CHAPTER 3

CHAPTER 3 POTENTIAL ANALYSIS OF REGIONAL DEVELOPMENT

3.1 National and Regional Policy on Socioeconomic Development

3.1.1 Review of Development Policy

Latvia aims at ensuring equal working, income, social, and cultural opportunities for all inhabitants of the state, as mentioned in the following legislation, development strategies and policies. However, the former course of development after independence in 1991 has resulted in differences in living environment and opportunities of economic activity in different regions of Latvia. In many areas including LWC, insufficient economic development and activity, high unemployment rate, low income, unequal conditions for social and cultural life have been found.

(1) Law on Spatial Development Planning of Latvia

The Law on Spatial Development Planning of Latvia was adopted in October 1998. According to this new law, development and land use planning in Latvia is to be carried out, as such:

- Local governments of districts, state cities, towns, and townships should prepare spatial development plans of their administrative areas,
- Spatial development plans of higher level should be observed when producing spatial development plans of lower levels, and
- Land use plans of regional and local municipal levels should be prepared in accordance with the relevant spatial development plans.

Development and land use plans for LWC, therefore, has to observe and coordinate with the directions and strategies mentioned in the existing national, regional, district, and township level plans.

(2) National development strategies

The long-term goal of development strategy for Latvia is to become a socially harmonized country with a dynamic, open and equal opportunity as well as its own national identity. Tasks for long-term economic development are to create a dynamic, effective, flexible and environmentally friendly economy. The basic attention is intended to be paid to the development of manufacturing using local resources. This relates to food and fish processing, construction industries, and wood processing. The other potential branches can be transit transport and tourism.

The Latvia's medium-term economic strategy up to the year 2003 is to define the economic policy priorities and to outline a set of consistent economic and social policies required to complete the economic transformation of the country and to prepare its economy for accession to EU. The tasks based on the medium-term strategy are to ensure a) sustainable economic growth and real convergence in accordance with EU's objectives

of economic and social cohesion, b) greater competitiveness of the Latvian economy, c) normal convergence of the Latvian economy compatible with the ultimate goal of adaptation of the euro, and e) economic development that is environmentally friendly and socially appropriate.

(3) Regional development policy

The Concept of the Regional Development Policy of Latvia issued in 1996 defines principles, objectives, and tasks for the regional development policy, in addition to designation system of special support regions. As regional development is a multi-sectoral activity, the concept requires establishment of horizontal coordination among different sectors, and also vertical coordination between the national, regional, and local levels. In planning and implementing development activities in LWC, careful attention has to be paid to these policy frameworks on a local level, in order to ignore any contradictory approaches. The following describe the principles for regional development policy.

Partnership: The state regional policy is part of the general development policy of the state. The state implements the regional development policy in cooperation with local authorities, entrepreneurs, the society and non-governmental organizations.

Identity: Regional development policy must ensure the leveling out of unfavorable regional differences, at the same time retaining and enhancing the natural and cultural peculiarities of each region.

Succession: Regional development policy must be long-term and independent of short-term decisions.

Responsibility: Development is based on individual responsibility which is rooted in self-initiative, self-education and readiness to shoulder responsibility.

Transparency: Development activities are based on attendance of different social groups, fostering of initiative, availability of information, openness in decision making, and adequate response to changes.

Participation: It ensures the participation of individuals, local and state governmental institutions. In all spheres, there should be a distinct division of functions and means required to ensure efficient performance.

Decentralization: Decentralization of the state power is ensured by encouraging the formation of new development centers, good use of local opportunities as well as differences in natural, social and economic conditions.

Consensus: Regional development strategy, plans, and programs are worked out on the basis of the initiative coming from the community and the local governments, and are coordinated with adjoining local authorities and national interests, thus paving the way for a harmonious development strategy.

Self-development: Special support measures for certain places or regions must be fixed for a definite and limited period with a view that they stimulate the processes of self-development.

Variety: Retention and development of variety in nature, culture, resources and economic activity must be carried out.

(4) Rural development policy

Sustainable rural development has become another basic principle that supports regional development policies in Latvia. Its objective is to lessen and prevent migration from rural areas, to reduce poverty of rural citizens, to pay maximum attention to the stimulation of employment, and to ensure equal possibilities. According to the Rural Development Program of Latvia approved in June 1998, sustainable rural development means increase in welfare of citizens and reacting on growing demands for better quality of life, health, security and possibilities for personal development. Preservation of the quality of rural environment and its improvement is also one of the main demands of EU policy to its member states, as below :

"There must be a fairer balance of public spending, infrastructure investments and educational, health and communication services between rural and urban areas. A growing share of available resources should be used for promoting rural development and securing environmental objectives." (Art.1 of Cork declaration "Rural Preference")

These rural development policies can be good guidelines to consider development concepts and directions for LWC, since all the area belongs to rural land where the existing major economic activities are agriculture, forestry, and fishery.

3.1.2 Current Socioeconomic Status of the Study Area

The present socioeconomic status of the area within the whole Latvia is reviewed from the development point of view, hereunder. In May 1997, the Latvian parliament approved the Law on Assisted Areas, and the status of assisted area was provided according to the set of criteria on social and economic development. Based on the social economic criteria in August 1997, the Ministry of Economy prepared the list of potential assisted areas. The potential assisted area is concrete parts of Latvia where negative tendencies of economic development last for a longer period of time. The status is confirmed and revoked by the Cabinet of Ministries in cooperation with the Regional Development Board of Latvia, development boards of concrete regions and local authorities, in accordance with the appropriate laws and regulations issued by the Cabinet of Ministers for a fixed period of time. The potential assisted areas are defined according to the several criteria using ranking method. Criteria for cities, towns and townships are:

a) proportion of the area occupied by objects of industry and infrastructure to common area of territory (%),

b) unemployment rate (%, unemployed persons to working age persons),

c) personal income tax per capita (LVL),

d) demographic burden (population under and over working age per 1,000 population of working age),

e) density of population (inhabitants/km^2), and

f) persons with higher and secondary education per 1,000 inhabitants at age of 18 and older.

Socioeconomic Rating of Town and Townships in LWC

Town/ Township	Rating of Criteria (points)						Sum of Ratings	Total Rating
	a)	b)	c)	d)	e)	f)		
Weight	1	2	2	1	1	1		
Gaigalava	500	1,072	878	384	513	325	3,672	529
Nagli	537	912	814	289	541	200	3,293	472
Deksare	338	1,092	1,050	455	364	454	3,753	540
Rugaji	497	908	910	403	525	352	3,595	516
Lazdukalns	495	1,084	1,028	373	509	430	3,919	556
Berzpils	505	884	1,042	503	380	512	3,826	546
Lubana town	56	740	108	266	33	83	1,286	106
Varaklani	173	486	800	543	313	552	2,867	393
Indrani	145	982	496	530	557	534	3,244	464
Osupe	554	1,098	770	187	482	356	3,447	495
Barkava	476	842	592	71	349	117	2447	309
Murmastiene	534	1,086	1,018	527	529	424	4,118	564
Dauksti	212	550	766	364	410	314	2,616	358

Notes : Rating of Criteria = (Ranking No. in better order among 566 cities, towns & townships) x (Weight)
Source: Towns and Civil Parishes in the Administrative Districts of Latvia, Part 2, CSB, 1998

This table is the result of rating for 13 town/townships belonging to LWC. The total rating ranges from 1 to 566 since there are 566 cities, towns or townships in Latvia. It shows that 12 townships are between 50 % of worse developed areas according to the total rating, and 9 townships are within 20 % of the worst area. In particular, Murmastiene township in Madona district is ranked as the 3rd worst area in Latvia. On the other hand, Lubana town is within 20 % of the best area. Therefore, most of LWC has been already designated as the assisted area. This means that LWC has the opportunity for entrepreneurs and municipalities to receive the assistance according to the regulations. For instance, the Regional Fund is available for investment into statute capital, payment for bank credit percent rates, single payment for economical education activities, investments into local development funds, elaboration of regional development programs, infrastructural improvement, and activities for enterpreneurship promotion organized by municipalities.

3.1.3 Current Regional Development Plans

After the independence of Latvia, establishment of new systems of development planning began. Instead of directive and centralized planning system prevailing during the Soviet period, a system of open and democratic planning has appeared. It is based on the initiative of local municipalities, ascertaining of local development preconditions and possibilities as well as agreement on objectives and priorities of development. Recommendations for strategic planning have been worked out by MEPRD, which are suitable for the preparation of district and regional development plans. Local municipalities should publish reports about spatial development planning progress or the

implementation of the plans annually by the end of March. The municipalities of state cities and district councils insert their reports in the official newspaper "Latvijas Vestnesis" and local newspapers.

In the new planning system, local municipalities and inhabitants play an essential role on harmonization of state interests with those of the whole local society. Common national interests will be motivated and defined in the National Spatial Plan, which is under preparation. Local interests are depicted as concepts and programs in development and land use plans of rural and urban municipalities. The task of district and regional development and land use plans is thus to connect national and local interests, for creating preconditions for a long-term sustainable development.

The next table shows availability or preparation progress of development and land use plans for the local municipalities related to LWC. Development concepts or plans for Latgale region as well as all the four districts concerned have been already prepared, while only four townships in LWC have the plans, at present. Reviewing these existing development documents related to LWC, target fields stressed commonly are income improvement, unemployment problem, agricultural and wood processing, creation of business opportunities, environmental preservation, educational and infrastructure improvement, and collaboration with neighboring municipalities. But none of them set out any socioeconomic targets in a quantitative way for their future development.

Availability Status of Development and Land Use Plans for Related Local Municipalities

Region	District	Town or Township	Development Plan		Land Use Plan	
			Concept	Plan	Concept	Plan
Latgale			O (1998)	O (1999)	O (1999)	X
	Rezekne		O (1997)	△	X	X
		Gaigalava	△	△	△	△
		Nagli	△	△	△	△
		Deksare	X	X	X	X
	Balvi		O (1998)	O (1998)	X	X
		Rugaji	△	△	X	X
		Lazdukalns	X	X	X	X
		Berzpils	X	X	X	X
Vidzeme			△	△	X	X
	Madona		O (1997)	O (1997)	X	X
		Lubana Town	X	X	X	X
		Varaklani	X	X	X	X
		Indrani	O (1998)	O (1998)	△	△
		Osupe	O (1998)	O (1998)	O (1998)	O (1998)
		Barkava	O (1998)	O (1998)	△	△
		Murmastiene	O (1998)	O (1998)	O (1998)	O (1998)
	Gulbene		O (1996)	O (1996)	X	X
		Dauksti	X	X	X	X
National Level of Latvia			O (1996)	O (1998)	△	△

Notes: O = Formulated (approved year), △= Under preparation, and X = No action at all

(1) Latgale region

"Pilot Regional Development Plan for Latgale Region" had been formulated under the EU Phare National Program 1997, and officially adopted in September of 1999. The development area is Latgale, a traditional geographical area in the southeast part of the

country which has a significant concentration of unemployment and economic problems in the state. This most disadvantaged region was one of the areas dependent on the old economic structures and remote from the core of economic activity in Riga. The area chosen for the pilot project approximates to all Latgale region comprising six districts (Kraslava, Ludza, Rezekne, Daugavpils, Balvi and Preili) as well as Daugavpils and Rezekne cities.

The project objectives are to develop the capacity of Latgale region in relation to regional development activities, and to create an ability to effectively access national and international assistance programs, especially in the context of EU integration as well as self sustaining development of the region. The core body to implement the plan is the Latgale Regional Development Agency which is a new task-force body independent from any national ministries, but in technical and financial association with the local municipalities concerned. Development in Rezekne and Balvi districts, which belong to Latgale region, is supposed to coordinate with this higher level plan. Target branches and strategic objectives included in the plan are as below:

1) Target branches for sustainable integrated development

The plan concept states that there are three main branches to be developed in Latgale, namely, as food industry and processing of agriculture products, wood processing, and production of electrical products.

2) Strategic objectives of Latgale region

The main aims of the concept are to secure the local market, to compete in international markets with high value added products, and to create a favorable environment for business with the following strategic objectives:

- creation of favorable environment for investments on central and regional levels,
- development of human resource, communication infrastructure and quality increase,
- development promotion of the region by developing international transport corridors,
- development of effective agriculture, and new technologies in industries, environment and services,
- development of tourism based on nature and cultural resources, and
- development of small and medium enterprises

(2) Rezekne district

“Rezekne District Development Strategy” (1997) is the first plan for socioeconomic development in Rezekne district. This details economically motivated plans about the competitiveness in the particular areas. The planning team consists of the people from the towns and townships. This plan includes such strategies as a) to unite the financial resources of the surrounding municipalities while working at the particular project, b) to collaborate with neighboring regions (including foreign countries) in development, c) to attract foreign investments, d) to help mutually on the local municipality level, and e) to

improve the local inhabitant's income level and preservation of the harmonious environment.

(3) Balvi district

The development plan of Balvi district in 1998 has the development visions such as specified production of agricultural goods, saving of traditional countryside living way, extraction and recycling of natural resources, establishment of intensive transit communication, development of local and transit infrastructure, improvement of employment rate, and balanced development for environment and people. The plan is made for the administrative area of Balvi district, including 21 local municipalities, and it relies on the following general principles and concepts:

- local municipalities take part in plan elaboration and accept leadership of the district,
- spatial structure is planned on the base of the existing borders,
- Balvi district is inalienable part of regional planning for Latgale region, connecting its development with the general plan of the region, and
- plan respects balance between environmental and agricultural interests.

Toward these visions, the strategic directions for development are a) to strengthen education and technology, b) to increase effectiveness of information exchange, c) to develop service sphere and infrastructure, d) to expand forest industry and wood recycling complex, e) to carry out long term sustainable development in integration with environment, and f) to improve building material quality using local sand.

On the other hand, the Pilot Regional Development Plan for Latgale region also specifies the following development targets for Balvi district:

- education, enlightenment, and development of the information technologies (ITs) for information exchange/interchange efficiency,
- development of traditional rural way of living and production, including agriculture, rural tourism, education of the people living in the country-side, traditional crafts, horse-breeding, fishery, gardening, forestry, and honey-making,
- development of the border areas including border defense, control infrastructure, border area roads, cross-border cooperation of local authorities, cross-border tourism development, and promotion of educational/business cooperation,
- development of services and infrastructure as the basis for business activities which includes promotion of entrepreneuship, optimization of education/social/medical services, and development of transport infrastructure/communication,
- development of wood-processing and forestry,
- development of sustainable and economically integrated environment including nature protection system, improvement of the environmental quality, and balanced economic activities; and

- creation of the construction complex based on local resources such as clay and sand.

(4) Madona district

The regional development plan of Madona district in 1997 is the first conclusive document which expresses the development policy of the district. It serves as a means for practical management and control of district development. It has been worked out during the radical agricultural reforms and changes. Main development goals for Madona district are mentioned in the plan as follows:

- to found a stabile base for economical development of the district in order to secure the increase of inhabitants' financial well-being,
- to stimulate the formation of developed infrastructures including transport and communication system that secure development of the district in the local and international scale, satisfying the needs of inhabitants,
- to develop spheres of traditional industry and services, and to facilitate the development of new industrial sphere based upon modern technology, supplying inhabitants with new workplaces,
- to improve the engineer-infrastructure of towns and inhabited areas, supplying the inhabitants with water, electricity and communications,
- to create a positive environment that includes housing and education to satisfy social and economic needs of the citizen, securing environmental preserving and improvement,
- to counterbalance the interconnected development of the district with the rest of the regions, and
- to balance economical development among towns and country area.

(5) Gulbene district

The development plan of Gulbene district" formulated in 1996 is the first development document in the district. Its strategy is balanced development between the towns and rural areas. The plan stresses such fields as wood cutting and forest, dairy and meat cattle breeding, tourism, transit roads, and private sectors, as possible development ways.

(6) Indrani township

In 1998, the social and economic development program for Indrani township was formulated including general characteristics of the situation, short development program and goals of the township. Its development level is closely connected with the development in the whole Madona district of agriculture, forestry, tourism, culture, and education. The creation of the long-term and constant economic development using geographical benefits, natural resources, traditions, and historical inheritance are the main development goals mentioned in the program for the township where the local

environment is suitable for recreation and tourism activities in addition to agricultural and forestry products.

(7) Osupe township

The township made in 1998 its development plan titled “Social and Economic Development Program of Osupe Township”. It mentions that development of agriculture, recreation and tourism is potential development fields, and proposes 11 projects with financial sizes of 30,000 ~ 900,000 LVL. Main goals in the plan are:

- to create the appropriate conditions for economic development, using the geographical advantages, nature resources, historical and cultural traditions,
- to develop the infrastructure, including transportation and communication system that will correspond to the international demands,
- to create the new working places, and to improve the residents’ education level,
- to create the human environment appropriate to the education, spiritual demands, to offer more possibilities for spending free time and improve the environmental quality, and
- to continue the collaboration tradition with the neighboring townships.

(8) Barkava township

The social economic strategy of Barkava township was formulated in 1998. Its target year is 2005 with main strategic fields such as agriculture and agricultural processing, wood processing, craft, and tourism. The township’s development goals are improvement of residents’ welfare level, limitation of overgrowing of drained lands, preservation of coordinated development of surrounding townships, development of infrastructure including transportation and communication system, promotion of better demographic situation, and creation of appropriate conditions for business activities and agricultural industry in Teici.

(9) Murmastiene township

The social economic development program of Murmastiene township was made in 1998, the goals of which are to stimulate the residents’ economic activities, and to prepare the environment for further development actions. The concrete tasks proposed in the program are to find the possibilities for ecological and practical education system, to improve the infrastructure, to work out the economical and ecological management methods according to the geographical position and the local resources, and to find the possible economic contracts and investments.

3.2 Agriculture

3.2.1 National and Regional Development Policy

According to the Rural Development Program of Latvia prepared by MEPRD in 1998, the policy of agricultural sector has been set in the "Concept of Agricultural Development" prepared by the Ministry of Agriculture (MOA). Main objectives of the agricultural policy can be summarized as follows:

a) to facilitate the development of agriculture by using potential of Latvia's natural resources and social economy;
b) to develop agriculture into an industry which is able to integrate into the common European market and to produce goods able to comply with the requirements of the world's market by competing with the quality and production costs of goods produced in other countries;
c) to ensure a certain living standard acceptable to farmers, especially by increasing income of those engaged in agriculture; and
d) to promote the development of multi-functional agriculture, thus creating new jobs in rural areas.

In order to achieve the mentioned objectives, systematic and simultaneous work is needed in the following three areas:

- modernization of production technology in accordance with the requirements of environmental protection;
- improvement of quality system for the whole process of production and sales; and
- increase of sales possibilities for products.

3.2.2 Trends and Characteristics

In the Soviet period, the agricultural sector in Latvia was oriented to provide maximum supplies of meat and milk to the large northwestern Russian cities, particularly Moscow and St. Petersburg. State and collective farms were producing agricultural products by making use of a large amount of agricultural inputs such as fertilizers, agro-chemicals, and agricultural machinery. These activities had been one of the main causes of environmental pollution on rivers and lakes.

Since the restoration of independence in 1991, the Government of Latvia has taken many steps to lay foundations for establishing a market-based economy. These steps included de-monopolization in grain sector, price liberalization, and land reforms. Land reforms were intended to restitute the land owned by the state and collective farms to former owners. De-monopolization was intended to abolish the state monopoly so that competition between enterprises would be promoted. This process resulted in fundamental changes in farming in Latvia. From the original number of more than 600 corporate farms, only 120 to 130 were in operation at the beginning of 1996. Large scale farms now account for a small proportion of total agricultural production. The individual farming sector includes full-time and part-time farms, and private subsidiary plots where agricultural production is a complementary source of income.

Agricultural production in LWC experienced a significant decline during the years after independence. The following table indicates the trend of agricultural production in the Rezekne district during 1990 to 1998. All the main production dropped sharply after 1990.

Agricultural Production in Rezekne District (1990~1998)

(Unit: tons)

Main Products	1990	1994	1995	1996	1997	1998
Cereals	92,800	37,182	25,537	35,560	35,804	21,000
Milk	84,000	99,500	43,170	45,640	45,835	45,000
Cattle and Poultry	15,700	4,100	3,677	3,420	3,010	2,500

Source: Rezekne District Development Plan (RDC, 1999)

The decrease of the agricultural production after 1990 was caused by fast changes in the agricultural system such as the closing of the state collective farms and large-scale agro-processing industries as a result of the land reform without agricultural subsidies. The most serious issue in agriculture has been lower prices of agricultural products than prices of agricultural machinery and fuel. With the narrowing of Russian market and elimination of state purchases of agricultural commodities, most agricultural products lost the way out. As a result, most farmers lost their incentives for agricultural activities. The following table shows the change of farm products prices during the last 2 years.

Main Farm Products Prices (1997~1999)

(Unit: LVL/ton)

Main Farm Products	Prices in 1997	Prices in 1999
Wheat	120	59 – 63
Barley	100	50 – 60
Oat	115	43
Flax	60	80 – 100
Potatoes	65	80 – 120
Cattle meat	360	210
Milk	100	60

Source: Rezekne District Council, 1999

In Gaigalava, Deksare, Osupe and Murmastiene townships, farmers constitute more than 50% of the labor force. The land reform and privatization of agriculture has led to fundamental changes in farming. The result has been the fragmentation of agriculture into small-scale producers with the average size of holdings estimated to be 20 hectares and the great majority (64.8%) of small farms (2 to 10 ha). Large farms (over 30 ha) form only 6.4%. In Rezekne district, small farms constituted 84.9% of all farms, which was the second highest percentage among 26 districts in Latvia.

Distribution of Small and Large Farms

District	Small Farms (2 – 10 ha)	Large Farms (over 30 ha)
Gulbene	59.6%	3.5%
Madona	61.0%	8.6%
Balvi	70.7%	2.3%
Rezekne	84.9%	1.0%
Total in Latvia	64.8%	6.4%

Source: Latvia Human Development Report, 1997, UNDP

The most land was returned to private individuals. Private farms, including peasant farms and household plots, accounted for over 80 % of the total agricultural area in Gulbene and

Madona districts. The share of private farms in Balvi and Rezekne is lower compared to that in Madona and Gulbene districts as indicated in the following table.

Agricultural Land by Farm Category

(Unit: Area in 1,000 ha)

District	Agricul-tural Land	State Farms and Statutory Companies		Peasant Farms		Private Subsidiary Farms		Household Plots	
Gulbene	68.9	6.8	9%	23.2	34%	1.8	3.0%	37.2	54%
Madona	123.9	10.7	9%	74.8	60%	3.7	3.0%	34.7	28%
Balvi	94.1	25.3	27%	22.7	24%	0.5	0.5%	45.5	48%
Rezekne	122.4	29.1	24%	27.1	22%	1.9	2.0%	64.2	52%

Source: Statistical Yearbook (CSB, 1998)

Large farms with the landholding of more than 100 ha are producing grain and crops based on the mechanized farming system. The main income source of the medium size farms (30 to 50 ha) is from a combination of livestock and grain production. Most households with the small family plot of less than 10 ha are mainly involved in livestock production and vegetable gardens for personal use and small-scale direct marketing. Crop production in five townships is presented in Table 3.2.1.

For the success of the private agricultural sector in Latvia, the development of effective extension services was considered to be urgent. Under such a situation, the Latvian Agricultural Advisory Service (AAS) was established in 1991 in cooperation with MOA and the Danish government, and was converted in 1997 into a non-profit organization. AAS plays a key role in farmers' education and training of agricultural teachers/advisers, including environmental training. The environment is now a compulsory subject on the agricultural training curriculum at the university level. Environmental training is also provided in agricultural schools. AAS has a branch office at each district to conduct seminars, demonstration at farms, and education program. The printed materials for better farming are delivered to the farmers and consultants in townships, and students of the agricultural schools. AASs at Rezekne and Madona districts are promoting cultivation of cash crops such as cranberries, flax and rape seeds.

3.2.3 Potential and Constraints

In Latvia, constant increase in production expenditure that is not compensated by increase in prices of agricultural products makes agricultural production even more unprofitable. Small-scale producers can neither save up necessary resources nor get credits with acceptable interest rates in order to make the necessary capital investments, intensify and rationalize the production process. Without this it is impossible to compete successfully at the markets of agricultural and food products. On the other hand, non-traditional agriculture has new development possibilities of providing farmers with additional income sources. Currently new types of agricultural activities have started in Latvia. For example, 200 farms are engaged in biological agriculture with area of 2,760 ha, 76 of whom have received the Green Certificate. Thirty farms are growing cranberries on 850 ha of raised bogs, and herbs are being cultivated in the area of 80 ~ 100 ha. In addition, 100 ~ 120 tons of mushrooms were industrially cultivated.

According to the Latvian State Institute of Agrarian Economics, future market potentials and constraints of major non-traditional agriculture possible in Latvia are summarized as below:

a) Development of non-traditional agriculture is obstructed by the lack of experience, information, capital investments and credit services. The technical and financial support is necessary for Latvian farmers to have the profit from non-traditional agriculture.

b) In the recent years, purchase price of cranberries have increased in the U.S.A where about 90% of all the cranberries in the world are grown. There will be potential markets also in Europe and Asia where the cranberries are hardly produced.

c) There is a high demand for mushrooms such as Shiitake in the Russian market. When the Russian economic situation is improved, it will be possible to export the mushrooms there.

d) In the recent years, the production of flax fibers and seed has increased in the world, showing the high demand for this production. However, Latvia has such problems in growing them as lack of information and experience on the harvesting technologies, as well as no flax processing enterprises that are well qualified.

(1) Agricultural production and productivity

Agricultural land constitutes more than 30% in most townships except Nagli where agricultural land constitutes only 11% of the total area. There are 11,472 ha of agricultural land in Osupe township which are extending to the west of Lake Lubana. Agricultural land use of 12 townships in and around LWC is presented in Table 3.2.2. Although the soil condition in LWC is not so fertile as Dobele and Jelgava districts in the central part of the country, soils are still able to generate good cereal, grass, and legume crops. Production of cereals such as rye, winter wheat, barley, spring wheat and oat has been the main agricultural activities in LWC. Crops produced have been used for both human consumption and animal feed. Dairy farming including milk and meat production has long been conducted in LWC. In addition, potatoes, legumes and vegetable cultivation and tree crops such as apples and pears have also been conducted. Supplementary agricultural activities include bee keeping, and berries picking.

In addition to traditional production activities, some additional activities can be considered for the improvement of income level of the individual households. Cranberry is one of the important income sources for the rural population residing nearby Lake Lubana. In addition to picking of natural cranberry, MOA is promoting cranberry cultivation through AAS. Cranberries usually grow in swamp area. The high bogs with sand bases, small peat layer, and low groundwater level are the best soils for growing cranberries. The sand has a drying function. It is not necessary to build the additional draining pipes. The berries also grow in peat, light sand clay, clay sand and sand soils with average acid of pH 3 to 6.5. It is possible to get 5 kg of cranberries per 1 m^2 in very good weather. It is enough, therefore, to have a 25 m^2 garden for family needs. The profit appears even from the 0.1 ha (20m x 50m)

field that gives about 2-3 tons of berries every year. The average productivity can be 10 to 15 tons per ha. Under very good weather conditions, it could be 20 tons per ha.

Some local people like to collect mushrooms in the forest area. In addition to collection of natural grown mushrooms, it is advisable to cultivate some edible mushroom species such as the Champignon de Paris (*Agaricus bisporus*), shiitake (*Lentinus edodes*), and oyster mushroom (*Pleurotus* species). Promotion of mushroom cultivation is considered to give good opportunity for rural people to get additional income in the future. Flax production level dropped sharply after 1990 due to high cost of production inputs, lack of specialized machinery and unattractive producer prices. However, the prices have recently been improved. The Selection and Experimental Center at Vilani town in Rezekne district, a joint stock company, is producing linen oil from seeds of flax. Stalks of flax are usually sent to a processing company at Ludza district to extract fiber for making linen products. Flax cultivation is considered to have good marketability in and around LWC in the near future. On-farm production of dairy products such as cheese, yogurt, and butter also has potential to be promoted for additional income for rural population. On-farm dairy production aims to produce dairy products not only for self-consumption but also for marketing outside of LWC. Although the existing milk processing company is producing dairy products, possibility will arise for rural people to produce different type of dairy products to meet the local requirement.

1) Rezekne district

It is possible to grow cereals, linen, sugar beats, vegetables as well as bees, and to do pig and sheep farming. Among them animal production has been dominating as the climate and soil conditions are suitable especially for dairy farming. The main potential for agricultural development are divided into traditional and non-traditional sectors. The traditional sectors have mostly potential in the short run, while the non-traditional ones bring opportunities in the mid and long run. The main potential for traditional agricultural production is milk production. Farms of any size producing milk have the potential to earn cash money and participate in the market economy. The increase of productivity of the arable crops are a second potential. Arable crops are also considered to supply the livestock with feeds. Kinds of non-traditional agriculture in the district have potential if the marketing is assured. Growing of flax for oil has been identified as a potential for the district as the local farmers have already had experience in flax growing. On the other hand, people collect wild berries, nuts, mushrooms, herbs, Christmas trees and other decorative material in the state and private forests. The most popular are cranberries and red bilberry. But the production of strawberries and raspberries have a limited potential.

2) Balvi district

The district has almost the same potentials as Rezekne district although some potential areas differs from those of Rezekne district. The arable production has more vocation than dairy farming and animal production. The main potential can be found also in fruit production, especially apples, followed by the production of berries which have market

prosperity as well as the production of vegetables even for processing. And the other potentials such as milk production, arable crops and flax exist.

3) Madona district

There are potentials in dairy products industry and cereal growing, as well as a good environment condition that secures the development of clean agricultural production. There has been a successful development of those agricultural spheres that have their own processing enterprises, although the dairy processing enterprises need considerable investments for technology improvement at present.

(2) Commercial market

There are several food processing industries, including milk processing, grain processing, and meat processing, in Rezekne and Madona districts. Most of these industries are traditionally oriented to the Russian market. After the closing of the Russian market, these industries have difficulties in marketing their products. As a result, these industries reduced their procurement of agricultural products.

A dairy company in Rezekne district procured 300 tons of milk per day in 1998. However, the procurement of milk in 1999 has been reduced to about 150 tons per day. A sugar beet processing company in Jekabpils district has financial problems due to difficulty in marketing its products (refined sugar), and therefore many farmers in LWC failed to sell their sugar beet to this company.

1) Domestic market

Grains: Grain processing enterprises in Rezekne and Madona districts are the main marketing outlets. About 20 to 30% of the total production can be marketed excluding grains for animal feed. It is expected that output prices will gradually be increased in line with growing demand for grains due to increase in per capita consumption in the future.

Milk: Dairy processing enterprises in Rezekne and Madona districts are the main marketing outlets. It is expected that output prices will gradually be increased in line with growing demand for milk due to increase in per capita consumption in the future.

Meat: Meat processing enterprises in Rezekne and Madona town are the main marketing outlets. It is expected that output prices will gradually be increased in line with growing demand for meat due to increase in per capita consumption in the future.

Flax: The Selection and Experimental Center at Vilani and a linen enterprise at Ludza city are the main marketing outlets. Demand for flax for the production of linen oil and linen cloths is expected to increase in the future.

Cranberry and mushroom: Shops in the urban areas such as Rezekne city, Madona town and Lubana town will be the main marketing outlets. Demand for this kind of cash crops is expected to increase in the near future.

2) Foreign markets

Milk products: Russia, USA, Netherlands, and Israel are the main marketing outlets. Additional market could be identified in CIS countries. Improved food quality control will be needed to increase exports to EU countries.

Meat: CIS and EU countries are the main marketing outlets. Additional market could be identified in CIS countries. Improved food quality control will be needed to increase exports to EU countries. Meat demand in world market is increasing at the rate of 2.9% per year. Pig and poultry meat demand is increasing in EU countries.

(3) Constraints on agricultural development

A number of constraints for agricultural development have been identified in LWC. Main constraints are related to the market system such as reduced market demand, lack of market information, and low product prices. Low production level in LWC is due mainly to reduced demand in both domestic and export markets. Domestic demand has been reduced due to lower income level of the people. Export demand has been reduced due mainly to the closing of Russian market. Export possibility of agricultural products are very limited due to higher production costs including oil, chemical fertilizers, and machinery.

The problem of lack of market information has been expressed by township leaders as well as rural people. Dissemination of market information under the current information system will not be applicable to private farmers who account for the majority of rural society. Many farmers in LWC are not in a position to get profit from agricultural production due to unattractive producer prices and higher production costs. Therefore, it is very difficult for them to obtain credit services for agricultural activities. The current interest rate of 15% to 20% per annum is also a heavy burden for them. Most farmers have long been sealed off from the outside world under planned economy during the Soviet times. Therefore, they are not accustomed to a free market system. Farmer education on farm management and farm business planning skills will be greatly needed.

3.2.4 Intentions of Stakeholders

Through a series of interviews with township leaders in LWC, their concerns for future agricultural development are mostly on business environment. The need to create an appropriate environment for the business activities has been mentioned. For example, a new curriculum of book-keeping has been adopted at the agricultural school in Osupe township. The need to create the appropriate conditions for the agricultural industry has also been mentioned. Establishment of agricultural processing facilities in LWC will be necessary in the near future.

The local people's intentions on agriculture were presented in the informal meetings, especially related to land holding size, farming cooperatives, and environmental production. As a result of land reform, local people could get their former land (15 to 20

ha) back. However, they are aware that their land is too small to get enough income from agriculture. The land holding size of at least 50 or 60 ha is considered to be appropriate to maintain farmers' life. Experiencing the Soviet collective farming system, some farmers have mentioned that they would never organize any type of cooperatives. The others, however, have noted that they feel the need to form some kinds of organizations like a farmers association for joint marketing activities. The farmers know about biologically clean production (e.g. organic agriculture) that is supported by the EU countries, although they do not have enough knowledge about the biologically clean agriculture. They are willing to attend the necessary seminars or courses on this subject, because the biologically clean production can be the first step to establish the new market. Also, some younger farmers have expressed their positive attitude towards future agricultural development possibility. A young farmer mentioned that he obtained credit services from a bank to produce grains and certified seeds.

3.3 Forestry

3.3.1 National and Regional Development Policy

According to the Rural Development Program of Latvia prepared by MEPRD in 1998, objectives and basic principles of forestry development strategy and tactics in Latvia for a long term period (15~20 years) are determined by the Forest Policies in Latvia. The main objectives are a) maintenance of wooded area, increase of fertility of forests' lands and afforestation of land not used for agriculture or other purposes by using facilitation mechanisms which are at the state's disposal, b) sustainable development and profitability of the forest industry with ecological and social viewpoints and by providing maximum increase of added value, c) maintenance of forest's bio-diversity at the existing level and protection of stabilizing functions of forests, d) formulation and delimitation of objectives, functions and tasks for the management of private and state forests, and e) guarantees for obtaining necessary education and skills by developing forestry education, forestry science, and information system. In order to achieve these objectives, implementation of several activities as mentioned below is considered to be needed:

- to provide development of Forest Policy, elaborate implementation programs for the Forest Policy and necessary legal acts, and improve institutional system for supervision of all forests and management of state forests;
- to promote afforestation of lands not used for agriculture and in private forests by using partial support from the State Subsidies' Program;
- to elaborate normative acts in order to promote the development of co-operation and self-organizing structure of entrepreneurs;
- to elaborate proposals on guarantees for long-term credits and state subsidies in order to regenerate and plant 600 ha of private forests annually;
- to facilitate establishment of training and consultation system for forest owners; and
- to perform monitoring of forest in order to obtain objective information on the conditions of newly planted forests and changes regarding impact caused by pollution of environment.

In addition, appropriate activities are expected to be carried out by MOA in collaboration with MEPRD including long-term use of forest lands, increase of value in private sector, wood waste utilization in power industry, market regulation for wooden and non-wooden forest products, and quality management system with international and EU requirements.

3.3.2 Trends and Characteristics

Forests are one of Latvia's most valuable natural resources, having grown from 25% of total land area in the 1930s to 49% today. Forest areas increased rapidly in the 1950s and 1960s largely through natural and uncontrolled growth at agricultural land. The total forest area is 3.2 million ha, of which 2.8 million ha is considered to be productive forest land. The productive forest is divided into commercial forests (57%) used for wood production, and protected forests (43%). The utilization of the protected forests is restricted to light thinning and sanitary felling.

The forests of Latvia are mainly dominated by coniferous stands, including pine (*Pinus sylvestris*) and spruce (*Picea abies*), while birches (*Betula* spp.) are the most important broad-leaved species. Alders (*Alnus* spp.), aspen (*Populus* spp.), oak (*Quercus* spp.), and ash (*Fraxinus* spp.) are also present. The high share of broad-leaved species in the agricultural land can be explained by the natural growth and by inadequate silvicultural treatments.

The current standing volume amounts to approximately 490 million m^3, which is equivalent to 196 m^3 per capita. The annual growth amounts to 8.6 million m^3, which is 3.1 m^3 per ha. The volume of the present annual timber harvest is 8.4 million m^3, including 5.7 million m^3 of final felling and 2.7 million m^3 of intermediate felling. About 1,080 sawmills are operating in Latvia, producing about one million m^3 of sawn timber, of which 75% is exported to European countries. Wood industries in Latvia include 3 particleboard, 1 fiberboard, 4 plywood, and 130 furniture factories. In addition, there are 4 medium-capacity paper mills.

In 1997, forest land constituted about 86,800 ha in Rezekne district, of which the state forest accounted for 34,800 ha (40% of the total forest land) and the remaining (52,000 ha) are private and other forest. Gaigalava is one of the most densely forested township in the district. A greater part of the forests (69,200 ha) can be categorized as economic forests and the remaining includes restricted and protected forests. Coniferous trees constitute 57% and broad leaved species 43% which include hard broad leaved species such as oak and maple. The most frequent species are pine (37%), birch (32%), and spruce (20%). The annual production of round logs from the state forests in Gaigalava and Nagli townships is estimated to be 12,600 m^3, of which coniferous trees such as pine and spruce constitute 40 % and broad-leaved trees such as birch and elm 60%. Most pine and spruce logs are processed in the sawmills and sent by truck to Riga for export to Great Britain, Germany, and other European countries.

Forest land constitutes about 48.8% of the total area of Madona district, slightly above the average (48.4%) in Latvia. Madona is one of leading districts of wood resources in Latvia. The total reserves are estimated to be 16.7 million m^3 in the district. A part of the woods is forbidden to use for economical activities because they are located within the restricted areas where they are objects of scientific resources. The sawn timber and paper wood is exported to Denmark, Germany and Great Britain. There are about 190 small companies and farms that have the wood processing business. The local people collect wild berries, nuts, mushrooms, herbs, Christmas trees and other decorative materials in the state and private forests. It is allowed for the local people to collect berries in the state forest. The most popular are cranberries. One of the important roles the forests and wood could play is a tourism and recreational object. The need for tree plantation is felt by administrative staff in some townships. In Osupe township, tree plantation in the eastern part of the township, nearby Lake Lubana, is planned on the unutilized agricultural land. The township office is planning to discuss it with the landowners.

Forests account for 38% of the district area of Balvi, and the major part of the forests belongs to the state. Reserves of wood are on the average level in Latvia. The forests are evenly distributed in the district. However, there are areas with the increased wooded productivity, particularly in the western part of the district. In Rugaji township, tree plantation is also planned in the far western part of the township. Private persons or companies will be involved in this plan. Wood industries are one of the fast growing industries in Balvi district. There are 40 enterprises concerned with wood processing in the district. The biggest are Ziguri MRS and Balvi-Holm, which annually produce 85,000 m^3 and 30,000 m^3, respectively.

3.3.3 Potential and Constraints

(1) Forestry production

LWC is endowed with forest resources. There are approximately 380 km^2 of forest land in LWC, of which Indrani township accounts for 27%, Gaigalava 12%, Osupe 12%, Rugaji 10%, and Nagli 10%. On the assumption that the tree volumes cut in a year are equivalent to the removal of 1.6 m^3/ha, round logs production from the forests in LWC is estimated to be about 45,000 m^3/year. Based on average growth of forests of 3.1 m^3/ha/year, total annual growth amounts to nearly 90,000 m^3, exceeding the tree volumes cut in a year. The average age of trees is estimated at 50 to 60 years. The chief forester offices of MOA are in charge of forest management in state-owned forests. In addition, the offices also perform general control over all Latvian forests. They have responsibilities in the field of forest management towards the new private forest owners, e.g. restriction of illegal activities and offering consultancy services. The offices sell felling rights to these forests, negotiate long and short term logging contracts and organize timber auctions.

Coniferous species such as pine and spruce have a good marketability for domestic as well as foreign market. Sawn timber from pine and spruce are exported to Britain, Germany and Nordic countries. Afforestation of abandoned or unutilized agricultural land is one of

the major goals of national forestry policy. It is suitable to plant conifers (e.g. pine and spruce) and such deciduous trees as birches and fast growing aspens to obtain input for wood processing industries, pulp, and energy.

(2) Commercial market

1) Domestic market

Wood production from state and private forests are main forestry products in LWC. A logging company or a private person can conclude a long term logging agreement with the chief forester offices in the districts for a period of 20 years. The logs extracted from the forests could be sold in the form of round logs to the buyers. Local sawmills usually buy round logs from these logging operators. Round logs with a diameter of 18 to 45 cm are sold to sawmills for processing. Small size logs with a diameter of less than 18 cm are sold to pulp mills.

Sawmills in and outside LWC and wood industries (e.g. furniture and joinery) in Latvia are the main marketing outlets. Pine and spruce have good marketability as the construction and furniture materials. Birch and oak also have good marketability as materials for furniture and handicraft.

2) Foreign markets

Wood industries (e.g. pulp mills) in EU countries including UK, Germany, and Sweden are the main importers of round wood and sawn wood. Most sawn timber in LWC are sent to the traders in Riga for export to Britain, Germany, and Nordic countries. The timber, however, are sold without any drying, resulted in the low quality. Some sawmills outside LWC have started to dry the timber dry kilns so that they can produce sawn timber with better quality.

(3) Constraints on forestry development

Forestry in Latvia has a large development potential, although forestry is considered as matter of a national level in the Latvian forestry policies, not subject on the local levels. The constraints on this industrial sector are more concerned with institutional and financial capabilities for forestry management.

The existing legal system regulating forestry does not really correspond the present structure of forest property, so that it does not fully balance ecological and economic interests in forests. There is no long-term strategy of land use in Latvia, therefore there is no clear idea about areas to be afforested and their structure. It is necessary to work out action programs based on the forest policies, including legal and institutional actions for financial support. Many enterprises operating in forestry are in a small size, limiting their capital saving to make long term investments in forestry. On the other hand, private forest owners have lack of associative structure and forest management experience and knowledge.

3.3.4 Intention of Stakeholders

All the four districts concerned have possibilities to develop forestry for timber industrial purposes, because there are considerable wood resources. Reforestation of the idle arable lands will further increase the forestry potentials. Forestry and associated wood processing are employment sources in and around LWC where many sawmills and timber processing factories exist. Therefore, it is probable that local residents feel afraid of unemployment and make objections against the establishment of a large size of strict conservation area prohibiting forestry activities in LWC.

At the informal meetings, the farmers expressed their intentions to follow the Government policy of afforestation on the abandoned or unutilized agricultural land, in the hope that they will be able to get additional income from future forests. Local people thus think that forestry industries will give good opportunities for additional income for the future, as well.

3.4 Fishery

3.4.1 National and Regional Development Policy

Regional policy on fishery is based on the national fishery development policy prepared by the National Board of Fishery (NBF) of MOA, and coordinates the development of the fishery sector in Latvia. Objectives of the fishery development policy are summarized as below. They aim at rehabilitation of the existing fishery activities by introducing new technologies and species to increase market values.

a) to increase effective use of fish resources in inland waters (lakes and rivers) and to promote use of caught fish in the fish processing industry;

b) to increase market value for fish species and resources in inland waters and to multiply fish stock by artificial reproduction;

c) to renew and increase possibilities for fishery by implementing new technology of rearing, introducing new fish species, and developing training on fishery; and

d) to increase tourism possibilities based on fishing.

The Government of Latvia and NBF continues privatization of state-own fish farms as shown in Figure 3.4.1. Today, the Nagli fish farm is the only state-own farm with full carp-growing system, and is under discussion about its privatization.

(1) Licensing and control of fishery

The Civil Law of the Republic of Latvia has indicated ownership of lakes and rivers, namely 189 lakes and 39 rivers or their parts are state-owned and the rest waters are private. Since Lake Lubana, the Aiviekste river and other rivers in LWC are all state owned, their fish resources except for fish specially grown for re-stocking or marketing purposes in private aquaculture farms, are state property, and a legal framework for state-owned

property management is applied. The fishing rights on use of fish resources in Latvia are laid down by a) Civil Law (1937), b) Fishing Law (1995), c) Regulations on Lease of Water Bodies and Commercial Fishing Rights and Order on Use of Fishing Rights, and d) Regulations on Use of Fishing Rights in Private Water.

The physical and legal persons are allowed to fish in inland waters when they have concluded a lease contract on fishing rights with local municipality and they have received the fishing license from REBs. Upper limit of fishing right in terms of the length of fishing net is decided annually for each lake and river by NBF based on the technical recommendation from the Latvia Fishery Research Institute (LFRI) of MOA. As the representative of state-owner, local municipalities allocate the fishing right to fishermen within the upper limit noticed by NBF, and exchange the agreement on rent of fishing right with each fisherman. In case of Lake Lubana, four townships surrounding the lake (usually three except for Barkava which have no fisherman) shall have a meeting on respective quota before its allocation to fishermen of the townships. Fishermen rented the fishing right need to prepare application form indicating specification and number of fishing gear to be used, and submit it to REB of each district. REB issues fishing license to fishermen after approval of the application. A rental fee of fishing right is standardized as 20 LVL/year per 100m of net length. However, Osupe township in Madona district applies 20% discounted fee. The rental fee of fishing right is an important budget source for the Fish Fund and townships.

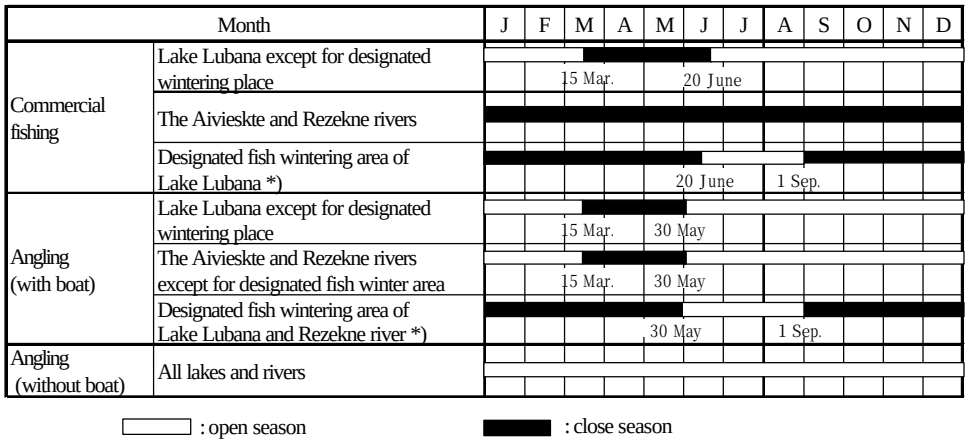
The Angling Rules in Latvia allows angling (recreational fishing) only after obtaining angling cards, which can be purchased at local shops designated by NBF at the prices of 1 LVL for 3 months and 3 LVL for a year. The angling card is not needed for the persons under the age of 16 and over 65, as well as for disabled people.

The Regulation on Licensing for Certain Types of Entrepreneur, approved by the Cabinet of Ministers (1996) states that a separate license is required to undertake the entrepreneur. In fishery sector, there are two types of license, namely fishery business and aquaculture. These licenses are in competence of NBF. Fish farms shall be inspected regularly by the veterinary offices in order to be certified health condition of fish and fish fry. In Rezekne district, Leici Co. which carries out integrated fishery business in Lake Razna and the Nagli fish farm in LWC are typical examples. A specific commission of NBF, which consists of the representatives from different institutions, now manages re-stocking of fish fry to natural environment. Some bio-technical standards of fish fry are set and controlled by LFRI.

Both commercial and recreational fishing activities are monitored and controlled by fish inspectors of REBs. There are three inspectors in Rezekne REB and two in Madona REB, who are responsible for patrol and inspection of all lakes and rivers in respective region using car, boat and snow mobile. Although they enable to coordinate with land guard groups, it seems difficult to inspect all area effectively by limited numbers of officers.

(2) Fishery regulations

An open and close season system is applied for both commercial and recreational fishing in Latvia. The fishing season and designated wintering place applied for LWC are shown in the next figure and Figure 3.4.2. Commercial fishing is conducted only in Lake Lubana. A close season is set from 15 March to 20 June for protection of fish spawning. This close season is longer comparing to other lakes, normally 15 April to 20 June, because the spawning of pike begins earlier than carp species. In addition, any fishing at a designated fish wintering area in Gaigalava township is forbidden from 1 September to 20 June of next year. Angling can be conducted in the lake and rivers, but the angling using boat is regulated by rule of close season slightly shorter than the period applied for commercial fishing. Attention shall be made for fish wintering place set for the lower stream of the Rezekne river up to Zogoti as well as that in the lake.



*) see Fig. 3.4.2

Source: 1) Freshwater commercial fishing regulation, No, 261, 1998,
2) Angling regulation, No. 223, 1997.

Open and Close Fishing Season in LWC

The regulation of commercial fishing (No. 261, 1998) indicates minimum size of fish to be caught. The minimum size by species inhabit LWC are 45 cm for pike and pikeperch, 50 cm for wel (a kind of catfish), 40 cm for eel, and 29 cm for ide, burbot, chub, tench, and asp (a kind of carp). The angling regulation (No. 223, 1997) also indicates similar criteria about the allowable minimum size. At present, there is no specific regulation for other species commonly caught in Lake Lubana such as bream, common carp, perch, and roach. The angling regulation indicates the daily allowable number of fish catch, such as five individuals/angler for pike, pikeperch, chub and eel, and three individuals/angler for wel.

Commercial fishing is prohibited within 100 m lake area measuring from the Aiviekste sluice gate (No. 261, 1998). Angling using boat is prohibited within 100 m downstream of the Aiviekste sluice in all the year. All angling is prohibited within 100 m both lake area and downstream around the Aiviekste sluice from 15 March to 31 May. There are some other regulations restricting fishing activities such as mesh size, fishing method, specific regulation on lamprey and crayfish fishing.

In order to conserve fish reproduction, the Fish Fund system was legally established in December 1995 (Cabinet order No. 388). This fund is an additional finance source specifically used for scientific research and countermeasures against environmental impacts on fish reproduction and resources. The fund is under jurisdiction of NBF, and managed by the Board of Fund which consists of 11 members from relevant Ministries including 2 representatives of MEPRD. Major financial source of the fund is comprised of parts of income from rent of fishing right, sales of angling cards, and fine from apprehended illegal fishermen. Seventy percent of rental fee of fishing right and angling card sales is deposited for this fund. The budgets provided from the fund to Rezekne REB ranged approximately between 5,500 and 15,000 LVL/year in 1997-1999.

3.4.2 Trends and Characteristics

During the Soviet time, the Nagli Kolkhoze established in 1950 was a single monopoly entity that carried out fishery, aquaculture and fish marketing in LWC. The Nagli Kolkhoze caught and cultured fishes based on the planned production target provided by the Moscow‘s administration. After the Soviet era, the state-owned company, namely Nagli fish farm succeeded parts of fishponds for continuous operation, while other parts were transferred to townships. Present ownership of thus divided fishponds is shown in Figure 3.4.1. The fishery-related activities other than the above fish farms were rendered for local people as private activity.

(1) Fishery Production in Latvia and LWC

A structure of marine and freshwater fishery production of Latvia was drastically changed after independence from the Soviet Union (1991) as shown in Figure 3.4.3. During the Soviet time, fishery production from the Atlantic Ocean was dominated in marine fishery, being 350,000-500,000 tons of fish catch, but thereafter it was decreased sharply to about 30,000 tons in recent years. In freshwater fishery, relatively high aquaculture production, 3,000 - 3,500 tons, was achieved in late 1980s, but the production was suddenly dropped to 500 tons level after 1991. Despite these drastic changes having occurred in the above two fishery categories, a production of marine fishery in the Baltic Sea and the Gulf of Riga and inland fishery did not fluctuate largely (Figure 3.4.3 and Table 3.4.1). This peculiar fishery production trend in Latvia indicates that the fishery in the Atlantic Ocean and the freshwater aquaculture production were closely related to fish production policy and fish demand of the ex-Soviet Union.

Table 3.4.1 shows a fish production of Latvia between the Soviet time (1986 to 1990) and the present (1998). Although the absolute production amount was decreased largely from about 525,000 tons to 102,000 tons, the relative importance of marine fishery is unchanged, contributing more than 99% of the Latvia‘s total fish production. Average inland fishery production of Lake Lubana during the Soviet time was 100 tons, which decreased to be 57 tons in 1998. In its adjacent area, a freshwater aquaculture has been carried out since the 1950s, and its production was reached approximately 1,500 tons in the late 1980s, which decreased to be 223 tons in 1998. A share of LWC among the total freshwater fish

production decreased in inland fishery from 15.8% to 11.3%, while increased in aquaculture from 46.2% to 53.7% between the Soviet time and the present as shown in Table 3.4.2. Although the production of freshwater fishery and aquaculture is minimal in Latvia, LWC produces significant amount of freshwater fishes. This suggests that the fishery and aquaculture activities in LWC have been important livelihood in this locality where industrial development was not largely pronounced. In addition to these commercial fishery activities, it should be noted that LWC offers favorable natural environment for large number of anglers at present.

(2) Natural conditions related to inland fishery in LWC

Lake Lubana is the largest lake in Latvia having about 8,000 ha of water surface, followed by Lake Razna 5,800 ha and Lake Engure 3,800 ha. Since 1983 when the current water management system was started in operation, Lake Lubana was a shallow reservoir facilitated with man-made dykes and sluice gates. At present the Rezekne river is a single source of water inflow to the lake. Outflow is regulated by two sluice gates, namely the Aiviekste sluice located at the north and the Kalnagala sluice at the southwest (see Figure 3.4.4). The lake water flows out directly to the Aiviekste river through the Aiviekste sluice. While, the water from the Izuvad canal flows out to the Meirani canal connecting to the main channel of the Aiviekste river through the Kalnagala sluice. The Aiviekste river runs into the main stream of the Daugava river, the largest river in Latvia connecting to the Baltic Ocean. Before establishment of this system, the Malta river was another water source of the lake. In order to regulate floodwater for agriculture during the spring period, the Malta river was diverted to eastward at the Nagli sluice and connected to the Rezekne river through the Malta-Rezekne canal or the Nagli fish farm No. 2. The original stream runs westward through the Nagli fish farm No. 1 and connected to the Idena canal (see Figure 3.4.4).

Before construction of the present dyke and gate system, water area of Lake Lubana was changed seasonally being less than 3,000 ha in autumn and winter, while more than 9,000 ha in spring causing inundation of adjoining lands. At present, water area is fluctuated approximately as follows except for extraordinary year. The lakebed is mainly silt, and in some places like the northeast part belonging to Gaigalava township are fine sand with little pebbles. Reed is the major surface vegetation, and bulrush and other water plants are also seen in fewer amounts. These plants are found approximately 30% of the lake area.

Seasonal Change of Water Area

Season		Elevation (m)	Surface Area (ha)	Depth of Lake (m)	
				Max.	Ave.
Spring (March to May)	High	94.5	8,600	4.5	3.7
	Low	93.5	8,000	3.5	2.8
Autumn to winter (Sep. to Jan)	High	92.0	7,800	2.0	1.4
	Low	91.5	6,500	1.5	1.2

Source: Rezekne REB, 1999/2000

Although little information is available about water temperature of Lake Lubana, a seasonal change of water temperature was estimated by integrating spot data and empirical information from fish inspectors of Rezekne and Madona REB as shown in Figure 3.4.5. Surface layer of the lake is usually completely iced during winter from December to February. The layer of ice extends 0.8-1.0 m deep. Temperature increased gradually from March to July up to 22℃ in mid layer. At that time water temperature at surface layer will reach to be 30℃. This large fluctuation of water temperature associated with shallow and wide water area forms unique and important nature of the lake.

LFRI carried out a zooplankton and zoobenthos survey of the lake in 1997. The result is summarized in Table 3.4.3. Number of zooplanktons such as rotatoria and cladocera are apparently abundant in Madona district or northwestern shallow area than in Rezekne district or southeastern deeper area. Since most fish larvae are hatched and start feeding in the survey period of June to, the northwestern area seems to play an important role as nursing ground of fishes. A distribution of zoobenthos is not uniformed. In both districts, species of chironomidea and oligochaeta are dominant in terms of number of individuals. Zooplankton species seems diverse in the northwestern shallow area comparing to southeastern deeper area. On the other hand, biological abundance in weight is higher in Rezekne than in Madona due to relatively large size of chironomidea and mollusca species collected. It suggests that the southeastern area is important both for juveniles and adults of fishes.

(3) Inland fishery and commercial fishing

The fishery production of Lake Lubana was 10 - 30 tons during the 1960s and 70s, which increased largely in the late 1980s with a peak of 136 tons in 1987 (see Figure 3.4.6). This could be related with construction of the Aiviekste sluice and application of the present water level management system in 1983, which contributed stable seasonal fluctuation of the lake water level. Major species caught in Lake Lubana are divided into pike (Salmoniforms), carps (Cypriniforms) and perches (Perciforms). A production of these 3 taxa groups corresponds to nearly 100% of fish production of the lake. In the late 1980s, carps dominated sharing about 65%, while in recent years share of pike and perches (pikeperch and perch) increased mainly due to reduction of carp production as shown in Figure 3.4.6. A species composition is pike 47%, perches 21% and carps 32% in 1998 reflecting effect of market economy. Although the bream, white bream and roach stocks are more sizable, the commercial fishery is targeted for the catch of economically valuable species like pike, pikeperch and perch. Table 3.4.4 shows the production of the above 3 species groups in Lake Lubana during the period from 1994-1998. One of the important characteristics of fish catch in the lake is high production share of pike and pikeperch of the country being 55% and 21% on average, respectively.

The recent years‘ cumulative net length of fishing right for Lake Lubana of 3 townships are constantly about 17,500 m. Number of licensed fishermen is 17 in Nagli, 6 in Gaigalava and 37 in Osupe, and total net length allocated are 6,565, 2,000 and 8,770 m, respectively as shown in Table 3.4.5. In Nagli and Osupe, allocated net length per licensee differs

largely from 30 m to 1,500 m. Very small-scale fishermen who are licensed with less than 100 m net length consist 25% in number but their cumulative net length is only 6%. On the other hand, there are 2 fishermen (3%) who operate each 1,500 m net or 17% of share in cumulative net length. In Gaigalava, there are only medium-scale fishermen operating 200-500 m net each. These licensed fishermen usually operate fishing with other licensed fishermen or several assistants who have no fishing right at actual base. Although exact number is not available, roughly about 100-150 people are estimated to engage in commercial fishing activities in the lake.

Although allocated length of net is longer in Osupe township, the actual fish catch is much larger in Rezekne district than that of Madona district for almost all species as shown in Figure 3.4.7. Based on the inquiry survey to fishermen in Nagli township, 1.0-1.5 kg of fish can be caught per 50 m net in fishing season from 20 June to the next 15 March. Based on an average total fish catch from 1994-1998, a catch per unit effort (CPUE) is calculated to be 4.5 kg/m/year for Rezekne (Nagli and Gaigalava) and 1.7 kg/m/year for Madona (Osupe). This estimation corresponds to the result of inquiry survey and natural conditions of the lake approximately.

3.4.3 Potential and Constraints

Since 1992, the fishery production level in Latvia dropped sharply mainly due to privatization of the fish farms and closing of the Russian market upon the Latvian independence. At present, most of the fishery products are directly consumed in the country, not exported with value added through the processing systems. A large expansion of the foreign and domestic fishery markets can not be expected because of the saturated demand for fish products. But it will be only possible to grow and export crayfish to many European countries, which have a high demand.

Fishery and fish processing industry have a potential profit around Lake Lubana, as far as a large investment for reconstruction of equipment is provided. Fish letting into the lake is not necessary, because there are rather good conditions for fish reproduction. Hydro technical buildings exploitation for the increase of fish resources should be made to provide fish spawning time and wintering with good conditions. Fish can use the whole lake territory for the spawning practically.

(1) Commercial fishery

A marketing value of fish per fisherman (M) can be estimated by the following calculation based on CPUE, average selling price of fish (P = 0.6 LVL/kg), licensed net length (L = meter), and % of fish sale to market (a):

Rezekne: $M = CPUE \times P \times L \times a = 4.5 \times 0.6 \times L \times a = 2.70 \times L \times a$

Madona: $M = CPUE \times P \times L \times a = 1.7 \times 0.6 \times L \times a = 1.02 \times L \times a$

Supposing that about 10% of fish catch is used for self-consumption, the income of fisherman who operates 300 m registered net in Rezekne is calculated to be 729 LVL per

year, and that in Madona, 275 LVL. When fisherman‘s annual income is the same as an average in LWC (83 LVL/month or 996 LVL/year), fishing activity contributes 73% of annual income in Rezekne, while only 28% in Madona. It means that the inland fishery could be generally a sideline business especially in Madona.

In the Soviet time, significant amount of fish fry was released continuously to Lake Lubana as shown below. Although some eel fry were recorded to release in 1993, these fry re-stocking activities have been stopped in recent years.

The Amount of Released Fish Fry

Species	1970s	1987	1988	1989	1990
Crucian carp (head nos.)	0	126,000	52,000	15,000	614,000
Common carp (-ditto-)	0	0	0	0	550,000
Pikeperch (-ditto-)	100,000	0	0	0	0

Source: Regulation of Fishery Exploitation of Lubana Lake, 1998, LFRI

(2) Angling (Recreational fishing)

On the other hand, fishery development perspectives are connected with an overall rural development of the national level, especially considering development possibilities of angling both in public and private water-bodies. It will depend on development of service sector connected with angling in the countryside, such as establishment of network of private hotels near rivers and lakes, rent of boats and fishing tackle, informative and guide services, as well as cooking facilities for the caught fish.

Approximately 10,000-15,000 members are registered of angler‘s organizations in Latvia today. At the same time, numbers of fishermen who obtain the angling cards exceed 90 thousand people. It means that more than 100 thousand persons are participated in angling in Latvia. Despite of importance of fish catch by recreational fishing, there is no available and reliable statistic data. According to the recent report entitled the Current Status and Trends in Inland Fisheries Latvia (1999), the total angler’s catches are supposed to be comparable with the registered professional fishermen‘s catch. Although commercial and recreational fisheries exploit similar fish resources, the amount of fish catch by recreational fishing has been ignored in the study related to fishing limit for commercial fishing. This may cause some underestimation in stock volume assessment. Besides, the illegal fishing of some anglers are another recent problem in Lake Lubana as well as many other lakes in Latvia.

(3) Aquaculture

The Kvapani ponds of Gaigalava township and the Idenas ponds of Nagli township were operated with pump-up water from the Rezekne river in the Soviet time. However, since this method appeared not viable financially under market economy, pump station has never been used thereafter so that the fishponds have dried up partly. Both Gaigalava and Nagli townships have decided to lease these former pond areas to several private persons or companies for their own business development. At present, no aquaculture activity is seen in Kvapani and Idenas ponds. Based on information from Nagli township, a lease fee

is 1.5-2.0 LVL/ha/year and a lease period is 10-15 years. Since there is no specific restriction on use of the leased area, a recreational or tourism development plan facilitated hotel, cottage, hunting field, and charged angling ponds could be introduced in the most leased areas.

Since the Soviet time, the Nagli fish farm has been producing common carp of marketable size, and its production was 1,500 tons using a total of 3,200 ha of fishponds with more than 300 employees. However, the fish production was only 223 tons in about 1,500 ha fishponds with 56 employees in 1988. A carp production of the farm could contain several disadvantages about unfavorable natural conditions such as severe cold winter of no fish growth expected. Fish have to spend at least 2 winter periods in wintering ponds with maximum depth of 4 m. It compels to take 3 - 4 years from larvae to market size of 0.5-1.0 kg.

According to an inquiry survey to the farm manager, only one-sixth of actual amount of produced fish can be sold to the market though the statistic fish production is more than 220 tons per year due to much lower demand. At present, the farm sells 1 ton of live carp to Riga a week from September to April, but a demand in Rezekne or other rural districts is very small as 300 kg/month. Thus the actual annual sales of the farm are roughly estimated about 35 tons or 24,500 LVL when the wholesale price of carp is 0.7 LVL/kg. On the other hand, salary of one employee is 60 - 70 LVL/month except for some specialists who are paid for 180 LVL/month. So, about 50,000 LVL is required for salary payment. Although there is supplemental sales of fish fry (about 4,000 LVL/year), it is obvious the farm is financially loosing now. The manager of the farm suggested that increase of imported cheap carp from Lithuania, made the situation worse. It is known that these imported carp are cultured in warm wastewater from an atomic power plant in Lithuania.

As for an alternative aquaculture practice, the farm started seed production of pike and crucian carp for re-stocking purpose. Spawners of these species are caught from Lake Lubana, and eggs are obtained by artificial fertilization at the hatchery of the farm. Produced fry are sold to municipalities for re-stocking, for which the Fish Fund provides subsidy. The price of fry is 2.95 LVL/1,000 fry (swim-up larvae) for pike, and 0.24 LVL per fry of 10g size for crucian carp. The Nagli fish farm has received 4,000 LVL from the Fund in 1999 by fry production and re-stocking activities. In the year 2000, about 2 million pike hatchlings (swim-up larvae) were produced and released to lakes in Latgale Region except for Lake Lubana and Lake Razna where subsidy is not provided from the Fund at present.

(4) Fish Marketing and Processing

There is no systematic marketing strategy in the inland fishery within LWC. Fishermen sell fish individually or sell to irregular fish buyers. Carp produced in the Nagli fish farm is mostly sold and transported to Riga by trucks. Approximate marketing prices of fishes produced in LWC are shown below. At present there is no fish processing factory operated in LWC and its vicinity.

Marketing Price of Fishes Produced in LWC

Species	Price (LVL/kg)	Relative market demand
Pikeperch	0.9-1.2	Very high
Pike and Perch	0.7	High
Burbot and Wel	0.5	Moderate
Carp	0.5	Moderate
Carp (live at Riga)	0.7	Moderate
Tench	0.4-0.5	Moderate
Ide, crucian carp	0.2-0.3	Moderate
Bream	0.2-0.3	Low
Roach and White bream	0.1-0.2	Very low
Eel	1.50	High (but rare in LWC)

(5) Constraints on fishery development

The following constraints are identified for inland fishery practices:

1) Low market demand for freshwater fish

This is particularly for major carp species caught in the lake. Bream usually is unsold, meaning to be sold together with more valuable fishes like pike and pikeperch.

2) No local organization responsible for fishery resource management

REBs are responsible for law enforcement about fishing activity, but not responsible for fishery development and fishery resource management which are tasks of NBF and LFRI. Up to now fishermen have not been organized only appealing their opinion at random. Complicated administrative boundary applied for the lake historically seems to be another constraint for overall resource management of the lake.

3) Illegal fishing

There is significant number of illegal fishermen who operate gears during fishing close season or who use prohibited fishing method like electric fishing and fine mesh net. These include anglers who come from Rezekne, Riga and other regions.

4) Fish mortality during winter

This phenomenon was observed in 1995 - 1996 when water level was too low for fish to survive. Some fishermen believe that it is caused by water demand of the Aiviekste hydroelectric power station. However, it seems mainly due to exceptionally small rainfall in the former autumn.

5) Fish damage by cormorants

Apart from the financial problem in carp culture, invasion of cormorants could be serious. They mostly fly from Russia from April to September and feed on a lot of fishes of ponds. Supposing that one bird eats 0.5 kg fish/day and average 500 birds attack to the fishponds for 150 days (5 months), loss of fish is estimated 37.5 tons or about 26,000 LVL (0.7 LVL/kg). This is equivalent to 17% of the present annual production amount of the farm.

The above problems concerning the cormorants could be supplemented by long-term research data of the Institute of Biology of the University of Latvia, which has elaborated more detailed analysis about physical losses caused by the birds and envisaged counter measures to be implemented by the fish farms. In case when those measures result in failure, state financing will be considered in order to compensate the losses. In 2000, the state is going to allocate some subsidies for the purchase and installation of equipment to protect the farms from birds and other predators.

3.4.4 Intention of Stakeholders

Opinions and intentions on fishery were collected from local people at the informal meetings, which varied from technical to institutional aspects. For them, the local authorities seem to ignore the local people's worries about the loss of fish. It was commented that the authorities should pay more attention to re-stocking of fish in Lake Lubana and its surrounding rivers. The local people mentioned that LWC is recommendable for eco-tourism need, and that the greatest problem is how to transport fresh fish to the market. As for its institutional aspect, local fishermen expressed the need to establish a responsible body to control fishery in Lake Lubana and surrounding waters. There is thus a great need to have one coordinating authority that would manage Lake Lubana area like one unit.

3.5 Tourism and Others

3.5.1 National and Regional Development Policy on Tourism

The tourism sector is managed by MEPRD, under which the tourism policy organization consists of the Latvian Tourism Consulting Board (LTCB) concerning with the policy of tourism and the Latvian Tourism Development Agency (LTDA) concerning with the implementation of the policy. LTDA promotes the tourism of Latvia as a whole. So far they have participated in 15 international tourism fairs, e.g. in London by the World Tourism Association, and in Berlin by the International Tourism Board. LTDA also publishes tourism brochures, pamphlets, posters and other materials for promoting the Latvian tourism. Currently they are supporting the preparation of National Program for Tourism Development. Although overall national policy on tourism has not been prepared yet, the above Program will set the national policy for year 2000~2010. On the other hand, one chapter of the National Development Plan drafted in October 1999, is for the tourism in Latvia. The primary items for the tourism development stated there are a) marketing for tourism, b) tourism product development, c) development of tourism infrastructure (including information network for the tourism, road sign and signpost, and d) education and research. These items will be integrated in the program under preparation.

According to the new state regulation about the tourism effective from January 1999, municipalities have the following duties in the field of local tourism development:

- to prepare the tourism development plans with its development possibilities,

- to advertise the tourism of its own municipality,
- to preserve the tourism resources,
- to take part in funding and financing of the tourism information center, and
- to educate the local society on the tourism issues.

However, in general, most local governments do not have appropriate personnel with experiences in tourism development to cope with the new state regulation. Therefore, there is hardly a district policy on local tourism, and few municipalities have any section which bears a name of tourism. For instance, in Rezekne district the Territorial Planning Department takes care of tourism. In Rezekne city there is a tourist information center, which is the only section to deal with the tourism in the city government, being placed directly under the mayor. Regarding the eco-tourism development, the both national and regional policies do not have a specific statement. However, LTDA has a web site where the eco-tourism in Latvia is briefly introduced. Main topics here are an ecologically sound agricultural system, bird watching, hunting, nature reserve, and bicycle tour.

3.5.2 Trends and Characteristics on Tourism

Latvia, together with the other two Baltic States, was an unknown country to most of Europeans, until they suddenly appeared on the scene in late 1980s by the break-up of the Soviet Union. Latvia is thus new in the world market of tourism, although during the Soviet period Latvia was one of the popular destinations among people who were restricted from going outside the Soviet Union. Riga city located on the Baltic coast is Latvia's chief visitor magnet. It is the biggest and most vibrant city in the Baltic States. Several other attractive destinations are within day-trip distance of Riga.

The next table shows the number of foreign tourists coming to Latvia, and their average length of stay. Figure 3.5.1 shows the figures in 1998. The number of incoming foreign tourists was in the peak in 1997, and slightly decreased in 1998. Most of the foreign tourists are coming from the other Baltic countries of Lithuania and Estonia.

Tourism to Latvia

Nationality	Travellers				Average length of stay (visitor nights)		
Year	1996	1997	1998	%	1996	1997	1998
Lithuania	654,100	587,795	621,459	35	0.6	0.6	0.6
Estonia	392,800	467,648	454,876	25	0.4	0.5	0.5
Russian Fed.	202,700	187,300	146,352	8	10.2	8.7	9.1
Finland	85,300	125,925	128,376	7	2.4	1.2	0.8
Sweden	31,500	69,015	86,175	5	5.1	3.8	3.7
Germany	112,400	67,042	71,399	4	5.8	3.3	3.2
Poland	47,600	27,499	56,061	3	1.1	0.9	1.2
Belarus	25,500	32,216	27,198	2	2.2	3.9	3.7
United states	29,100	37,377	23,697	1	3.0	4.5	9.4
Denmark	12,000	42,774	16,159	1	3.4	7.2	5.0
Others	157,000	179,465	169,557	9	6.6	5.3	4.2
Total	1,750,000	1,824,056	1,801,309	100	2.9	2.4	2.1

Source: Central Statistical Bureau, 1999

However, the next table shows the tourists from Lithuania, Estonia, and other countries of the previous Soviet Union are in fact visiting their relatives and friends in or just passing

through Latvia. Finland sends the largest percentage of 35%. That is followed by the United States, Denmark, Germany, U.K., and Sweden, indicating that Europeans and Americans will be growing markets of the Latvian tourism.

Purpose of Trip by Country of Residence (1998)

(Unit: %)

Nationality	Business	Visiting friends, relatives	Shopping	Holiday, health, treatment, sport	Transit	Other purposes	Total
Finland	15.9	1.5	0.0	17.6	54.7	10.3	100
United States	29.8	22.2	0.0	15.2	0.5	32.3	100
Denmark	54.7	19.2	0.0	14.8	9.1	2.2	100
Germany	27.0	15.3	0.0	13.1	37.1	7.5	100
U.K.	51.6	23.2	0.0	11.6	10.9	2.7	100
Sweden	31.8	18.4	0.8	10.9	10.3	27.8	100
Russian Fed.	32.2	43.0	0.0	8.0	10.1	6.7	100
Poland	22.5	7.1	0.0	7.6	54.6	8.2	100
Belarus	8.8	69.4	0.4	6.1	9.1	6.2	100
Ukraine	15.6	71.6	0.0	5.1	2.7	5.0	100
Estonia	18.6	16.9	6.3	3.0	41.9	13.3	100
Lithuania	20.4	25.8	3.7	1.9	39.2	9.0	100
Total	22.5	21.4	2.9	6.0	36.0	11.2	100

Source: Central Statistical Bureau, 1999

Figure 3.5.2 shows the points of entrance of foreign tourists to Latvia. It shows that only 10% of total tourists are coming through Riga. There are 6 entrance points closer to LWC. A total number of tourists coming from these 6 points is over 2 millions. Considering this figure and the fact that Rezekne city is the crossing point of two major railways of Riga-Moscow line and St.Petersberg-Warsaw line, Rezekne city has a good possibility of receiving a larger number of tourists.

LWC is also new to tourism markets. Even bird watchers and conservationists in Europe knew very little about LWC. There is no statistics of the tourists to LWC, since neither districts nor townships take their own statistics related to local tourism. At present, local municipalities are seeking a possibility of developing LWC as an eco-tourism and rural-tourism destination. Among the 13 townships/town belonging to LWC, Indrani and Gaigalava townships as well as Lubana town have shown their strong interests in the eco-tourism development. Gaigalava township currently has a plan to develop a small project to encourage eco-tourism at Lake Lubana. This contains bird observation places, boat mooring, car park, and improvement of the existing structure and roads. Indrani township has prepared by themselves a draft brochure of interest points for the eco-tourism within the township. Lubana town used to have a plan to construct a museum to exhibit the archeological findings in LWC, although it was not implemented because of financial difficulty.

3.5.3 Potential and Constraints on Tourism

MEPRD implements informative program for tourism, including cultural history of Latvian countryside and towns and relating it to the development of rural infrastructure and tourism service. The program is financed from the state's budget as well as tourism organizations.

Since demand for recreation in rural areas grows, farms have begun to be re-orientated from traditional agriculture to reception of tourists, to widen the existing premises and build new cottages for guests. People pay more attention to additional proposals, such as horse riding, boat rent, rural bathhouse, guide services, rent of sport equipment, angling, excursions in the vicinity, and farms for demonstration. In 1997, 61 farms received tourists, 78 farms in 1998, and 22 more farms are preparing to start this business in 1999. For the last five years, 4,000 tourists booked their holidays in rural areas in 1997, 20 % of whom were from abroad compared with 8 % in 1995.

Rezekne district has been described as "Switzerland of Latvia" giving the image of meadows, pastures and fodder crops surrounded with woodland and lakes. All these landscapes are tourism and recreation objects. The location of Rezekne district gives the possibility to develop the relations with Eastern, Western, and Russian markets. Potentials for tourism industry development have been used insufficiently in Madona district. Clients of tourism in the district will be a middle layers of people as well as foreign tourists who are interested in spending their time in untouched nature area in environmentally healthy situation. The west-east transport passage creates good conditions for development of service structures, and road network is well developed mainly in the center and the northwestern part of the district.

Since LWC is an unique ecosystem even in Latvia, forests, meadows, marshes, ponds, and Lake Lubana altogether can offer good resources for eco-tourism and rural tourism. LWC's potential resources and constraints on tourism are defined below.

(1) Ecological and archeological resources

Among bird species, tourists usually can expect to see beautiful corncrakes, thousands of swans, black storks and white storks, geese, wild ducks, cranes, and birds of prey. Black stork is rarely observed in the other parts of Europe, but here it is not difficult to see. White storks can be observed almost everywhere in LWC during the season. This situation itself can be a potential resource of eco-tourism, since white storks are becoming rare in the other part of Europe. It is not easy for usual tourists to see mammals directly, but beaver, otter, elk, and doe can be expected to be observed. There are many beaver dams along the Balupe river flowing through the northern part of LWC, though beavers can not be seen during the daytime. The species of fish in LWC are not rare species, but can be utilized for angling which is a potential product of tourism. There are several fishponds in LWC, and the way of catching fishes in a pond is dynamic such as catching of all fishes by draining water from a fishpond. This can be a potential attraction for tourism. There are extended raised bogs that should be carefully preserved. These sites should not be open to mass tourists, but can be used as a board walk area. The Teici nature reserve and Lake Razna are also rich in eco-tourism resources, so that the attractiveness of LWC can be multiplied by providing eco-tour objects jointly with them.

Archeological ruins are other tangible resources for tourism. As it is shown in Figure 3.5.3, archeological sites in Latvia are concentrated in the eastern part of the country, especially

around LWC area. So far 25 sites have been found in the area (refer to Figure 3.5.4). This area has been producing amber products since the stone age, and the amber products were exported to the other parts of Europe as far away as Greece since the beginning of AD.

(2) Landscape resources

Various landscapes in LWC can be characterized by land use and wetland vegetation. On the whole, distinctive landscape in LWC has potential to attract tourism development. Some elements consisting of the typical landscape in LWC are shown in Figure 3.5.5.

Wide agricultural field and meadow with studded farmhouses on the flat topographic condition can be seen in and around LWC as a peaceful rural landscape. Natural and afforested forest are mixed and extended in LWC. Deciduous forest makes beautiful scenery in fall. Many abandoned fishponds and its facilities are located on the southern part of Lake Lubana, while some fishponds are being operated. Many water birds are observed in these fishponds as well as Lake Lubana. People enjoy angling in riverside of the Aiviekste river and other small streams with calm flow.

Wetland vegetation and various kinds of animals create a landscape of nature in LWC. Raised bog area locating within LWC create a distinguished landscape. Thousands of migratory birds come flying into LWC in spring. Water birds are crowded on the surface of Lake Lubana and flying away, and a remarkable landscape is created. It will fascinate not only bird watchers, but also urban tourists in and outside of Latvia. Also, it is noted that many white storks can be seen from spring to fall in and around LWC. Their nests are placed in any places at high points such as top of the electricity poles, on the roof of farmhouses, and trees near farms. They get on well with local community and create peaceful landscape.

(3) Constraints on tourism development

The current constraints of LWC in terms of tourism are as follows.

1) Lack of information and advertisement

The publicity about LWC is very limited and not easily available to most people who can be potential tourists. Even though LWC is unique in ecosystem and many special birds and animals can be observed here, people hardly know about this fact. Only a few people, who have a special connection to specific information source such as ecological societies in Latvia, can have an opportunity to know about this area.

2) Difficult access to LWC

Since LWC is quite large (about 814 km^2) and open, there are many roads to go into the site. But tourists access routes to the site are mainly from Rezekne city via Gaigalava township and from Madona town via Lubana town. Both routes take approximately one hour by car to the LWC entrance points. From there it is about 7~10 km to Lake Lubana. The road pavement to Gaigalava township and Lubana town is not well. Most roads inside

LWC are unpaved. The other two entrance points at Barkava and Varaklani townships are used by one-day-trip tourists from Riga.

3) Insufficient tourism facilities

There are insufficient accommodations around LWC. Within 60 km radius from Lake Lubana there are 5 hotels (309 beds), 2 motels (14 beds), 8 youth hostels (380 beds), and 4 private lodges (22 beds) as listed in Table 3.5.1. But these accommodations are neither well publicized nor easy to find for general tourists. Among these there is only one hotel which is good enough for foreign tourists use. Also, quality of services to tourists are generally at a low level, a leftover from the Soviet time.

4) Limited flow of tourists

Tourists who come to Rezekne city from Riga tend to go to the southern part of Latgale region, which has more attractive tourism products, many beautiful blue lakes, nature park, and famous cathedrals. General tourists coming all the way to Lake Lubana are very limited.

5) Weak magnet for tourism

Although LWC is unique in its ecosystem not only for Europeans but also for Latvians, tourism resources are very special ones, which attract specific people who are oriented to or have special interest of the local environment. It is not a kind of product which will attract a large number of general tourists. In this sense similar products can be found in the Teici nature reserve though it is much more restricted to enter and to utilize the reserve than LWC.

6) Inefficiency cooperation among tourism organizations

Cooperation between central and local governments, Tourism Information Center (TIC), entrepreneurs providing services for tourists, tourism associations and tourism marketing companies is not efficient. There is a lack of understanding that they all are in one chain for development of complete tourism product. There is no common understanding of what kind of tourism product should be developed and what is the potential for development.

3.5.4 Intention of Stakeholders on Tourism

From the discussion among the local participants in the informal meeting, the following intentions and ideas for the tourism development were expressed.

(1) Cooperation and financing

Cooperation among the local people is agreeable, because LWC is very wide and divided among many townships which have their own potentials and resources. They should be united for developing tourism. When somebody decides to provide overnight services for the tourists, he needs the neighbors' support to entertain the tourists for some days. Although Latvian people usually do not want to collaborate, local residents are ready to collaborate only when they can get profit from the collaboration. Farmers and fishermen

are willingly to accept visitors from other districts of Latvia if their visit brings some income. However, local farmers are afraid of financial cooperation with private organizations, since there have been hardly positive results of such cooperation in Latvia. People have been usually cheated at the end by the private organizations without any guarantees. Some farmers are not worried so much about such financial risk from tourism business, and are ready to take the loan with low interest rates.

(2) Potential tourists

The landscape is rather monotonous in Latvia and even in LWC except for some places. Anglers and hunters, however, want to visit LWC. The local schoolchildren are potential visitors, too. English is a prerequisite to attract foreign tourists to LWC, but the local people do not speak it very well. The Nagli fish farm has difficulties in finding markets for their production. In its privatization process, angling is considered to be a potential profitable activity since some other fishponds in LWC are used for angling. There are tourism associations in Latvia. It is necessary to make effective use of such organizations to easily spread the information about tourism potentials in LWC.

3.5.5 Other Industry

At present, the major hope is the newly founded Rezekne Special Economic Zone (RSEZ) in Rezekne city. Rezekne gives a strategic location at the junction of international railways and highways, the existing industrial infrastructure, and cheap labor force. The main directions of the RSEZ are the further improvement of infrastructure, the development and production of export goods, the addition of value to materials and products, the establishment of entrepreneurship programs, and the development of customs and bureaucratic procedures to help the rapid logistics.

There are peat quarry sites in Salas around LWC. The peat collected there used to be processed in the peat factory and exported to Moscow and Leningrad before the Latvian independence. Even at present, bedding or litter peat is being exploited in Barkava township of Madona district. According to the past study done by the Survey Office of Geology, there exist peat for domestic fuel demand of 0.2 mil. t/year, as shown in the next table. The potential sites are mostly situated outside of LWC. But the state energetic program is supposed to increasingly utilize local resources suitable for heating. It might increase peat mining and decrease the precious swamp in LWC as well.

Potential Peat Mining Sites around LWC

Potential Sites	District	Area (ha)	Study Year
Sulagala	Rezekne	1,713	1991
Salas I	Rezekne	5,813	1983
Lielais	Madona	1,809	1986
Berzpils	Balvi	3,800	1988

Source: Survey Office of Geology

Table 3.2.1 Crop Production and Productivity by Township in 1998

Crops	Productivity	Gaigalava	Nagli	Deksare	Rugaji	Lazdukalns
Rye	Area (ha)	50	40	52	146	75
	Production (ton)	75	80	117	292	135
	Productivity (ton/ha)	1.5	2.0	2.3	2.0	1.8
Winter Wheat	Area (ha)	150	61	41	235	19
	Production (ton)	225	150	86	517	38
	Productivity (ton/ha)	1.5	2.5	2.1	2.2	2.0
Spring Wheat	Area (ha)	50	35	130	35	20
	Production	75	105	221	71	40
	Productivity (ton/ha)	1.5	3.0	1.7	2.0	2.0
Oat	Area (ha)	30	31	60	140	101
	Production (ton)	45	62	108	214	192
	Productivity (ton/ha)	1.5	2.0	1.8	1.5	1.9
Legume	Area (ha)	250	23	50	174	0
	Production	300	31	150	350	0
	Productivity (ton/ha)	1.2	1.3	3.0	2.0	0.0
Barley	Area (ha)	400	96	247	130	82
	Production (ton)	1,000	288	325	208	131
	Productivity (ton/ha)	2.5	3.0	1.3	1.6	1.6
Flax	Area (ha)	5	0	15	6	0
	Production (ton)	15	0	39	12	0
	Productivity (ton/ha)	3.0	0.0	2.6	2.0	0.0
Potatoes	Area (ha)	50	33	86	123	110
	Production (ton)	750	660	430	1,840	2,420
	Productivity (ton/ha)	15.0	20.0	5.0	15.0	22.0
Vegetables	Area (ha)	30	11	5	15	40
	Production (ton)	600	0	0	0	800
	Productivity (ton/ha)	20.0	0.0	0.0	0.0	20.0
Total	Area (ha)	1,015	330	686	1,004	441
	Production (ton)	3,085	1,376	1,476	3,504	3,740

Sources : Department of Agriculture of Rezekne, and each township office

Table 3.2.2 Agricultural Land Use of 12 Townships

(Unit: ha)

Items	Rezekne			Balvi			Madona					Gulbene
	Gaigalava	Nagli	Deksare	Rugaji	Lazdukalns	Berzpils	Indrani	Ospe	Barkava	Murmastiene	Varaklani	Dauksti
Total Area	19,263	13,826	10,286	31,763	19,450	12,769	34,300	22,400	18,791	17,451	9,917	16,486
Agricultural land	6,367	1,533	4,642	9,809	7,682	6,210	n.a.	11,472	8,949	6,913	6,562	6,253
Arable land	4,648	1,041	3,871	6,264	4,792	2,766	n.a.	7,782	6,301	4,723	3,825	4,164
Orchard	15	n.a.	n.a.	39	30	44	n.a.	17	59	37	48	n.a.
Meadows	1,146	319	337	1,179	1,021	1,961	n.a.	2,700	1,140	1,155	1,472	876
Pastures	558	164	402	2,327	1,840	1,439	n.a.	972	1,450	998	1,217	1,147
Bushes	128	n.a.	n.a.	n.a.	826	501	n.a.	15	173	81	247	n.a.
Mires (Swamp)	2,363	n.a.	n.a.	0	4,306	2,282	n.a.	616	3,441	6,102	262	0
Water Bodies	1,277	n.a.	n.a.	n.a.	315	332	n.a.	4,320	332	74	136	n.a.
Fish ponds	603	n.a.	n.a.	n.a.	0	0	n.a.	n.a.	n.a.	0	0	n.a.
Garden plot	78	n.a.	n.a.	n.a.	155	120	n.a.	n.a.	175	101	113	n.a.
Drained area	4,505	875	n.a.	n.a.	5,401	3,853	n.a.	10,504	n.a.	6,655	4,676	5,439
Unused land	n.a.	195	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Forest land	6,790	2,769	4,441	17,504	0	2,833	n.a.	3,908	5,378	3,741	2,300	7,656
State forests	4,544	1,817	3,116	7,265	n.a.	n.a.	n.a.	3,681	3,175	1,600	800	5,829
Private forest	1,828	925	1,325	10,139	n.a.	n.a.	n.a.	27	842	400	400	1,765
Other forest	418	27	0	100	n.a.	n.a.	n.a.	200	1,361	1,741	1,100	62

Note: n.a. = not availabe

Source: Data from each township office, 1999

Table 3.4.1 Comparison of Latvia's Fish Production in Soviet Time (1986-90) and Present

Production	Fish prodution (ton)				Approximate Ratio
	1986-90 Average (a)		1998 (b)		(a : b)
1. Marine fish production	521,421	99.3%	100,639	99.1%	5 : 1
(1) Atlantic Ocean	459,284		22,530		20 : 1
(2) Baltic Sea and the Gulf of Riga	62,137		78,109		1 : 1
2. Freshwater fish production	3,877	0.7%	923	0.9%	4 : 1
(1) Inland fishery	633		508		1 : 1
・Lakes	489		352		1 : 1
・Rivers	126		132		1 : 1
・Water reservoirs	17		24		1 : 1
(2) Aquaculture	3,245		415		8 : 1
・Ponds	3,103		415		7 : 1
・Cages	141		0		N.A.
Grand Total	525,298	100.0%	101,562	100.0%	5 : 1

Sources: Fisheries of Latvia '99

Table 3.4.2 Share of Lake Lubana's Fish Production in National Freshwater Fish Production

(Unit: tons)

Category	1986-90 (Average)			1998		
	Latvia	Lake Lubana	Ratio	Latvia	Lake Lubana	Ratio
Inland fishery	633	100	15.8%	508	57	11.3%
Aquaculture	3,245	1,500	46.2%	415	223	53.7%
Total	3,877	1,600	41.3%	923	280	30.4%

Table 3.4.3 Abundance of Zooplankton and Zoobenthos in Lake Lubana

	Madona (18 June 1997)				Rezekne (30 July 1997)			
	Occurrence	Avarage	STD	(Range)	Occurrence	Avarage	STD	(Range)
1) Abundance in number of individuals								
Zooplankton (x 1000 ind./m^3)		1452	± 736	(718 ～3175)		377	± 63	(290 ～ 503)
Rotatoria	10/10	111	± 51	(35 ～ 200)	10/10	17	± 5	(10 ～ 25)
Cladocera	10/10	1161	± 722	(405 ～2900)	10/10	147	± 52	(56 ～ 213)
Copepoda	10/10	180	± 50	(70 ～ 245)	10/10	213	± 58	(146 ～ 313)
Zoobenthos (x 1000 ind./m^2)		1050	± 525	(400 ～2200)		800	± 365	(400 ～ 1500)
Chironomidea	6/10	240	± 228	(0 ～ 800)	10/10	350	± 201	(100 ～ 800)
Ephemeroptera	2/10	30	± 71	(0 ～ 200)				
Trichoptera	3/10	40	± 58	(0 ～ 200)	1/10	10	± -	(0 ～ 100)
Malacastraca	3/10	70	± 58	(0 ～ 300)	1/10	20	± -	(0 ～ 200)
Oligochaeta	9/10	410	± 503	(0 ～1600)	8/10	260	± 231	(0 ～ 800)
Mollusca	3/10	30	± 0	(0 ～ 100)	3/10	40	± 58	(0 ～ 200)
Hirudinae	2/10	20	± 0	(0 ～ 100)				
Odonata	1/10	10	± -	(0 ～ 100)				
Others	8/10	200	± 160	(0 ～ 500)	8/10	120	± 76	(0 ～ 300)
2) Abundance in weight								
Zooplankton (g/m^3)		24	± 13	(11 ～ 52)		6.9	± 2.3	(3.0 ～ 9.5)
Rotatoria	10/10	0.17	± 0.14	(0.02 ～ 0.43)	10/10	0.02	± 0.01	(0.01 ～ 0.04)
Cladocera	10/10	21	± 12	(8 ～ 49)	10/10	5.2	± 2.0	(1.7 ～ 7.5)
Copepoda	10/10	3.0	± 0.8	(1.3 ～ 4.1)	10/10	1.7	± 0.5	(1.1 ～ 2.5)
Zoobenthos (g/m^2)		4.7	± 4.5	(1.1 ～ 14.4)		8.6	± 11.3	(1.4 ～ 38.0)
Chironomidea	6/10	0.4	± 0.5	(0 ～ 1.4)	10/10	2.7	± 2.8	(0.2 ～ 8.1)
Ephemeroptera	2/10	0.1	± 0.1	(0 ～ 0.4)				
Trichoptera	3/10	1.3	± 6.7	(0 ～ 12.0)	1/10	0.0	± -	(0 ～ 0.2)
Malacastraca	3/10	0.5	± 1.3	(0 ～ 3.3)	1/10	0.1	± -	(0 ～ 0.8)
Oligochaeta	9/10	1.7	± 3.1	(0 ～ 9.6)	8/10	0.7	± 0.7	(0 ～ 2.4)
Mollusca	3/10	0.2	± 0.3	(0 ～ 0.8)	3/10	4.9	± 18.0	(0 ～ 37.0)
Hirudinae	2/10	0.2	± 0.8	(0 ～ 1.4)				
Odonata	1/10	0.1	± -	(0 ～ 1.5)				
Others	8/10	0.2	± 0.3	(0 ～ 1.0)	8/10	0.2	± 0.1	(0 ～ 0.5)

Note: Occurrence indicates number of sampling station which animal were collected/total number of sampling stations.
Source: Regulations of fishery exploitation of Lake Lubana, 1988 LFRI

Table 3.4.4 Freshwater Fish Catch by Major Species and Share of Lubana Lake

(Unit:tons)

Major Species			1994	1995	1996	1997	1998	Average
Latvia (*)			1,091	1,030	853	811	842	487
	Pike		41	52	49	47	55	49
	Carps	Bream	145	149	134	172	135	147
		Common carp (*)	550	520	364	345	412	438
		Other carps	74	87	74	88	78	80
	Perches	Pikeperch	26	28	18	20	21	23
		Perch	20	38	22	29	34	29
	Others (*)		235	156	192	110	107	160
Lake Lubana			58	69	51	37	57	55
	Pike		25	32	31	19	27	27
	Carps	Bream	23	24	12	10	11	16
		Common carp	4	3	2	1	4	3
		Other carps	3	2	1	2	3	2
	Perches	Pikeperch	3	6	4	2	8	5
		Perch	1	1	1	2	5	2
	Others		0.12	0.00	0.00	0.01	0.01	0.03
Share of Lake Lubana			-	-	-	-	-	-
	Pike		61%	61%	63%	41%	49%	55%
	Carps	Bream	16%	16%	9%	6%	8%	11%
		Common carp	-	-	-	-	-	-
		Other carps	3%	3%	2%	3%	4%	3%
	Perches	Pikeperch	12%	23%	22%	12%	36%	21%
		Perch	5%	3%	6%	7%	14%	7%
	Others		-	-	-	-	-	-

Note : (*) include production of aquaculture.

Source : 1) Fishery of Latvia '99, 2) Regulations of fishery exploitation of Lake Lubana, 1998 LFRI.

Table 3.4.5 Number of Licensed Fisherman and Length of Net Registered

Length of net (m)	No. of licensed fisherman				Cumulative length of net (m)			
	Nagli	Gaigal.	Osupe	Total (%)	Nagli	Gaigal.	Osupe	Total (%)
100>	8	-	7	15 (25 %)	555	-	450	1,005 (6 %)
100-299	2	3	18	23 (38 %)	425	700	2620	3,745 (22 %)
300-499	2	2	8	12 (20 %)	760	800	2400	3,960 (23 %)
500-699	1	1	2	4 (7 %)	600	500	1100	2,200 (13 %)
700-899	1	-	1	2 (3 %)	750	-	700	1,450 (8%)
900-1099	2	-	-	2 (3 %)	1,975	-	-	1,975 (11%)
1100-1299	-	-	-	0 (0 %)	-	-	-	0 (0%)
1300-1499	-	-	-	0 (0 %)	-	-	-	0 (0%)
1500	1	-	1	2 (3 %)	1,500	-	1500	3,000 (17%)
Total	**17**	**6**	**37**	**60 (100 %)**	**6,565**	**2000**	**8770**	**17,335 (100%)**

Note : Data for Nagli and Gaigalava are those of 2000, while for Osupe, 1999.

Source: Rezekune and Madona REBs

Table 3.5.1 List of Accommodations in the Vicinity of LWC

	Rooms	Beds	Season
Rezekne city			
"Latgale" hotel	139	200	all year
"Rebir" hotel	5	17	all year
Youth hostel		50	June - August
Youth hotsel		30	all year
Rezekne district			
Youth hostel Makasani		20	June - August
Youth hostel Vereni pag.		120	June - August
Youth hostel Luznava pag.		70	June - August
Youth hostel Malta		30	June - August
Youth hostel Malta		30	all year
Private house Kaunata (outsid	4	8	April - December
Private house Vereni pag	2	4	June - August
Private house Lendzi pag.	4	8-9	April - December
Madona city			
Hotel "Madona"	14	22	all year
Madona district			
Hotel "Gaizinhil"		20	all year
Hotel, Lazdona			all year
Hotel "Cesvaine"			all year
Hotel "Kusa"		40	all year
Youth hostel		30	all year
Balvi city			
Hotel "Balvi"	25	40	all year
Balvi district			
Motel Berzkalne pag.	3	6	all year
Hotel Berzpils pag.	7	10	all year
Gulbene city			
Gulbene district			
Hause Stameriene	2	4	
Jekabpils district			
Motel "Mezare"	3	8	all year
Ludza city			
Hotel	16	34	all year
Private house	4	6	all year

Source: District of Rezekne, Madona Tourist Information Centre,
The Assessment of the Existing Situation of Tourism in Latgale Region

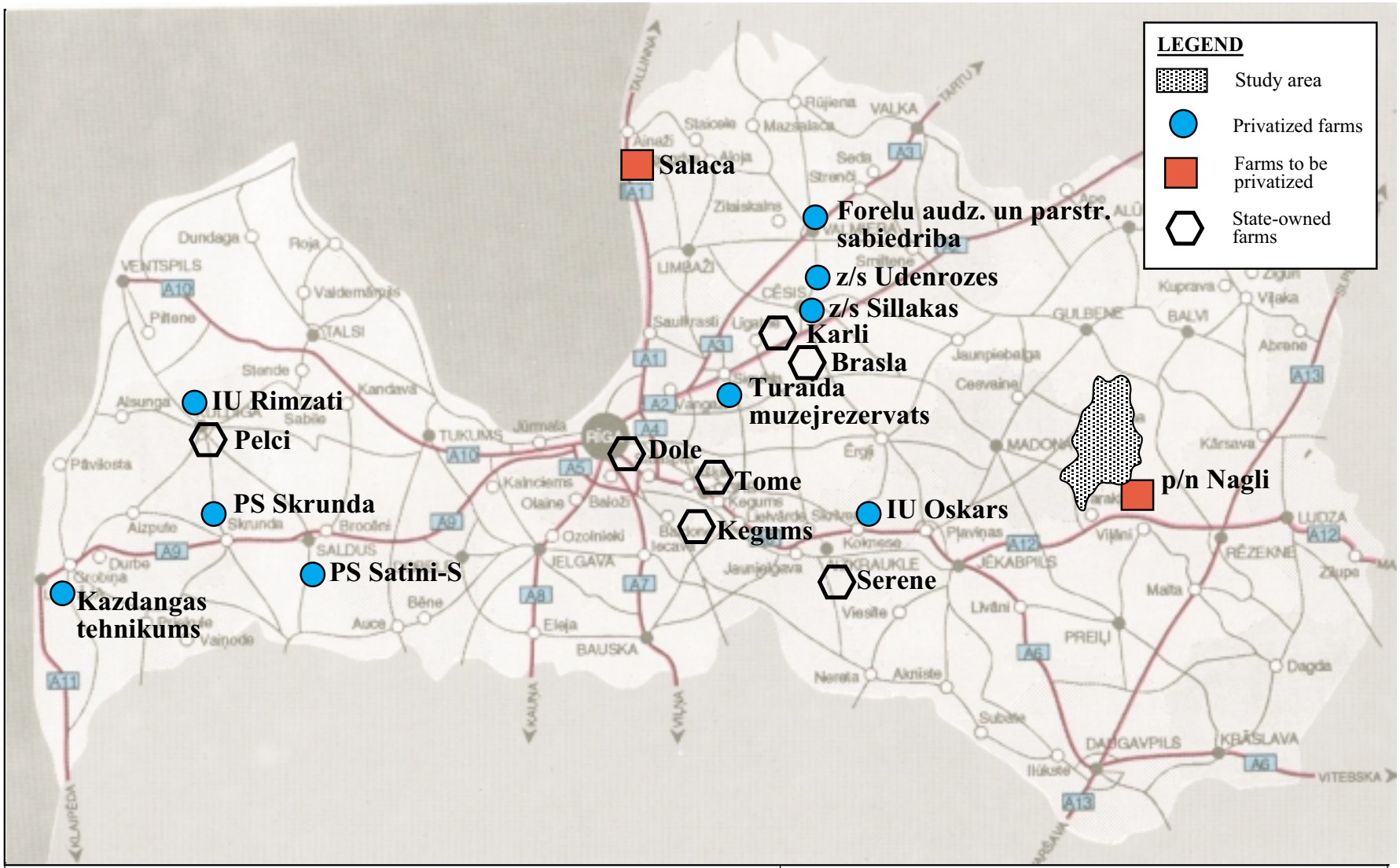


Figure 3.4.1 Location of State - Own and Privatized Freshwater Aquaculture Farms

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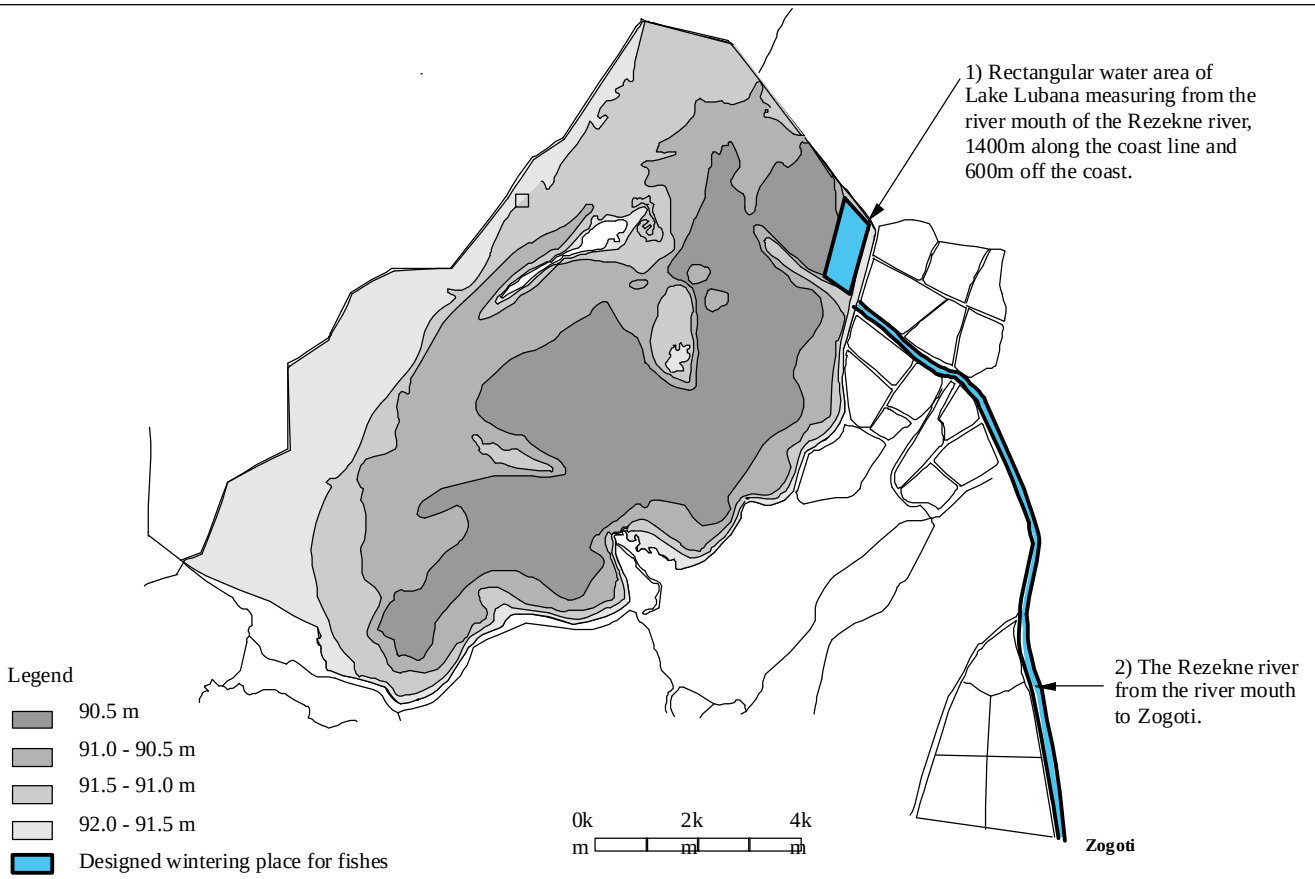


Figure 3.4.2 Elevation and designated wintering places for fishes

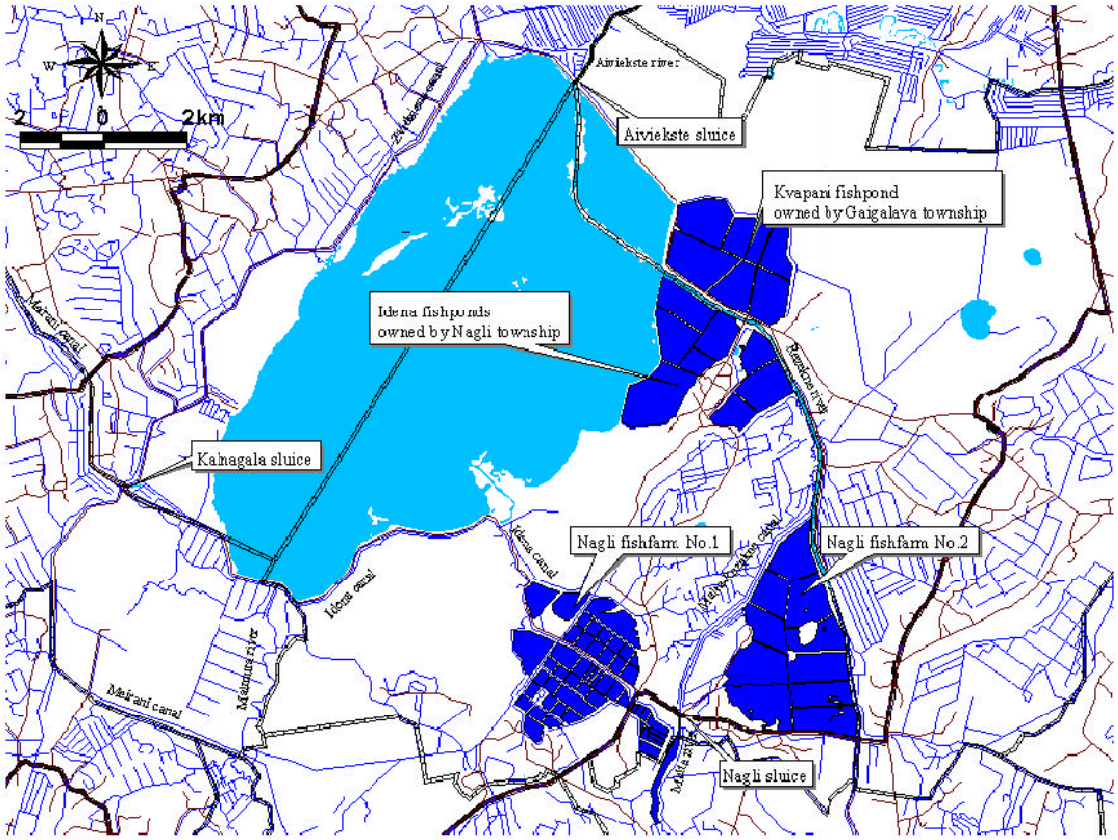
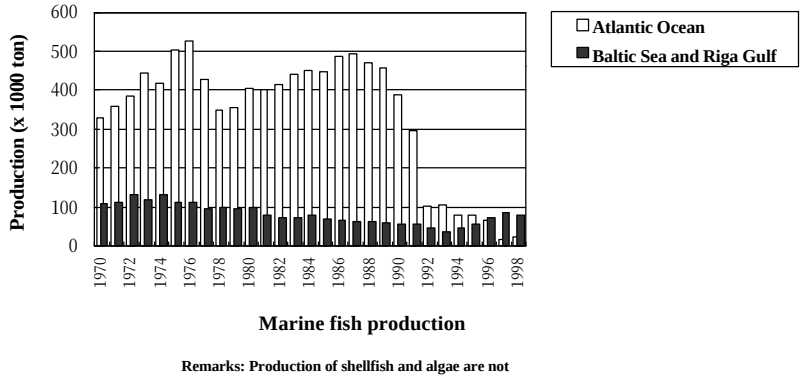
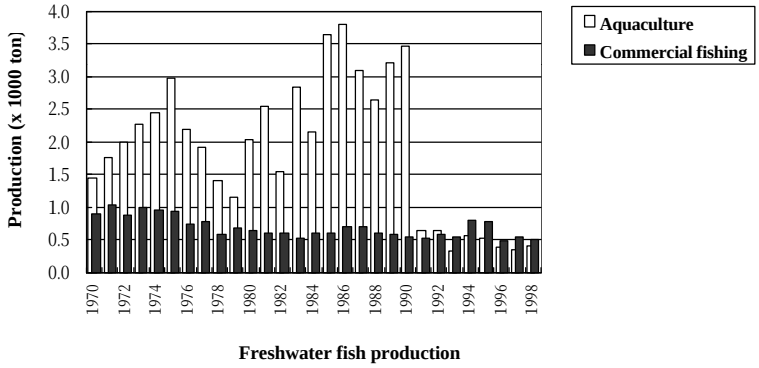


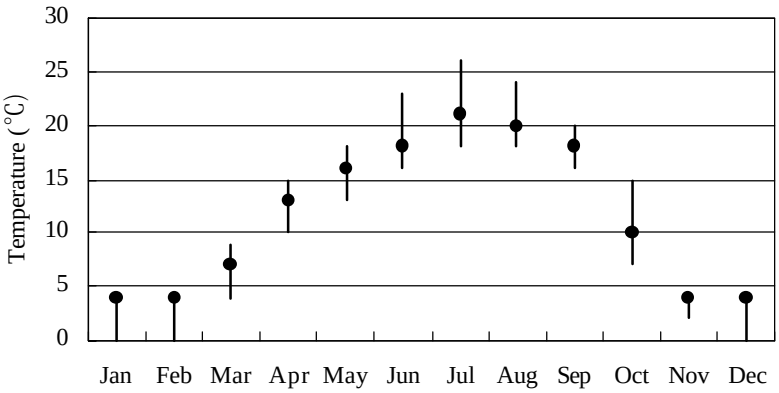
Figure 3.4.4 Water System around Lake Lubana and Fishponds





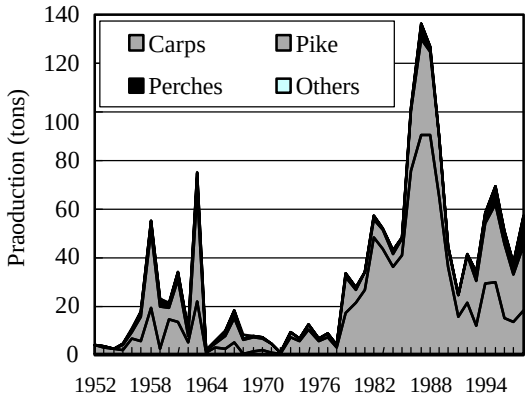
Source: Fishery of Latvia, '99

Figure 3.4.3 Fishery and Aquaculture Production of Latvia (1970 – 1998)

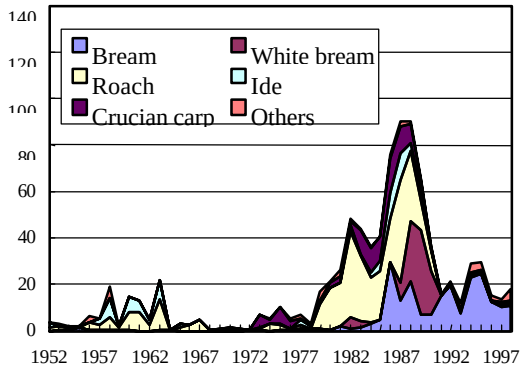


Source: Information from Rezekne REB

Figure 3.4.5 Estimated Water Temperature Change in Mid-layer of Lake Lubana



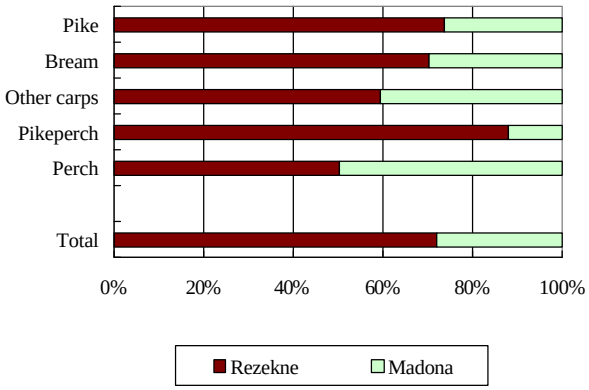
Fish catch by species group



Breakdown of carp species

Source: Regulations of fishery exploitation of Lake Lubana, 1998 LFRI

Figure 3.4.6 Species Composition in Fish Catch of Lake Lubana(1952-1998)



Note: Average production during 1994-1998 is used.
Source: Rezekune and Madona REBs

Figure 3.4.7 Proportion of Fish Catch of Lake Lubana in Two Districts

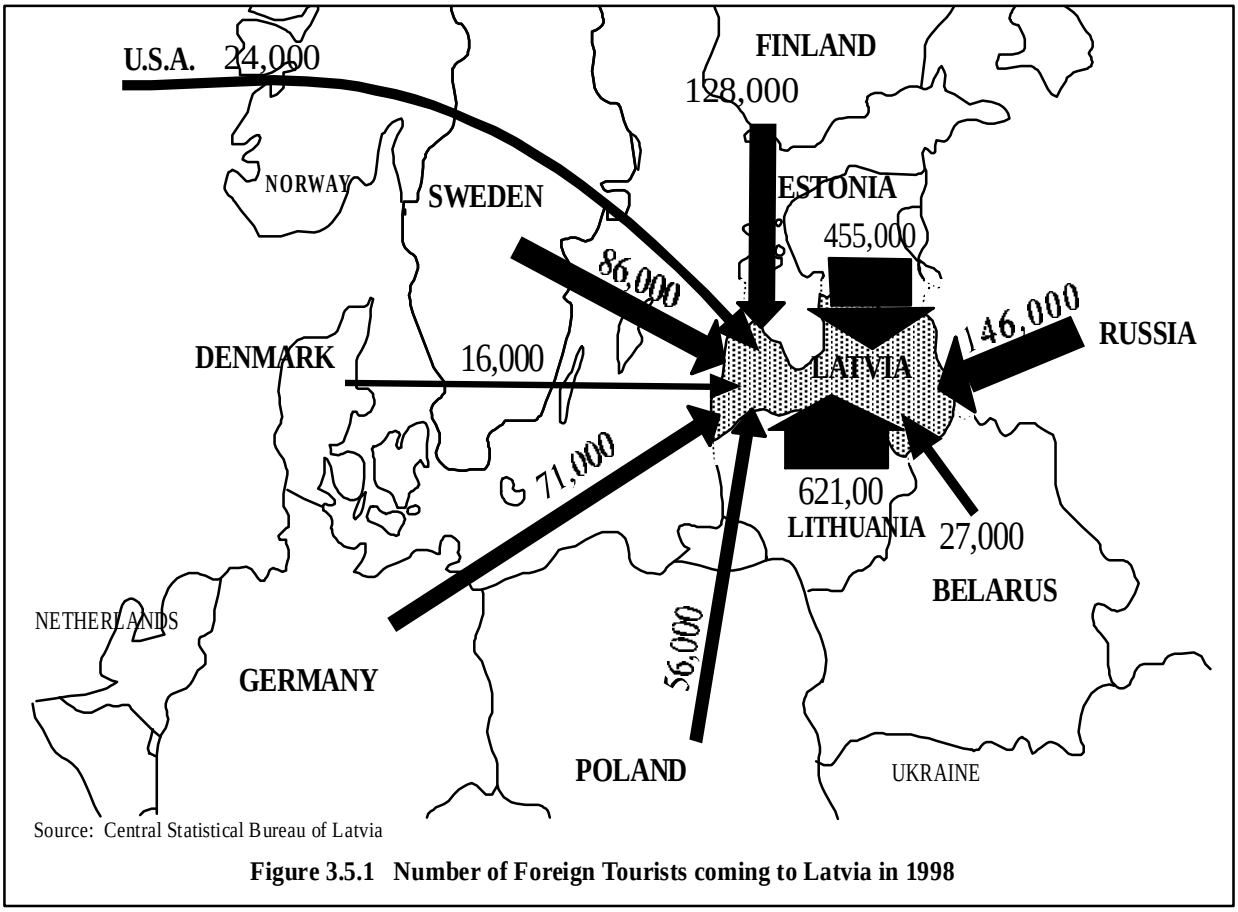
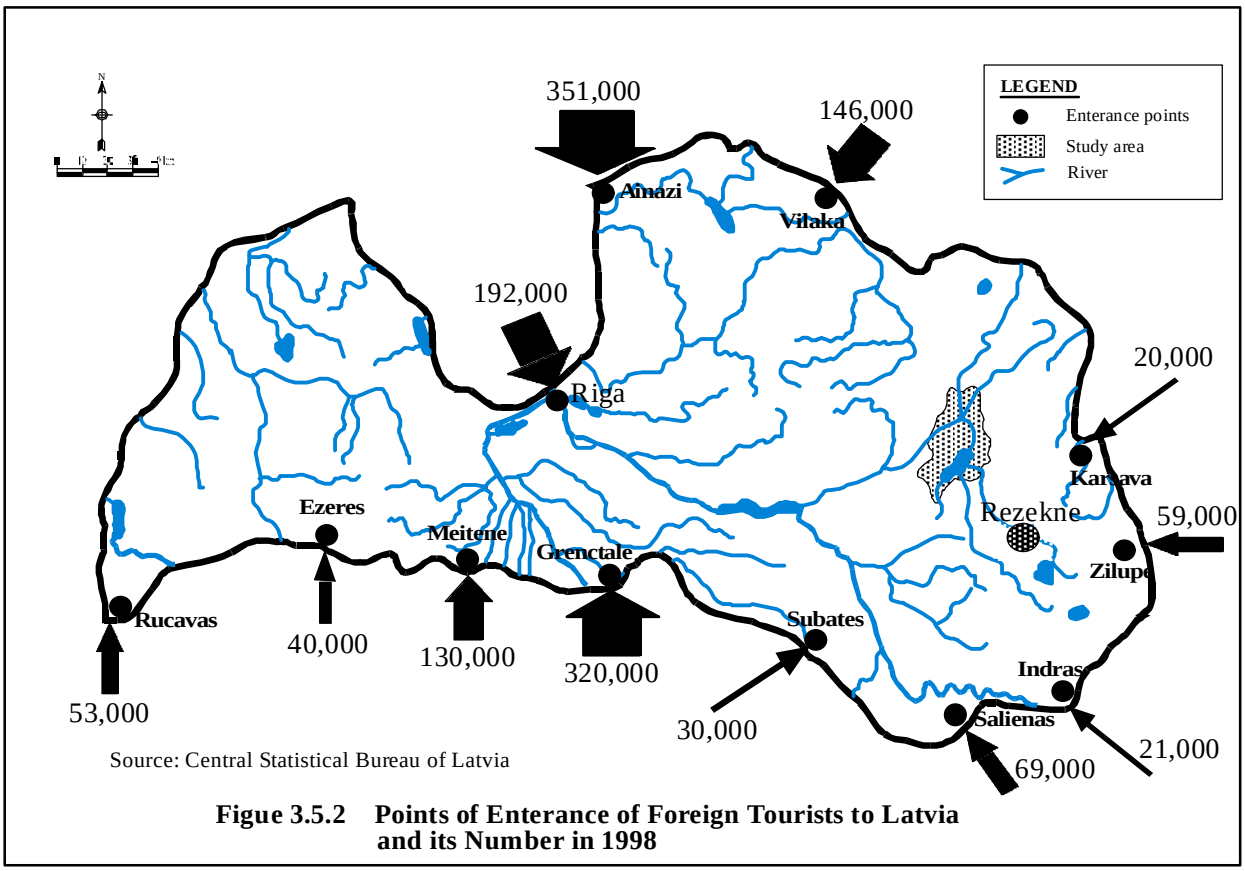
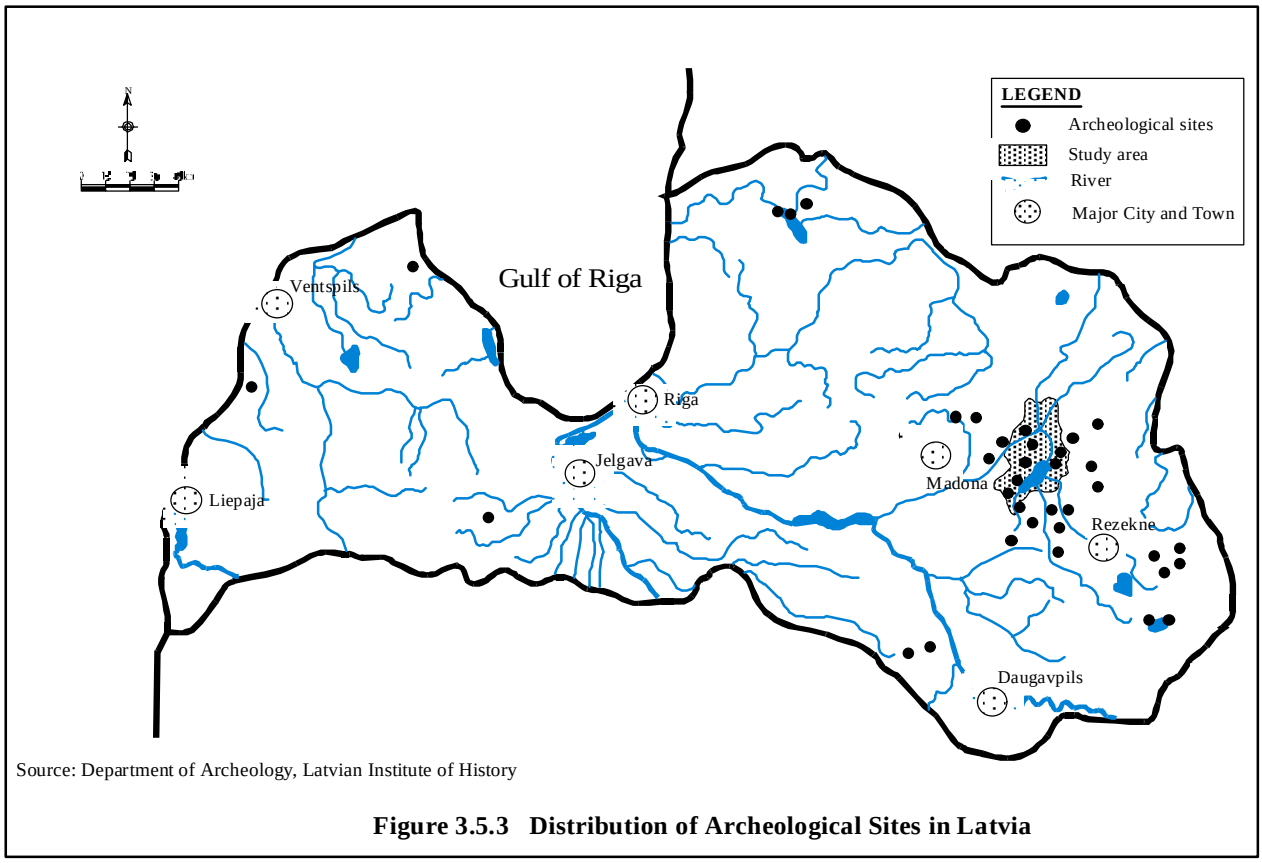


Figure 3.5.1 Number of Foreign Tourists coming to Latvia in 1998

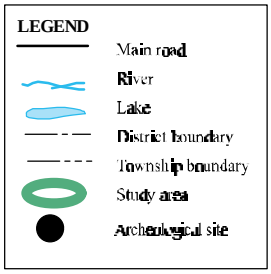


Figue 3.5.2 Points of Enterance of Foreign Tourists to Latvia and its Number in 1998



Source: Department of Archeology, Latvian Institute of History

Figure 3.5.3 Distribution of Archeological Sites in Latvia



Source: Department of Archeology, Latvian Institute of History

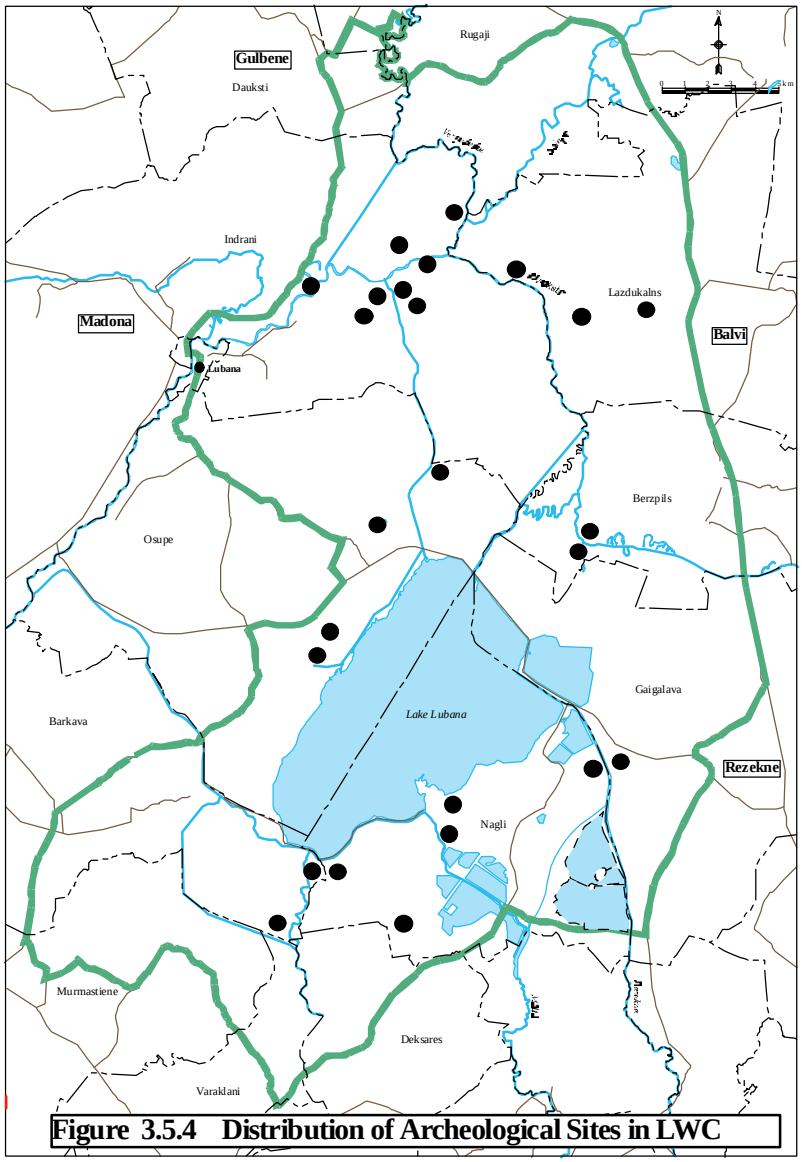


Figure 3.5.4 Distribution of Archeological Sites in LWC

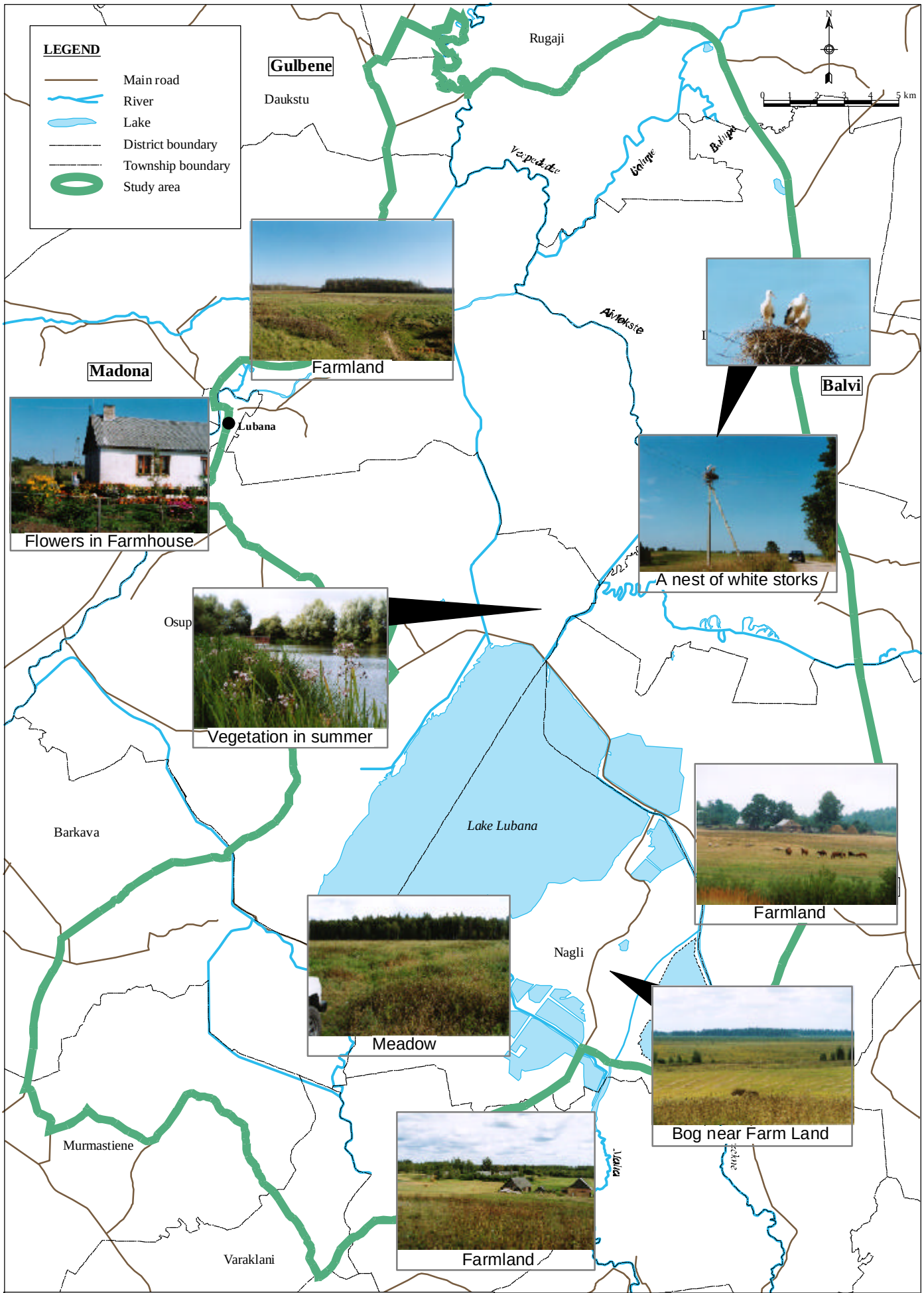


Figure 3.5.5(1) Landscapes of LWC

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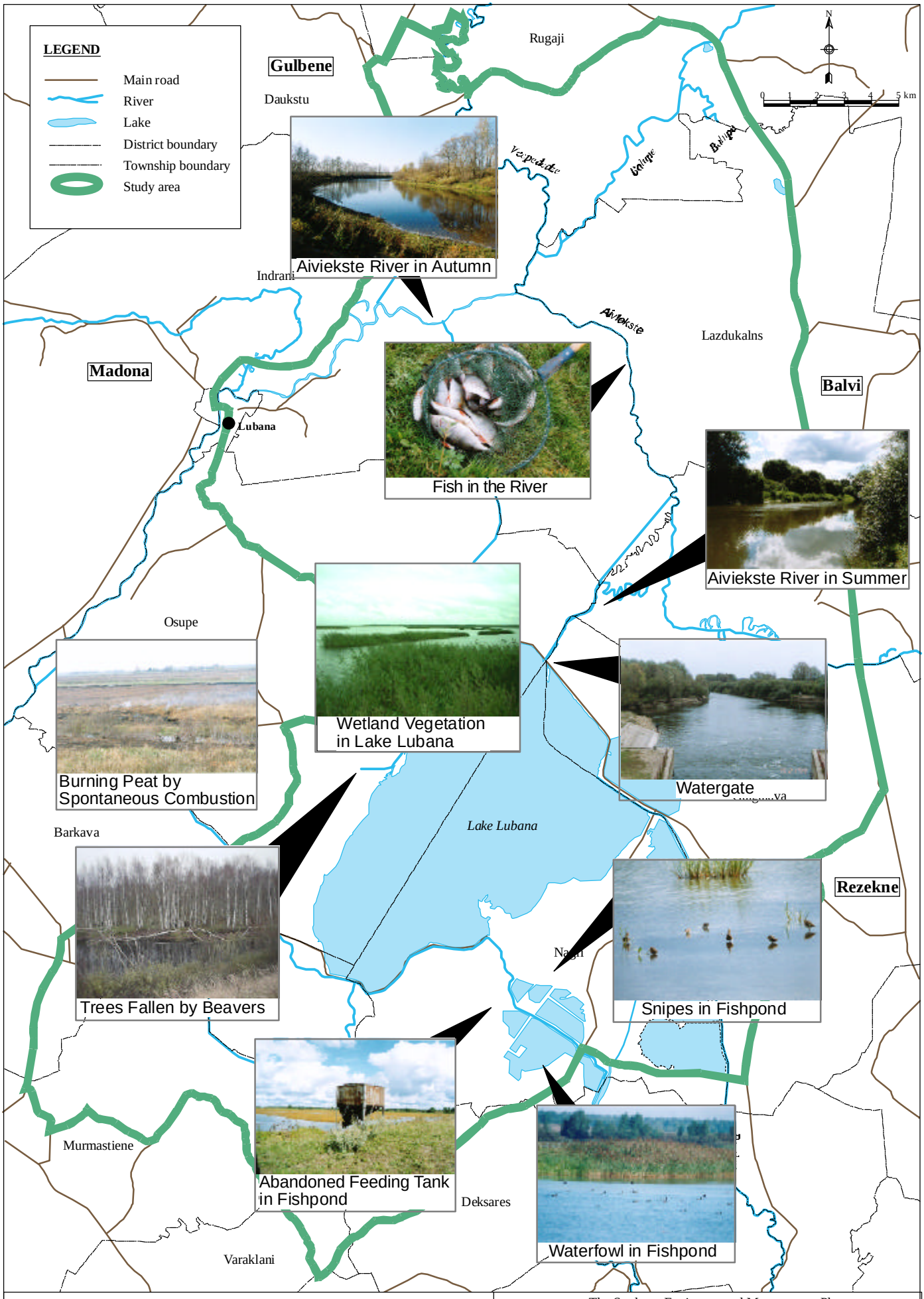

Figure 3.5.5(2) Landscapes of LWC

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CHAPTER 4

CHAPTER 4 WATER QUALITY

4.1 Water Quality Conditions

4.1.1 Current Water Quality

A water quality survey was conducted in October 1999 and June 2000 at 18 survey points as shown in Figure 4.1.1, and results are shown in Table 4.1.1.

(1) Lake Lubana

The results of water quality monitoring conducted by the Rezekne REB in August 1996 showed mineral nitrogen of 2.1 to 2.5 mg/l (Points I, II, and III), T-P of 0.11 to 0.23 mg/l (Points I, II, III, and VI), and COD_{Cr} of 37 to 38 mg/l (Points I and II). The water quality survey conducted in October 1999 resulted in COD_{Cr} of 42 to 80 mg /l and T-N of 1.3 to 1.6 mg/l at Points 3, 4, 5, 6, and 7, and T-P of 0.10 mg/l at Point 6 in the lake.

Lake Lubana belongs to the shallow lakes where ammonia and phosphate should be kept less than 0.5 and 0.04 mg/l, respectively. In August 1996, Points I, II, III, and VI showed the N/NH_4 concentrations from 0.61 to 0.94 mg/l, and the former 3 points contained the P/PO_4 concentrations from 0.09 to 0.19 mg/l. In October 1999, Point 6 showed the low water quality with P/PO_4 of 0.09 mg/l, while Point 5 bore N/NH_4 of 0.5 mg/l.

(2) Rivers

The October 1999 survey revealed that Points 10 and 18 of the Rezekne river which had the current velocity of less than 0.2 m/s did not meet the Latvian ambient water quality requirement for good water quality: the respective T-P concentrations of 0.23 and 0.50 mg/l at Points 10 and 18, and N/NH_4 of 1.18 mg/l and N/NO_2 of 0.14 mg/l at Point 18 right downstream from the waste water treatment plant (WWTP) of the Rezekne city. The data obtained from the State Hydro-meteorological Agency (SHMA) continually showed the T-P concentrations of more than 0.20 mg/l at 2.5 km downstream from the Rezekne city from 1988 to 1994. Though the Meirani canal showed the N/NH_4 concentration of 0.40 mg/l at Point 17 due to the water from the upstream Nagli fishpond, the overall water quality of the rivers in LWC, except for the Rezekne river, indicated the good water quality following the ambient water quality standards for rivers.

(3) Comparison with the Survey Results

The data in June 2000 are compared with those in October 1999 based on the indicators of dissolved oxygen (DO), eutrophication, hygienic conditions, and pesticide and heavy metals.

The DO levels in Lake Lubana and fishponds presented satisfactory results for fish showing from 77-92 % of the saturated O_2 levels in June 2000 and from 82-100 % in October 1999.

The results in June 2000 were a little less saprobic than in October 1999. Lake Lubana and most fishponds still belong to alpha- or beta–mesosaprobic conditions indicating moderate eutrophication levels and progress of organic oxidation and decay. From 12 to 25 mg/l in June 2000, and from 16 to 33 mg/l in October 1999 in terms of COD_{Mn} for lakes and fishponds. The concentrations of T-P and T-N in June 2000 were still more or less eutrophic at Point 1 and 20 (about 0.05 T-P mg/l).

The requirements of total coliform, oil, phenol should follow the guidelines of the EU Directive concerning the quality of bathing water (76/160/EEC). Overall concentrations of total coliform and oil were safe both in 1999 and 2000. The concentrations of phenol, however, did not meet the mandatory requirement (0.005 mg/l) in Lake Lubana and many fishponds and rivers. Safe bathing water is necessary especially in Lake Lubana, the Kvapani and Orenisi fishponds, the Pededze river, and the Idena canal for eco-tourism development. The levels of PCB, Cr^{+6}, Pb, Cd, As, and Hg did not indicate significant threats on the human health at all the points in both years.

It is found that water quality monitoring points should include the Pededze river and the Idena canal in future for eco-tourism development. The monitoring should also continue at points 1 (Nagli fishpond), 3, 4, 6, 7 (Lake Lubana), 9 (the Malta), 10 (the Rezekne), 19 and 20 (Idena and Kvapani fishponds). Point 2 is better located to the middle of the Orenisi fishpond close to eco-tourism development sites.

The water quality of the Idena canal was unacceptable due to the clogged water, so the water gate management should be well conducted at the end of the Malta river for eco-tourism. The total coliform in the Rezekne river (Point 10) was relatively high. It means that the upstream water quality management is a pre-condition for eco-tourism development in LWC.

4.1.2 Conditions of Wastewater Treatment Facilities and Plans

The National Environmental Policy Plan for Latvia (NEPP) sets the national goal to deal with eutrophication of watercourses: to reduce T-N emissions into water from point sources by 50% of the 1994 level by the year 2010. Taking into account that the Baltic Sea is an almost closed and shallow sea with brackish water with an exchange rate of 30 years, the water quality target is of significance. In response to NEPP which regards eutrophication as a priority problem in Latvia, MEPRD commenced the project "800+" in 1995 to reconstruct or establish more than 800 WWTPs in small and medium-sized towns and rural areas in Latvia.

In association with the 800+ project, the project "Improvements to Water Supply and Wastewater Management in Five Municipalities in Eastern Latvia" financed by Denmark is now in progress. Rezekne city, Vilani town, and Malta township are included in the five municipalities and located in Lake Lubana's catchment area. In addition, there are two projects related to the rehabilitation of WWTPs in Stolerova and Sokolku townships. All the projects are targeted to improve efficiency in biological treatment and need concrete recommendations on it.

4.2 Direction for Water Quality Conservation

With the unsatisfactory water quality in Lake Lubana, the formulation of a water quality conservation plan (WQCP) is highly recommended to integrate the water quality management in the Lake Lubana catchment area and to promote eco-tourism development for LWC. The following two basic principles are to be set in mind to formulate the plan:

- To make the best use of wetlands' self-purification ability, and
- To abate upstream pollution

As waters flow across wetlands, chemicals that otherwise would contaminate waterways are removed through natural processes that assimilate pollution. The WQCP for LWC should be closely linked to the fundamental vision of EMP "Wise use of LWC". Considering the importance of sustainable development of LWC, the ability of self-purification of wetlands should be optimized as a result of WQCP. The annual usage of agricultural fertilizers in Latvia in 1997 had decreased by 91%, and that of pesticides by 88%, in comparison to their levels of 1990. However, nutrients runoff from non-point sources in Latvia has remained at the same level as in the beginning of the 1990s due to the washing-out of accumulated pollution of N and P. Strengthening the self-purification ability of LWC itself is a promising measure to tackle with non-point sources. As wetlands themselves have a great potential of water purification, the maximum utilization of the ability becomes the fundamental strategy for LWC with the help of the upstream water quality management.

Though a self-purification ability of wetlands is undeniable, overburdened pollution loads from the upstream areas make overall water quality management quite difficult to succeed. The upstream water pollution abatement measures are preconditioned to formulate WQCP for LWC. The following directions are to be set for the proposed WQCP:

- to make the effluent N and P concentrations from the upstream point sources abide by the requirements of the EU directive (15 mg/l T-N and 2 mg/l T-P for municipal WWTP) by the year 2010,
- to reduce upstream N and P emissions from non-point sources as much as possible, and

- to restore and strengthen the self-purification ability of aquatic ecosystems in and around Lake Lubana.

The overview of WQCP is presented in Figure 4.2.1. While nine possible cause-oriented measures are mentioned to tackle with point sources, three candidates are considered to handle non-point sources. three measures are proposed for the effect-oriented approach. The table below summarizes the location and applicability of each measure, and measures with "A"(more applicable) are recommended for the water quality conservation in LWC.

Possible Measures and Applicability

Measure	Location*	Applicability**
(1) Tariff reform	upstream	A
(2) Construction of new WWTPs	upstream	B
(3) Chemical treatment for WWTPs	upstream	C
(4) Upgrade of biological treatment for WWTPs	upstream	A
(5) Aeration	onsite (fishponds)	C
(6) Change in feeding	onsite (fishponds)	A
(7) Construction of new sewer system	upstream	B
(8) Soil infiltration trench	upstream	B
(9) Ban on P-containing detergents	upstream	B
(10) Dredging	onsite	C
(11) Restoring of aquatic plants	onsite	A
(12) Lagoon	onsite (Gomelis)	B

Notes: * Onsite means the project within the study area, while some projects need to be done upstream from the study area.

** Applicability: A = more applicable, B = applicable, and C = less applicable

Table 4.1.1 Results of Water Quality Surveys

(1) Data in 1999

sampling dates : 3rd Oct - 7th Oct 19

Parameter	Unit	No.1	No.2	No.3	No.4	No.5	No.6	No.7	No.8	No.9	No.10	No.11	No.12	No.13	No.14	No.15	No.16	No.17	No.18	No.19	No.20
pH	-	8.6	7.6	8.0	8.1	8.2	8.3	8.3	8.0	8.3	8.1	7.9	7.9	7.8	7.5	8.1	8.0	7.7	7.9	-	-
DO	mg / l	13.5	8.6	8.6	10.9	9.9	11.1	11.1	7.5	10.2	5.6	8.3	7.8	8.2	4.7	8.6	8.0	4.9	8.2	-	-
COD_{Mn}	mg / l	29.0	33.0	25.5	24.0	16.0	28.0	25.5	9.2	6.7	6.4	13.7	19.0	15.0	34.0	19.0	14.6	20.0	10.5	-	-
Total Nitrogen	mg / l	1.09	10.95	1.30	1.38	1.56	1.62	1.37	0.30	0.29	2.50	0.71	0.87	0.50	1.31	1.16	1.06	1.10	2.74	-	-
Total Phosphorus	mg / l	0.060	0.730	0.030	0.030	0.060	0.100	0.020	0.015	0.370	0.230	0.050	0.050	0.090	0.100	0.030	0.020	0.065	0.500	-	-
Coliforms	CFU / 100ml	12	10	5	1	5	110	1	21	2	71	5	38	2	1	5	14	5	400	-	-
Oil	mg / l	0.20	0.05	0.12	0.20	0.08	0.10	0.07	<0.05	0.24	0.15	0.21	<0.05	0.12	0.12	0.09	0.06	0.05	0.06	-	-
Phenol	mg / l	0.007	0.009	0.006	0.009	0.005	0.010	0.006	0.005	0.001	0.002	0.003	0.007	0.003	0.007	0.008	0.006	0.007	0.001	-	-
CN	mg / l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
PCB	mg / l	<0.0002	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	-	-
Cr^{6+}	mg / l	<0.03	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Pb	mg / l	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	-	-
Cd	mg / l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
As	mg / l	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	-	-
Hg	mg / l	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	-	-

Remark : The survey was not conducted at No.19 and No.20 in Oct. 1999.

(2) Data in 2000

sampling dates : 7th June - 24th June 20

Parameter	Unit	No.1	No.2	No.3	No.4	No.5	No.6	No.7	No.8	No.9	No.10	No.11	No.12	No.13	No.14	No.15	No.16	No.17	No.18	No.19	No.20
pH	-	8.97	7.7	7.6	7.7	-	7.6	7.6	8.0	9.0	8.6	8.5	8.5	8.3	8.3	8.7	8.6	8.3	-	7.6	8.7
DO	mg / l	8.68	7.9	8.1	7.3	-	8.3	8.0	7.4	9.0	8.0	7.5	8.6	7.1	7.8	7.4	7.5	6.6	-	8.3	8.4
COD_{Mn}	mg / l	23	12.2	18.0	19.8	-	21.0	22.4	8.6	6.4	5.6	12.8	12.8	12.0	25.6	16.2	10.7	16.0	-	25.0	22.0
Total Nitrogen	mg / l	0.8	0.40	0.58	0.60	-	0.65	0.50	0.20	0.25	5.50	0.50	0.60	0.30	1.10	1.30	0.72	0.90	-	0.51	0.48
Total Phosphorus	mg / l	0.052	0.010	0.020	0.010	-	0.020	0.010	0.015	0.040	0.191	0.070	0.040	0.080	0.040	0.022	0.030	0.060	-	0.020	0.050
Coliforms	CFU /100ml	5	7	14	4	-	17	2	100	39	430	5	48	20	10	110	140	120	-	1	150
Oil	mg / l	0.18	0.13	0.13	0.15	-	0.10	0.13	n.d.	0.07	0.05	0.05	0.05	0.07	0.09	0.11	0.05	0.07	-	0.07	0.20
Phenol	mg / l	< 0.001	<0.001	0.009	0.010	-	0.010	0.007	0.005	<0.005	0.001	0.002	0.008	<0.005	0.009	0.010	0.010	0.004	-	0.010	<0.005
CN	mg / l	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.01
PCB	mg / l	< 0.0003	<0.0003	<0.0003	<0.0003	-	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	-	<0.0003	<0.0003
Cr^{6+}	mg / l	< 0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05
Pb	mg / l	< 0.02	<0.02	<0.02	<0.02	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	-	<0.02	<0.02
Cd	mg / l	< 0.01	<0.01	<0.01	<0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.01
As	mg / l	< 2	<0.002	<0.002	<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	-	<0.002	<0.002
Hg	mg / l	< 0.05	<0.00005	<0.00005	<0.00005	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	-	<0.00005	<0.00005

Remark : The survey was not conducted at No.5 and No.18 in June 2000.

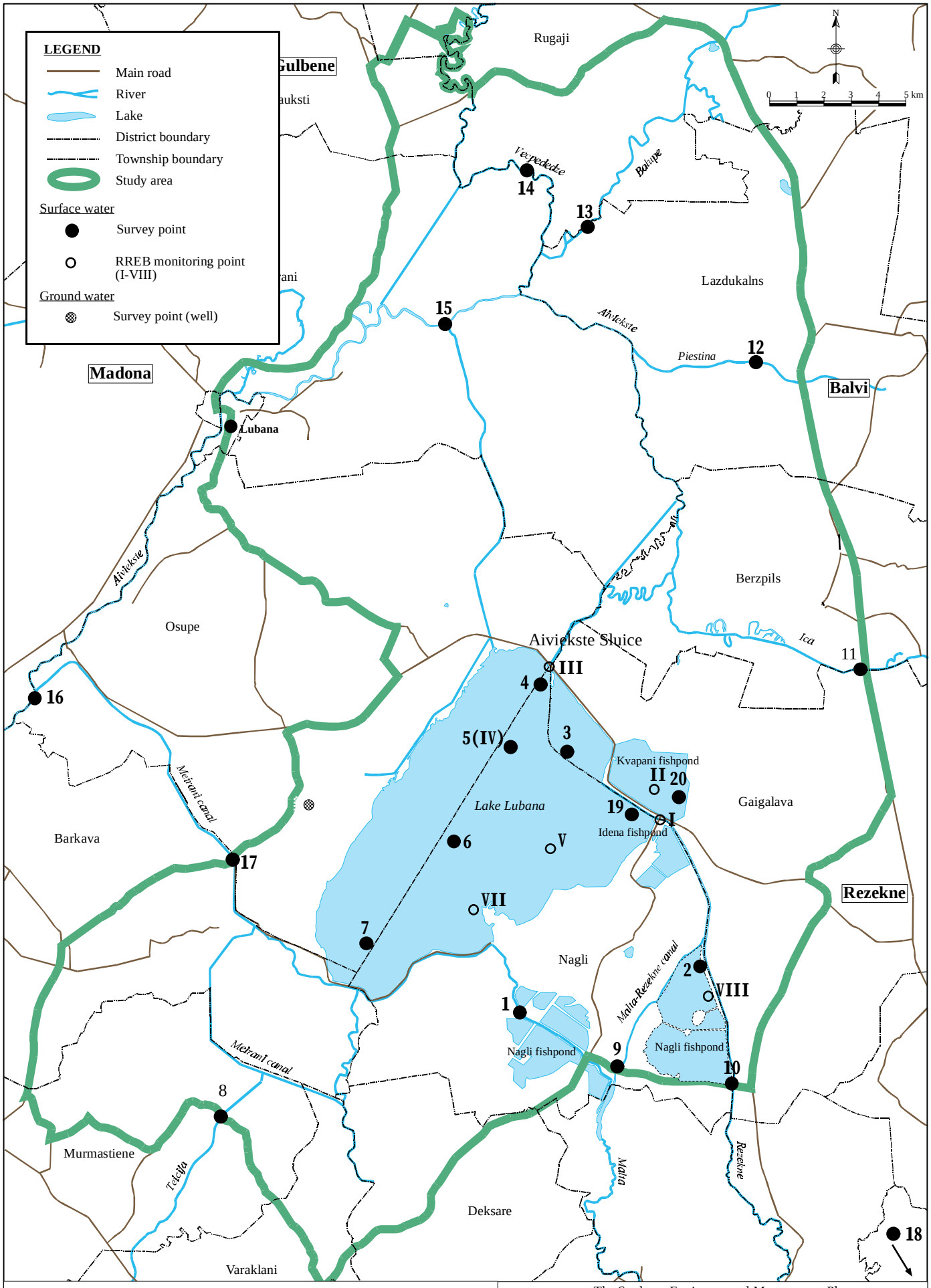

Figure 4.1.1 Survey Points of Water Quality

The Study on Environmental Management Plan
for Lubana Wetland Complex in the Republic of Latvia

JAPAN INTERNATIONAL COOPERATION AGENCY

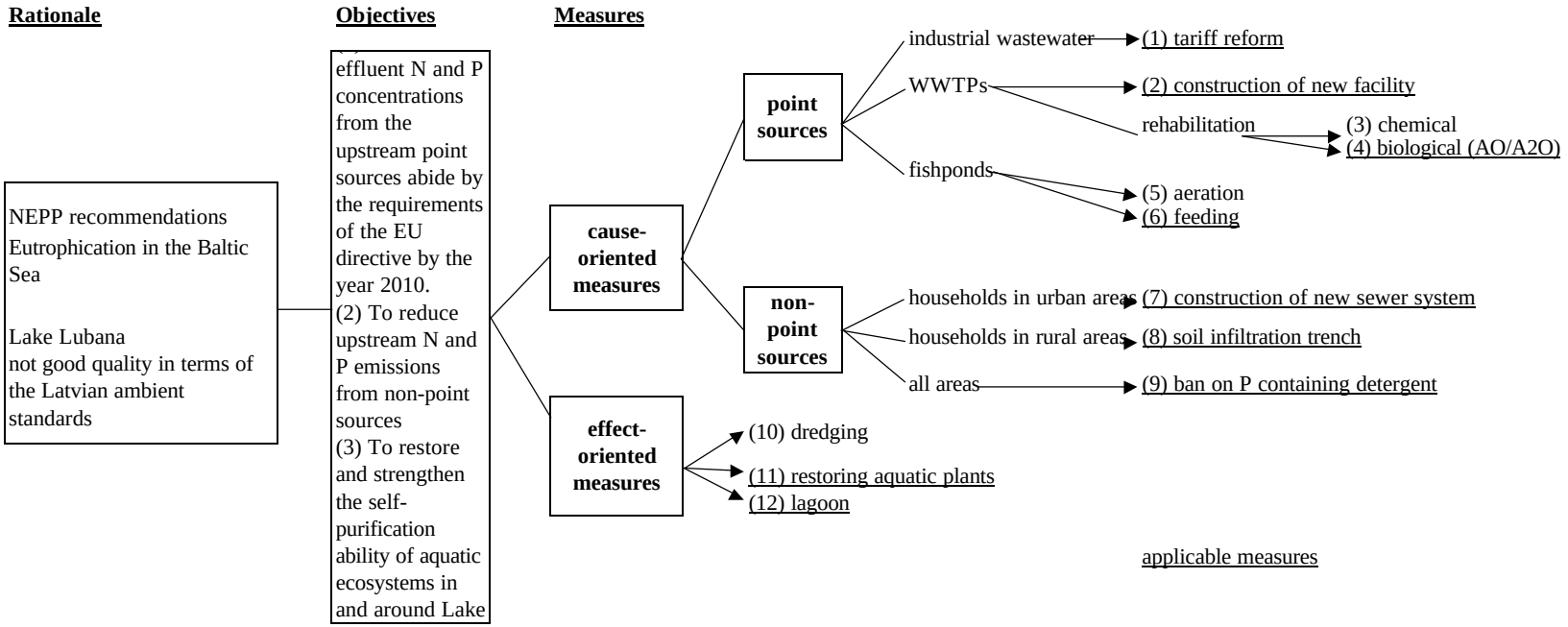

Figure 4.2.1 Water Quality Conservation Plan

CHAPTER 5

CHAPTER 5 BIRDS AND WILDLIFE

5.1 Conditions of Birds and Wildlife

5.1.1 Fauna in Latvia

The Latvian fauna has developed in the post-glacial (Holocene) period over the last 12,000 years. The fauna development started after the extinction of arctic (mammoth) fauna complexes, though the relics are not found in Latvia nowadays. Data on genesis of Latvian fauna in post-glacial times are provided by archaeological investigations in which sub-fossil remains of animal skeletons are found in ancient settlements. The existing fauna of Latvia is geologically new and migration of fauna has been recognized. According to Paaver's fauna classification by periods (1965), the existing fauna of Latvia's mammals refers to the third stage of genesis or fauna of mixed forests and cultivated landscapes. The fauna of mammals of the third stage has changed over the last centuries. Several species became extinct in the 17th century when the climate turned colder. The second distribution of Europe's broad-leaved forest fauna species to the northern Europe, including the eastern Baltic, started in the middle of the 19th century when the climate became warmer. Due to these situations, fauna of the West Palaearctic's mixed forests and cultivated landscapes has characteristically developed in Latvia (Taurins 1982). The following table shows the numbers of species found in Latvia.

Number of Species Found in Latvia

Latin Name	English Name	Number of Species
Protozoa	Mono-cellular species	200
Nonvertebrata	Invertebrate species	6,500
Cyclostomata	Lamprey and similar species	3
Pisces	Fish species	114
Amphibia	Amphibian species	13
Reptilia	Reptile species	7
Aves	Bird species	325
Mammalia	Mammal species	63

Source: Environmental Review of Latvia 1996

Such boreal temperate forests as pine *Pinus*, spruce *Picea*, birch *Betula* and aspen *Populus*, providing suitable habitats for animal species, are typical for the entire Latvia, though the numbers of the species are limited.

5.1.2 Birds

(1) Recorded Bird Species

Over the period 1974-1999, 224 bird species (16 orders and 48 families) were recorded in LWC as shown in Table 5.1.1. The number of bird species significantly exceeds that of the Latvian Ramsar site "Teici nature reserve" which is located to the southeast of the study area with 240 km^2 and 186 bird species (16 orders and 14 families) recorded (Bergmanis & Avotins 1990, Bergmanis 1996). There are 185 species of breeding birds

(83% of the total species) recorded in LWC. Among them, 39 bird species are observed only during migration periods. Several species were observed to breed for the first time in Latvia, for example, Marsh sandpiper (*Tringa stagnatilis*) in 1974, Terek sandpiper (*Xenus cinereus*) in 1987 (Baumanis 1989), Cormorant (*Phalacrocorax carbo*) in 1989 (Baumanis, Bergmanis & Smislov 1997), and Whiskered tern (*Chlidonias hybridus*) in 1992 (Baumanis & Roze 1995). For some bird species such as Spotted eagle, their habitats can be found only in LWC (Petrins et al. 1997, Bergmanis et al. 1997).

Importance of LWC to conserve rare and vanishing breeding bird species is testified by their presence in various legal acts for nature protection in LWC. Two species, spotted eagle and Corncrake, are included in the List of Globally Threatened Species, while two other species, White-tailed eagle and Great snipe, are found in the category of potentially threatened species of the above-mentioned list (Collar & Crosby 1994). Forty-four species or 24% of breeding birds are described in the Red Data Book of Latvia, whilst 48 species are categorized as endangered species in the list of European endangered species (Tucker & Heath 1994). Forty-six species are listed up in the EU Directive (79/409/EEC) on the Conservation of Wild Birds.

(2) Population Trend of Birds

In 1974, the Laboratory of Ornithology of Latvia USSR Academy of Science, currently called the Ornithological Laboratory of the Institute of Biology at the University of Latvia started investigations on ecology of water bird populations and trends in the fishponds of the Nagli fish farm established at the beginning of the 1970s. The Teici nature reserve has initiated monitoring of rare diurnal raptors as well as building of artificial nests for them in LWC since 1984. Counting of bird fauna in Lake Lubana and surrounding mires and forests has been conducted several times. Fauna investigations focusing on some species have been conducted, especially by the Latvian Ornithology Society, the Latvian Nature Fund, and the Museum of Zoology in the University of Latvia. The following table providing the numbers of water birds points out that the study area fully complies with the criteria of the Ramsar Convention.

Population of Major Bird Species in LWC

Latin Name	English Name	Numbers during migration period		
		Spring (Apr. to Jun.)	Autumn (Sep. to Oct.)	Number of breeding pairs
Phalacrocorax carbo	Cormorant	n.a.	n.a.	300
Botaurus stellaris	Bittern	n.a.	n.a.	25
Cygnus columbianus	Bewichk's Swan	200	n.a.	n.a.
Cygnus cygnus	Whooper Swan	1,700	n.a.	14
Anser fabalis	Bean Goose	1,000	1,000	n.a.
Anser albifrons	White-fronted Goose	1,000	1,000	n.a.
Anas penelope	Wigeon	4,000	n.a.	n.a.
Anas crecca	Teal	4,000	n.a.	n.a.
Anas acuta	Pintail	3,000	n.a.	n.a.
Aythya ferina	Pochard	4,000	n.a.	n.a.
Mergus albellus	Smew	200	n.a.	n.a.
Total		19,100	2,000	339

Source: Opermanis 1998 Note: n.a. means that data are not available

As methods, specifics and quality of ornithological investigations differ over periods, population trends are evaluated only for some species. The fact that the area has been changed significantly since the end of the 1940s should be taken into account. Ornithological data in the fishponds established in the 1970s have characterized bird population trends in artificial biotope which significantly differ from natural one in terms of biodiversity of species. Compared to the period of the 1920s-1930s, 5 species have vanished in LWC and 11 species have decreased, while 19 species have increased in population.

5.1.3 Mammals

(1) Mammal species

An overall investigation on mammals has not yet been implemented in LWC. Therefore, species of insectivores, bats and most of rodent species found in Latvia are not included in the list shown in Table 5.1.2. The list of mammal species (5 orders, 12 families and 23 species are recorded) is being prepared to include the numbers of hunted mammals. Fauna of mammals in LWC is very similar or even identical to that of the Teici nature reserve where 42 species were recorded because LWC and the Teici nature reserve have similar biotopes (Bergmanis 1996).

(2) Mammal populations

EU Directive (92-43/EEC) includes beaver, wolf, brown bear, lynx and otter among protected animals in Annex II. In Latvia, however, the numbers of wolf, lynx and otters are increasing and the tendency is particularly sharp in the 1990s. Major reason of game animal increase is the decrease of hunting pressure in the 1990s. In 1996 about 26,000 beavers, 5,000 otters, 1,000 wolf, and more than 600 lynx was reported as total population in Latvia (State of the Latvian Environment, 1997). Presently in Latvia, only brown bear and otter are protected species and hunting of other animals are permitted. The Latvian Red book (1990) lists brown bear, stoat and weasel as rare species, but information is available on non-game animals including stoat and weasel.

In LWC, the only information source for mammal population is hunting statistics that are compiled from the statement of hunter groups in respective hunting territories. Brown bear is near to extinction. The only sighting was a foot print at Vilani, and the individual is thought to be a transit one. Beavers are increasing and populations of wolf, lynx and otter seem not to be decreasing. Increase of forested areas also functions positively as most game animals are forest dwellers. Consequently, there are no specific mammal species to be protected in LWC.

5.1.4 Fish

(1) Fish species

There are 42 fish and 3 lamprey species in inland waters of Latvia, of which 24 fish species are found in LWC as shown in Table 5.1.3 based on the published book on Latvian fishes, study reports of the Latvia Fishery Research Institute (LFRI), and results of inquiry survey. There are no endangered fish species for strict conservation in LWC.

Common carp (*Cyprinus carpio*) and pikeperch (*Stizostedion lucioperca*) are exogenous species introduced artificially to the lake. There are three migratory species, namely asp (*Aspius aspius*), Vimba (*Vimba vimba*) and eel (*Anguilla anguilla*). They are rarely caught in recent years mainly due to physical interruption by dams in the Daugava rivers.

Relative abundance of fish was studied by LFRI in 1997 by means of control net fishing. Most common species in 3 townships of the lake are Bream (*Abramis brama*), White bream (*Blicca joerkna*), and Roach (*Rutilis rutilis*) which are medium-size Cyprinidae species. These species occupied about 70 - 90% in number of individuals on the control fishing. Followed by these species, Perch (*Perca fluviatilis*), and Rudd (*Scardinitus erythrophthalmus*) are caught frequently. Pike (*Esox lucius*) and Pikeperch are the highest trophic level predators in the lake, and they are also caught in this control fishing though relative abundance in number is low.

(2) Spawning and early life history

A spawning season and some other characteristics on reproductive biology and early life stages of major fish species in LWC are summarized in Table 5.1.4. Most species occurring in LWC are considered to spawn in spring from March to June. The earliest spawner seems to be Burbot (*Lota lota*) that starts spawning probably from February, and then followed by pike from March. The last spawner could be common carp that spawn in June-July, but some fishery specialists doubt about natural spawning of them in the lake.

A depth of spawning place seems not largely valuable for fish species in LWC. Water bodies which have 10 cm to several meters with water plants as substrata for egg sticking could be enough for most fish species except for some species like Chub (*Leuciscus cephalus*) and Pikeperch which prefer spawning in sandy bottom. Lake Lubana provides a lot of such shallow and planted environment, particularly in the area of Osupe township. Pikeperch is known to prepare spawning nest in sandy bottom and parent guards eggs. This is not endemic one, but lays eggs in the lake area of Gaigalava where sandy bottom is available.

Since an incubation period of fish is closely related to water temperature, the period is normally expressed in ℃-day. In pike, it is about 150 ℃-day, meaning that it takes about 30 days at constant water temperature of 5℃ from spawning to hatching of larvae, 15 days at 10℃, or 7 - 8 days at 20℃. Considering water temperature of Lake Lubana, the

incubation period could be several weeks to 1 month for eggs spawned in March and April, and several days to 1 week for those spawned in May-July. In some species like pike, common carp, bream, and tench (*Tinca tinca*), newly hatched larvae stick to plants and other substrata for 1 - 15 days during their further development without feeding.

It should be noted that the fishes can spawn not only in the lake but also in shallow areas of river channel, particularly for upstream of the Aiviekste river. This area is characterized by meandered river stretches, and seems to be former inundated grassland in which fishes like pike probably spawned actively. Although specific survey has not been conducted in this area, spawning could be taking place even now.

(3) Ecological constraints of fish in LWC

1) Interruption of ecosystem by the Aiviekste sluice

Before construction of the Aiviekste sluice, the Aiviekste river system including Lake Lubana, the Rezekne and Malta rivers could be a single ecosystem where fish reproduction was sustained by inundated grassland, particularly in the lake. The Aiviekste sluice divided this ecosystem, and there is no fish movement between the lake and the Aiviekste river except for possible run-off of early juveniles from lake to river. It is apparent that the sluice gate affects movement of migratory fish species and recruit of juveniles to the Aiviekste river. This has caused reduction of bio-diversity of Lake Lubana and upstream area.

2) Effect of water level fluctuation

Most intensive spawning of freshwater fishes often takes place in shoals, although they spawn practically in the whole lake area except for the deepest portion. Considering prolonged spawning season and required incubation time together with the time of sticking larval stage, water area must be preferably kept at same level or rather increased from March to June. It is sure that the reduction of water level during this period affects physical mortality of eggs and early larvae to some extents.

3) Stagnant water circulation

Since the regular water flow route from the Rezekne river to the Aiviekste sluice is restricted only in the northern part of the lake, the water circulation of southern part of the lake becomes relatively stagnant. Although only few data related to bottom and water quality conditions are available, this relatively stagnant water circulation would deteriorate habitat circumstance of fish in future.

5.2 Important Species and Habitats

5.2.1 Endangered and Rare Species

International and national criteria such as the list of the European and World Threat Status, the Red Data Book of Latvia, and the List of European Endangered Species are used to select endangered, rare, and unique species found in LWC.

(1) Birds

Thirty-seven species are selected within the study area using the above-mentioned criteria as shown in Table 5.2.1. Among them, 30 species are included in the Red Data Book of Latvia and 32 species in the European Threat Status. Seven species (Black Brouse, Redshank, Wood Sandpiper, Little Gull, Whiskered Tern, Black Tern, and Nightjar) are not included in the Red Data Book but they listed up in the List of European Endangered Species. Although Capercaillie is not found in any lists for protected species, it is added to the important species group as the species is still important as a game bird.

(2) Other Fauna

According to the criteria of Latvian Red Data Book and EU Directive 92/43/EEC, following 7 mammal species in LWC correspond to rare and endangered: beaver, wolf, brown bear, lynx, otter, stoat, weasel. Brown bear is especially rare and endangered, but population numbers of other species seem not so much threatened as far as LWC area is concerned.

5.2.2 Distribution of Precious Biotopes

Possible locations of nesting and breeding for birds, which characterize the LWC ecosystem, such as storks (*Ciconiidae*) and diurnal raptor birds as well as waders and waterfowls are shown in Figure 5.2.1. Based on the mutual decision between the Ministry of Environmental Protection & Regional Development (MEPRD) and the JICA study team, however, the habitat map of those species are not printed on this report for the purpose of strict protection of endangered species. Analysis of breeding and feeding biotopes of the most important bird species leads to the conclusion that each wetland type has greatest importance (see Table 5.2.1). Most species are bound in bogs (52% of the total bird species), fishponds (52%), flood grasslands (47%), and lakes (35%). Wetland biotopes are considered as the only breeding places for 25 bird species (about 70% of the total breeding species).

Migrating water birds preferably feed and rest in such wetland biotopes as lakes, fishponds and flood grasslands in spring, especially, for Black stork (*Ciconia nigra*), White-tailed eagle (*Haliaeetus albicilla)*, Short-toed eagle (*Circaetus gallicus*) and Spotted eagle (*Aquila clanga)*. Density of Corncrake (*Crex crex)* in flooded grasslands is significantly higher than in other biotopes.

Wetland forests and deciduous forests, especially, broad-leaved forests with hard woods, black alders and birches, have great importance in conserving a variety of bird and animal species. Such forests are main breeding and feeding biotopes for Middle spotted woodpecker (*Dendrocopus medius*) and White-backed woodpecker (*Dendrocopus leucotos)*. Lesser spotted eagle (*Aquila pomarina)* and Spotted eagle (*Aquila clanga*) also preferably reside in those forests.

Thus, vegetation types essential for bird species in LWC are: 1) raised and transitional bogs, 2) fens, 3) all types of forest stands on islands in bogs, 4) broad-leaved forests, 5) natural coniferous forest, 6) water, and 7) inundated grasslands.

5.2.3 Potential of Fishing and Hunting Development

(1) Mammals

Economically, commercially, and aesthetically, the most intensive game animals are mostly artiodactyls (*Artiodactyla*) such as Wild boar, Roe Deer, Elk, and Red dear. Highly valuable meat and trophies are exploited from artiodactyls, and trophies, furs, and sculls from Wolf and Lynx. Hunting is organized for foreigners to shoot those species. Demand for furs of other predators and fur animals has been decreasing, and hunting fur animals is not an intensive activity any more.

(2) Birds

Lake Lubana, fishponds and the surrounding areas are popular for hunters. Due to high water levels in summer, numbers of ducks have been declining since 1985 though Lake Lubana is still one of the most popular duck hunting places in Latvia. Hunting licenses for two species, Black grouse and Capercaille, can be sold even to foreigners at higher prices, but numbers of those birds have dropped significantly.

(3) Fish

Fishing and sport angling have a long history in Lake Lubana and the surrounding rivers. Fish catching is one of the most popular favorites for local residents and visitors. Industrial fishery was intensified before 1941, and fish catches have been recorded since 1952. The amount of catches over years depends on fishing intensity. Though interpretation of these data remains speculative, the figures of catches indicate few differences between before and after the rise of water levels in Lake Lubana in 1985. Fish cultivation in the lake consists of Bream (*Abramis brama)* and Roach (*Rutilus rutilus)*. Quite large numbers of Pike (*Esox lucius*), Pikeperch (*Stizostedion lucioperca)*, Perch (*Perca fluviatilis)*, and White bream (*Blicca bjoerkna*) have been caught, and Rudd (*Scardinius erythrophthalmus*), Tench (*Tinca tinca)*, Crucian carp (*Carassius carassius*), Goldfish (*Carassius auratus*) and Ide (*Leuciscus idus*) caught in small numbers. Pike showed the greatest catches before the rise of water levels in the lake. A positive trend can be observed for Bream and Pikeperch. Additional data on fishing

intensity and nets supplied are essential to make more relevant analysis of dynamics in Lake Lubana.

5.2.4 Potential for Eco-tourism and Recreation

Eco-tourism and other types of recreation in nature, including bird watching, angling, hunting, could be suggested as a prospective development in LWC. Informing the local people of natural values could raise public awareness on sustainable use of natural resources and nature conservation. Therefore, nature values should be noticeable to the public so that they understand why financing is necessary for environmental protection and why different types of human activities should be limited in protected areas.

Diversity and unique of species and biotopes in LWC seem to be pre-conditions for eco-tourism development. Eco-tourism would create a demand for services to be provided by the local people. Such services as lodging, feeding, boating, canoeing, and angling could form a significant part of additional income resources. Taking into account impacts on nature, signs and objects for visitors should be site specific for birds, animals and biotopes watching.

(1) Watching of birds, animals, and biotopes

The study area is the most suitable and attractive for bird watching. Pre-conditions are great diversity of species including rare species, well-developed road networks, gather of birds in easily observed sites such as fishponds. To prevent rare and endangered bird species such as diurnal raptors and Black stork, from being harmed, bird watching should be allowed and organized just on the existing roads, and preferably competent guides should accompany bird watchers. It is possible to watch water birds breeding and feeding on the roads. Organizers of bird watching should take into account the fact that what tourists' intentions are. Tourists might collect some eggs of birds. Professional photographers might show off nests of especially vulnerable and endangered species such as rare and extinct raptors and let the public know their locations, which might put them in serious danger.

(2) Recreation

It should be avoided to locate recreational sites on private lands without any agreements with landowners and land users. The local people can arrange whatever recreational services they want to provide if there is a demand for such services.

5.3 Directions for Nature Protection

5.3.1 Impacts on Habitats

There are specific drainage and surface runoff conditions in LWC. Several rivers once discharging into Lake Lubana now discharge into the Aiviekste river as a result of dyke construction around the lake. Therefore, flows and hydrological regimes of the lake have

changed. Blocking of the Pededze river in one spot has stopped water flowing in the lower part of the river over 6 km long, which has contaminated its riverbeds with organic matters that worsen water quality.

The tributaries to Lake Lubana and the Aiviekste river gather a lot of surface runoff waters from the surrounding highlands. Due to the limited discharge capacity of the Aiviekste water gate, it cannot divert floodwaters very quickly. Long flooding duration has developed bogs and wetlands in the vicinities of Lake Lubana providing preferable habitats for fauna. The presence and dynamics of biotopes crucially depend on water level changes and flooding duration.

The drainage systems in LWC changed surface water runoff from wetland areas, and decreased thickness of water-saturated soil layers. A change in hydrological conditions causes transformation of wetland vegetation. Then, its biodiversity is influenced by changes in typical structures of wetlands in LWC. Human activities and their ecologically negative impacts mentioned below should be kept in mind, especially, in LWC.

1) Due to drainage in bogs, especially, in the Solagala and Sala bogs, changes in vegetation types have been observed in the belts of wet forests typical for peripheries of bogs. Growing conditions for forests and composition of tree species have also changed as well as invasion of trees, such as birches and pines, into the bogs is observed. Areas with small lakes and water pools disappeared in the Sala bog.

2) Drainage of marshy grasslands facilitates less moisture content in the grasslands, and causes more trees and bushes, especially along the drainage ditches, with their seeds encouraging further distribution of trees and bushes in the grasslands.

3) Drainage activities in the wetland forests and road construction change growing conditions for forests into those for drained soils (mineral or peat soils).

4) Flooding areas and marshy grasslands have shrunk due to delimitation of Lake Lubana with dykes.

5) Construction of water gates in the Aiviekste river and Lake Lubana has interrupted and cut off traditional fish migration routes, especially for Ide and Pike. The two species used to spawn in the lake. Mainly due to shortened flood duration in Lake Lubana and the surrounding areas, fish spawning in marshy grasslands along the Aiviekste river has been unsuccessful. Therefore, fish resources in Aiviekste river become scarce.

6) With the high water levels of Lake Lubana in summer, the study area is not so attractive as used to be as a game spot for water birds. LWC has diminished its previous importance as a place for hunting.

7) Forestry activities destroyed the only one recorded breeding place for Spotted Eagle (World Threat Status) in Latvia.

8) There are some human activities that cause positive ecological effects. The fishponds of about 3,000 ha around the lake has positively influenced biodiversity of bird species in the study area. The fishponds provide water birds with shallow water levels, rich vegetation in water plants, and abundant fish resources.

5.3.2 Existing Conservation Frame

(1) Nature protection territories

Lake Lubana and the surrounding mires, forming LWC, are ecologically united and unique in view of biodiversity. The study area has been attracting much attention from scientists and environmental protectionists. As a result of biological investigations carried out by the Institute of Biology, the Teici nature reserve, the Latvian Fund for Nature, and the Latvian Ornithological Society (LOS), the areas to be protected are proposed to the Cabinet of Ministers. The proposal was adopted by the Cabinet of Ministers of the Republic of Latvia on June 15, 1999 (Regulations No. 212/199). The locations and the areas of the current nature protection territories are shown in Figure 5.3.1 and the following table.

According to the General Regulations on Protection and Use of Special Protected Nature Areas, a nature protection management plan, including protection measures and zones specifying protection and exploitation activities, should be developed for each designated protection territories. However, no nature protection management plan has been developed in LWC. On the other hand, the Department of Forestry established 24 protected forest plots for protection of breeding habitats of rare raptor birds in LWC based on the approved areas to be protected mentioned above. Based on the mutual decision between the Ministry of Environmental Protection & Regional Development (MEPRD) and the JICA study team, however, those plots are not printed on this report for the purpose of strict protection of endangered species.

Current Nature Protection Territories in LWC

No.	Name of Restricted Area	Area (ha)
1	Barkava oak stand	62
2	Berzpils bog	3,319
3	Idinu bog	818
4	Idena and Kvapani ponds	1,116
5	Lagazas-Snitku bog	3,386
6	Lubana depressions	5,905
7	Lubana and Solagala bog	2,899
8	Parabaine	9,822
9	Pededze river lower stretch	4,147
10	Sala bog	3,862
11	Tirumnieki bog	266
Total		35,602

Note: The numbers shown here correspond to the numbers in Figure 5.3.1.
Source: The Cabinet of Ministers of the Republic of Latvia on June 15, 1999 (Regulations No 212/199)

(2) Selection Criteria

Current practice for protection of bird and animal species in Latvia is based on establishment of different types of protected areas, mainly for birds. Mainly species included in the Latvia Red Data Book Category I are selected for protection (all eagle species). Besides, species from other Categories are selected if their existence depend on specific biotopes (Black stork and Woodpeckers) or species with high economic value (Capercaillie - gaming bird).

Protection of specific bird species in LWC as well as in the whole Latvia is organized so that forest stands as nesting sites of specific species are conserved by stopping economic activities there. Protection of forest stands as habitat of rare species is stated in Regulations No.132 of the Cabinet of Ministers of the Republic of Latvia "On enclosure of forests in categories and selection of particularly protected forest sites". Article 22 of those regulations foresees establishment of forest biotopes for protected plants, fungus, lichens and animals. Forestry activities are limited by number of regulations issued by State Forest Survey, such as regulations on main cutting, recommendations for main cutting, regulations on thinning (inter-cutting), and recommendations on thinning.

(3) Territories to be Protected

The following protected areas are established within LWC for protection of species and habitats. That is done in accordance with the existing data on occurrence and distribution of rare and endangered bird species and taking into consideration botanical, ornithological, zoological and old forest stand criteria of the territories.

Protected nature territories:

Their total area is 35,602 ha. Protection of species within the protected nature areas is stated by the Nature Protection Plan for each area which includes individual regulations on protection and exploitation. The plans have been formulated by MEPRD for three protected areas (Parabaine, Pededze lower and Lubana depressions) within LWC in 1999/2000. Protection of the other protected nature areas in LWC currently is subject to the Regulation of the Cabinet of Ministers of the Republic of Latvia No.354 "General regulations on protection and exploitation of particularly protected nature areas" from October 21, 1997.

Forest biotopes for protected bird species:

Based on the instructions No.98 and No.133 of State Forest Survey, there are 24 forest clusters for protected bird species established in LWC. Their total area is 904 ha.

5.3.3 Directions for Birds and Wildlife Protection

(1) Water level control of Lake Lubana for birds

By analyzing dynamics and consequences of water level changes and applying the water levels at the beginning of the 1980s, water levels for such water birds as dabbling ducks should be kept reasonable at least from June to September. The important features of Lake Lubana as habitats for breeding and summering water birds, and a hunting activity should be restored. It is recommended that depths of the peripheries of the lake be not deeper than 0.5 m.

(2) Drainage activity control for bogs

Administrative measures should be developed and implemented to ensure any kinds of drainage activities. Water runoff from bogs to drainage ditches should be limited. Water flows in the old and natural Pededze riverbeds should be restored. An analysis of the existing conditions in bogs and their surrounding areas should be carried out.

(3) Fauna monitoring program

The table below lists up the monitoring systems necessary to LWC. This list can be revised and made more detailed if there are pre-conditions for establishment and realization of a united monitoring system. At present, investigations are being carried out by different institutions for their own purposes.

Necessary Monitoring Systems in LWC

Monitoring Objects	Targets and Periods
Water quality	Lake Lubana and its surrounding rivers
Water levels	Lake Lubana
Groundwater table	Bogs and fens
Flooded areas	During spring
Water birds	Fishponds
Rare diurnal raptors	LWC
Colonial bird species	Lake Lubana and Gomelis
Migrating water birds	Gomelis and fishponds in spring
Waders	Mires
Corncrake and Great Snipe	LWC
Woodpeckers	Broad-leaved and wet deciduous forests
Typical vegetation of marsh grasslands	LWC
Game mammals	LWC
Productivity of fish	Lake Lubana

(4) Program preparation of nature protection plans

Nature protection plans are not developed for all particularly protected nature areas in LWC. Therefore, it is necessary to develop the nature protection plans for other protected nature areas. There are territories important for birds outside the protected nature areas as well (e.g., Lubana Lake, fish ponds of Orenisi and Zvejsala parts in Nagli fishery, parts of inundated grasslands - *Klani*). Protection concept for those areas should be also elaborated within the frames of nature protection plans.

(5) Establishment program of forest biotope sites

Forest biotope sites for protected bird species are established just in some part of LWC, according to the instructions of State Forest Survey. Several localities of rare bird species are located outside the protected nature areas and so remain unprotected. So it is recommendable to establish new forest biotope sites for protected bird species, where they are not established and are required in LWC.

(6) Habitat protection program

It is recommendable to facilitate abidance of regulations on protection of species and biotopes by co-operating with State Environmental Inspection and State Forest Survey. Besides, a grass cutting activity on marshy (flood) grasslands is recommended to avoid unique habitats from vanishing and to prevent trees and bushes from overgrowing.

5.3.4 Directions for Fish Conservation

(1) Proper management of water level

From the viewpoint of fish conservation and fishery resource management, it is favorable to keep high water level for the whole year following the current rule described in "The Regulations of Exploitation of Lake Lubana and Hydro Technical Buildings". This regulation indicates the determined elevation levels of the lake water; maximal level in an extreme situation of 95.3 m; normal water level of 92-93 m, and minimal level of 91.75-91.20 m.

Fishermen and fish inspectors of REBs suggest that fishes could be conserved as long as water level is managed in accordance with the current regulation. However, the minimal elevation level (91.2 m) means only 1.2 m water depth even in the deepest area of the lake. There is a little doubt that fishes can survive over the winter under such a shallow water level.

According to the hydrological data obtained, the lowest water level during the period from 1984-1995 was 91.7 m on October 1991. This water level is higher than that of the regulation, but the fishermen complained of damage over the winter period. This means that the required water level by fishermen must be more than 91.7 m. Re-examination of the lakebed elevation and up-date of the topographical map would be necessary to clarify this argument. Besides, a quick decrease of water level should be avoided for movement of fish juveniles from the shoal, as suggested less than 2-3 cm / 24 hours in the regulation.

(2) Conservation and monitoring of aquatic environment

In general, water quality of Lake Lubana is well maintained. However, water circulation in the southern part of the lake could be stagnant and would cause deterioration of fish

habitat. It is recommended to increase water flow toward the Kalnagale sluice during the spring period for enhancement of water exchange in the southern part.

Conservation of fish spawning activity is now regulated by the closure of fishing activities for the whole lake. When the intensive spawning ground is specified by species in future, spatial regulation such as fish sanctuary should be applied in combination with the existing regulation. Overall, periodical monitoring on aquatic environment not only water quality but also living organisms should be conducted through institutional strengthening and provision of relevant analytical equipment.

(3) Expansion of fish wintering place

A fish mortality due to insufficiency of fish wintering places in the lake has been observed in some dry years. Considering that the ice layer of the lake extends to be 0.8-1.0 m, fish wintering place must have a depth of more than 2.5 m in the winter. An availability of continuous water current to supply dissolved oxygen to fish is another important factor restricting the wintering place. At present, the place satisfying these conditions in the lake is limited to the river mouth area of the Rezekne river. The lower reach of the Rezekne river could also be a wintering place sustained by water flow. A physical expansion of fish wintering places by dredging is recommended for fish to survive winter safely.

(4) Fish way construction

As a countermeasure for present interruption of ecosystem at the Aiviekste sluice, there is an idea of construction of fish way. However, the effectiveness of this fish way seems to be restricted only for fishes inhabiting the upstream of the Plavinu Hydroelectric Power Station (HPS) in the Daugava river, because the fish movement has been interrupted by the existing HPS sites as shown below. Thus, a recovery of highly migratory fish species such as salmon and eel cannot be expected even though a fish way is constructed at the Aiviekste sluice.

The Hydroelectric Power Stations (HPS) Sites

Hydroelectric Power Stations (HPS)		Facility of fish way
Daugava river		
1)Riga HPS	Public	No.
2)Kegums HPS	Public	Yes (but not used)
3)Plavinu HPS	Public	No (although it was planned)
Aiviekste river		
4)Aiviekste HPS	Private	Yes

The fish way may improve fish stock of migratory carps such as Asp and Vimba in the Aiviekste river stretch and Lake Lubana to some extent. However, Pike and these carp species already have their own spawning areas in the river, especially in the upstream meandered area in LWC. From viewpoint of fish conservation in the Aiviekste river, it seems to be important to protect existing spawning areas rather than construction of a new fish way. Moreover, no commercial fishing is allowed in the Aiviekste river, and

the target migratory carps (Asp and Ide) are low price in the market. Therefore, it is not recommended to construct a fish way at the Aiviekste sluice.

(5) Establishment of Lake Lubana Fishery Management Authority

One of the constraints on management and development of fishery in Lake Lubana is complexity of government administration. There is no scientific reason that limit of fishing right, which is allocated to the lake as a whole, is divided into three township waters.

Rezekne and Madona REBs seem to carry out fish control activities without close collaboration. For example, the fry restocking of pike to Lake Lubana was conducted by the fishermen of Osupe township who asked artificial seed production to the state-own Serene fish farm in Plavinas, while the Nagli fish farm produced pike fry but sold them to the other lake.

It is strongly recommended to establish an integrated coordinating authority about overall management of fishery-related activities in Lake Lubana, tentatively named “the Lake Lubana Fishery Management Authority”. Major function of this organization is as follows:

- Allocation of commercial fishing right to fishermen,
- Issue of commercial fishing license, and of specific angling card on LWC,
- Coordination of fish control activity and arbitration of conflicts on fishery,
- Preparation and execution of overall fishery development plan, and
- Support establishment of fishermen’s and angler’s organization.

Board members of this organization should be composed of the following representatives of a) Rezekne and Madona DCs and relevant townships, Rezekne and Madona REBs, the fishermen‘s and angler’s organizations (to be established), the hatchery complex (to be established). Representatives from NBF and LFRI should attend regular board meetings as advisors.

(6) Encouragement fishermen‘s organization and angler’s organization

At present, there is no functional organization regarding commercial fishing or recreational fishing, and this situation often causes inefficiency and misunderstanding on fishery activities. A spontaneous formation of integrated fishermen‘s organization seems to be difficult without some incentives. In this context the proposed facilities and equipment could be one of incentives for them to formulate organization.

Possible people who join the fishermen‘s organization are the licensed fishermen (60 persons), their family members and assistants, and employees of the Nagli fish farm (56 persons). Few informations are now available about anglers number to be organized.

Possibility of exclusive fishing right system, like the one applied for the Leici Co. of Lake Razna, should be discussed in the proposed integrated coordinating authority.

(7) Introduction of specific angling card system

The specific angling card system has been ruled out in the nationwide fishery regulation. The municipality or designated organization that are responsible for fishery management of particular water can issue specific angling card aside from common angling card as a budget source for specific fishery resource management and propagation activity. In the case of specific angling card, 74% of sales are transferred to the Fish Fund for possible refunding. Introduction of this system would be essential for operation of hatchery and other activities on fishery resource management in LWC.

(8) Future balance of commercial fishing and angling

In near future when number of angler increased, there may be some conflicts between anglers and commercial fishermen, because those two parties use the same fish resources. Some lakes in Latvia, for example Lake Burtnieks, apply time sharing and spatial segregation system. This new system is able to apply for Lake Burtnieks because this lake has not experienced any commercial fishing before. Appropriate institutional and regulative measures for balancing commercial fishing and angling of Lake Lubana should be discussed in the proposed integrated coordinating authority.

Table 5.1.1 Bird Species Recorded in Lubana Wetland Complex (1/4)

	Latin Name	English Name	Status *	Red Data Book of Latvia (1)	European Threat Status (2)	SPEC category (2)	World Threat Status (3)	Birds Directive Annex (4)	Ramsar Conv. (5)	Trend (6)
	PODICIPEDIFORMES(ORDER)									
	Podicipedidae(Family)									
1	*Tachybaptus ruficollis*	Little Grebe	Br							
2	*Podiceps cristatus*	Great Crested Grebe	Br							
3	*Podiceps grisegena*	Red-necked Grebe	Br							
4	*Podiceps auritus*	Slavonian Grebe	Br					I		
5	*Podiceps nigricollis*	Black-necked Grebe	Br	3						
	PELECANIFORMES									
	Phalacrocoracidae									
6	*Phalacrocorax carbo*	Cormorant	Br					I	○	+
	CICONIIFORMES									
	Ardeidae									
7	*Botaurus stellaris*	Bittern	Br	3	V	3		I	○	
8	*Ixobrychus minutus*	Little Bittern	Br	3	V	3		I		
9	*Egretta alba*	Great White Egret	M					I		
10	*Ardea cinerea*	Grey Heron	Br	5						+
	Ciconiidae									
11	*Ciconia nigra*	Black Stork	Br	3	R	3		I		
12	*Ciconia ciconia*	White stork	Br		V	2		I		
	ANSERIFORMES									
	Anatidae									
13	*Cygnus olor*	Mute Swan	Br							+
14	*Cygnus columbianus*	Bewick's Swan	M	2	L	3		I	○	
15	*Cygnus cygnus*	Whooper Swan	Br	3	S	4		I	○	+
16	*Anser fabalis*	Bean Goose	M						○	
17	*Anser albifrons*	White-fronted Goose	M						○	
18	*Anser erythropus*	Lesser White-fronted Goose	M		V	1	V	I		
19	*Anser anser*	Greylag Goose	Br	3						+
20	*Branta canadensis*	Canada Goose	M							
21	*Tadorna tadorna*	Shelduck	M	3						
22	*Anas penelope*	Wigeon	Br						○	
23	*Anas strepera*	Gadwall	Br		V	3				
24	*Anas crecca*	Teal	Br						○	
25	*Anas platyrhynchos*	Mallard	Br							
26	*Anas acuta*	Pintail	Br		V	3			○	
27	*Anas querquedula*	Garganey	Br		V	3				
28	*Anas clypeata*	Shoveler	Br							
29	*Netta rufina*	Red-crested Pochard	M		D	3				
30	*Aythya ferina*	Pochard	Br		S	4			○	
31	*Aythya nyroca*	Ferruginous Duck	M		V	1		I		
32	*Aythya fuligula*	Tufted Duck	Br							
33	*Aythya marila*	Scaup	M		L	3				
34	*Clangula hymealis*	Long-tailed Duck	M							
35	*Bucephala clangula*	Goldeneye	Br							
36	*Mergus albellus*	Smew	M		V	3			○	
37	*Mergus serrator*	Red-breasted Merganser	M	1						
38	*Mergus merganser*	Goosander	Br	2						
	FALCONIFORMES									
	Accipitridae									
39	*Pernis apivorus*	Honey Buzzard	Br		S	4		I		
40	*Milvus migrans*	Black Kite	Br	3	V	3		I		
41	*Haliaetus albicilla*	White-tailed Eagle	Br	1	R	3	NT	I		+
42	*Circaetus gallicus*	Short-toed Eagle	Br	3	R	3		I		
43	*Circus aeruginosus*	Marsh Harrier	Br					I		
44	*Circus cyaneus*	Hen Harrier	PBr	1	V	3		I		
45	*Circus pygargus*	Montagu's Harrier	Br	3	S	4		I		+
46	*Accipiter gentilis*	Goshawk	Br							
47	*Accipiter nisus*	Sparrowhawk	Br							
48	*Buteo buteo*	Buzzard	Br							
49	*Buteo lagopus*	Rough-legged Buzzard	M							
50	*Aquila pomarina*	Lesser Spotted Eagle	Br	3	R	3		I		
51	*Aquila clanga*	Spotted eagle	Br	1	E	1	V	I		
52	*Aquila chrysaetos*	Golden Eagle	Br	1	R	3		I		
	Pandionidae									
53	*Pandion haliaetus*	Osprey	Br	3	R	3		I		+
	Falconidae									
54	*Falco tinnunculus*	Kestler	Br	2	D	3				
55	*Falco vespertinus*	Red-footed Falcon	M	3	V	3				
56	*Falco subbuteo*	Hobby	Br							

(continued)

Table 5.1.1 Bird Species Recorded in Lubana Wetland Complex (2/4)

	Latin Name	English Name	Status *	Red Data Book of Latvia (1)	European Threat Status (2)	SPEC category (2)	World Threat Status (3)	Birds Directive Annex (4)	Ramsar Conv. (5)	Trend (6)
	GALLIFORMES									
	Tetraonidae									
57	*Bonasa bonasia*	Hazel Grouse	Br					I		
58	*Lagopus lagopus*	Willow Grouse	PBr	1						
59	*Tetrao tetrix*	Black Grouse	Br		V	3		I		
60	*Tetrao urogallus*	Capercaillie	Br							
	Phasanidae									
61	*Perdix perdix*	Grey Partridge	Br	2	V	3				
62	*Coturnix coturnix*	Quail	Br	3	V	3				
	GRUIFORMES									
	Rallidae									
63	*Rallus aquaticus*	Water Rail	Br							
64	*Porzana porzana*	Spotted Crake	Br		S	4		I		
65	*Porzana parva*	Little Crake	Br	4	S	4		I		
66	*Crex crex*	Corncrake	Br	2	V	1	V	1		
67	*Gallinula chloropus*	Moorhen	Br							
68	*Fulica atra*	Coot	Br							
	Gruidae									
69	*Grus grus*	Crane	Br	3	V	3				
	CHARADRIIFORMES									
	Haematopodidae									
70	*Haematopus ostralegus*	Oystercatcher	M	3						
	Glareolidae									
71	*Glareola pratincola*	Collared Pratincole	M		E	3		I		
72	*Glareola nordmanni*	Black-winged Pratincole	M		R	3				
	Charadriidae									
73	*Charadrius dubius*	Little Ringed Plover	Br							
74	*Charadrius hiaticula*	Ringed Plover	M							
75	*Pluvialis apricaria*	Golden Plover	Br	3	S	4		I		+
76	*Pluvialis squaturola*	Grey Plover	M							
77	*Vanellus vanellus*	Lapwing	Br							
	Scolopacidae									
78	*Calidris minuta*	Little Stint	M							
79	*Calidris temminckii*	Temminck's Stint	M							
80	*Calidris ferruginea*	Curlew Sandpiper	M							
81	*Calidris alpina*	Dunlin	M	1	V	3				
82	*Limicola falcinellus*	Broad-billed Sandpiper	M							
83	*Philomachus pugnax*	Ruff	Br	2	S	4		I		
84	*Lymnocryptes minimus*	Jack Snipe	M		V	3				
85	*Gallinago gallinago*	Common Snipe	Br							
86	*Gallinago media*	Great Snipe	Br	0	V	2	NT	I		
87	*Scolopax rusticola*	Woodcock	Br		V	3				
88	*Limosa limosa*	Black-tailed Godwit	Br	3	V	2				
89	*Limosa lapponica*	Bar-tailed Godwit	M		L	3				
90	*Numenius phaeopus*	Whimbler	Br	3	S	4				+
91	*Numenius arquata*	Curlew	Br	2	D	3				
92	*Tringa erythropus*	Spotted Redshank	M							
93	*Tringa totanus*	Redshank	Br		D	2				
94	*Tringa stagnatilis*	Marsh Sandpiper	Br							+
95	*Tringa nebularia*	Greenshank	M							
96	*Tringa ochropus*	Green Sandpiper	Br							
97	*Tringa glareola*	Wood Sandpiper	Br		D	3		I		
98	*Xenus cinereus*	Terek Sandpiper	Br							+
99	*Actitis hypoleucos*	Common Sandpiper	Br							
100	*Arenaria interpres*	Turnstone	M							
101	*Phalaropus lobatus*	Red-necked Phalarope	M					I		
	Laridae									
102	*Larus ichtyaetus*	Great Black-headed Gull	M							
103	*Larus minutus*	Little Gull	Br		D	3				+
104	*Larus ridibundus*	Black-headed Gull	Br							+
105	*Larus canus*	Common Gull	Br		D	2				
106	*Larus fuscus*	Lesser Black-backed Gull	M		S	4				
107	*Larus argentatus*	Herring Gull	Br							+
108	*Larus marinus*	Great Black-backed Gull	M		S	4				
	Sternidae									
109	*Sterna caspia*	Caspian Tern	M		E	3		I		
110	*Sterna hirundo*	Common Tern	Br		*			I		
111	*Sterna albifrons*	Little Tern	Br	3	D	3		I		
112	*Chlidonias hybridus*	Whiskered Tern	Br		D	3		I		+
113	*Chlidonias niger*	Black Tern	Br		D	3		I		+
114	*Chlidonias leucopterus*	White-winged Black Tern	Br							+
	COLUMBIFORMES									
	Columbidae									
115	*Columba livia domest.*	Feral Pigeon	Br							
116	*Columba palumbus*	Woodpigeon	Br		S	4				
117	*Streptopelia turtur*	Turtle Dove	Br		D	3				

(continued)

Table 5.1.1 Bird Species Recorded in Lubana Wetland Complex (3/4)

	Latin Name	English Name	Status *	Red Data Book of Latvia (1)	European Threat Status (2)	SPEC category (2)	World Threat Status (3)	Birds Directive Annex (4)	Ramsar Conv. (5)	Trend (6)
	CUCULIFORMES									
	Cuculidae									
118	*Cuculus canorus*	Cuckoo	Br							
	STRIGIFORMES									
	Strigidae									
119	*Glaucidium passerinum*	Pygmy Owl	PBr	4				I		
120	*Strix aluco*	Tawvy Owl	Br		S	4				
121	*Strix uralensis*	Ural owl	Br	3						+
122	*Asio otus*	Long-eared Owl	Br							
123	*Asio flammeus*	Short-eared Owl	PBr	1	V	3		1		
124	*Aegoliuf funereus*	Tengmalm's Owl	Br	3				I		
	CAPRIMULGIFORMES									
	Caprimulgidae									
125	*Caprimulgus europaeus*	Nightjar	Br		D	2		I		
	APODIFORMES									
	Apodidae									
126	*Apus apus*	Swift	Br							
	CORACIIFORMES									
	Alcedinidae									
127	*Alcedo atthis*	Kingfisher	Br		D	3		I		
	Upupidae									
128	*Upupa epops*	Hoopoe	PBr	3						
	PICIFORMES									
	Picidae									
129	*Jynx torquila*	Wryneck	Br		D	3				
130	*Picus canus*	Grey-headed Woodpecker	Br		D	3		I		
131	*Dryocopus martius*	Black Woodpecker	Br					I		
132	*Dendrocopos major*	Great Spotted Woodpecker	Br							
133	*Dendrocopos medius*	Middle Spotted Woodpecker	Br	3	S	4		I		
134	*Dendrocopos leucotos*	White-backed Woodpecker	Br	3				I		
135	*Dendrocopos minor*	Lesser Spotted Woodpecker	Br							
136	*Picoides tridactylus*	Three-toed Woodpecker	Br	3	D	3		I		
	PASSERIFORMES									
	Alaudidae									
137	*Lullula arborea*	Woodlark	Br		V	2		I		
138	*Alauda arvensis*	Skylark	Br		V	3				
	Hirundinidae									
139	*Riparia riparia*	Sand Martin	Br		D	3				
140	*Hirundo rustica*	Swallow	Br		D	3				
141	*Delichon urbica*	House Martin	Br							
	Motacillidae									
142	*Anthus campestris*	Tawny Pipit	Br		V	3		I		
143	*Anthus trivialis*	Tree Pipit	Br							
144	*Anthus pratensis*	Meadow Pipit	Br		S	4				
145	*Motacilla flava*	Yellow Wagtail	Br							
146	*Motacilla citreola*	Citrine Wagtail	PBr							
147	*Motacilla alba*	Pied Wagtail	Br							
	Bombycillidae									
148	*Bombucilla garrulus*	Waxwing	M							
	Troglodytidae									
149	*Troglodytes troglodytes*	Wren	Br							
	Prunellidae									
150	*Prunella modularis*	Dunnock	Br		S	4				
	Turdidae									
151	*Erithacus rubecula*	Robin	Br		S	4				
152	*Luscinia luscinia*	Thrush Nightingale	Br		S	4				
153	*Luscinia svecica*	Bluethroat	Br	4				I		
154	*Phoenicurus ochruros*	Black Redstart	Br							
155	*Phoenicurus phoenicurus*	Redstart	Br		V	2				
156	*Saxicola rubetra*	Whinchat	Br		S	4				
157	*Oenanthe oenanthe*	Northern Wheatear	Br							
158	*Turdus merula*	Blackbird	Br		S	4				
159	*Turdus pilaris*	Fieldfare	Br		S	4				
160	*Turdus philomelos*	Song Thrust	Br		S	4				
161	*Turdus iliacus*	Redwing	Br		S	4				
162	*Turdus viscivorus*	Mistle Thrush	Br		S	4				
	Sylviidae									
163	*Locustella naevia*	Grasshopper Warbler	Br		S	4				
164	*Locustella fluviatilis*	River Warbler	Br		S	4				
165	*Locustella luscinioides*	Savi's Warbler	Br	3	S	4				
166	*Acrocephalus schoenobaenus*	Sedge Warbler	Br		S	4				
167	*Acrocephalus dumetorum*	Blyth's Reed Warbler	Br							
168	*Acrocephalus palustris*	Marsh Warbler	Br		S	4				
169	*Acrocephalus scirpaceus*	Reed Warbler	Br		S	4				
170	*Acrocephalus arundinaceus*	Great Reed Warbler	Br							
171	*Hippolais icterina*	Icterine Warbler	Br		S	4				
172	*Sylvia nisoria*	Barred Warbler	Br		S	4		I		
173	*Sylvia curruca*	Lesser Whitethroat	Br							

(continued)

Table 5.1.1 Bird Species Recorded in Lubana Wetland Complex (4/4)

	Latin Name	English Name	Status *	Red Data Book of Latvia (1)	European Threat Status (2)	SPEC category (2)	World Threat Status (3)	Birds Directive Annex (4)	Ramsar Conv. (5)	Trend (6)
	Sylvia									
174	*Sylvia communis*	Whitethroat	Br		S	4				
175	*Sylvia borin*	Garden Warbler	Br		S	4				
176	*Sylvia atricapilla*	Blackcap	Br		S	4				
177	*Phylloscopus trochiloides*	Greenish Warbler	Br							
178	*Phylloscopus sibilatrix*	Wood Warbler	Br		S	4				
179	*Phylloscopus collybita*	Chiffchaff	Br							
180	*Phylloscopus trochilus*	Willow Warbler	Br							
181	*Regulus regulus*	Goldcrest	Br							
	Muscicapidae									
182	*Muscicapa striata*	Spotted Flycatcher	Br		D	3				
183	*Ficedula parva*	Red-breasted Flycatcher	Br					I		
184	*Ficedula hypoleuca*	Pied Flycatcher	Br		S	4				
	Timaliidae									
185	*Panurus biarmicus*	Bearded Tit	PBr	3						
	Aegithalidae									
186	*Aegithalos caudatus*	Long-tailed Tit	Br							
	Paridae									
187	*Parus palustris*	Marsh Tit	Br							
188	*Parus montanus*	Willow Tit	Br							
189	*Parus cristatus*	Crested Tit	Br		S	4				
190	*Parus ater*	Coal Tit	Br							
191	*Parus caeruleus*	Blue Tit	Br		S	4				
192	*Parus major*	Great Tit	Br							
	Sittidae									
193	*Sitta europaea*	Nuthatch	Br							
	Certhiidae									
194	*Certhia familiaris*	Treecreeper	Br							
	Remizidae									
195	*Remiz pendulinus*	Penduline Tit	Br	3						
	Oriolidae									
196	*Oriolus oriolus*	Golden Oriole	Br							
	Laniidae									
197	*Lanius collurio*	Red-backed Shirke	Br		D	3				
198	*Lanius excubitor*	Great Grey Shrike	Br	2	D	3				
	Corvidae									
199	*Garrulus glandarius*	Jay	Br							
200	*Pica pica*	Magpie	Br							
201	*Nucifraga caryocatactes*	Nutcracker	Br							
202	*Corvus monedula*	Jackdaw	Br		S	4				
203	*Corvus frugilegus*	Rook	Br							
204	*Corvus corone cornix*	Carrion Crow	Br							
205	*Corvus corax*	Raven	Br							
	Sturnidae									
206	*Sturnus vulgaris*	Starling	Br							
	Passeridae									
207	*Passer domesticus*	House Sparrow	Br							
208	*Passer montanus*	Tree Sparrow	Br							
	Fringillidae									
209	*Fringilla coelebs*	Chaffinch	Br		S	4				
210	*Fringilla montifringilla*	Brambling	PBr							
211	*Carduelis chloris*	Greenfinch	Br		S	4				
212	*Carduelis carduelis*	Goldfinch	Br							
213	*Carduelis spinus*	Siskin	Br		S	4				
214	*Carduelis cannabina*	Linnet	Br		S	4				
215	*Carduelis flammea*	Redpoll	M							
216	*Carduelis hornemanni*	Arctic Redpoll	M							
217	*Loxia curvirostra*	Crossbill	Br							
218	*Carpodacus erythrinus*	Scarlet Rosefinch	Br							
219	*Pyrrhula pyrrhula*	Bullfinch	Br							
220	*Coccothraustes coccothraustes*	Hawfinch	Br							
	Emberizidae									
221	*Plectrophenax nivalis*	Snow Bunting	M							
222	*Emberiza citrinella*	Yellowhammer	Br							
223	*Emberiza hortulana*	Ortolan Bunting	PBr							
224	*Emberiza schoeniclus*	Reed Bunting	Br							

Status* Br- Breeding, PBr- Probable breeding, M- Passage migrant

(1) Lipsbergs et al. 1990: Popularzinatiska Latvijas Sarkana gramata. Dzivnieki
0 - extinct species, 1 - vanishing species, 2 - rare species, 3 - species with decreasing number of individuals, 4 - indeterminate species, 5-increasing species

(2) Tucker & Heath. Birds in Europe, 1994: E - Endangered; V - Vulnerable; D - Declining; L - Localised; S - Secured; R -Rare, SPEC category 1-4 (1-3 endangered)

(3) Collar et al., Birds to Watch 2 The World List of Threatend Birds, 1994: C - Critical; V - Vulnerable; C - Conservation Dependent; NT - Near-threatened

(4) EU Directive on the conservation of Wild Birds: I-species recorded in Annex I of this Directive and for which special conservation measures are necessary

(5) Ramsar Convention: ○-included in the convention

(6) Trend: + increasing, - decreasing

Table 5.1.2 Mammals Species Recorded in Lubana Wetland Complex

	Latin Name	English Name	Latvian Red Data Book (1)	EU Directive 92/43/EEC (2)
	INSECTIVORA(ORDER)			
	Erinaceidae(Family)			
1	*Erinaceus europaeus*	Hedgehog	-	-
	Talpidae			
2	*Talpa europaea*	Mole	-	-
	LAGOMORPHA			
	Leporidae			
3	*Lepus europaeus*	Brown Hare	-	-
4	*Lepus timidus*	Blue Hare	-	-
	RODENTIA			
	Castoridae			
5	*Castor fiber*	Beaver	-	II
	Cricetidae			
6	*Ondatra zibethicus*	Muskrat	-	-
	Sciuridae			
7	*Sciurus vulgaris*	Red Squirrel	-	-
	CARNIVORA			
	Canidae			
8	*Nyctereutes procynoides*	Raccoon Dog	-	-
9	*Canis lupus*	Wolf	-	II
10	*Vulpes vulpes*	Fox	-	-
	Ursidae			
11	*Ursus arctos*	Brown Bear	2	II
	Felidae			
12	*Lynx lynx*	Lynx	-	II
	Mustelidae			
13	*Meles meles*	Badger	-	-
14	*Lutra lutra*	Otter	-	II
15	*Martes martes*	Pine Marten	-	-
16	*Mustela erminea*	Stoat	2	-
17	*Mustela nivalis*	Weasel	2	-
18	*Putorius putorius*	Polecat		-
19	*Mustela vison*	American Mink	-	-
	ARTIODACTYLA			
	Suidae			
20	*Sus scrofa*	Wild boar	-	-
21	*Capreolus capreolus*	Roe Deer	-	-
	Cervidae			
22	*Alces alces*	Elk	-	-
23	*Cervus elaphus*	Red Dear	-	-
	Total		3	5

Sources and Legends:

(1) Lipsbergs et al. 1990: Popularzinatiska Latvijas Sarkana gramata. Dzivnieki
0 - extinct species, 1 - vanishing species, 2 - rare species
3 - species with decreasing number of individuals, 4 - indeterminate species

(2) EU Directive on the Conservation of Natural Habitats of Wild Fauna and Flora, 1992.
II - species specified in Annex II of EU Directive

- : not mentioned

Table 5.1.3 Fish Species Found in LWC

No.	Scientific name	English	Latvian	Remarks
	Salmoniformes			
	Esocidae			
1	*Esox lucius*	* Pike	Lidaka	
	Cypriniformes			
	Cyprinidae			
2	*Cyprinus carpio*	* Common carp	Karpa	Introduced species
3	*Abramis brama*	* Bream	Plaudis	
4	*Alburnus alburnus*	* Bleak	Vike	
5	*Aspius aspius*	Asp	Salate	from Aiviekste and Rezekne rivers
6	*Blicca joerkna*	* White bream	Plicis	
7	*Carassius carassius*	* Crucian carp	Karusa	
8	*C. auratus gibelio*	* Silver crucian, Goldfish	Sudrabkar karusa	Introduced species
9	*Leucaspius delineatus*	Bleak	Ausleja, Verkhovka	
10	*Leuciscus idus*	* Ide, Orfe	Alants	
11	*L. cephalus*	* Chub	Sapals	
12	*L. leuciscus*	Dace	Baltais sapals	from the Aiviekste and Rezekne Rivers
13	*Rutilis rutilis*	* Roach	Rauda	
14	*Scardinius erythrophthalmus*	* Rudd	Rudulis	
15	*Tinca tinca*	* Tench	Linis	
16	*Vimba vimba*	* Bleak	Vimba	No catch since 1958
	Cobitidae			
17	*Cobitis taenia*	Spiny loach	Akmengrauzis	
18	*Misgurmus fossilis*	Pond loach	Pikste	
	Siluriformes			
	Siluridae			
19	*Silurus glanis*	Wels, catfish	Sams	
	Gadiformes			
	Gadidae			
20	*Lota lota*	* Burbot	Vedzele	
	Perciformes			
	Percidae			
21	*Perca fluviatilis*	* Perch	Asaris	
22	*Stizostedion lucioperca*	* Pikeperch	Zandert	Introduced species
23	*Gymnocephalus cernua*	* Ruffe	Kisis	
	Anguilliformes			
	Anguillidae			
24	*Anquilla anquilla*	* Eel	Zutis	No catch since 1982

Note : (*) indicate species enlisted in fishery statistics.

Table 5.1.4 Spawning Season and Summary of Spawning Ecology of Major Fishes Occurring in Lake Lubana

Species		Maturation		Spawning season							Depth at spawning (m)				Eggs sticking to	Incubation period		Sticking larval stage
		age	size	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	<0.1	0.1-1.0	1-5	5<		days	℃-days	
Pike		1- 7	27-30 cm				0-23℃				◄	─	─	►	P	7-30 days	83-175	1-15 days
Carps	Common carp	1- 6	17-30 cm							10-30℃	◄	─	─	►	P	2-13 days	60-180	2-10 days
	Bream	2-13	14-34 cm					8-24℃			◄	─	─	►	P	2-19 days	90-161	2 days
	Bleak	1- 6	6-10 cm						13-28℃		◄	─	─	►	P	3- 8 days	60- 70	-
	White bream	2- 8	6-14 cm					8-25℃				◄	─	►	P	3-14 days		-
	Crucian carp	2- 7	11-23 cm						13-27℃			◄	─	►	P	2-10 days	75-90	1- 3 days
	Silver Crucian	1-6	11-16 cm						9-28℃		◄	─	─	►	P	3-9 days		
	Verkhovka	1- 2	3- 5 cm					5-25℃				◄	─	►	P	4-12 days	90-110	-
	Ide	2-10	12-40 cm					3-19℃			◄	─	─	►	P	4-32 days	80-120	-
	Chub	2-12	12-35 cm					8-18℃				◄	►		S	3-14 days	60-80	-
	Rudd	1- 7	6-13 cm						10-28℃		◄	─	─	►	P	3-15 days	50-60	3-4 days
	Tench	2- 7	9-25 cm							14-27℃		◄	─	►	P	3- 7 days	60-80	3- 4 days
Perches	Perch	1- 7	5-18 cm					3-20℃				◄	─	►	P	4-24 days	80-164	-
	Pikeperch	2-10	17-57 cm						8-26℃			◄	─	►	N	2-32 days	45-140	-
	Ruffe	1- 6	6- 7 cm					3-23℃				◄	─	►	P	5-18 days	80-90	-
Others	Spiny loach	1- 3	5- 7 cm						15-24℃			◄	►		P	3- 7 days	-	-
	Burbot	1- 8	14 cm				0-10℃				◄	─	►		P	3-15 days	50-60	-

Note : P: Plant and other substratum, S: Stone and other substratum, N: Nest
Source : Zivis, DPU, November 1999, and information from fish inspector of Rezekne and Madona REBs

Table 5.2.1 Most Important Bird Species and Habitats in Lubana Wetland Complex

	Latin Name	English Name	Red Data Book of Latvia (1)	European Threat Status (2)	SPEC category (2)	World Threat Status (3)	All forests	Agri-cultural lands	Deciduous forests	Wet coniferous forests	Fish, ponds	Lakes	Inundated grasslands	Raised/ transitional bogs
	PODICIPEDIFORMES													
	Podicipedidae													
1	*Podiceps nigricollis*	Black-necked Grebe	3								B/F			
	CICONIIFORMES													
	Ardeidae													
2	*Botaurus stellaris*	Bittern	3	V	3						B/F	B/F		
3	*Ixobrychus minutus*	Little Bittern	3	V	3						B/F			
	Ciconiidae													
4	*Ciconia nigra*	Black Stork	3	R	3		B/F				/F		/F	
	ANSERIFORMES													
	Anatidae													
5	*Cygnus cygnus*	Whooper Swan	3	S	4						B/F	B/		
6	*Anser anser*	Greylag Goose	3								B/F	B/F		
	FALCONIFORMES													
	Accipitridae													
7	*Haliaetus albicilla*	White-tailed Eagle	1	R	3	NT	B/				/F	/F	/F	/F
8	*Circaetus gallicus*	Short-toed Eagle	3	R	3		B/F							B/F
9	*Circus cyaneus*	Hen Harrier	1	V	3								B/F	B/F
10	*Circus pygargus*	Montagu's Harrier	3	S	4			/F				B/	B/F	B/F
11	*Aquila pomarina*	Lesser Spotted Eagle	3	R	3		B/F	/F	B/F	B/F			/F	
12	*Aquila clanga*	Spotted eagle	1	E	1	V			B/F	B/F		/F	/F	
13	*Aquila chrysaetos*	Golden Eagle	1	R	3		/F						/F	B/F
	Pandionidae													
14	*Pandion haliaetus*	Osprey	3	R	3						/F	/F		B/
	GALLIFORMES													
	Tetraonidae													
15	*Lagopus lagopus*	Willow Grouse	1											B/F
16	*Tetrao tetrix*	Black Grouse		V	3			/F		B/F			/F	B/F
17	*Tetrao urogallus*	Capercaillie					B/F			B/F				B/F
	Phasanidae													
18	*Coturnix coturnix*	Quail	3	V	3			B/F						
	GRUIFORMES													
	Rallidae													
19	*Crex crex*	Corncrake	2	V	1	V		B/F					B/F	
	Gruidae													
20	*Grus grus*	Crane	3	V	3			/F		B/F		B/F	B/F	B/F
	CHARADRIIFORMES													
	Charadriidae													
21	*Pluvialis apricaria*	Golden Plover	3	S	4									B/F
	Scolopacidae													
22	*Philomachus pugnax*	Ruff	2	S	4						B/F		B/F	
23	*Gallinago media*	Great Snipe	0	V	2	NT					/F		B/F	
24	*Limosa limosa*	Black-tailed Godwit	3	V	2						/F			B/F
25	*Numenius phaeopus*	Whimbler	3	S	4									B/F
26	*Numenius arquata*	Curlew	2	D	3			/F					B/F	B/F
27	*Tringa totanus*	Redshank		D	2						B/F		B/F	B/F
28	*Tringa glareola*	Wood Sandpiper		D	3						/F			B/F
	Laridae													
29	*Larus minutus*	Little Gull		D	3						B/F	B/F		
	Sternidae													
30	*Chlidonias hybridus*	Whiskered Tern		D	3						B/F	/F		
31	*Chlidonias niger*	Black Tern		D	3						B/F	B/F		
	STRIGIFORMES													
	Strigidae													
32	*Strix uralensis*	Ural owl	3				B/F							
33	*Asio flammeus*	Short-eared Owl	1	V	3			/F					B/F	
	CAPRIMULGIFORMES													
	Caprimulgidae													
34	*Caprimulgus europaeus*	Nightjar		D	2		B/F							B/F
	PICIFORMES													
	Picidae													
35	*Dendrocopos medius*	Middle Spotted Woodpecker	3	S	4				B/F	B/F				
36	*Dendrocopos leucotos*	White-backed Woodpecker	3						B/F	B/F				
37	*Picoides tridactylus*	Three-toed Woodpecker	3	D	3		B/F							
38	*Lanius excubitor*	Great Grey Shrike	2	D	3			/F					B/F	B/F
	Total		*30*	*32*	*32*	*4*	*9*	*9*	*4*	*7*	*16*	*11*	*16*	*18*

Sources and Legends:
(1) Lipsbergs et al. 1990: Popularzinatiska Latvijas Sarkana gramata. Dzivnieki
0 - extinct species, 1 - vanishing species, 2 - rare species
3 - species with decreasing number of individuals, 4 - indeterminate species
(2) Tucker & Heath. 1994: Birds in Europe
E - Endangered; V - Vulnerable; D - Declining; L - Localised; S - Secured; R - Rare
SPEC category 1-4 (1-3 endangered)
(3) Collar et al. 1994: Birds to Watch 2 The World List of Threatend Birds
C - Critical; V - Vulnerable; C - Conservation Dependent; NT - Near-threatened

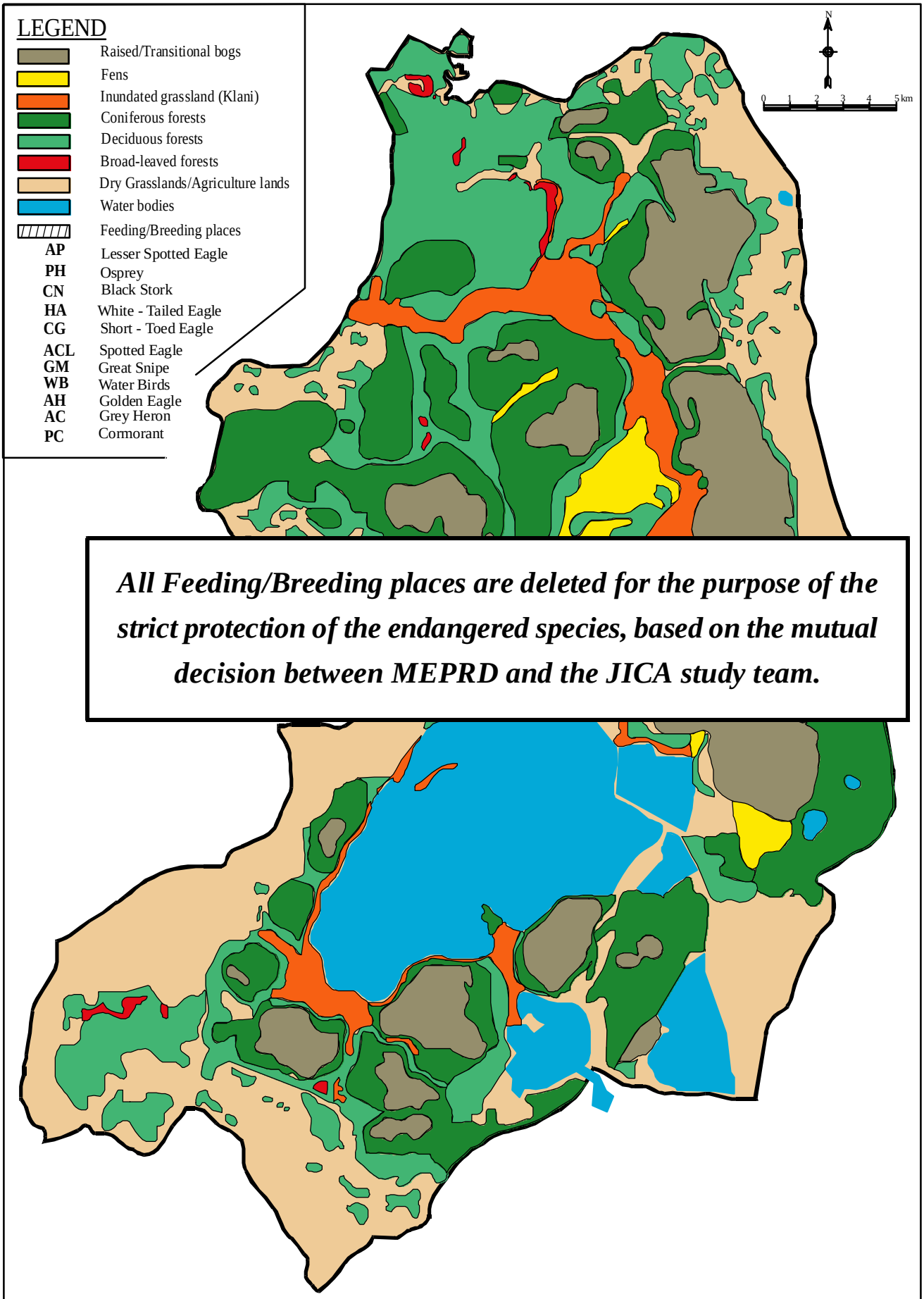

Figure 5.2.1 Feeding and Breeding Places for Important Bird Species in LWC

The Study on Environmental Management Plan for Lubana Wetland Complex in the Republic of Latvia

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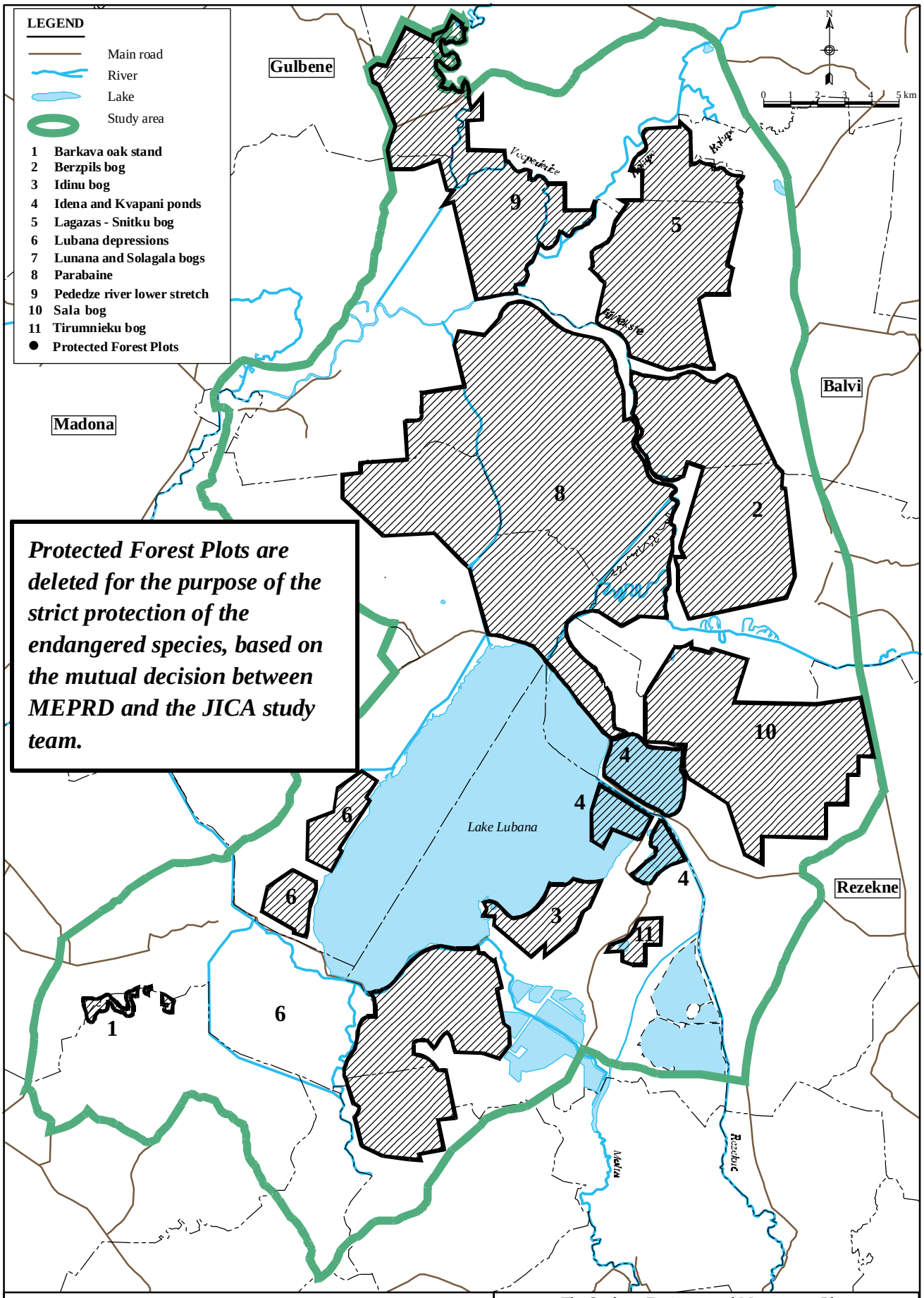

Figure 5.3.1 Current Nature Protection Areas in LWC

The Study on Environmental Management Plan
for Lubana Wetland Complex in the Republic of Latvia

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