11.9	260.4	12.2	10,726	107.2	11,530	107.5
Hotel and restaurants		62.5	2.8	64.8	3.0	7,476	74.7	8,126	75.7
Transport, storage, post and telecommunication		169.7	7.7	166.0	7.8	10,608	106.0	11,563	107.8
Financial intermediation		37.2	1.7	36.7	1.7	19,280	192.7	19,955	186.0
Real estate, renting and business activities		77.3	3.5	80.0	3.8	12,137	121.3	13,108	122.2
Public administration and defense		153.9	7.0	150.4	7.1	12,407	124.0	13,052	121.7
Education		165.3	7.5	166.7	7.8	8,187	81.8	8,400	78.3
Health and social works		146.3	6.7	155.0	7.3	9,091	90.9	9,100	84.8
Other community, social and personal service activities		72.9	3.3	72.9	3.4	8,489	84.9	9,423	87.8
Private Households		2.8	0.1	1.9	0.1				
Extra -territorial organizations		0.1	0.0	0.2	0.0				
Total/Average		2,198.7	100.0	2,132.2	100.0	10,003	100.0	10,728	100.0

Source: Statistical Year Book, 2000, Statistical Office

Note: 1) Persons aged 15 and over who are working at least one hour for pay or profit in the reference week, as well as contributing (unpaid) family workers, professionals in military service, person in substitute civil service and person working abroad.

2) NACE: Branch Classification of Economic Activities

Table C.1.7 (a) Foreign Trade by Commodity Groups

(Unit: Million SKK, FOB/FOB)

Commodity Groups	Imports						Exports					
	1997 Amount	Share to Total(%)	1998 Amount	Share to Total(%)	1999 Amount	Share to Total(%)	1997 Amount	Share to Total(%)	1998 Amount	Share to Total(%)	1999 Amount	Share to Total(%)
0 Food and live animals	22,163	5.6	24,249	5.3	24,121	5.1	11,164	3.4	12,144	3.2	12,849	3.0
1 Beverages and tobacco	4,115	1.0	4,130	0.9	5,178	1.1	2,207	0.7	2,046	0.5	2,185	0.5
2 Crude materials	17,373	4.4	17,669	3.8	17,894	3.8	13,761	4.2	13,565	3.6	16,276	3.8
3 Fuels and related products	61,841	15.7	50,291	10.9	60,665	12.9	14,946	4.6	13,235	3.5	20,126	4.8
4 Animal and plant oils, fats and waxes	722	0.2	967	0.2	882	0.2	497	0.2	700	0.2	570	0.1
5 Chemicals and related products	45,520	11.6	48,843	10.6	52,869	11.3	34,944	10.8	33,579	8.9	33,417	7.9
6 Intermediate manufactured products	64,857	16.5	82,984	18.0	85,765	18.3	110,011	34.0	113,284	30.0	116,385	27.5
7 Machinery and transport equipment	142,003	36.0	185,625	40.3	176,935	37.7	92,018	28.4	141,144	37.4	166,899	39.4
8 Miscellaneous manufactured articles	35,192	8.9	45,758	9.9	44,480	9.5	44,311	13.7	47,967	12.7	54,543	12.9
9 Other commodities and products of trade	186	0.0	221	0.0	104	0.0	158	0.0	144	0.0	400	0.1
Total	393,972	100.0	460,737	100.0	468,893	100.0	324,017	100.0	377,808	100.0	423,650	100.0

Table C.1.7 (b) Commodity Groupwise Trade Balance

Commodity Group	1997	1998	1999
0 Food and live animals	-10,999	-12,105	-11,272
1 Beverages and tobacco	-1,908	-2,084	-2,993
2 Crude materials	-3,612	-4,104	-1,618
3 Fuels and related products	-46,895	-37,056	-40,539
4 Animal and plant oils, fats and waxes	-225	-267	-312
5 Chemicals and related products	-10,576	-15,264	-19,452
6 Intermediate manufactured products	45,154	30,300	30,620
7 Machinery and transport equipment	-49,985	-44,481	-10,036
8 Miscellaneous manufactured articles	9,119	2,209	10,063
9 Other commodities and products of trade	-28	-77	296
Total	-69,955	-82,929	-45,243

Source: Statistical Year Book, 2000

Note:

1) The data before the year 1997 are not comparable with those after 1997 in consequence of methodological changes introduced in 1997
2) FOB: free on board.
3) Value of Imports is expressed in Trade Parity (OP, FOB). OP, FOB is invoiced price of the goods which is neither increased nor decreased by direct trade costs abroad.
4) Value of Exports is given in Franco-price-Slovak border (FCO, FOB). FCO, FOB is invoiced price of the goods decreased by direct trade costs abroad. Direct trade cost abroad are the costs of domestic suppliers or purchasers for delivery or receiving of goods abroad, e.g. costs for transport, insurance and storage of goods.

Table C.1.8 Territorial Structure of Foreign Trade

Particulars	Imports						Exports					
	1997 Amount	Share to Total(%)	1998 Amount	Share to Total(%)	1999 Amount	Share to Total(%)	1997 Amount	Share to Total(%)	1998 Amount	Share to Total(%)	1999 Amount	Share to Total(%)
Europe	352,946	89.6	412,525	89.5	423,594	90.3	305,976	94.4	361,984	95.8	401,824	94.8
Asia	22,135	5.6	26,115	5.7	26,984	5.8	7,712	2.4	5,667	1.5	8,027	1.9
Africa	1,489	0.4	1,378	0.3	1,427	0.3	1,383	0.4	1,399	0.4	3,017	0.7
America	16,441	4.2	17,579	3.8	15,987	3.4	8,532	2.6	7,206	1.9	9,287	2.2
Australia	547	0.1	573	0.1	486	0.1	199	0.1	198	0.1	361	0.1
Oceania	5	0.0	1	0.0	8	0.0	111	0.0	14	0.0	16	0.0
Without specification	410	0.1	2,565	0.6	406	0.1	106	0.0	1,338	0.4	1,115	0.3
Total	393,973	100.0	460,736	100.0	468,892	100.0	324,019	100.0	377,806	100.0	423,647	100.0

Trade Balance

Area	1997	1998	1999
Europe	-46,970	-50,541	-21,770
Asia	-14,423	-20,448	-18,957
Africa	-106	21	1,590
America	-7,909	-10,373	-6,700
Australia	-348	-375	-125
Oceania	106	13	8
Without specification	-304	-1,227	709
Total	-69,954	-82,930	-45,245

Particulars	Imports			Exports			
	1997	1998	1999	1997	1998	1999	1999
CEFTA	107,702	115,132	109,676	120,564	123,070	126,078	16,402
EU	172,528	230,989	242,357	152,551	210,250	251,550	9,193
EFTA	6,118	7,297	7,027	4,155	6,974	8,147	1,120
OECD	303,697	371,797	375,839	278,984	339,812	387,657	11,818

Source: Statistical Year Book 2000

Note: 1) CEFTA: Central European Free Trade Agreement (Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovakia and Slovenia.
2) EU: European Union (Belgium, Denmark, Finland, France, Greece, Netherlands, Ireland, Luxembourg, Germany, Portugal, Austria, United Kingdom, Spain, Sweden, Italy)
3) EFTA: European Free Trade Association (Iceland, Liechtenstein, Norway, Switzerland.

Table C.1.9 Consumer Price (cost of living) Indices

December 1995=100

Branches and Groups by COICOP Classification	1995		1996		1997		1998		1999	
	Indices Percent	Rate of Inflation Percent	Indices Percent	Rate of Inflation Percent	Indices Percent	Rate of Inflation Percent	Indices Percent	Rate of Inflation Percent	Indices Percent	Rate of Inflation Percent
Total	97.1		102.7	5.8	109	6.1	116.3	6.7	128.6	10.6
Foodstuffs and non alcoholic beverages	97.4		101.4	4.1	107.2	5.7	113.5	5.9	116.5	2.6
Alcoholic beverages and tobacco	98.9		102.2	3.3	106.3	4.0	118.8	11.8	123.9	4.3
Clothing and foot wear	96.6		103.5	7.1	111.4	7.6	120	7.7	129	7.5
Housing, water, electricity, gas and other fuels	98.1		102.7	4.7	110.1	7.2	117	6.3	151.7	29.7
Furnishings, household equipment and regular maintenance of dwelling	96.3		102.1	6.0	106.9	4.7	114.4	7.0	123.4	7.9
Health	89.5		104.5	16.8	117.7	12.6	125.4	6.5	138.6	10.5
Transport	96.6		102.7	6.3	108.9	6.0	111.6	2.5	125.6	12.5
Recreation and culture	97.5		107.7	10.5	114.5	6.3	123.9	8.2	135.4	9.3
Education	90.2		100.2	11.1	104.4	4.2	101.7	-2.6	111	9.1
Hotels, cafes and restaurants	96.5		102.1	5.8	108.6	6.4	115.8	6.6	125.3	8.2
Miscellaneous goods and services	96.5		101.7	5.4	106.7	4.9	119.6	12.1	130.8	9.4

Source: Social Trends in the Slovak Republic, August 2000

Table C.2.1 Structure of Net Money Income and Expenditure of Households
by Social Groups (1999)
(Annual Per Capita Average)

Particulars	Unit	Total Households N=1640	Households of Employees N=1035	Households of Farmers N=188	Households of Pensioners Without Working Members N=272	Households of Self Employees N=145
Net Money Income Total (SKK)	**SKK**	**62,982**	**63,519**	**56,695**	**60,341**	**72,107**
Net Income from Employment	%	62.4	81.2	76.3		
Income from Business[1)]	%	4.8			93.1	66
Social Income	%	25.6	10.1	14.1	(of which Pension 92.7)	9.4
Net Money Expenditure Total (SKK)	**SKK**	**62,707**	**62,575**	**55,061**	**62,545**	**73,014**
Consumption Expenditure	%	92.6	93.1	93.4	90.4	92.9
Foodstuffs and non-alcoholic Beverages	**%**	**27.6**	**26**	**28.1**	**34.9**	**28.8**
Alcoholic Beverages and Tobacco	**%**	**3.3**	**3.7**	**3.7**	**3.7**	**3.7**
Clothing and Footwear	**%**	**8.6**	**9.2**	**9.7**	**5.7**	**10.1**
Housing, Water Electricity, Gas and other Fuels	%	14.6	13	15.8	20.2	14.1
Furnishing Household Equipment and Regular Maintenance	%	5.7	5.7	5.7	5.7	5.7
Health	%	1.4	1.3	1.1	2.1	1.2
Transport	%	8	3.7	3.7	3.7	3.7
Communication	%	2.4	2.4	1.9	2.6	3
Recreation and Culture	%	7.7	8.2	6.4	5.4	9.1
Education	%	0.5	0.6	0.4	0	0.8
Hotels, Cafes and Restaurants	%	5.1	6.3	4.5	1	4.2
Miscellaneous Goods and Services	%	7.7	8.2	7.9	5.4	8.3
Other Expenditure	%	7.4	6.9	6.6	9.6	7.1

Source: Social Trends in the Slovak Republic, Statistical Office, August 2000, pp.35-39

Note 1) Amount by which a self-employer contributes to household budget

2) Net Monetary Income: Sum of money incomes from wages, incomes from cooperatives, monetary part allocated by self employed person from its entrepreneurial income for the purpose of household, social incomes, monetary gifts, compensation from insurance companies, winning in lottery.., including collected new loans.

Table C.2.2 Balance of Grains in Slovakia

Indicator	unit	Grains Total		Wheat		Barley		Rye		Oats		Maize		Other Grain	
		Actual Figures		Actual Figures		Actual Figures		Actual Figures		Actual Figures		Actual Figures		Actual Figures	
		1998-1999	1999-2000	1998-1999	1999-2000	1998-1999	1999-2000	1998-1999	1999-2000	1998-1999	1999-2000	1998-1999	1999-2000	1998-1999	1999-2000
Production	1000 ton	3,487.6	2,829.4	1,789.3	1,187.3	875.0	723.7	96.2	69.5	47.5	48.4	637.4	779.3	42.2	21.2
Initial stock	"	606.3	607.3	220.2	338.3	179.2	152.1	12.5	18.2	10.3	12.4	176.3	76.5	7.8	9.8
Import	"	**27.7**	**42.6**	**14.7**	**9.3**	**2.3**	**13.2**	**2.0**	**7.6**	**0.2**	**0.1**	**8.4**	**12.4**	**0.1**	**0.0**
Other source	"	0.0	78.0	0.0	25.0	0.0	11.0	0.0	0.0	0.0	0.0	0.0	42.0	0.0	0.0
Total supply	"	4,121.6	3,557.3	2,024.2	1,559.9	1,056.5	900.0	110.7	95.3	58.0	60.9	822.1	910.2	50.1	31.0
Domestic consumption	"	**3,084.6**	**2,970.4**	**1,586.6**	**1,366.2**	**759.3**	**779.0**	**85.3**	**84.6**	**45.2**	**51.5**	**569.5**	**659.9**	**38.7**	**29.5**
Food nutrition	"	989.9	1,008.7	604.1	575.8	209.2	235.0	63.1	60.3	1.2	1.8	111.4	135.1	0.9	0.7
Sowing seed	"	121.8	140.0	58.6	74.7	40.3	38.4	4.9	5.5	6.3	6.2	9.7	13.4	2.0	1.8
Fodder.	"	1,744.5	1,615.9	790.0	600.7	469.0	467.5	15.1	15.3	32.5	37.9	405.2	469.1	32.7	25.4
Other use	"	228.4	205.8	133.9	115.0	40.8	38.1	2.2	3.5	5.2	5.6	43.2	42.0	3.1	1.6
Export	"	**411.6**	**317.7**	**99.3**	**81.5**	**133.9**	**59.6**	**0.3**	**0.0**	**0.4**	**2.2**	**176.1**	**174.2**	**1.6**	**0.2**
Other expenses	"	18.1	0.0	0.0	0.0	11.2	0.0	6.9	0.0			0.0	0.0		
Total utilization	"	3,514.3	3,288.1	1,685.9	1,447.7	904.4	838.6	92.5	84.6	45.6	53.7	745.6	833.8	40.3	29.7
Ending stock	"	**607.3**	**269.2**	**338.3**	**112.2**	**152.1**	**61.4**	**18.2**	**10.7**	**12.4**	**7.2**	**76.5**	**76.4**	**9.8**	**1.3**

Source: MA SR. SO SR. Central Customs Administration of SR. RIAF , Quoted from AITS

Table C.3.1 ((a) Budget Allocated to SR under the Program PHARE by EU

Year	Allocated Amount (MEUR)	Contracted Amount (MEUR)	Resources used for
1997	43.58	43.58	-Restructuring of industrial enterprises -Development of small and medium-sized enterprises -Promotion of exports and foreign investments -Strengthening integration in the sector of agriculture -Development of civil society -Community programs
1998	78.32	33.69	-Approximation of law, European integration and coordination of Phare -Agriculture -Special Preparatory Program for Structural Funds of EU -Building institutions in the environment -Grant Environmental Fund -Community Programmes -Program Pre-Ins, of which individual projects -Increase of the Slovak Post-Privatisation Fund -Improvement of the position of Romanies in the district of Sisska Nova Ves -Large-Sized Infrastructural Project Fund (LSIPF) -61 by-pass of Bratislava in the length Senecka-Mierova -Phare Program of Cross-Border Cooperation
1999	69.5		-Economic reform -Internal market -Agriculture -Statistics -Environment -Energy -Institutional and administrative capacities -Bridge Sturovo-Ostrihom -LSIF IV - ISPA Preparation of the program -1999 Phare Pre-Ins Facility -Phare CBC

Source: National Plan of Regional Development of the Slovak Republic, March 2001

Table C.3.1(b) Overview and Evaluation of the Previous Actions Under EU Support

Programmes	Financial Memorandum	Allocation of Financial sources (ECU)	Contracted (ECU)	Status of Programme Implementation	Objectives of the Program
SR 94 02 Agriculture and Land Registration	1994	2,009,102	1,990,057	Implemented	-
SR 95 13 Agriculture	1995	1,624,345	1,574,466	Implemented	-to expand and complement the scope of analyses and assist in implementing appropriate strategic measures aimed at supporting the process of restructuring and developing agricultural institutions and supporting priority areas in the primary agricultural production and processing -to provide technical and financial assistance in the implementation of the so-called "harmonisation projects" focusing on the EU internal market's rule in the area of plant protection, phytosanitary and veterinary control, infrastructure for food quality monitoring, and the like; -to provide further support in the process of land consolidation, identification and registration of titles to land and creation of a functioning land market -to support rural development activities (establishment of a Rural Development Fund)
SR 97 06 Development of the Agricultural Sector	1997	3,999,888	3,994,736	Stage of implementation	-strategic consulting and training, support of the state forestry policy, with main emphasis on the private sector -support in the harmonisation of the Slovak phytosanitary and veterinary infrastructure -further development of the national network of advisory services for farmers -support of the rural development policy in compliance with the EU rules -support to marketing
SR 98 07 Institutional Support to the Agricultural Sector	1998	4,300,000	1,553,000	Stage of implementation	-harmonisation of veterinary, food quality and phytosanitary standards, delivery of equipment and training of experts in the veterinary, food quality and phytosanitary control on the EU standards and requirements -assistance in the restructuring of agricultural and food sector, gradual adoption and implementation of the CAP principles, creation of intervention agency -harmonisation of the system of agricultural and forestry statistics in conformity with EU standards
SR 99 09 Preparation for EU CAP Implementation, Harmonasition of Internal Market Legislation	1999	4,000,000		Stage of contracting	-implementation of the EU common agricultural policy (preparation of strategy and development of (supporting systems) -implementation of the internal market legislation

Source: Agricultural and Rural Development Plan of the Slovak Republic for the Period of 2000-2006, (SAPARD), MoA, Oct. 2000, p.74

Note: 1) ECU: former EU Currency
2) CAP: Common Agricultural Policy

Table C.3.2 SAPARD- Draft Financial Plan for the Years of 2000-2006
According to Individual Priorities and Measures

(Unit: EUR, 1000)

Priorities and Measures	Total Expenditures	Public Expenditure						Private Expenditures	
		Total Public Expenditure		Community Contribution		National Contribution			
	EUR	EUR	%	EUR	%	EUR	%	EUR	%
1	2=3+9	3=5+7	4	5	6	7	8	9	10
Priority No.1									
Improvement of agricultural production sector including the food industry									
Measures: No.1: Investment into agricultural enterprises	94,406	47,203	50.0	35,402	75.0	11,801	25.0	47,203	50.0
Measures: No.2: Improvement of processing and marketing of agricultural and fish products	89,663	44,832	50.0	33,624	75.0	11,208	25.0	44,831	50.0
Measures: No.3: Setting up of producers' groups	7,800	7,800	100.0	5,850	75.0	1,950	25.0	0	0.0
Total	**191,869**	**99,835**	52.0	**74,876**	75.0	**24,959**	25.0	**92,034**	48.0
Priority No.2									
Sustainable rural development									
Measures: No.4: Diversification activities in rural areas-total	45,210	25,992	57.5	19,494	75.0	6,498	25.0	19,218	42.5
Measure No.4: Investment not involving infrastructure	*38,435*	*19,217*	50.0	*14,413*	75.0	*4,804*	25.0	*19,218*	50.0
Measure No.4: Infrastructure investment not generating substantial net revenue	*6,773*	*6,773*	100.0	*5,080*	75.0	*1,693*	25.0	*0*	0.0
Measure No.5: Forestry	25,790	12,895	50.0	9,671	75.0	3,224	25.0	12,895	50.0
Measure No.6. Agricultural production methods designed to protect the environment and maintain the countryside	6,000	6,000	100.0	4,500	75.0	1,500	25.0	0	0.0
Measure No.7: Land consolidation	16,824	16,824	100.0	12,618	75.0	4,206	25.0	0	0.0
Total	**93,824**	**61,711**	65.8	**46,283**	75.0	**15,428**	25.0	**32,113**	34.2
Priority No.3									
Measure No.8: Development of human resources	3,333	3,333	100.0	2,500	75.0	833	25.0	0	0.0
Measure No.9: Technical Assistance	5,333	5,333	100.0	4,000	75.0	1,333	25.0	0	0.0
Total	**8,666**	**8,666**	100.0	**6,500**	75.0	**2,166**	25.0	**0**	0.0
Grand Total (All Measures)	**294,359**	**170,212**	57.8	**127,659**	75.0	**42,553**	25.0	**124,147**	42.2

Source: Agricultural and Rural Development Plan of the Slovak Republic for the Period of 2000-2006, (SAPARD), MoA, Oct. 2000

Note: 1) ECU: former EU Currency, EUR: EU Currency

ANNEX D	*GEOGRAPHIC INFORMATION SYSTEM (GIS)*

ANNEX D GEOGRAPHIC INFORMATION SYSTEM (GIS)

D.1 INTRODUCTION

A Geographic Information System and digital maps were used in the Study as tools to assist the preparation of the Guidelines. Moreover it was aimed at:

- demonstrating the capabilities of GIS in planning sustainable development of agriculture, and
- guiding non-GIS experts through GIS database development and the processes of analysis with GIS,
- describing the database and analysis results to make possible the direct utilisation of them by non-GIS experts.

Information on the Database in more details is presented in the User's Manual. The Manual provides information basically for GIS experts, but the level of presentation was set for the requirements of non-GIS experts as well. Additional information that can be found in the Manual are

- basic information about the GIS database (data sources, content and characteristics) for appropriate maintenance of the system.

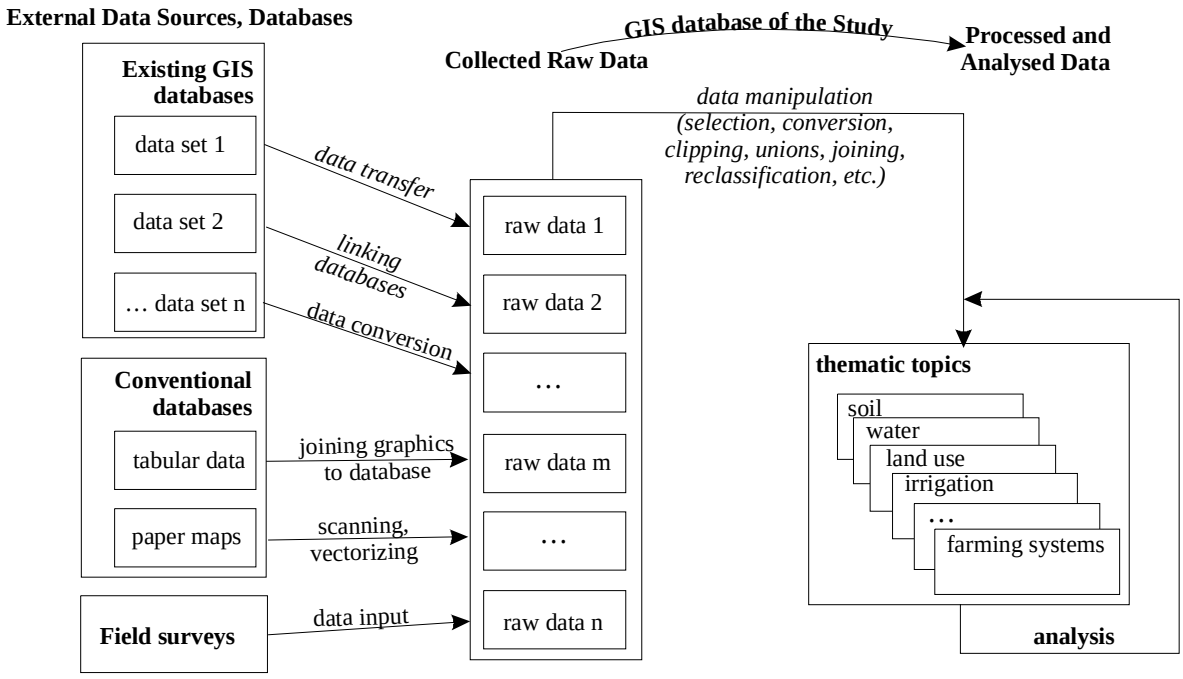
Furthermore, the processing and analysis techniques including necessary details are presented mainly in Chapter 3 of this Appendix.

D.1.1 CONCEPT OF GIS DATABASE DEVELOPMENT

The main aim of GIS database construction in the Study is to evaluate existing conditions in the Study Area and, based on the obtained information, to assist in preparation of the Guidelines. Furthermore, its planned utilisation is to establish basic data source for the case study areas, thus providing a tool to formulate site-specific agricultural development plans. It is aimed at applying the analysing and simulation capabilities of Geographic Information Systems, as well.

The approach in establishing the GIS database of the Study is that the database had to be developed by the "full use" of available data from both the counterpart organisation (Slovak Water Management Enterprise Branch Office of Irrigation and Drainage) and other state and private organisations.

The concept of GIS database integration is presented in following.



Concept of GIS database integration

In general, data are readily available in digital form at the originator, and the originator provides regular updates of the data. Thus, instead of a robust central database, integration is based on the inter-connection of individual sub-systems and components at distant locations. This method assigns clear responsibilities to data providers, meanwhile avoids a giant centralised database where data management and updates are less evident. It is especially valuable, since in most cases the data owner carries out not only data processing and validation, but also it is the primary user of the data.

D.2 COLLECTION OF BASIC DATA AND PREPARATION OF BASE MAPS

D.2.1 DATA SOURCES AND ORGANISATIONS

GIS databases are developed by organisation participating in the development of IS of different sectors. However, it is an important objective for these IS to establish an integrated database network. The effort to achieve this goal is supported by the systematic structuring and distribution of available information about the databases. Summary information on data is organised in a so called “Metadata IS” (catalogue of data sources). Metadata systems are used to navigate users among data sources and information providers.

The metadata base of the Ministry of Agriculture can be accessed only in Slovak language at the website: http://www.mpsr.sk/slovak/mis/index.php.

The metadata information site managed by the Slovak Environmental Agency is accessible from the: http://www.sazp.sk/english/tematika/stav/ed11/index.html in bilingual.

D.2.2 DATA COLLECTION

In the first phase of the Study the primary objective was to establish a GIS database and carry out preliminary analysis on existing conditions. In the subsequent stages of the Study the database will be used for further analysis and based on the obtained information it aims at assisting in preparation of the guidelines. Furthermore, the planned utilisation of the GIS database is to establish basic data source for the case study and to providing tools to formulate site-specific agricultural development plans.

The GIS database had to be developed by the "full use" of available data. Based on the reviews of existing databases and sources the tentative content of GIS database was presented and discussed on the 1st Workshop. Data collection was organised to implement the agreed concept.

GIS data acquired by the Study Team during the Study are listed below by thematic classes. Each data accompanied by a brief description on main contents. Further details on the data are presented in Appendix B part of the Manual.

Thema	Data
Topography	• Topographic Map of Slovakia • Digital Elevation contours of the Study Area • satellite images/ SPOT Panchrometic (2000) and Multispectral (1999)
Climate, meteorology, hydrology	• Hydrological and Meteorological observation network data
	• Soil Monitoring Database • Bonited pedo-ecological unit (BPEU) map • Geochemical atlas of Slovakia: soils
Waters	• Water Management Map: River Network • Water Management Map: Water Areas • Water Management Map: Water Sources and Groundwaters • Water Management Basins • Groundwater Balance Units • Hydro-Ecological Maps
Land Cover	• Atlas of Slovakia: Potential Natural Vegetation • CORINE Land Cover 1970 • CORINE Land Cover 1990
Forests	• Forest Management Database
Infrastructure	• Irrigation and drainage database • Irrigation and Drainage Maintenance Map • Maps of irrigation and drainage project documents • Water Management Map: Hydraulic Structures
Administrative Boundaries	• Map of administrative divisions of Slovakia • Existing and Proposed Protected Natural Areas
Socio-Economy	• Statistical Office data • Field surveys

D.3 DATA PROCESSING AND GENERATION OF THEMATIC MAPS

Processing of obtained raw data and base maps led to the generation of thematic maps. Thematic maps contain additional information required by specialists. In the following chapters thematic topics are organised by the key components of the Guidelines development. For each thematic topic, first the flowchart of processing and short background information is provided to guide the user from concept to processing. Below, the details are presented by the three core elements of any analysis (input-processing-output). Finally, a short discussion on the results is provided.

1. Flowchart and short background information

This introductory figure and text is included to help the orientation of users

2. Input data

Input data required for the processing are listed. Data sets are referred by the name and characteristics used during the establishment of GIS database. Details of the data sets are given in the sections of obtained GIS data specifications.

3. Processing

The processing techniques and steps constitute the most important part of descriptions for both GIS specialists and non-expert users. It includes not only the flow and the main steps of processing, but also the theoretical background and applied methodology, whenever is necessary.

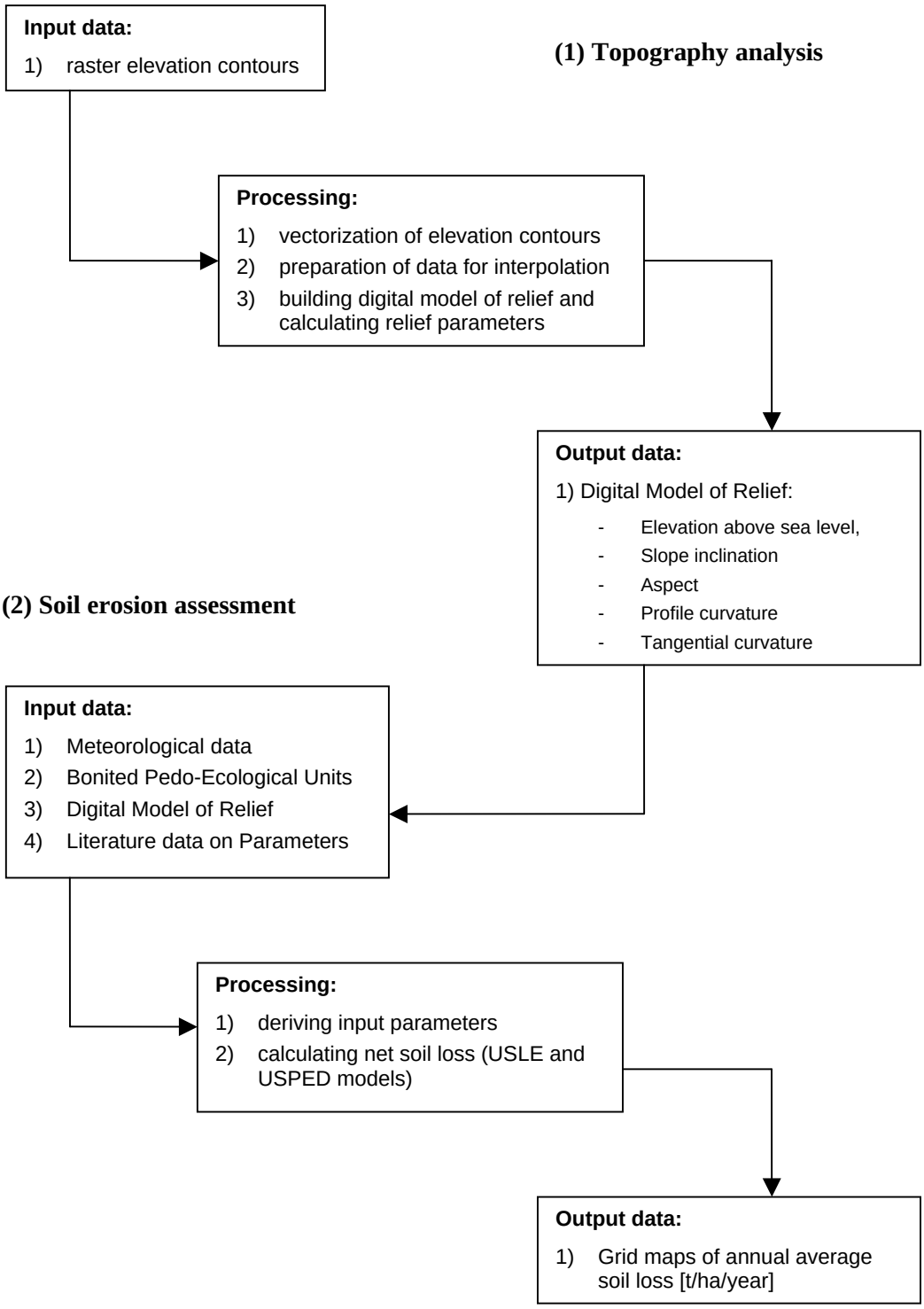
4. Outputs

Outputs represent the main results of GIS data processing. The generated thematic maps are listed with an accompanying text about their key features.

5. Discussion

Although data are used by field specialists in their analysis, under the discussion paragraphs short evaluations of analysis results are provided. Analyses are carried out by GIS techniques, such as spatial analysis, queries and statistics.

D.3.1 DIGITAL MODEL OF RELIEF AND SOIL EROSION ASSESSMENT



Flowchart of relief modelling and erosion assessment

(1) Topography Analysis

Relief (terrain surface) influences many environmental processes (soil erosion, soil water content, landslides, etc.). Therefore, a digital model of relief (DMR) is an important data source for spatial analysis and modelling.

Input data

1) Raster image of topographic maps at scale 1:10 000 - elevation contours layer only

Processing

The conducted works can be summarised as follows:

1) Preparation of digital vector elevation contours;
2) Preparation of data for interpolation;
3) Building the model and calculating relief parameters.

1) Preparation of Digital Vector Elevation Contours

The raster topographic maps do not support direct GIS application. Therefore, the elevation contour lines and elevation points from the raster topographical maps were vectarized. Vectorization was done by grid vector conversion function of GIS software TOPOL, while attribute data (elevation values) were input manually.

2) Preparation of Data for Interpolation

Following vectorization the verification and error-cleaning steps were carried out. In some areas further digitalisation of selected valley and ridge lines was required to enhance the precision of interpolation. In addition, in flat areas where topography does not change much, thus contour lines are sparse, supporting line and point features were added.

3) Building the Model and Calculating Relief Parameters

The digital elevation model was built by GRASS GIS built-in function. Irregularly spaced input elevation points were interpolated and specified grids created using the interpolation method *Regularized Spline with Tension* (RST) implemented in GRASS GIS.

Topographic parameters were computed directly from the interpolation function so the important relationships between these parameters were preserved. The equations for computation of these parameters and their interpretation are described in the Software Manual. The RMSE interpolation error in input points was about 0.678 m considering the whole study area.

Outputs

The raster-based model of relief and all parameters were computed with grid resolution of 10 m. Thus the study area is represented by a 5206 x 4106 cells grid image.
The resulting digital model consists of the following basic raster data layers:

1) Elevation above sea level [m];
2) Slope inclination [deg.];
3) Aspect [deg.];
4) Profile curvature [m^{-1}];
5) Tangential curvature [m^{-1}].

Elevation data are in meters with precision in cm.
Slopes and aspect are computed in degrees (0-90 and 0.01-360 respectively) with precision in hundredths of degree.

The aspect raster file has value 0 assigned to flat areas (with slope less than 0.1%) and to singular points with undefined aspect. Aspect points downslope and its value is 90 to the North, 180 to the West, 270 to the South and 360 to the East, the values increase counter clockwise.
Curvatures are positive for convex and negative for concave areas. Singular points with undefined curvatures have been assigned zero values.

Profile curvature represents rate of change of slope inclination in the direction of gradient. It controls flow acceleration/slackening. Tangential curvature represents rate of change of aspect in direction of tangent to the contour. It controls flow convergence/divergence.

(2) Soil Erosion Assessment

The soil erosion by water is one of the most discussed environmental problems in Slovakia. Its increase in Slovakia during the last 50 years is associated with changes in land use caused by collectivisation, enlargement of agricultural plots, monoculture production, etc. On the study area the actual soil erosion is studied with respect to a present endangering, taking into account all relevant soil erosion factors including rainfall erosivity, soil erodibility, erosion potential of relief and contemporary land cover.

The erosion assessment was done using a combination of USLE (Universal Soil Loss Equation - Wischmeier and Smith) and USPED (Unit Stream Power based Erosion Deposition model - Moore and Burch) models in GIS. The USLE is a soil erosion model well-known in Slovakia. The USPED is a more physically-based soil erosion model that predicts deposition areas as well.

Input data

1) Meteorological data
2) Bonited Pedo-Ecological Units (soil map)
3) Digital Model of Relief (Slope, Curvatures)

4) Literature data on parameters

Processing

The assessment of soil erosion is based upon principles and parameters defined in the Universal Soil Loss Equation (USLE):

$$E=R.K.L.S.C.P$$

The input parameters (factors) refer to:

R *rainfall erosivity* computed as the total kinetic energy of a given rainfall event multiplied by its maximum 30-minute intensity;

K *soil erodibility* that is function of soil properties;

L.S *potential of relief* computed from slope length (L) and inclination (S);

C *land cover/management* that takes into account differences in density and structure of the vegetation cover, reflecting its protective influence and also the methods of land management;

P supporting conservation practice factor (not considered in this study).

The most important limitation is that USLE predicts only soil loss (net erosion). It was intended to be used in field conditions where erosion affected areas are easy to trace. At a regional scale assessment by GIS, however, a method is needed to identify automatically potential erosion areas. Deposition areas have to be excluded from the USLE calculations.

Therefore, since the Unit Stream Power based Erosion Deposition model (USPED) can be used to predict the extent of accumulation/deposition zones, it was decided to use the combination of USLE and USPED. USPED was applied to identify all possible deposition areas.

The calculations had two main steps:

1) deriving the input parameters;
2) calculating net soil loss.

1) Deriving Input Parameters

In the first stage a GIS database of the relevant primary data sets and derived model input parameters was compiled. This involved collection and integration of spatial data into one coherent raster database with grid resolution of 10 metres.

Rainfall Erosivity (R factor): is determined as a function of total storm kinetic energy (*E*) and its maximum 30-min intensity (I_{30}). The R factor for Slovak territory was computed from the rainfall measurements of meteorological stations. The raster data layer of R factor was computed in GRASS GIS by interpolation using regularised spline with tension. It was found that the average value of R factor is equal to 13 for the whole study area.

Soil Erodability (K factor): is the function of soil texture parameter, organic matter content, structure and permeability. The estimation of K factor was based on the use of pedo-ecological maps and literature data. Since the maps do not contain detailed information on sands, sands were included in category of Light soils.

Derived K factor from soil maps

Soil texture	**K factor**
Light soils (Sand and Loamy Sand)	0.32
Medium heavy soils (Loam)	0.57
Heavy soils (Clay Loam)	0.32
Very heavy soils (Cay and Heavy Claylike)	0.17
Medium heavy soils-lighter (Sandy Loam)	0.7

Land cover (C factor:) the value of C-factor was attributed to the CORINE land cover map classes based on the expert assessment of published values for the territory of Slovakia as below table.

Deriving a C factor from CORINE land cover

CLC ID	**Land Cover Class**	**C factor**
112	Discontinuous urban fabric	-
121	Industrial or commercial units	-
122	Road and rail networks and associated land	-
124	Airports	-
131	Mineral extraction sites	-
132	Dump sites	-
133	Construction sites	-
141	Green urban areas	0.003
142	Sport and leisure facilities	0.01
211	Non-irrigated arable land	0.245
221	Vineyards	0.45
222	Fruit trees and berry plantations	0.35
231	Pastures	0.01
242	Complex cultivation patterns	0.2
243	Land principally occupied by agriculture, with significant areas of natural vegetation	0.15
311	Broad-leaved forests	0.002
312	Coniferous forests	0.003
313	Mixed forests	0.002
324	Transitional woodland-scrub	0.008
332	Bare rocks	-
411	Inland marshes	0.001
511	Water courses	-
512	Water bodies	-

Potential of relief (S and L factor:) is a function of slope inclination and slope length. Calculating the parameters the digital model of relief was used.

L factor is a function of slope length. Slope length was approximated by slope-lines length. Barrier effects for overland flow of some land cover categories was taken into account. By definition, slope length should be computed on areas with runoff generation. Therefore we took only areas with slope steepness above 0.5^{o}, where overland flow should be generated under other appropriate conditions.

The S factor values were derived from slope angle A (%) using the following equation of Morgan:

$$S=0.065 + 0.045A + 0.0065A^2$$

2) Calculation of Net Soil Loss

In the second stage the derived parameters were used for modelling and assessment of the results. Following, the modelling approach was applied in several iterative steps in order to refine the C factor estimates (exclusion of deposition areas) and to balance the results based on an empirical knowledge of erosion in the different physical-geographical regions.

In calculations the USLE equation was used. Each parameter represented an individual 10 m resolution grid layer and thus the resulting grid was the simple output of grid calculations applying the E=R.K.L.S.C.P equation.

Outputs

Summary table of soil erosion assessment

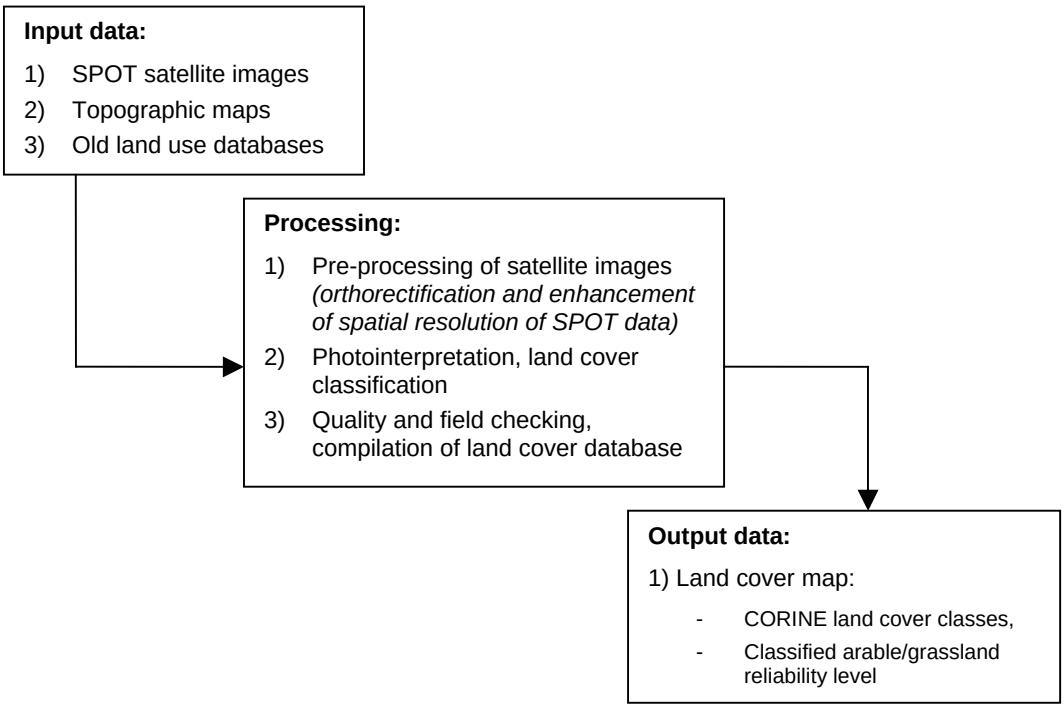
Actual erosion	**Class**	**E_A=R.K.L.S.C [t/ha/year]**	**Area [km^2]**	**[%]**
none or very low	1	0 – 0.75	740.28	81.3
low	2	0.75 – 7.5	95.11	10.4
moderate	3	7.5 – 22.5	5.75	0.6
high	4	22.5 – 75.0	2.68	0.3
excessively high	5	75.0 – 300	0.28	0.1
not considered	-1	-	65.28	7.3
Total			*909.38*	*100.0*

Grid data layer with 10 m grid cell resolution.
Cell values represent annual average soil loss expressed in tons per hectare. The intervals used to delineate soil erosion classes are presented in above table.

Discussion

The study area in general does not belong to the seriously affected regions in Slovakia. The spatial pattern of assessed erosion is dominantly controlled by relief and land cover. 81.4% of the territory falls into class of none or very low erosion. This area is situated mainly on flat alluvial plains, smoothly undulated hilly-lands and moderate slopes of Male Karpaty mountains covered by forests. Spatial pattern and intensity of predicted soil erosion for some land cover categories (e.g. CLC ID=242,243) is influenced by their spatial heterogeneity. Therefore erosion rates in these areas present bulk values. The results indicate that about 0.33% (296.69 ha) of the area is endangered by water erosion of intensity classified as high and excessively high. Beside the relief also the local lithological, soil and climate conditions play an important role modifying the potential erosion in positive or adverse direction. Although the highest potential endangerment is bound to strongly inclined mountainous areas, the actual soil erosion is quite low here, because these parts are generally well protected by forests. The modelled actual erosion is most dangerous in mountain foot-slopes that are agriculturally utilised.

D.3.2 LAND USE AND LAND COVER CLASSIFICATION



Flowchart of land cover classification

Land cover is one of the basic data needed for regional scale analyses. Nowadays mapping of land cover, and thus tracing of land cover changes, of larger areas is based on the application of satellite images.

Input data

1) SPOT Xi 1999-05-10 (spatial resolution 10m)
2) SPOT PAN 2000-08-20 (spatial resolution 20m)
3) Topographic maps at scale 1:10 000 – as support data layer
4) Older land use databases of the part of study area

Processing

Depending on the planned usage the methodology and applied nomenclatures of mapping vary. To make comparison possible with earlier land cover mapping results the classification of land cover was based on the methodology applied in the CORINE Land Cover project. The methodology was modified to suit mapping requirements at scale 1:50 000. To achieve the objectives finer resolution data (SPOT instead of Landsat) and larger scale topographic maps (scale 1:10 000 instead of 1:50 000) were utilised.

1) The land cover mapping included the following main steps:
2) Preparation of the SPOT satellite data for land cover mapping;
3) Photo-interpretation, creation of primary land cover database;
4) Field checking and based on field and quality check modification and compilation of the land cover database.

1) Preparation of the SPOT Satellite Data

Raw satellite images have to be pre-processed before photo-interpretation. Thus, *orthorectification* and *enhancement of spatial resolution of SPOT* images were performed.

Orthorectification of satellite data was ordered from the data provider. Required by processing, digital elevation model with grid resolution 25 metres and ground control points (28) were used

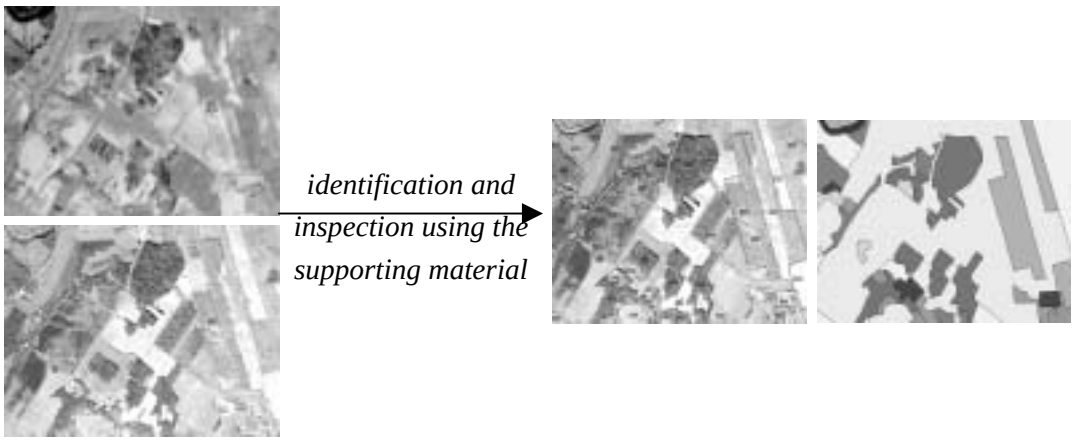
Enhancement of spatial resolution of SPOT data was performed for selected colour composites of SPOT Xi channel combinations Xi321 and Xi432. The spatial enhancement of spectral data is based on re-sampling of original 20 m data to a raster with 10 m pixel resolution and replacement of intensity component of colour represented in IHS colour space by SPOT PAN data. Resulted data have spectral information from original Xi SPOT data and textural from SPOT PAN data. The results of this step are 2 digital colour composites of 321 and 432 channel combinations with spatial resolution of 10 m that were used in the photo-interpretation.

2) Photo-Interpretation of SPOT Data

The satellite data integrated together with vector datasets provided the basis for the computer-aided photo-interpretation. The used methodology and nomenclature was compatible with the CORINE land cover classification manual.

The process consisted of the following steps:

(i) Selection of proper combination of spectral channels used to differentiate area of interest. In the interpretation two spatially enhanced combinations 321, 432, original SPOT PAN data and spatially not enhanced combination of channels 342 were used;
(ii) Identification and drawing the outline of polygons representing individual classes;
(iii) Assignment of the class code of identified area to the attribute field "**CLC**", based on the spectral properties of area and inspection of support material (maps).



Process of Photo-interpretation

3) Field Checking and Compilation of Database.

The precision of the data layer represents the scale of topographic map 1:50 000 or better. The primary database was checked within a 6-days field checking campaign. The focus was mainly put to heterogeneous classes, to the arable land and grasslands. The topographic data layers of the map 1:10 000 were used as support reference.

Although the field checking and mapping were done with high precision, to cope with uncertainty of distinguishing the thematic content of some polygons on arable land/grasslands it was decided that a new attribute field "**subclass**" will be introduced into the database. It provides information about the reliability of the mapped polygons as follows:

0 clear identification of arable land and grassland;
1 probably abandoned arable land (based on the field checking results);
2 uncertain the difference between arable/grasslands (the CLC attribute 211/231 assigned to the polygon represents most probable class).

Outputs:

1) CORINE Land Cover Map of the Year 2000

Topology: polygon

The criteria for minimum mapped unit (polygon) were set to 5 ha with minimum polygon width at least 50 m. The criterion of minimum size of 5 ha was not carried out strictly in the cases where good possibility to differentiate distinct classes was found. In such cases (mainly man-made areas) criterion of minimum size was set to 2.5 ha.

Attributes:

(i) land cover classes (CLC – 3 digits based on CORINE nomenclature),
(ii) reliability level of mapped classes of arable land and grasslands (subclass: 0 – reliable, 1 – probably abandoned land, 2 – not reliable).

Discussion:

The CORINE Land Cover database of study area consists of 23 classes of the 3rd hierarchical legend of the standard CORINE nomenclature. The dominating classes are as follows: arable land (211), forests (311+312+313), grasslands (231), heterogeneous areas (242) and forest clear cuts/young forest stands (324). The thematic precision has some degree of uncertainty for a set of polygons especially those that are classified as arable land/grasslands. Due to the high quality of orthorectification the positional precision is representing scale 1:50 000 or better.

The land cover data layer can be integrated with other GIS data at similar level of detail. Its combination and use with other data, produced at different scales (e.g. 1:10 000), needs careful considerations. The total area of each land cover class is presented in below table, between brackets following the text description of the categories.

CORINE land cover nomenclature and area extent of land cover classes

(classes not present in the study area are in italics)

1. Artificial surfaces (59.27 km^2)

1.1. Urban fabric

1.1.1. Continuous urban fabric

1.1.2. Discontinuous urban fabric (35.96)

1.2. Industrial, commercial and transport units

1.2.1. Industrial or commercial units (11.30)

1.2.2. Road and rail networks and associated land (5.68)

1.2.3. Port areas

1.2.4. Airports (0.71)

1.3. Mine, dump and constructions sites

1.3.1. Mineral extraction sites (1.66)

1.3.2. Dump sites (0.53)

1.3.3. Construction sites (0.15)

1.4. Artificial, non-agricultural vegetated areas

1.4.1. Green urban areas (1.02)

1.4.2. Sport and leisure facilities (2.26)

2. Agricultural areas (430.96 km^2)

2.1. Arable land

2.1.1. Non-irrigated arable land (315.07)

2.1.2. Permanently irrigated land

2.1.3. Rice fields

2.2. Permanent crops

2.2.1. Vineyards (2.92)

2.2.2. Fruit trees and berry plantations (5.35)

2.2.3. Olive groves

2.3. Pastures

2.3.1. Pastures (82.08)

2.4. Heterogeneous agricultural areas

2.4.1. Annual crops associated with permanent crops

2.4.2. Complex cultivation patterns (23.25)

2.4.3. Land principally occupied by agriculture, with significant areas of natural vegetation (2.29)

2.4.4. Agro-forestry areas

3. Forest and semi-natural areas (407.02 km^2)

3.1. Forests

3.1.1. Broad-leaved forests (230.71)

3.1.2. Coniferous forests (87.98)

3.1.3. Mixed forests (66.60)

3.2. Scrub and/or herbaceous vegetation associations

3.2.1. Natural grasslands

3.2.2. Moors and heathland

3.2.3. Sclerophyllous vegetation

3.2.4. Transitional woodland-scrub (21.68)

3.3. Open spaces with little or no vegetation

3.3.1. Beaches, dunes, sands

3.3.2. Bare rocks (0.05)

3.3.3. Sparsely vegetated areas

3.3.4. Burnt areas

3.3.5. Glaciers and perpetual snow

4. Wetlands (5.95 km^2)

4.1. Inland wetlands

4.1.1. Inland marshes (5.95)

4.1.2. Peat bogs

4.2. Maritime wetlands

4.2.1. Salt marshes

4.2.2. Salines

*4.2.3. Intertida*l flats

5. Water bodies (9.92 km^2)

5.1. Inland waters

5.1.1. Water courses (4.77)

5.1.2. Water bodies (5.15)

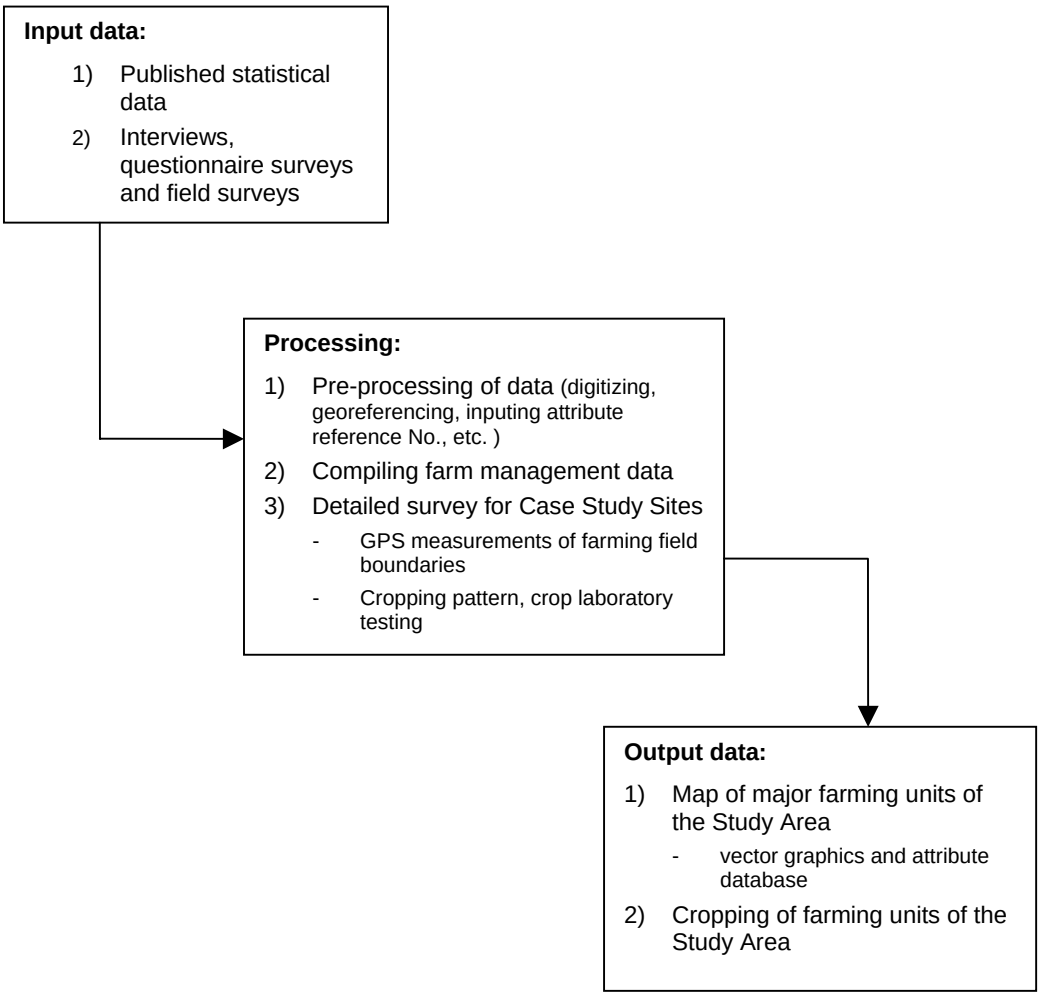
5.2. Marine waters

5.2.1. Coastal lagoons

5.2.2. Estuaries

5.2.3. Sea and ocean

D.3.3 AGRICULTURAL LAND USE SURVEY AND FARM MANAGEMENT



Flowchart of agricultural land use and farming maps generations

Relying on old cadastre and topographic maps, field characteristics for large scale farming cannot be drawn in detail. The lines "drawn" on maps don't always correspond to the actual field boundaries. Depending on weather conditions and other uncertainties the boundary of cultivated areas may vary year by year. Cultivated fields can be measured very accurately by GPS aided surveying. Accurate information on boundaries will give information not only on actual areas used, but also help agronomists in planning. GPS surveying is capable of recording existing land use and other attributes observable during the measurement. More value can be achieved if the measurement is accompanied by soil sampling and analysis. Site specific information on soil and nutrient conditions is the basis for modern farming. Such techniques are used primarily by agricultural enterprises working on larger fields.

Inputs

1) Published statistical data (collected from statisticsl office, district offices)
2) Interviews, questionnaire surveys and field surveys
3) GPS measurements

Processing

1) Pre-Processing of Data (Digitizing, Georeferencing, Inputing Attribute ref. No., Etc.)

The preparation of the database and related maps started from the pre-processing of already available data by digitizing existing maps, such as cropping maps from cooperatives (agronomists), etc. In addition, based on the interview and field surveys farm boundaries were adjusted on-screen from 1:10.000 scale topographic maps.

2) Compiling Farm Management Data

Using the field boundaries attribute infotmation was entered from the processed questionnaires, such as: arable land area, management form (farmer, enterprise), type of farming (cereals, animals, oil crops, vegetables). Simple ratios were calculated as well, output ratio from cultivation and livestock, and cultivating area ratio for feed and food and raw matter.

3) Detailed Survey for Case Study Sites

The GPS survey was carried out to measure the areas of major agricultural companies and farmers using land in the Case Study Area. Agricultural land of the STOMFA and ASPARAGUS companies and the land of the private farmers Mr. Dunar and Mr. Holly were measured. During the survey crop types were recorded.

In addition samples were collected at specific locations of the case study sites. Plants were tested on site and collected samples were analysed in the laboratory of the counterpart. Cropping pattern was recorded on field surveys.

Outputs

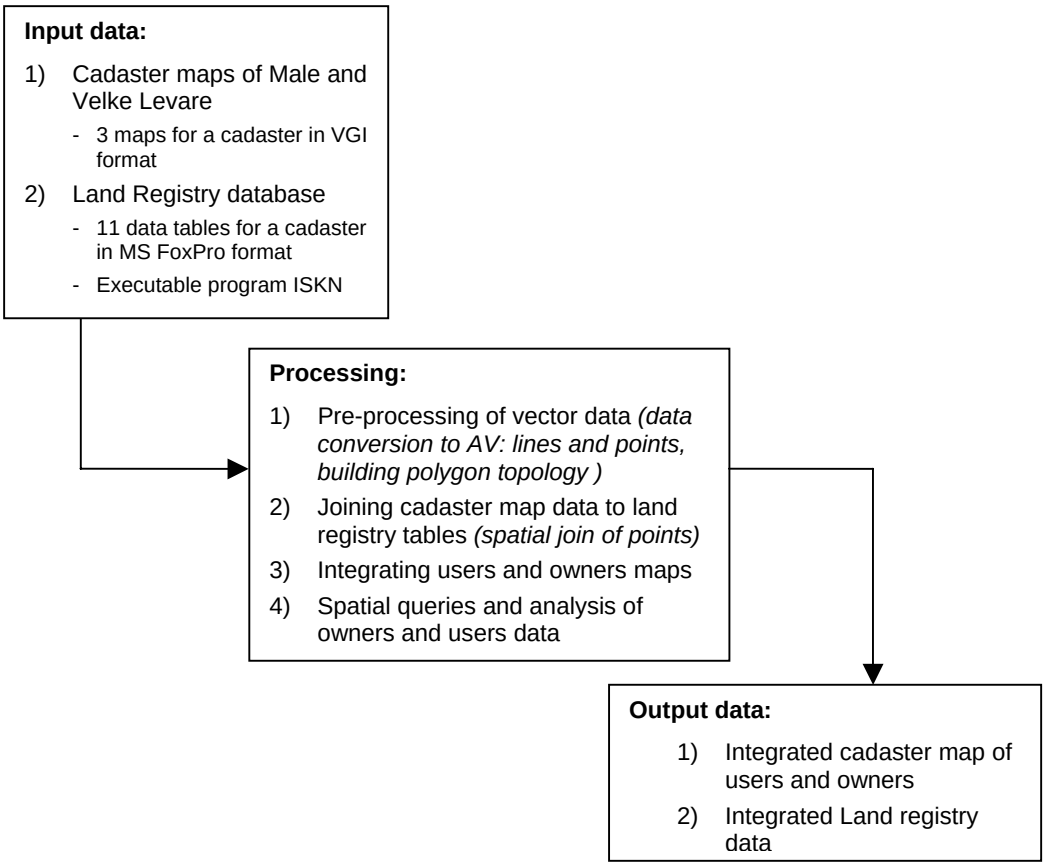
1) Map of Major Farming Units of the Study Area
- vector graphics at scale 1:50 000 for study area and 1:5 000 for case study sites
- attribute database by type and name of users, management forms

2) Cropping of Farming Units of the Study Area
- vector graphics at scale 1:50 000 for study area and 1:5 000 for case study sites
- attribute database by types of farming (cereals, animals, oil crops, vegetables) and more details including the results of laboratory testing for case study sites

Discussion

The discussion on the additional findings and results of the interviews, questionnaire surveys and field surveys are presented in the Main Report as well as the corresponding sections of the Supporting Report.

D.3.4 INTEGRATION OF CADASTER MAPS AND LAND REGISTRY



Flowchart of integration of cadaster maps and land registry data

The land registration and cadastral system of the Slovak Republic dates back to the middle of the nineteenth century. Historically the system had two main elements: 1) Land Cadaster containing map-based information on parcels and their description and 2) Land Book that was used to record up-to-date legal ownership information. Originally the two components were maintained separately. In the 1950's the Land Use Register, that later become the Land Register, was introduced. It was used mainly to record property usage reflecting the results of collectivisation of agricultural lands. Boundary and user information were regularly updated, but earlier land ownership records were kept without maintenance.

In 1992, with a new Law, the legal basis of the Cadastre of Real Estates (CRE) was established. The new system aims at unifying all land and property records into a single register based on the registration of contract or Deed of Sale following the inclusion of the geometric description.

Land Consolidation: The land consolidation programme started in 1993. 200 cadastral units (out of 3580) were subject to the consolidation process. By the year 2000 only 11 cadasters were completed. The result of the work is that all claims are processed and the land is rearranged into the best possible pattern consistent with legal ownership claims. The process is expensive, time consuming, requires the identification and agreement of all participants, and can result in many small parcels, if there are many claimants.

Land Title Consolidation: The land title consolidation program started in 1996. Compared to land consolidation, the main difference is that land title consolidation process does not rearrange parcels nor carry out any marking out of the lots in the field. It only clarifies the ownership and boundary information (where possible).

The program includes 1600 cadastral units out of 3580. 600 were already completed to the level that was possible. It means that ownership and parcel boundaries could be determined in about 80% of cases. In the remaining cases (20%) the land was transferred to the State Land Fund for leasing, pending final resolution.

Input data

Land title consolidation of both extravilan and intravilan areas of Male Levare, as well as of the intravilan area of Velke Levare have already been completed. Neither of the villages was involved in the land consolidation program, so far. It is planned that from next year Velke Levare will participate in the program; land consolidation of its extravilan areas will start.

In addition to consolidation programs, Male Levare and Velke Levare were involved in the program of digitising (vectorising) cadaster maps. Digital vector maps of both cadasters are now available. Both the digital program of the Land Register and the digital cadaster maps were collected for the two cadasters.

(1) Cadaster Maps

During the historical development of the cadastre system the registration of users and owners went through several changes. Nowadays, two kinds of ownership are represented in the system:

(i) “Full ownership”: All ownership information, rights, owners, and the parcel description in geometric terms are clear and have been legally and technically verified.

(ii) “Simplified ownership”: where the ownership, rights, owners and the parcel description are clear in the registers (database), but the parcel description is either non existent or does not correspond to the boundaries established in the field (maps).

The differences are caused by historical changes when parcels were joined to form large fields to suit the needs of collective farms (collectivisation), while the corresponding records of ownership were no longer being updated.

Corresponding to the different sort of ownership, nowadays, two types of cadaster map are in use: 1) users' map and 2) (historical) owners map. The users' map represents the geometric boundaries of fields currently used. The owners map shows the historical parcels from which the original owners could be traced back in case the information is not available through the user maps. Parcels referenced in both maps by unique numbers. However, the numbers are not identical and there are no any cross-references between the maps.

(2) Land Registry

The current version of the land registry is a computer based program called ISKN programmed in MS

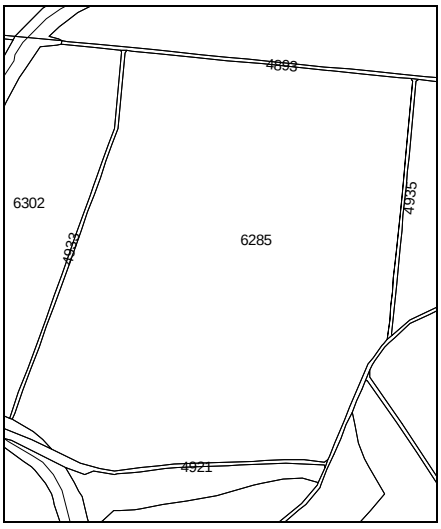
FoxPro. The database contains several data tables. Some tables are used to keep records of parcels, owners, and users, others are used to keep information on the coding applied. The basic data tables are:

- parcels of Register C (PA) - parcels that exist on the cadastral map (i.e. have boundary information);
- parcels of Register E (EP) – parcels exist but are not shown on the cadastral map (i.e. don't have clarified boundary information);
- list of renter/user (UZ) - information about lease;
- list of owners (VL) - ownership information relating to parcels;
- letter of ownership (LV) - relates ownership information to information relating to the object ownership.

For each table the relate items are defined. Relate items (keys) are used to "join" records throughout tables. Records of the tables are not joined to the vector graphics.

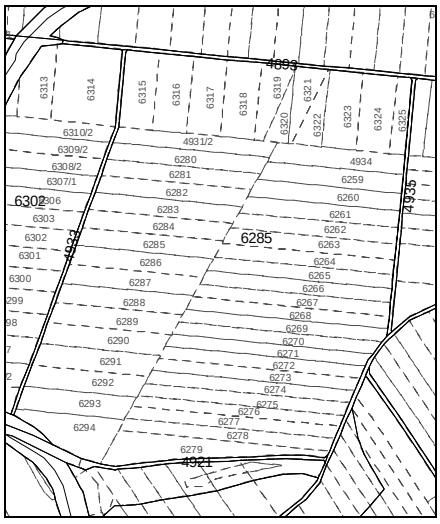
Processing

In the case of full ownership the owner description is joined to the user map. In case of simplified ownership the owner is registered only on the owners map. Currently the users map is in primary usage. It includes user information for all parcels and information on all full ownership. When owners are not registered to a parcel in the users map it means that the parcel has only simplified ownership. In such cases, frequently a lot of smaller parcels correspond to one user parcel. Simplified ownership issues could be investigated only on owners' maps. An example is given in below.



Map of Users (KN) - Register C

parcel No.: 6285;
area = 27 ha 889 m^2;
land use: arable land;
user: private company;
owner: simplified ownership



Map of Owners (UO) - Register E

total number of parcels: 49
average area: about 0.5 ha;
for parcel No 6285:
area: 5705 m^2;
land use: arable land;
owners: 2 (natural persons).

Sample map sections from Cadaster maps

The user parcel No. 6285 is used by a private company. The ownership of the area is not demarcated by any “boundaries” in the field, thus the owners can be traced only from the owners map. Investigating the same area on the owners map we find 49 historical parcels. Each parcel may have several owners. For example, parcel No. 6285 has two owners (a wife and her husband). Although the two parcel numbers are the same for the two different maps, they do not represent identical areas! In the case of the users' map the number refers to a 27 ha area, while the same number on the owners' map corresponds to a 0.5 hectare area only.

Relationships between parcel numbers, and thus registers, can be established only graphically by overlaying the maps and spatially joining the parcels.
Thus GIS processing was done by the Study Team:

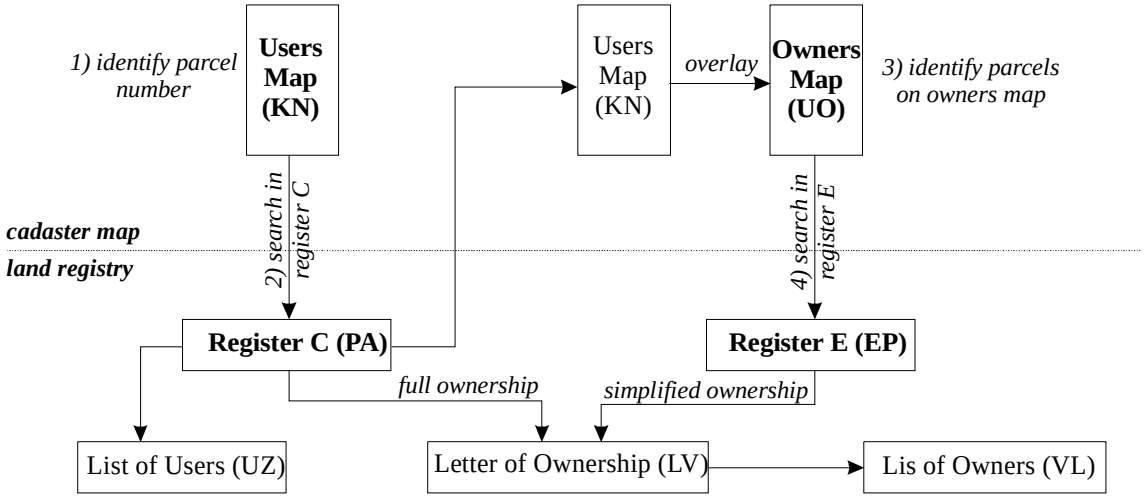
a) pre-processing of data
b) to join land registry tables to vector graphics of parcels,
c) to integrate users and owners maps to allow automatic search and query in the system,
d) analysis of the integrated database on users and owners relations.

(1) Pre-Processing of Data

Since the original vector data received from the district cadastre office of Malacky had VGI format, first the data had to be converted to DXF format. DXF format was exported into ArcView. In the original format parcels were represented by lines. Lines had to be converted to polygons to allow easy GIS applications. Polygons were assigned by the unique parcel numbers. These processes were repeated for both cadastres and for both kinds of maps (users and owners). The resulting maps were joined to the land registry tables through the corresponding parcel numbers.

(2) Joining Land Registry Tables and Vector Graphics

The process of identification of owners is presented in below. It demonstrates that the operator should switch between maps and tables at least three times. Although in some lucky cases when maps are already in digital form all can be done on the screen of a computer, switching between database and graphics (and thus between software) several times is still necessary.



Flowcharts on how to clarify parcel – ownership relations

(3) Integration of Users Map and Owners Map

The next step of cadastre data processing shall be to establish relationship between users and owners maps. Spatial query helps to select quickly parcels of interest from both maps. It is a very convenient technique for one or two fields only. It still requires much processing for the investigation of larger areas. Therefore, it is recommended to record the relations between the maps. It serves as a basis to establish relations between parcels of register C and E directly within the land registry tables.

(4) Analysis of the Integrated Database

Using the integrated database the analysis of spatial data has been carried out. Spatial queries and statistics were made to derive users and owners characteristics for parcels and agricultural fields. The results of the analysis are presented in the discussion part of this chapter.

Outputs

(1) Integrated Cadaster Map of Users and Owners

Topology: polygon, keeping the original details of cadaster maps KN and UO
Attributes: parcel ID numbers for both register C and, where applicable, register E

(2) Integrated Land Registry Data

Topology: polygons and associated dBASE files of land registry
Attributes: parcel ID numbers, and through the unique parcel numbers of cadaster maps the data of land registry can be joined as required. Thus the attribute information on the integrated maps can be extended by the details of land registry.

Discussions, results of analysis

(1) Land Use and Parcels

Summary tables of land use categories were prepared. Total, minimum, maximum and average sizes of parcels by each land use type are listed. Total numbers of parcels and areas of parcels were calculated for both extra- and intravilan areas, as well as for full (register C) and simplified (register E) ownership types.

It can be seen that in both cadastre (villages) about 2/3 of the total area is used for agricultural purposes. (In the analysis, due to the purpose of the Study, forests were not categorised as agricultural land.)

However, in Velke Levare about half of the agricultural land (1/3 of total cadastre area) is utilised as arable land and the other half as grasslands, while in Male Levare about ¾ of the agricultural land (almost half of the total cadastre area) is used as arable land and only ¼ as grasslands.

There is a large range in the sizes of parcels. Minimum, maximum and average sizes of different land use parcels are very similar in the two cadastres. In the case of arable land the average parcel size is 2.6 ha in Male Levare and 3.0 ha in Velke Levare.

In Velke Levare the number of garden parcels (568) is double the number found in Male Levare (276) and the total garden area is about 1.5 times larger. However, with a population over 3 times larger, the gardens area per head in Velke Levare is lower. There is also a large area of orchards in Velke Levare, which accounts for about 5% (130 ha) of total cadastre area, while there are no orchards in Male Levare.

Not only the ratio of arable lands and gardens to total cadastre area show significant differences for the two villages, but also the locations of these lands. While there is a significant portion (25%) of arable land in the intravilan area of Male Levare, it is comprised of almost double the number of parcels (251) that occur in the extravilan land (148). However, in Velke Levare, arable lands in intravilan areas comprise only 0.6%! of the arable land found in extravilan areas. In intravilan area only 17 parcels (compared to 209 of extravilans') are registered as arable land.

On the other hand, the total number of garden parcels is 2.5 times more in the intravilan of Velke Levare than in the intravilan of Male Levare, reflecting the larger population.

(2) Users

The basis of the analysis was the land register data. Data are representative for 1st of January, 2002. It is important to note that the land registry is updated whenever the cadastre office receives a legal document with requests for change by either users or owners. Unfortunately, users do not always report their changes of activities. For example, Agro Levare is still registered as the main private agricultural company in Velke Levare; however the company went bankrupt 3 years ago. Presently, their land is used by a different private company and by a private farmer. Therefore, the database of users was applied only to grasp the tendencies and main features of parcels and fields corresponding to users rights.

(3) Owners by Parcels

Two groups of data are included for each cadastre: 1) number of parcels (cells) per land use category of agricultural lands (columns) per classes of owners (rows), and 2) the area of agricultural land (cells) per land use type (columns) per classes of owners (rows). Each table was split into full (register C) and simplified ownership (register E) type. Classes of owners were set into six categories depending on the number of owners (co-owners) of a parcel.

In addition minimum, maximum and average areas of parcels for land use categories were calculated for parcels that have only one owner and for parcels that have more than one owner.

There are no significant differences between the cadastres in terms of parcel characteristics by the number of owners, except the average sizes of parcels of arable land. In the case of the full ownership (register C) type of arable land the average size of parcels belonging to one owner is 6 times greater in Velke Levare (1.1 ha) than in Male Levare (0.2 ha). The probable reason is that, as was highlighted in the previous section, while in Male Levare there is much intravilan arable land, in Velke Levare most of the arable land is extravilan. In addition, the difference in average size of parcels is only for the full ownership type of owners; for simplified ownership the average areas do not show significant differences.

The ratios of total agricultural areas by the owners' classes are also very similar in the two cadastres. In both cases about 35% of land has one owner, about 25% of land has two owners and about another 25% of land has three to five owners. In total, 85% of agricultural land is formed of parcels that are owned by one to five owners.

(4) Owners by Agricultural Fields

During the case study 87 agricultural fields were recognised for Male Levare and 82 fields for Velke Levare. In both villages the total area of agricultural land are about 1000 ha. Out of registered owners in the cadaster, the numbers of those who have property in agricultural fields are about the same: 2051 owners (54% from 3818) in Male Levare and 2230 owners (40% from 5545) in Velke Levare. The ratio of owners who has agricultural land is higher in Male Levare.

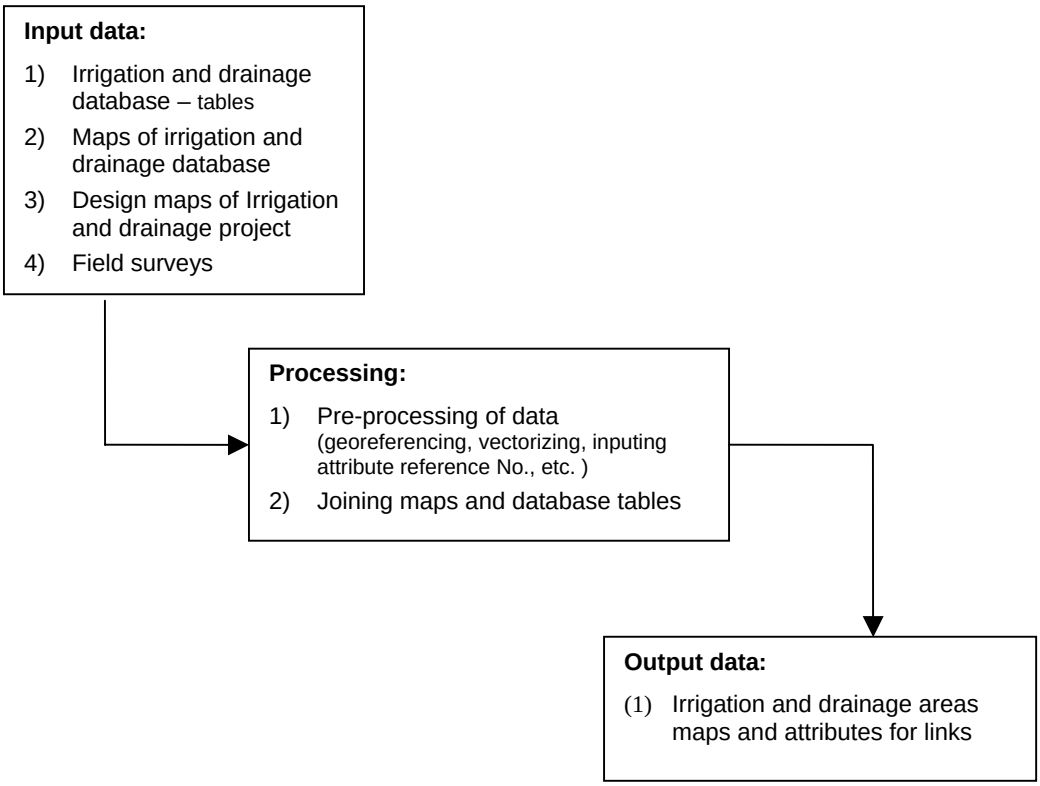
For both Cadaster about half of the ownerships in agricultural fields are managed by the Slovak Land Found: 994 ownerships (49%) in Male Levare and 1241 ownerships (56%) in Velke Levare.

In terms of parcels – due to an owner can have property rights in more parcels and thus in more fields – about 36% of ownerships of parcels are managed by Slovak Land Found in Male Levare and about 41% of ownerships in Velke Levare. It indicates the involvement of Land Found by about 15% less cases in both cadastre.

In average a field has 212 owners in Male Levare and it has 157 owners in Velke Levare. About the owners, the Slovak Land Found manages 89 ownerships in Male Levare and 69 in Velke Levare. Thus, in general the user has to contract 124 owners per fields in Male Levare, while 89 owners per fields in Velke Levare.

The ownership characteristics do not show any significant differences between the two villages. However, comparing the average sizes of area managed by different owners in an agricultural field – that is how big area owned by one owner – shows significant differences. In Velke Levare it is about 1 ha per person, while in Male Levare it is only 0.3 ha per person. Thus in general a user have to contract 1 new owner to every 1 ha additional land he wants to use in Velke Levare and in case of Male Levare he has to contract 3 owners for the same size of area. If we exclude fields where average land size of owners is above 5 ha per person (4 fields in Velke Levare and 2 fields in Male Levare), the land sizes of owners become half in Male Levare (0.17 ha/ person) and less than half in Velke Levare (0.3 ha/ person).

D.3.5 PREPARATION OF DIGITAL IRRIGATION AND DRAINAGE SYSTEM MAPS



Flowchart of digital irrigation and drainage maps preparation

Until 1992 the irrigation and drainage database in Slovakia was developed by a central organisation. From 1992 Water Authorities took over responsibilities for maintaining the irrigation and drainage systems. In the Study Area it meant that the department of Malacky branch office of Danube River Basin Authority became the responsible organisation. The area specific part of the central database was transferred to the departments. The updating of the database as a whole was stopped. Each department updated the database according to their everyday needs.

In recent years the responsibility for coordinating of irrigation and drainage systems was taken over by the Irrigation and Drainage Branch Office of the Slovak State Water Management Enterprise (SWME-ID). Due to the lack of coordination on database maintenance for almost one decade, the condition of information and data now available is variable. The SWME-ID has started an intensive re-gathering work to bring all relevant data into their own database.

Input data

There are three main sources of irrigation and drainage information:

(1) irrigation and drainage database, and
(2) the accompanying irrigation and drainage operation and maintenance maps;
(3) design maps of irrigation and drainage projects.

(1) Irrigation and Drainage Database and (2) Maps

Irrigation and drainage database and maps are used for everyday O&M. The tabular database has two main elements: “project” table and “buildings of projects” table. The first one contains information on the main characteristics of irrigation and drainage projects constructed. Data about the type of project, construction dates, cost of the project, main technical parameters, specification of investor, etc. are all included. The second database is the extension of the first one by the characteristics of main facilities and structures of the given projects. It contains detailed information on each facility: canals, reservoirs, etc. Each object (facility) has a unique ID code. The objects and their codes are presented on maps.

The Study Team collected both a tabular database and the maps for the whole Study Area. The digital version of the database was available only as last updated in 1992.

(3) Design Maps of Irrigation and Drainage Projects

Design maps of irrigation and drainage projects are also available for the Study Area. The previous databases contained information only on “large” objects managed as part of regional systems. These main facilities are important for the operation of the whole system, and thus are of regional interest. The proper operation of smaller objects, such as hydrants, underground drains, etc. is important for the users of the field. This is a local interest. This level of detail of irrigation and drainage systems is represented only on the original design maps. Since many of the components are hard to identify after construction, it is believed that no modifications of design occurred during constructions.

The GIS department of SWME-ID collected available design maps from all Slovakia, thus the Study Team has received all relevant maps for the Study Area from its counterpart.

Processing

Although irrigation and drainage data are available for all Slovakia their present format is not readily suited for GIS applications. Processing of the data was carried out at two levels: regional (Zahorska area) and local (case study sites).

(1) Study Area

The 1:50 000 scale irrigation and drainage maps (O&M maps) were scanned in colour to keep all details of the maps. The scanned images were then geo-referenced to have real world coordinates. Vectorisation was done by head-up (on screen) digitisation. The extent of irrigation and drainage areas was vectorised as polygons by the counterpart organisation. For each area a unique ID code was assigned using the coding system of the tabular database („projects”). Similarly, the main facilities (objects) were vectorised from the scanned images (mainly lines) and assigned the same ID value as those used in the „buildings of projects” database. Applying the codes makes it possible to join vector graphics to tabular data, thus fulfilling the requirements of true GIS.

Unfortunately, in some cases due to the quality of the original paper maps, the identification of objects was not possible. In such cases information was derived from the field surveys of the previous phase of the Study. The filling of all gaps could be done mainly for the case study area due to the availability of necessary details.
Design maps were collected, scanned and geo-referenced for the whole Study Area. 29 irrigation and 52 drainage maps were processed.

(2) Case Study Area

Using the design maps those irrigation and drainage objects that are not represented in the regional scale database could be identified and vectorised. Smaller drainage canals, main under-drain lines, irrigation pipelines and hydrants were digitised as point or line features. A unique ID code was assigned to each vector following the numbering and naming conventions on the design maps. Examples of the output maps are presented in the irrigation and drainage section of the report, as well as the tables and attribute information that can be joined to the vector graphics through the common ID codes.

Outputs

(1) Irrigation and drainage areas maps and attributes for links
(2) Detailed irrigation and drainage system maps for Case Study Sites

Discussion

The analysis and discussion on the irrigation and drainage systems are presented in the Main Report as well as other corresponding sections of the Supporting Report.

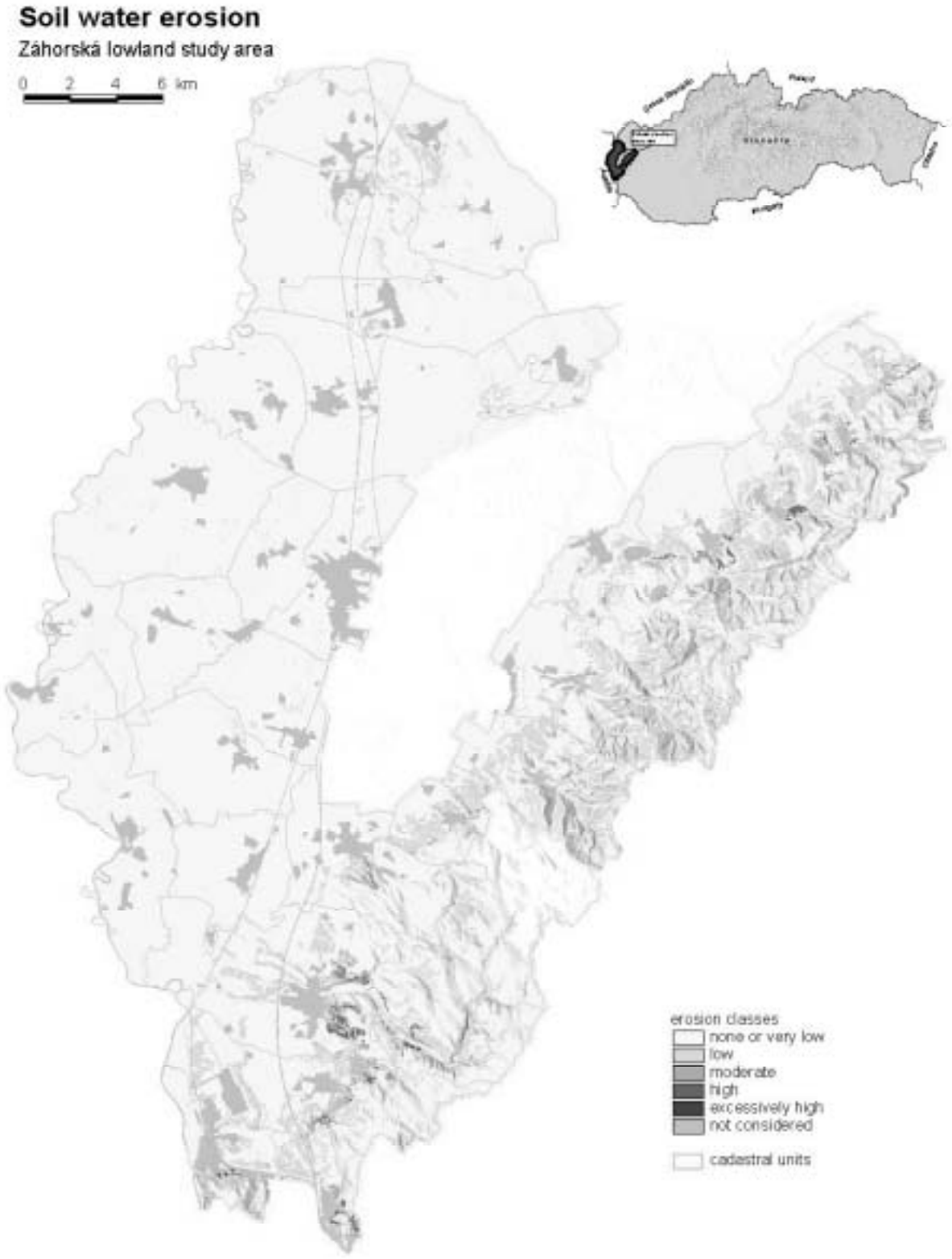


Figure. D.3.1 Results of soil Erosion Assessment

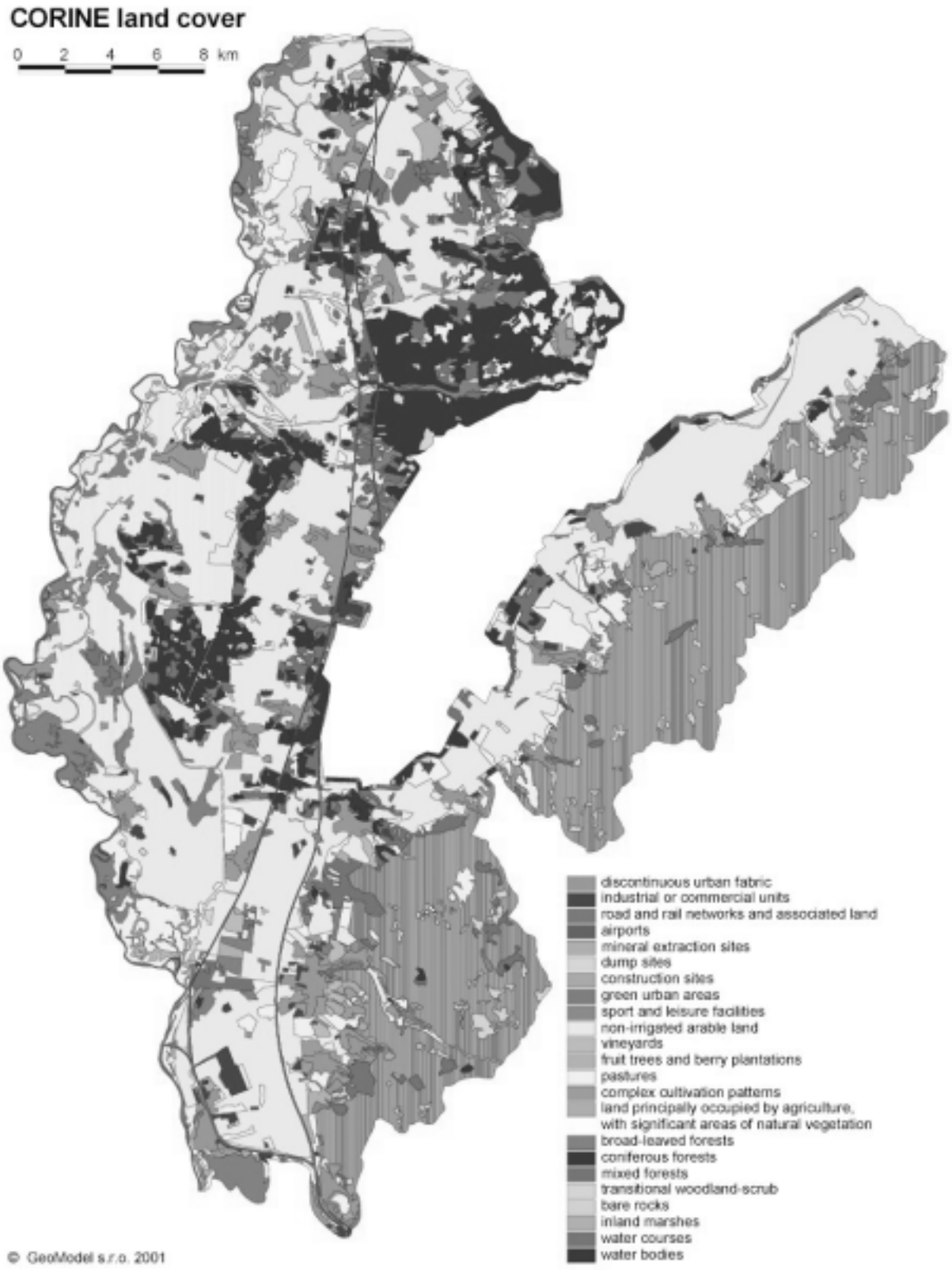


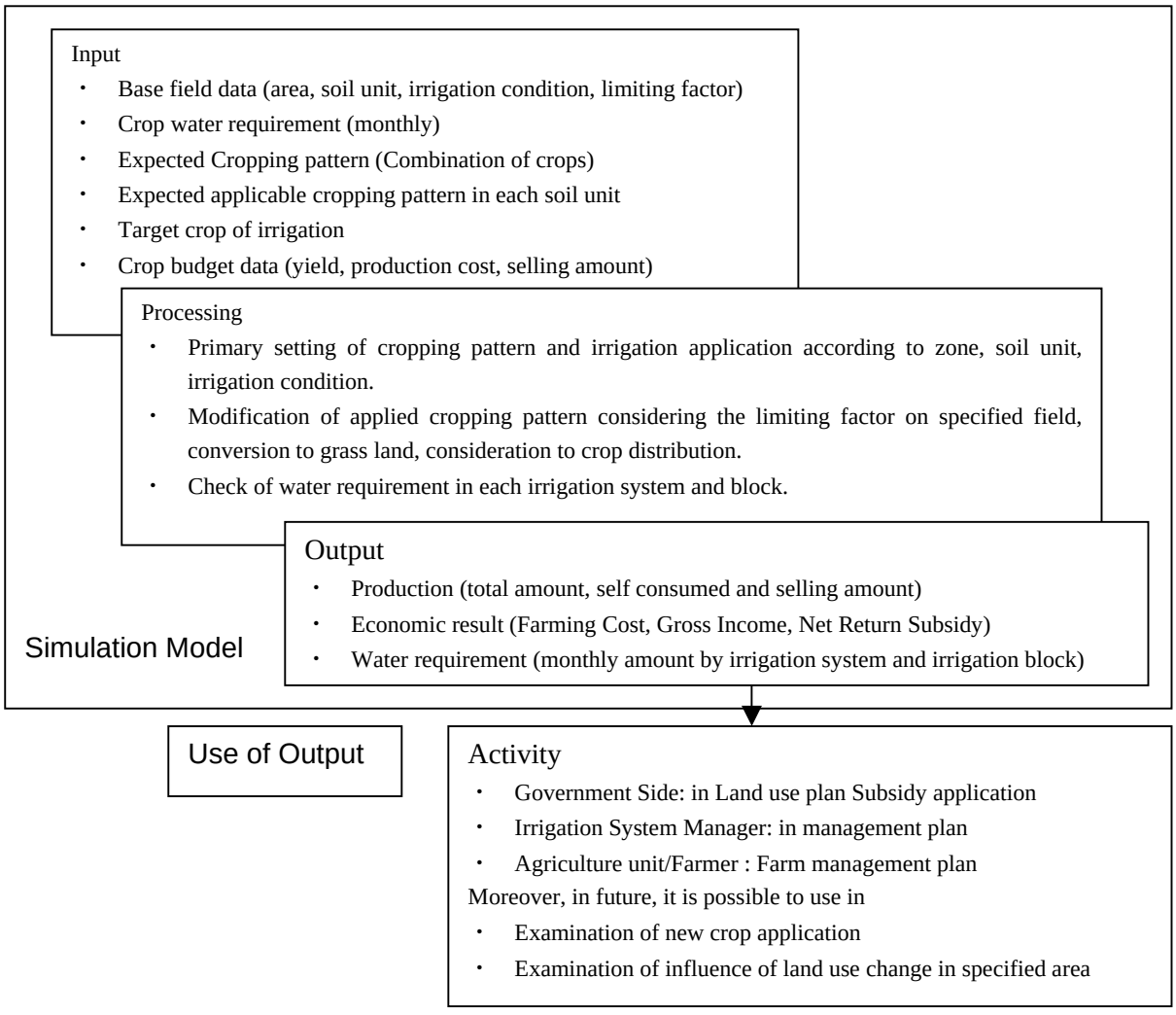
Figure. D.3.2 Final CORINE land cover database

D.4 SIMULATION CALCULATION

(1) Object of Simulation

The land use is changed when the Guideline is applied in the area. Because of that, several effects on agricultural production (crop, amount and domestic consumption) and income structure are expected. In order to study these effects, simulation modelling was carried out to examine the change in water use, production amount and economic balance when agricultural productivity is improved in the region by applying the combined measures written in the Guideline.

Moreover, the following studies are possible with the output of this model. First, the examination of the regional land use plan or appropriate subsidy application by the government. Second, conversion of crops and land use, effects of using irrigation and change of economic balance by farming units. The results of calculation of water requirement in each irrigation system and irrigation block can be used to prepare the management and maintenance plan for irrigation facilities by the responsible organization or Maintenance Company, as well.



(2) Setting of Simulation calculation

The simulation basis the possible crop rotation of scenarios discussed in the Part 3 Chapter 3.2.3 of the Main Report. The crop rotation for each field in scenarios, which is shown in Figure D.4.2 ~ D.4.4, was decided in consideration of the result of the land resources evaluation discussed in the Part 3 Chapter 3.2.3 of the Main Report (Figure 3.9). The applied crops by field were automatically decided from the selected crop rotation of the field as shown in Figure D.4.5 ~ D.4.7. Cultivated area of crops by Zone and by irrigation system is summarized in Table D.4.5.

The applicability of irrigation in the field equipped irrigation facilities was evaluated by the capacity of irrigation systems by irrigation block. The capacity of pump and the peak velocity of water flow in pipe were check in the evaluation. As a part of results of the simulation, the average and maximum amount of monthly irrigation water use are estimated as shown in Table D.4.4.

The details of parameters used in the simulation model are described in the GIS Operation Manual.

(3) Result of Calculation

The simulation is calculated based on the expected cropping and “crop budget” data.
Followings are issued as Output of Simulation calculation.

- Summary of cultivated area and yield
- Monthly irrigation water in each irrigation system and blocks
- Farming cost, gross income, net return, subsidy based on the expected crop area.
- Demand of feed and possible amount to sell.
- Summary of financial balance, estimated subsidy expenditure, net return excluding subsidy.
- Sensitivity analysis of net return.

Table D.4.1 Summary Tables of Land Use Categories and Parcels

a) MALE LEVARE

DRP	LU Type	No. Of "C" Parcels	Area [m2] Total	Min	Max	Average	%
2	**Arable land**	399	10567751	4	592716	26486	48.6%
3	**Hopyards**	0	0	0	0	0	0.0%
4	**Vineyards**	13	4951	129	964	1270	0.0%
5	**Gardens**	276	195180	13	5841	758	0.9%
6	**Orchards**	0	0	0	0	0	0.0%
7	**Grasslands**	126	3659478	68	225186	25288	16.8%
10	**Forests**	78	3234253	58	230067	24872	14.9%
11	**Waters**	156	2196881	68	305550	20211	10.1%
13	**Buildings/ Yards**	1137	938794	7	93224	4547	4.3%
14	**Other Areas**	193	962590	15	121378	11551	4.4%
Agri:		*814*	*14427360*	*4*	*592716*	*17724*	*66.3%*
Non-Agri		*1564*	*7332518*	*7*	*305550*	*4688*	*33.7%*
SUM:		**2378**	**21759878**	**4**	**592716**	**9150**	**100.0%**

DRP	LU Type	Intravilan Parcels	Intravilan Area	Extravilan Parcels	Extravilan Area	Unclassified Parcels	Unclassified Area	Total Parcels	Total Area
2	**Arable land**	251	2560495	148	8007256	0	0	399	10567751
3	**Hopyards**	0	0	0	0	0	0	0	0
4	**Vineyards**	5	1356	8	3595	0	0	13	4951
5	**Gardens**	219	154326	57	40854	0	0	276	195180
6	**Orchards**	0	0	0	0	0	0	0	0
7	**Grasslands**	25	93883	101	3565595	0	0	126	3659478
10	**Forests**	4	104371	74	3129882	0	0	78	3234253
11	**Waters**	38	79907	118	2116974	0	0	156	2196881
13	**Buildings/ Yards**	595	338646	539	597120	3	3028	1137	938794
14	**Other Areas**	18	28394	175	934196	0	0	193	962590
Agri:		*500*	*2810060*	*314*	*11617300*	*0*	*0*	*814*	*14427360*
Non-Agri		*655*	*551318*	*906*	*6778172*	*3*	*3028*	*1564*	*7332518*
SUM:		**1155**	**3361378**	**1220**	**18395472**	**3**	**3028**	**2378**	**21759878**

DRP	LU Type	Register C Parcels	Register C Area	From Register C to E Parcels	From Register C to E Area	Total of Register C Parcels	Total of Register C Area	Total of Register E Parcels	Total of Register E Area	Total of C+E
2	**Arable land**	150	220230	249	10347521	399	10567751	3881	8152947	4031
3	**Hopyards**	0	0	0	0	0	0	0	0	0
4	**Vineyards**	6	1744	7	3207	13	4951	0	0	6
5	**Gardens**	236	163587	40	31593	276	195180	11	9389	247
6	**Orchards**	0	0	0	0	0	0	0	0	0
7	**Grasslands**	10	60671	116	3598807	126	3659478	2922	7528309	2932
10	**Forests**	16	268436	62	2965817	78	3234253	203	1971384	219
11	**Waters**	41	567282	115	1629599	156	2196881	206	782027	247
13	**Buildings/ Yards**	910	376698	227	562096	1137	938794	77	61813	987
14	**Other Areas**	118	418040	75	544550	193	962590	316	1194386	434
Agri:		*402*	*446232*	*412*	*13981128*	*814*	*14427360*	*6814*	*15690645*	*7216*
Non-Agri		*1085*	*1630456*	*479*	*5702062*	*1564*	*7332518*	*802*	*4009610*	*1887*
SUM:		**1487**	**2076688**	**891**	**19683190**	**2378**	**21759878**	**7616**	**19700255**	**9103**

b) VELKE LEVARE

DRP	LU Type	No. Of "C" Parcels	Area [m2] Total	Min	Max	Average	%
2	**Arable land**	242	7154268	4	663791	29563	29.8%
3	**Hopyards**	0	0	0	0	0	0.0%
4	**Vineyards**	19	17846	136	2576	939	0.1%
5	**Gardens**	568	277213	11	14526	488	1.2%
6	**Orchards**	17	1300598	8	1077211	76506	5.4%
7	**Grasslands**	194	7226626	4	618736	37251	30.1%
10	**Forests**	130	4515314	41	1187012	34733	18.8%
11	**Waters**	188	737513	10	80058	3923	3.1%
13	**Buildings/ Yards**	1657	1174844	3	125327	709	4.9%
14	**Other Areas**	434	1593891	5	88521	3673	6.6%
Agri:		*1040*	*15976551*	*4*	*1077211*	*15362*	*66.6%*
Non-Agri		*2409*	*8021562*	*3*	*1187012*	*3330*	*33.4%*
SUM:		**3449**	**23998113**	**3**	**1187012**	**6958**	**100.0%**

DRP	LU Type	Intravilan Parcels	Intravilan Area	Extravilan Parcels	Extravilan Area	Unclassified Parcels	Unclassified Area	Total Parcels	Total Area
2	**Arable land**	17	38960	209	7098365	16	16943	242	7154268
3	**Hopyards**	0	0	0	0	0	0	0	0
4	**Vineyards**	7	3469	12	14377	0	0	19	17846
5	**Gardens**	521	230866	42	43407	5	2940	568	277213
6	**Orchards**	1	948	15	1295720	1	3930	17	1300598
7	**Grasslands**	17	48142	176	7177639	1	845	194	7226626
10	**Forests**	0	0	130	4515314	0	0	130	4515314

Table D.4.2 Summary Tables of Owners Data

a) MALE LEVARE/ owners

PARCELS		Register C					Register E					Total		
		2	4	5	6	7	2	4	5	6	7	Reg C	Reg E	Reg C+E
owners		Arable land	Vineyards	Gardens	Orchards	Grasslands	Arable land	Vineyards	Gardens	Orchards	Grasslands			
1	1	85	2	144	0	4	1159	0	5	0	903	235	2067	*2302*
2	2	39	3	54	0	4	935	0	1	0	745	100	1681	*1781*
3-5	5	21	1	30	0	2	1114	0	4	0	743	54	1861	*1915*
6-10	10	5	0	7	0	0	492	0	0	0	358	12	850	*862*
11-25	25	0	0	1	0	0	176	0	1	0	161	1	338	*339*
25<		0	0	0	0	0	5	0	0	0	12	0	17	*17*
total		**150**	**6**	**236**	**0**	**10**	**3881**	**0**	**11**	**0**	**2922**	**402**	**6814**	**7216**
from Reg C		*399*	*13*	*276*	*0*	*126*	*249*	*7*	*40*	*0*	*116*	*814*	*412*	*1226*

AREAS		Register C					Register E					Total		
		2	4	5	6	7	2	4	5	6	7	Reg C	Reg E	Reg C+E
owners		Arable land	Vineyards	Gardens	Orchards	Grasslands	Arable land	Vineyards	Gardens	Orchards	Grasslands			
1	1	131264	1004	94610	0	53111	2513884	0	5598	0	2808252	279989	5327734	*35.06%*
2	2	50595	611	38337	0	4934	1960555	0	990	0	1953042	94477	3914587	*25.06%*
3-5	5	32735	129	21412	0	2626	2262125	0	2484	0	1605206	56902	3869815	*24.55%*
6-10	10	5636	0	8560	0	0	998592	0	0	0	729915	14196	1728507	*10.89%*
11-25	25	0	0	668	0	0	409818	0	317	0	298636	668	708771	*4.44%*
25<		0	0	0	0	0	0	0	0	0	0	0	0	*0.00%*
min1		*4*	*249*	*26*	*0*	*2678*	*7*	*0*	*41*	*0*	*6*	*4*	*6*	*4*
min2		*18*	*129*	*13*	*0*	*550*	*2*	*0*	*5*	*0*	*5*	*13*	*2*	*2*
max1		*4622*	*755*	*5841*	*0*	*28403*	*32455*	*0*	*3575*	*0*	*363236*	*28403*	*363236*	*363236*
max2		*4708*	*279*	*4240*	*0*	*2902*	*17286*	*0*	*1737*	*0*	*74025*	*4708*	*74025*	*74025*
average1		**1544**	**502**	**657**	**0**	**13278**	**2169**	**0**	**1120**	**0**	**3110**	**1187**	**2578**	**2436**
average2		**1369**	**185**	**750**	**0**	**1260**	**2072**	**0**	**632**	**0**	**2338**	**995**	**2183**	**2143**
total		220230	1744	163587	0	60671	8144974	0	9389	0	7395051	446232	15549414	15995646

b) VELKE LEVARE/ owners

PARCELS		Register C					Register E					Total		
		2	4	5	6	7	2	4	5	6	7	Reg C	Reg E	Reg C+E
owners		Arable land	Vineyards	Gardens	Orchards	Grasslands	Arable land	Vineyards	Gardens	Orchards	Grasslands			
1	1	46	4	333	0	55	857	1	12	0	532	438	1402	*1840*
2	2	9	3	106	0	0	1076	0	6	0	673	118	1755	*1873*
3-5	5	19	1	58	3	3	883	0	7	0	482	84	1372	*1456*
6-10	10	3	0	13	0	0	600	0	2	0	380	16	982	*998*
11-25	25	0	0	1	0	1	250	0	0	0	168	2	418	*420*
25<		0	0	0	0	0	6	0	0	0	0	0	6	*6*
total		**77**	**8**	**511**	**3**	**59**	**3672**	**1**	**27**	**0**	**2235**	**658**	**5935**	**6593**
from Reg C		*242*	*19*	*568*	*17*	*194*	*165*	*11*	*57*	*14*	*135*	*1040*	*382*	*1422*

AREAS		Register C					Register E					Total		
		2	4	5	6	7	2	4	5	6	7	Reg C	Reg E	Reg C+E
owners		Arable land	Vineyards	Gardens	Orchards	Grasslands	Arable land	Vineyards	Gardens	Orchards	Grasslands			
1	1	495405	3666	169789	0	339968	2660879	1547	21157	0	1824254	1008828	4507837	*31.43%*
2	2	11149	846	37571	0	0	3237806	0	5129	0	1375286	49566	4618221	*26.60%*
3-5	5	23223	440	36620	658	2113	2435841	0	7551	0	1038589	63054	3481981	*20.20%*
6-10	10	4686	0	7540	0	0	1847687	0	583	0	749140	12226	2597410	*14.87%*
11-25	25	0	0	300	0	2403	829968	0	0	0	371936	2703	1201904	*6.86%*
25<		0	0	0	0	0	6407	0	0	0	0	0	6407	*0.04%*
min1		*4*	*176*	*11*	*0*	*4*	*16*	*0*	*54*	*0*	*11*	*4*	*11*	*4*
min2		*297*	*136*	*24*	*33*	*360*	*7*	*0*	*4*	*0*	*4*	*24*	*4*	*4*
max1		*245427*	*1390*	*14526*	*0*	*70232*	*102321*	*0*	*10153*	*0*	*223589*	*245427*	*223589*	*245427*
max2		*3738*	*440*	*3953*	*382*	*2403*	*24191*	*0*	*3439*	*0*	*39444*	*3953*	*39444*	*39444*
average1		**10770**	**917**	**510**	**0**	**6181**	**3105**	**1547**	**1763**	**0**	**3429**	**2303**	**3215**	**2998**
average2		**1260**	**322**	**461**	**219**	**1129**	**2969**	**0**	**884**	**0**	**2076**	**580**	**2626**	**2532**
total		534463	4952	251820	658	344484	11018588	1547	34420	0	5359205	1136377	16413760	17550137

Table D.4.3 Applied Condition in Simulation Calculation

Applied Cropping Pattern in each Field Category

Scenario		A		B		C	
Zone	Irrigation	Soil	Cropping Pattern	Soil	Cropping Pattern	Soil	Cropping Pattern
2	No Existing	A1	RF1	A1	RF1	A1	RF1
		A2	RF4	A2	RF4	A2	RF4
		A3	RF5 rye	A3	RF5 rye	A3	RF5 rye
		A4	meadow	A4	meadow	A4	meadow
		A5	meadow	A5	meadow	A5	meadow
	Available	A1	IR1	A1	IR1	A1	RF1
		A2	IR2 IR3	A2	IR2 IR3	A2	RF2 RF3
		A3	IR4 IR5	A3	IR4 IR5	A3	RF5 rye
		A4	IR4 IR5	A4	meadow RF5	A4	meadow RF5
		A5	meadow	A5	meadow	A5	meadow
		B1	IR2 IR3	B1	IR2 IR3	B1	RF2 RF3
		B2	IR4 IR5	B2	IR4 IR5	B2	RF5 rye
		B3	IR4 IR5	B3	meadow RF5	B3	meadow RF5
		B4	meadow	B4	meadow	B4	meadow
	Underground Irrigation	A1		A1		A1	
		A2	IR5	A2	IR5	A2	IR5
		A3		A3		A3	
		A4		A4		A4	
		A5		A5		A5	
3	No Existing	A1	NR1 meadow	A1	NR1 meadow	A1	NR1 meadow
		A2	meadow	A2	meadow	A2	meadow
		A3	meadow	A3	meadow	A3	meadow
		A4	meadow	A4	meadow	A4	meadow
		A5	meadow	A5	meadow	A5	meadow

Measures for Limiting Factor

Water logging-Zone II	Avoid Vegitable
Water logging-Zone III	NR2 (Rapeseed is avoided, instead of it, Maize is introduced)
Dry Mound	Meadow
Wind erosion/damage	RF5, meadows, rye etc. (Consideration of land cover in spring)

No.	Cropping pattern	Code	Rotation y	Year-1	Year-2	Year-3	Year-4	Year-5	Year-6
17	apple	apple	1	apple					
16	asparagus	asp	1	asparagus					
1	sunflower-s. barley-rapeseeds-food wheat	IR1	4	sunflower	s.barley	rapeseed	f.wheat		
3	sunflower-food wheat-rapeseeds-food wheat	IR2	4	sunflower	f.wheat	rapeseed	f.wheat		
4	sunflower-soybean-food wheat-s. barley	IR3	4	sunflower	soybean	f.wheat	s.barley		
5	maize-maize-s. barley-alfalfa-alfalfa-alfalfa	IR4	6	maize	maize	s.barley	alfalfa	alfalfa	alfalfa
6	maize-maize-s. barley-maize- w. wheat	IR5	5	maize	maize	s.barley	maize	wheat	
13	artificial meadow	meadow	1	meadow					
14	sunflower-s. barley-maize-food wheat	NR1	4	sunflower	s.barley	maize	f.wheat		
15	sunflower-s. barley-maize-maize	NR2	4	sunflower	s.barley	maize	maize		
7	rapeseeds-food wheat/s. barley	RF1	3	rapeseed	f.wheat	s.barley			
8	food wheat-maize-maize-alfalfa-alfalfa-alfalfa	RF2	6	f.wheat	maize	maize	alfalfa	alfalfa	alfalfa
9	wheat-maize-maize-rapeseeds	RF3	4	wheat	maize	maize	rapeseed		
10	wheat-rye	RF4	2	wheat	rye				
11	wheat-rye-maize-alfalfa-alfalfa-alfalfa	RF5	6	wheat	rye	maize	alfalfa	alfalfa	alfalfa
12	rye	rye	1	rye					
2	vegetables	veg	1	veg					

E: Irrigation Efficiency: 0.85

Item	Amount of Irrigation Water (mm)							Total	
Average year (1993,1998)								(mm)	(m3/ha)
Crop	APR	MAY	JUN	JUL	AUG	SEP	OCT		
Wheat	0	70.1	61.1	0.0	0.0	0.0	0	131.3	1,313
Spring Barley	0	77.8	83.1	5.0	0.0	0.0	0	165.9	1,659
Maize	0	44.6	77.6	89.8	85.0	16.1	0	313.2	3,132
Vegetable	0	67.7	70.8	69.8	26.9	0.0	0	235.2	2,352
Sunflower	0	0.0	33.9	84.1	88.8	0.0	0	206.8	2,068
Alfalfa	0	107.6	3.6	79.8	22.5	24.2	0	237.6	2,376
Rape Seed	0	9.4	10.7	0.0	0.0	0.0	0	20.1	201
Rye	0	0	0	0	0	0	0	0	0
Soybeans	0	0.0	49.9	74.1	0.0	0.0	0	124.0	1,240
Apple	0	0	0	0	0	0	0	0	0
Meadow/Turf	0	108	4	80	22	24	0	238	2,376
Asparagus	0	57.6	57.0	55.5	58.5	13.7	0	242.3	2,423

Table D.4.4 Irrigation Water

Monthly Irrigation Water in Irrigation System

Scenario A

	APR	MAY	JUN	JUL	AUG	SEP	OCT	Capacity of pump
No.21	0	271,303	239,058	267,310	174,279	43,254	0	376,320
No.11	0	128,604	145,103	127,490	86,651	8,038	0	159,531
No.12	0	127,769	128,280	141,107	92,380	18,415	0	155,072

Scenario B

	APR	MAY	JUN	JUL	AUG	SEP	OCT	Capacity of pump
No.21	0	68,119	80,890	59,897	37,129	0	0	376,320
No.11	0	86,454	103,262	107,880	82,929	6,694	0	159,531
No.12	0	77,670	49,578	65,132	31,786	8,462	0	155,072

Scenario C

	APR	MAY	JUN	JUL	AUG	SEP	OCT	Capacity of pump
No.21	0	34,535	36,089	35,593	13,737	0	0	376,320
No.11	0	41,747	42,078	41,173	34,065	6,694	0	159,531
No.12	0	57,960	22,480	48,868	15,945	8,462	0	155,072

Summary of Irrigated Area and Maximum Monthly Irrigation Water in irrigation Block

Scenario A

Irrigation	Irrigation Area (ha)						Max Monthly Irrigation Water (m3)					
Block	Year-1	Year-2	Year-3	Year-4	Year-5	Year-6	Year-1	Year-2	Year-3	Year-4	Year-5	Year-6
ML1B1	430.3	455.1	386.7	418.9	431.5	430.3	382,102	402,581	342,990	366,194	387,136	381,102
ML1 B2	104.5	104.5	38.7	71.6	104.5	104.5	91,197	87,128	33,613	53,206	92,206	88,305
ML1 B3	51.3	70.1	70.1	70.1	54.2	51.3	44,236	61,188	58,401	64,560	51,504	48,863
ML1 B4	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0
ML1 B5	90.6	90.6	90.6	87.5	75.8	90.6	88,758	84,296	78,187	81,358	75,382	93,525
ML1 B6	3.1	9.0	9.0	9.0	9.0	3.1	3,290	8,594	8,049	7,657	7,847	3,290
ML1 B7	46.3	53.5	43.7	53.5	53.5	46.3	43,700	54,499	45,713	50,216	48,003	39,479
ML2 B1	15.3	15.4	14.4	25.7	17.6	19.4	13,661	11,299	12,586	19,769	15,683	14,915
ML2 B2	150.7	150.7	158.3	115.3	147.4	150.7	105,225	112,879	111,502	83,002	102,219	113,101
ML2 B3	69.7	69.7	81.0	81.0	69.7	69.7	49,912	52,026	56,678	54,465	49,912	52,026
Ga B1	122.5	144.9	100.8	90.0	161.3	191.6	97,275	117,723	79,229	69,582	130,287	158,664
Ga B2	32.5	54.9	10.7	0.0	71.3	101.5	27,694	48,143	9,647	0	60,706	89,084
Ga B3	105.4	81.9	105.4	105.4	107.3	81.9	99,985	78,892	99,985	99,985	100,025	78,892
Ga B4	58.8	35.3	58.8	58.8	60.8	35.3	59,108	38,015	59,108	59,108	59,148	38,015

Scenario B

Irrigation	Irrigation Area (ha)						Max Monthly Irrigation Water (m3)					
Block	Year-1	Year-2	Year-3	Year-4	Year-5	Year-6	Year-1	Year-2	Year-3	Year-4	Year-5	Year-6
ML1B1	134.1	126.1	113.6	86.8	135.8	124.8	106,770	101,424	88,264	65,926	108,147	100,326
ML1 B2	5.8	56.4	56.4	20.9	38.7	56.4	4,079	49,040	46,149	16,702	31,427	49,040
ML1 B3	51.3	18.9	0.0	0.0	9.3	15.9	43,132	15,697	0	0	8,277	13,251
ML1 B4	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0
ML1 B5	14.2	0.0	2.1	0.0	0.0	4.4	11,795	0	1,858	0	0	3,633
ML1 B6	0.0	5.9	3.1	0.0	0.0	0.0	0	4,911	2,543	0	0	0
ML1 B7	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0
ML2 B1	15.4	4.0	0.0	17.6	15.4	0.0	13,645	3,348	0	14,619	13,645	0
ML2 B2	79.5	130.0	103.7	100.2	79.5	130.0	54,319	98,946	75,094	72,728	54,319	98,946
ML2 B3	81.0	69.7	32.7	32.7	81.0	69.7	59,915	52,026	19,157	19,157	59,915	52,026
Ga B1	45.9	70.9	67.7	100.8	45.9	45.9	34,779	55,515	52,825	82,922	34,779	34,779
Ga B2	0.0	24.9	21.7	54.9	0.0	0.0	0	20,737	18,047	48,143	0	0
Ga B3	37.3	37.3	37.3	37.3	37.3	37.3	39,759	39,759	39,759	39,759	39,759	39,759
Ga B4	35.3	35.3	35.3	35.3	35.3	35.3	38,015	38,015	38,015	38,015	38,015	38,015

Scenario C

Irrigation	Irrigation Area (ha)						Max Monthly Irrigation Water (m3)					
Block	Year-1	Year-2	Year-3	Year-4	Year-5	Year-6	Year-1	Year-2	Year-3	Year-4	Year-5	Year-6
ML1B1	50.7	50.7	50.7	50.7	50.7	50.7	35,855	35,855	35,855	35,855	35,855	35,855
ML1 B2	5.8	5.8	5.8	5.8	5.8	5.8	4,079	4,079	4,079	4,079	4,079	4,079
ML1 B3	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0
ML1 B4	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0
ML1 B5	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0
ML1 B6	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0
ML1 B7	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0
ML2 B1	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0
ML2 B2	34.9	34.9	34.9	34.9	34.9	34.9	22,778	22,778	22,778	22,778	22,778	22,778
ML2 B3	32.7	32.7	32.7	32.7	32.7	32.7	19,157	19,157	19,157	19,157	19,157	19,157
Ga B1	30.1	30.1	30.1	30.1	30.1	30.1	21,270	21,270	21,270	21,270	21,270	21,270
Ga B2	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0
Ga B3	35.3	35.3	35.3	35.3	35.3	35.3	38,015	38,015	38,015	38,015	38,015	38,015
Ga B4	35.3	35.3	35.3	35.3	35.3	35.3	38,015	38,015	38,015	38,015	38,015	38,015

ML: Male Levare Irrigation System
Ga: Gajary Irrigation System

Table D.4.5 Crop Area Summary

(unit : ha)

Scenario A	Site A															Site B			GROUNG TOTAL
	Zone II													Zone III		Zone II			
	No.21			No.11			Groundwater control		Not equipmed		Sub total								
	Without plan	With plan - Non irrigated	With plan - Irrigated	Without plan	With plan - Non irrigated	With plan - Irrigated	Without plan	With plan - Irrigated	Without plan	With plan - Non irrigated	Without plan	With plan - Non irrigated	With plan - Irrigated	Without plan	With plan - Non irrigated	Without plan	With plan - Non irrigated	With plan - Irrigated	
Wheat	0	28	9	0	7	36	0	0	0	14	0	49	44	0	79	0	44	2	218
Spring Barley	0	0	73	0	0	18	0	10	0	0	0	0	101	0	105	0	10	44	259
Maize	0	0	139	0	4	7	0	29	0	5	0	9	175	0	115	0	49	62	410
Vegetable	0	0	80	0	0	84	0	0	0	0	0	0	164	0	0	0	0	40	204
Sunflower	0	0	17	0	0	33	0	0	0	0	0	0	50	0	93	0	0	24	167
Alfalfa	0	0	86	0	6	1	0	0	0	16	0	22	87	0	0	0	78	0	187
Rape Seed	0	9	0	0	12	0	0	0	0	0	0	21	0	0	0	0	7	0	28
Rye	0	0	0	0	0	0	0	0	0	41	0	41	0	0	0	0	0	0	41
Soybeans	0	0	0	0	0	8	0	0	0	0	0	0	8	0	0	0	0	10	18
Apple	0	34	0	0	0	0	0	0	0	0	0	34	0	0	0	0	0	0	34
Meadow	0	115	0	0	31	0	0	0	0	58	0	204	0	0	393	0	0	35	632
Asparagus	0	0	0	0	0	49	0	56	0	0	0	0	105	0	0	0	0	0	105
Sum	0	186	403	0	59	236	0	94	0	135	0	380	734	0	785	0	187	217	2,302

(unit : ha)

Scenario B	Site A															Site B			GROUNG TOTAL
	Zone II													Zone III		Zone II			
	No.21			No.11			Groundwater control		Not equipmed		Sub total								
	Without plan	With plan - Non irrigated	With plan - Irrigated	Without plan	With plan - Non irrigated	With plan - Irrigated	Without plan	With plan - Irrigated	Without plan	With plan - Non irrigated	Without plan	With plan - Non irrigated	With plan - Irrigated	Without plan	With plan - Non irrigated	Without plan	With plan - Non irrigated	With plan - Irrigated	
Wheat	0	64	0	0	53	0	0	0	0	14	0	131	0	0	79	0	57	0	267
Spring Barley	0	0	43	0	0	19	0	8	0	0	0	0	71	0	105	0	0	25	201
Maize	0	105	0	0	5	0	0	0	0	5	0	115	0	0	115	0	55	0	285
Vegetable	0	0	51	0	0	64	0	0	0	0	0	0	115	0	0	0	0	30	145
Sunflower	0	0	26	0	0	42	0	0	0	0	0	0	68	0	93	0	0	18	179
Alfalfa	0	86	0	0	3	0	0	0	0	16	0	105	0	0	0	0	69	0	174
Rape Seed	0	11	0	0	16	0	0	0	0	0	0	27	0	0	0	0	15	0	41
Rye	0	18	0	0	0	0	0	0	0	41	0	59	0	0	0	0	15	0	74
Soybeans	0	6	0	0	15	0	0	0	0	0	0	21	0	0	0	0	11	0	32
Apple	0	34	0	0	0	0	0	0	0	0	0	34	0	0	0	0	0	0	34
Meadow	0	145	0	0	31	0	0	0	0	56	0	232	0	0	393	0	75	35	735
Asparagus	0	0	0	0	0	49	0	56	0	0	0	0	105	0	0	0	0	0	105
Sum	0	469	121	0	121	174	0	64	0	133	0	723	359	0	785	0	296	108	2,271

(unit : ha)

Scenario C	Site A															Site B			GROUNG TOTAL
	Zone II													Zone III		Zone II			
	No.21			No.11			Groundwater control		Not equipmed		Sub total								
	Without plan	With plan - Non irrigated	With plan - Irrigated	Without plan	With plan - Non irrigated	With plan - Irrigated	Without plan	With plan - Irrigated	Without plan	With plan - Non irrigated	Without plan	With plan - Non irrigated	With plan - Irrigated	Without plan	With plan - Non irrigated	Without plan	With plan - Non irrigated	With plan - Irrigated	
Wheat	0	58	0	0	47	0	0	0	0	14	0	119	0	0	79	0	41	0	239
Spring Barley	0	17	0	0	0	0	0	0	0	0	0	17	0	0	105	0	0	0	122
Maize	0	46	0	0	70	0	0	0	0	5	0	121	0	0	115	0	60	0	296
Vegetable	0	0	51	0	0	20	0	0	0	0	0	0	71	0	0	0	0	30	101
Sunflower	0	0	0	0	0	0	0	0	0	0	0	0	0	0	93	0	0	0	93
Alfalfa	0	123	0	0	47	0	0	0	0	16	0	186	0	0	0	0	91	0	276
Rape Seed	0	17	0	0	30	0	0	0	0	0	0	47	0	0	0	0	11	0	58
Rye	0	99	0	0	2	0	0	0	0	41	0	142	0	0	0	0	62	0	203
Soybeans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Apple	0	34	0	0	0	0	0	0	0	0	0	34	0	0	0	0	0	0	34
Meadow	0	145	0	0	31	0	0	0	0	58	0	234	0	0	393	0	75	35	737
Asparagus	0	0	0	0	0	49	0	56	0	0	0	0	105	0	0	0	0	0	105
Sum	0	538	51	0	226	69	0	56	0	135	0	899	176	0	785	0	339	65	2,264

(unit : ha)

Current 2001	Site A															Site B			GROUNG TOTAL
	Zone II													Zone III		Zone II			
	No.21			No.11			Groundwater control		Not equipmed		Sub total								
	Without plan	With plan - Non irrigated	With plan - Irrigated	Without plan	With plan - Non irrigated	With plan - Irrigated	Without plan	With plan - Irrigated	Without plan	With plan - Non irrigated	Without plan	With plan - Non irrigated	With plan - Irrigated	Without plan	With plan - Non irrigated	Without plan	With plan - Non irrigated	With plan - Irrigated	
Wheat	15			4				0	0		19	0	0	254		15			288
Spring Barley	0			0				0	0		0	0	0	0		22			22
Maize	140			11				31	0		151	31	0	59		25			266
Vegetable	0			0				0	0		0	0	0	0		0		19	19
Sunflower	29			64				0	0		93	0	0	7		0			100
Alfalfa	19			0				0	0		19	0	0	0		0			19
Rape Seed	18			0				13	17		35	13	0	8		44			100
Rye	148			76				2	52		276	2	0	114		237			629
Soybeans	0			0				0	0		0	0	0	0		0			0
Apple	55			0				0	17		72	0	0	0		0			72
Meadow	165			91				0	49		305	0	0	263		35			603
Asparagus	0			0		48		56	0		0	56	48	0		0			104
Sum	589	0	0	246	0	48	0	102	135	0	970	102	48	705	0	378	0	19	2,222

(unit : ha)

Current 2002	Site A															Site B			GROUNG TOTAL
	Zone II													Zone III		Zone II			
	No.21			No.11			Groundwater control		Not equipmed		Sub total								
	Without plan	With plan - Non irrigated	With plan - Irrigated	Without plan	With plan - Non irrigated	With plan - Irrigated	Without plan	With plan - Irrigated	Without plan	With plan - Non irrigated	Without plan	With plan - Non irrigated	With plan - Irrigated	Without plan	With plan - Non irrigated	Without plan	With plan - Non irrigated	With plan - Irrigated	
Wheat	0			4				0	0		4	0	0	130		0			134
Spring Barley	0			0				0	0		0	0	0	29		38			67
Maize	93			11				31	0		104	31	0	98		97			330
Vegetable	0			0				0	0		0	0	0	0		0		19	19
Sunflower	119			93				0	0		212	0	0	129		0			341
Alfalfa	19			0				0	0		19	0	0	0		0			19
Rape Seed	18			0				0	0		18	0	0	8		44			70
Rye	122			47				15	69		238	15	0	46		165			464
Soybeans	0			0				0	0		0	0	0	0		0			0
Apple	55			0				0	17		72	0	0	0		0			72
Meadow	166			91				0	49		306	0	0	271		35			612
Asparagus	0			0		48		56	0		0	56	48	0		0			104
Sum	592	0	0	246	0	48	0	102	135	0	973	102	48	711	0	379	0	19	2,232

Table D.4.6 Production Amount and Balance of Sold and Consumed

Production Amount (ton/Year)

	Current 2001	Current 2002	Scenario A	Scenario B	Scenario C
Wheat	61.0	13.0	351.9	713.0	605.5
f.Wheat	940.0	481.0	566.4	349.0	349.0
Spring Barley	106.4	202.4	1,093.1	839.5	451.0
Maize	1,221.5	1,213.5	2,155.3	1,185.4	1,228.0
Vegetable	684.0	684.0	7,344.0	5,220.0	3,636.0
Sunflower	172.0	618.0	415.4	446.4	223.0
Alfalfa	160.0	160.0	1,932.0	1,457.4	2,318.2
Rape Seed	158.0	109.0	50.2	74.4	104.8
Rye	1,383.0	1,138.0	114.0	207.0	569.1
Soybeans	0.0	0.0	36.3	47.5	0.0
Apple	0.0	0.0	0.0	0.0	0.0
Meadow	1,809.0	1,836.0	1,896.0	2,206.0	2,211.0
Asparagus	416.0	416.0	420.0	420.0	420.0

Unit Demand Amount (kg/day/Head)

		Cattle	Pig	Cow
Unit Demand Amount (kg/day)	Wheat	1.1	1.1	1.0
	Barley	0.5	0.3	1.0
	Maize	0.4	0.6	0.6
	Grass	20.0		
	Sailage Maize			15.0
	Alfalfa			15.0

Demand in Case Syudy Site (Ton/Year)

		Cattle	Pig	Cow	Total in C/S site
Head in CS Site		282	550	199	
Demand in CS site A	Wheat	115	211	73	399
	Barley	46	60	73	179
	Maize	36	116	44	196
	Grass	2059	0	0	2,059
	Sailage Maize	0	0	1090	1,090
	Alfalfa	0	0	1090	1,090

Balance between Self-cosume and selling amount

Demand

Ton/Year
578
0
0
434
0
0
1,090
0
0
0
0
2,059

Possible Amount for Sell (Ton)

	Current 2001	Current 2002	Scenario A	Scenario B	Scenario C
Wheat	0	0	0	169	63
f.Wheat	940	481	566	349	349
Spring Barley	106	202	1,093	840	451
Maize	0	0	1,499	751	794
Vegetable	684	684	7,344	5,220	3,636
Sunflower	172	618	415	446	223
Alfalfa	0	0	766	367	1,228
Rape Seed	158	109	50	74	105
Rye	1,129	832	114	207	569
Soybeans	0	0	36	48	0
Apple	0	0	0	0	0
Meadow	0	0	0	0	0
Asparagus	416	416	420	420	420

Comsumed Amount for livestock (Ton)

Current 2001	Current 2002	Scenario A	Scenario B	Scenario C
61	13	352	544	543
0	0	0	0	0
0	0	0	0	0
1,222	1,214	656	434	434
0	0	0	0	0
0	0	0	0	0
160	160	1,166	1,090	1,090
0	0	0	0	0
254	306	0	0	0
0	0	0	0	0
0	0	0	0	0
1,809	1,836	1,896	2,206	2,211
0	0	0	0	0

*Maizeの収量はGrainとした場合の収量。

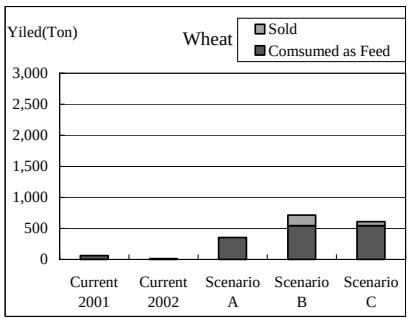
Production Cost

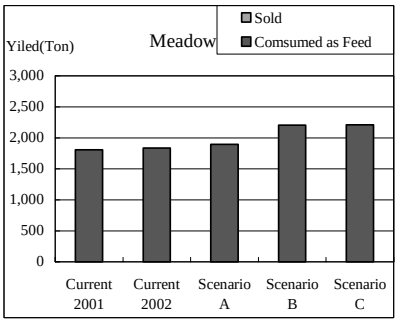
Production Cost for Selling Amount（SKK）

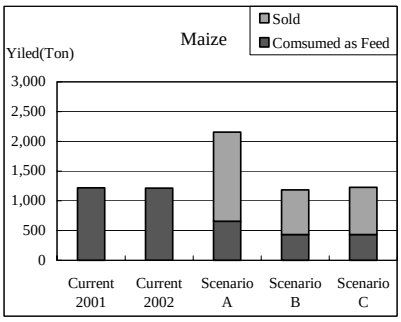
	Current 2001	Current 2002	Scenario A	Scenario B	Scenario C
Wheat	0	0	0	603,930	225,134
f.Wheat	0	0	2,104,004	1,320,212	1,320,212
Spring Barley	474,096	859,509	4,030,590	3,097,358	1,731,893
Maize	0	0	5,046,368	2,732,779	2,893,902
Vegetable	1,943,067	1,943,067	20,862,398	14,828,666	10,328,933
Sunflower	1,444,670	5,018,455	3,000,961	3,227,520	1,593,224
Alfalfa	0	0	879,580	433,817	1,451,574
Rape Seed	1,235,097	858,275	363,225	538,325	758,286
Rye	5,007,082	3,708,722	470,787	854,851	2,349,807
Soybeans	0	0	311,515	449,698	0
Apple	0	0	0	0	0
Meadow	0	0	0	0	0
Asparagus	22,153,926	22,153,926	22,366,945	22,366,945	22,366,945
Total	32,257,938	34,541,954	59,436,373	50,454,102	45,019,909

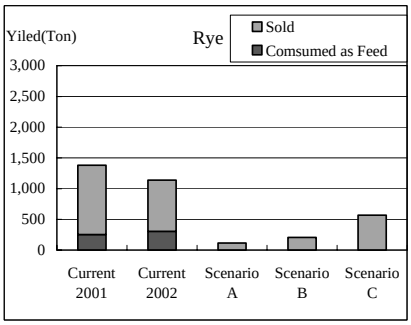
Production Cost for selfsupply feed（SKK）

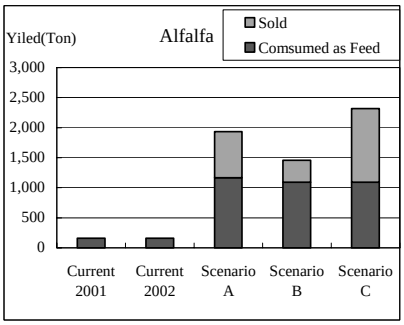
	Current 2001	Current 2002	Scenario A	Scenario B	Scenario C
Wheat	233,068	49,670	1,257,891	1,944,013	1,940,439
f.Wheat		0			
Spring Barley		0			
Maize	4,683,777	4,626,107	2,208,417	1,579,262	1,581,806
Vegetable		0			
Sunflower		0			
Alfalfa	189,130	189,130	1,338,891	1,288,449	1,288,449
Rape Seed		0			
Rye	1,126,483	1,364,025	0	0	0
Soybeans		0			
Apple		0			
Meadow	1,346,499	1,366,596	1,333,101	1,641,999	1,567,566
Asparagus					
Total	7,578,957	7,595,529	6,138,299	6,453,724	6,378,260

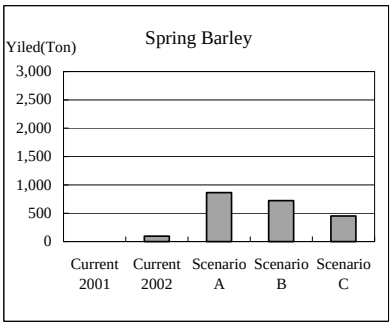

Wheat
Yiled(Ton)
Sold
Comsumed as Feed
3,000
2,500
2,000
1,500
1,000
500
0
Current 2001
Current 2002
Scenario A
Scenario B
Scenario C

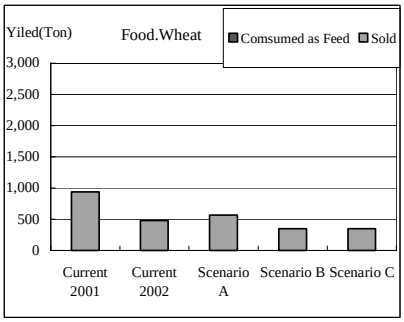

Meadow
Yiled(Ton)
Sold
Comsumed as Feed
3,000
2,500
2,000
1,500
1,000
500
0
Current 2001
Current 2002
Scenario A
Scenario B
Scenario C

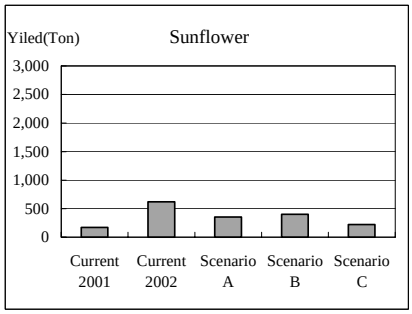

Maize
Yiled(Ton)
Sold
Comsumed as Feed
3,000
2,500
2,000
1,500
1,000
500
0
Current 2001
Current 2002
Scenario A
Scenario B
Scenario C

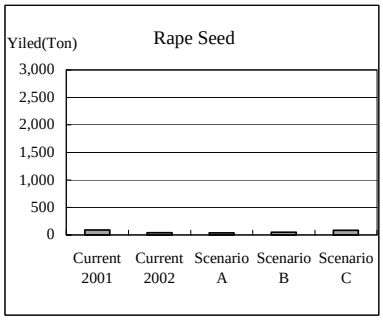

Rye
Yiled(Ton)
Sold
Comsumed as Feed
3,000
2,500
2,000
1,500
1,000
500
0
Current 2001
Current 2002
Scenario A
Scenario B
Scenario C

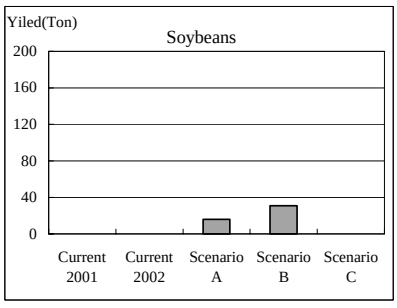

Alfalfa
Yiled(Ton)
Sold
Comsumed as Feed
3,000
2,500
2,000
1,500
1,000
500
0
Current 2001
Current 2002
Scenario A
Scenario B
Scenario C


Spring Barley
Yiled(Ton)
3,000
2,500
2,000
1,500
1,000
500
0
Current 2001
Current 2002
Scenario A
Scenario B
Scenario C


Food.Wheat
Yiled(Ton)
Comsumed as Feed
Sold
3,000
2,500
2,000
1,500
1,000
500
0
Current 2001
Current 2002
Scenario A
Scenario B
Scenario C


Sunflower
Yiled(Ton)
3,000
2,500
2,000
1,500
1,000
500
0
Current 2001
Current 2002
Scenario A
Scenario B
Scenario C


Rape Seed
Yiled(Ton)
3,000
2,500
2,000
1,500
1,000
500
0
Current 2001
Current 2002
Scenario A
Scenario B
Scenario C


Soybeans
Yiled(Ton)
200
160
120
80
40
0
Current 2001
Current 2002
Scenario A
Scenario B
Scenario C

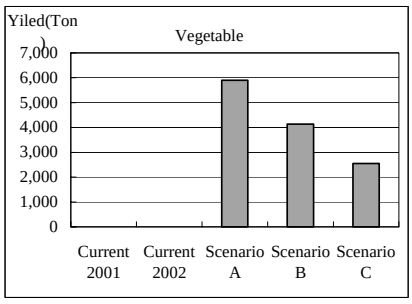

Vegetable
Yiled(Ton)
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Current 2001
Current 2002
Scenario A
Scenario B
Scenario C

Table D.4.7 Summary of Financial Balance and Subsidy

Summary of Financial Balance of Crop Cultivation

(unit: 1,000 SKK)

Items	Current 2001			Current 2002			Scenario A			Scenario B			Scenario C		
	Farming cost	Gross income	Net return	Farming cost	Gross income	Net return	Farming cost	Gross income	Net return	Farming cost	Gross income	Net return	Farming cost	Gross income	Net return
Site A															
Zone II															
Without plan	7,931	8,425	494	8,199	8,689	491	0	0	0	0	0	0	0	0	0
With plan - non irrigated	12,570	14,425	1,855	12,551	14,377	1,826	2,211	2,420	210	6,317	7,011	694	8,203	9,223	1,020
With plan - irrigated	10,225	11,722	1,497	10,225	11,722	1,497	47,255	56,639	9,384	36,593	43,295	6,703	29,628	34,630	5,002
Zone III															
Without plan	6,429	7,703	1,274	6,782	8,042	1,261	0	0	0	0	0	0	0	0	0
With plan - non irrigated	0	0	0	0	0	0	7,023	8,688	1,665	7,023	8,688	1,665	7,023	8,688	1,665
Sub-total of A	37,155	42,275	5,120	37,756	42,830	5,074	56,488	67,747	11,259	49,933	58,994	9,062	44,854	52,540	7,687
Site B															
Without plan	3,983	4,184	201	4,208	4,533	326	0	0	0	0	0	0	0	0	0
With plan - non irrigated	0	0	0	0	0	0	2,297	2,615	318	2,933	3,287	354	3,344	3,766	422
With plan - irrigated	1,943	2,405	462	1,943	2,405	462	6,672	8,339	1,667	3,827	4,759	932	3,068	3,798	730
Sub-total of B	5,926	6,589	663	6,151	6,939	788	8,969	10,954	1,986	6,760	8,046	1,286	6,412	7,564	1,152
Ground total	43,080	48,864	5,784	43,907	49,768	5,862	65,457	78,701	13,244	56,693	67,041	10,348	51,266	60,105	8,839
Ratio of net return to farming cost			13%			13%			20%			18%			17%
Net return per hector (SKK/ha)			2,603			2,626			5,753			4,557			3,904

Remarks: Farming cost and profit of apple is excluded from the summary. With plan - non irrigated includes the groundwater control area.

Summary of Estimated Subsidy Expenditure

(unit: 1,000 SKK)

Items	Current 2001			Current 2002			Scenario A			Scenario B			Scenario C		
	Product subsidy	Irrigation subsidy	Total	Product subsidy	Irrigation subsidy	Total	Product subsidy	Irrigation subsidy	Total	Product subsidy	Irrigation subsidy	Total	Product subsidy	Irrigation subsidy	Total
Site A															
Zone II															
Without plan	1,190	0	1,190	1,196	0	1,196	0	0	0	0	0	0	0	0	0
With plan - non irrigated	314	376	690	313	376	690	364	0	364	953	0	953	1,215	0	1,215
With plan - irrigated	202	322	524	202	322	524	1,951	5,157	7,109	1,175	2,455	3,630	739	1,312	2,051
Zone III			0			0			0			0			0
Without plan	911	0	911	924	0	924	0	0	0	0	0	0	0	0	0
With plan - non irrigated	0	0	0	0	0	0	923	0	923	923	0	923	923	0	923
Sub-total of A	2,617	699	3,315	2,636	699	3,334	3,238	5,157	8,395	3,050	2,455	5,505	2,877	1,312	4,189
Site B			0			0			0			0			0
Without plan	602	0	602	604	0	604	0	0	0	0	0	0	0	0	0
With plan - non irrigated	0	0	0	0	0	0	319	0	319	440	0	440	494	0	494
With plan - irrigated	80	162	242	80	162	242	440	1,267	1,707	203	492	696	126	256	382
Sub-total of B	682	162	844	683	162	846	758	1,267	2,025	644	492	1,136	620	256	876
Ground total	3,298	861	4,159	3,319	861	4,180	3,996	6,424	10,421	3,694	2,947	6,641	3,497	1,568	5,065
Total subsidy per hector (SKK/ha)			1,872			1,873			4,526			2,925			2,237
Ratio of subsidy to gross income			9%			8%			13%			10%			8%
Ratio of subsidy to net return			72%			71%			79%			64%			57%

Summary of Net Return Excluding Subsidy

(unit: 1,000 SKK)

Net return excluding subsidy per ha	731	753	1,226	1,632	1,667
Ratio to farming cost	3.8%	3.8%	4.3%	6.5%	7.4%

Table D.4.8 Sensitivity Analysis of Net Return

Sensitivity on Subsidy Level

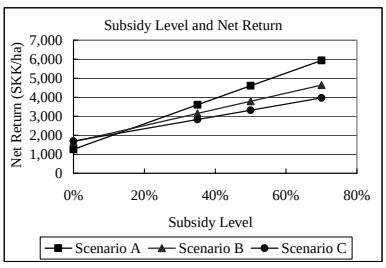
	Scenario A				Scenario B				Scenario C			
Subsidy level	70%	50%	35%	0%	70%	50%	35%	0%	70%	50%	35%	0%
Net return	13,244	10,267	8,034	2,824	10,348	8,450	7,027	3,707	8,839	7,391	6,306	3,773
Ratio to cost	20%	16%	12%	4%	18%	15%	12%	7%	17%	14%	12%	7%
Net return per ha	5,934	4,600	3,599	1,265	4,636	3,786	3,148	1,661	3,960	3,312	2,825	1,691

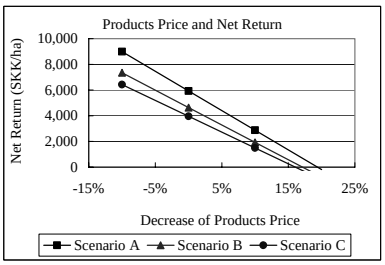
Sensitivity on Production Cost

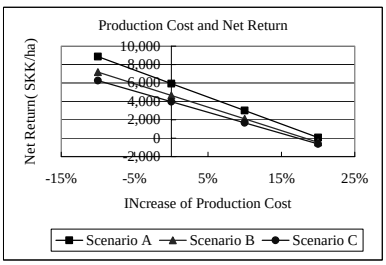
	Scenario A				Scenario B				Scenario C			
Cost increase	-10%	0%	10%	20%	-10%	0%	10%	20%	-10%	0%	10%	20%
Net return	19,790	13,244	6,699	153	16,017	10,348	4,679	-991	13,965	8,839	3,712	-1,415
Ratio	34%	20%	9%	0%	31%	18%	8%	-1%	30%	17%	7%	-2%
Net return per ha	8,866	5,934	3,001	69	7,176	4,636	2,096	-444	6,257	3,960	1,663	-634

Sensitivity on Products Price

	Scenario A				Scenario B				Scenario C			
Price decrease	-10%	0%	10%	20%	-10%	0%	10%	20%	-10%	0%	10%	20%
Net return	20,072	13,244	6,416	-412	16,388	10,348	4,308	-1,732	14,343	8,839	3,335	-2,169
Ratio	31%	20%	10%	-1%	29%	18%	8%	-3%	28%	17%	7%	-4%
Net return per ha	8,993	5,934	2,875	-185	7,342	4,636	1,930	-776	6,426	3,960	1,494	-972







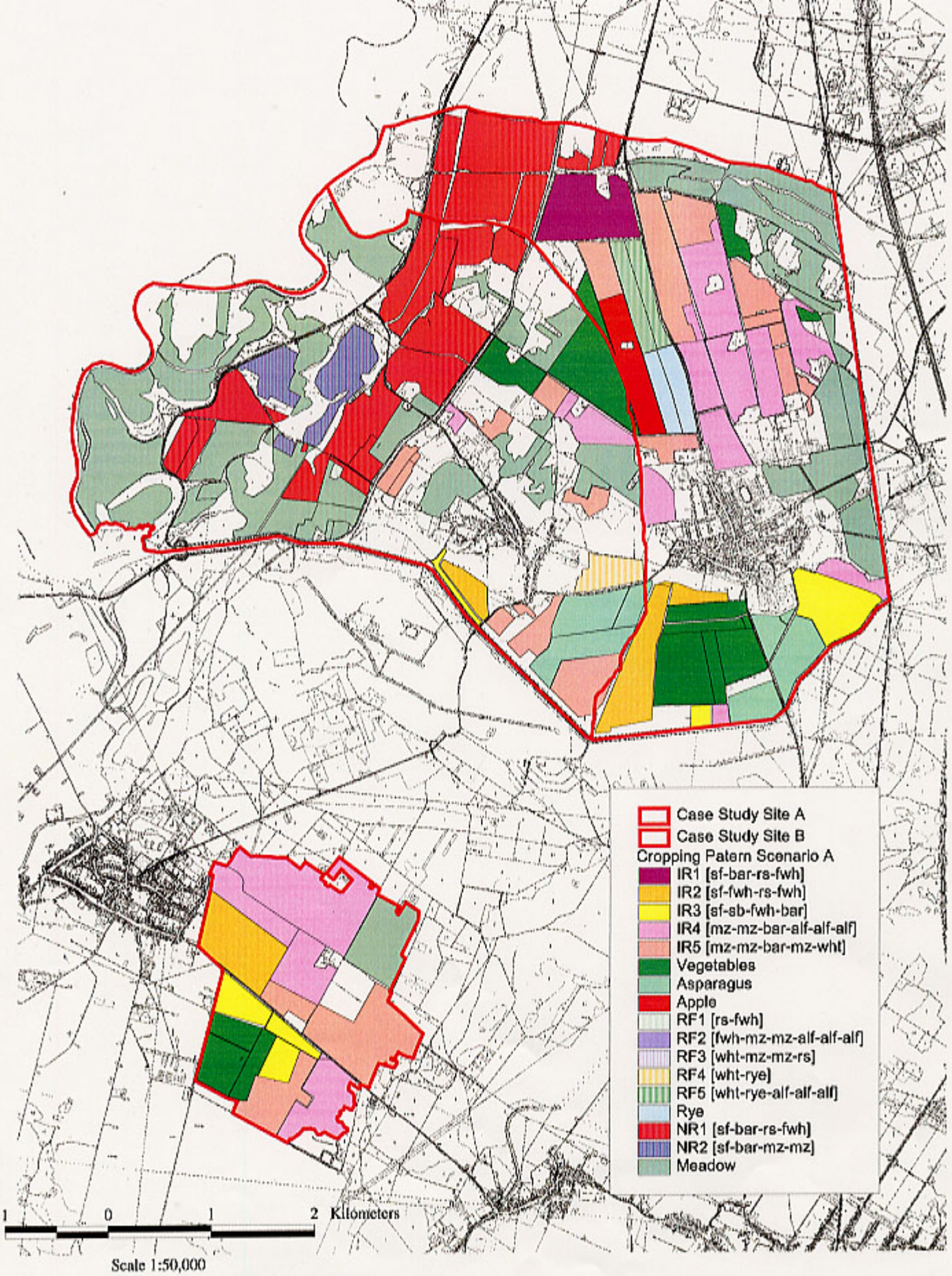


Figure D.4.1 Expected Crop Rotation - Scenario A

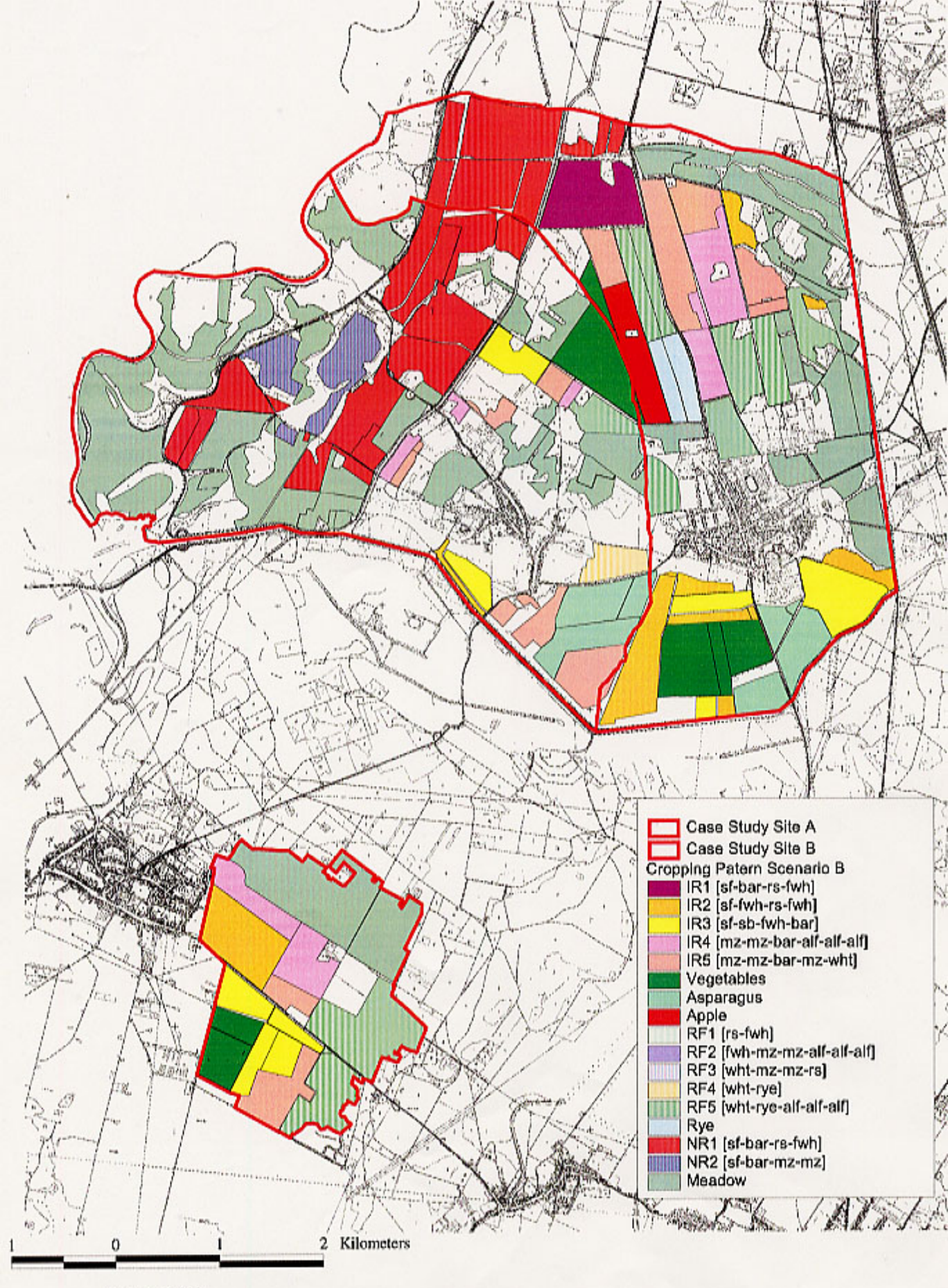


Figure D.4.2 Expected Crop Rotation - Scenario B

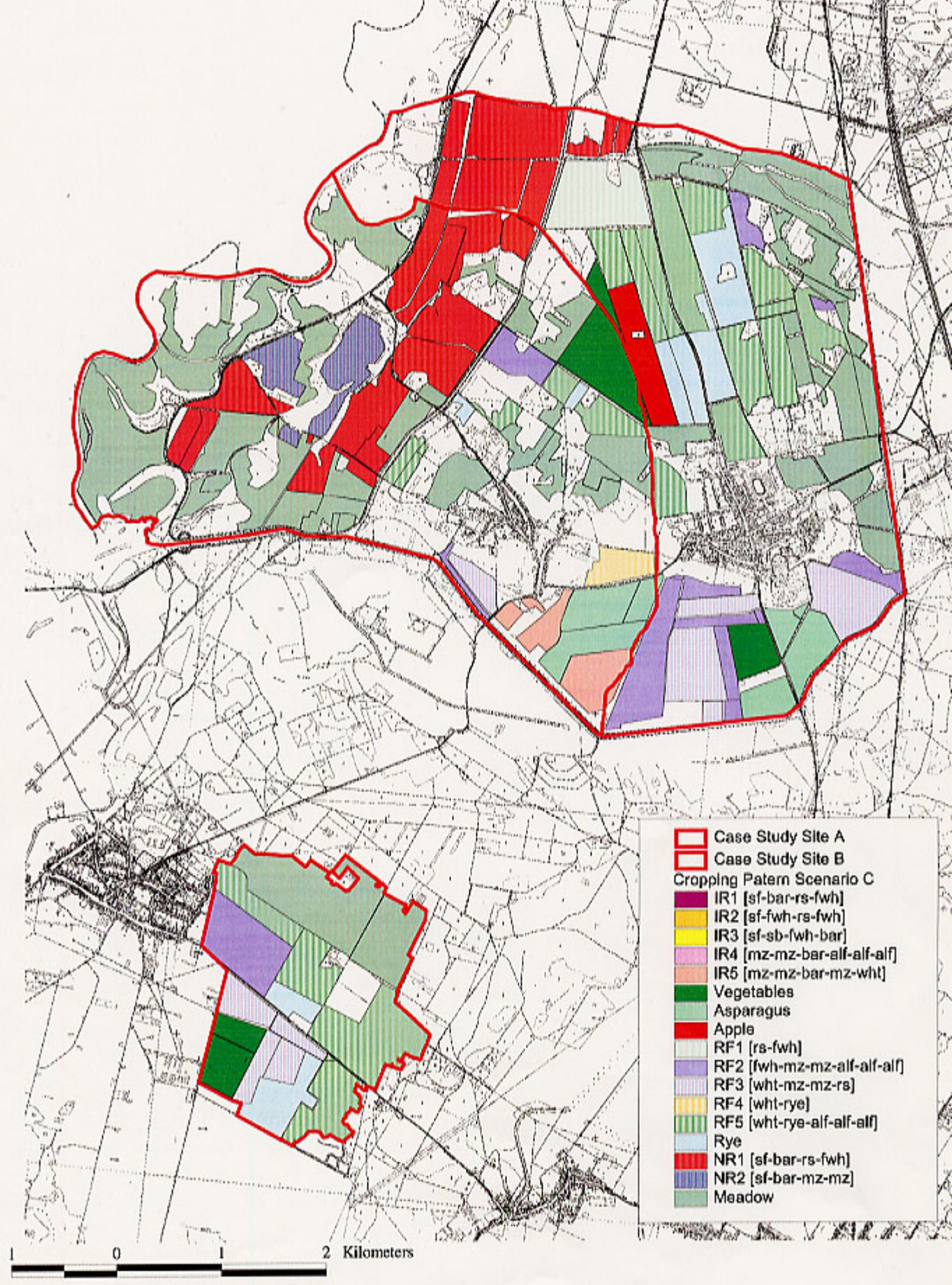


Figure D.4.3 Expected Crop Rotation - Scenario C