Georgian Center for Conservation of Wildlife

LAND USE AND LANDSCAPE CONSERVATION IN SOUTHERN GEORGIA

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FINAL REPORT (*Detailed summary of the results of the research*)

D. Tarkhnishvili (general edition)

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1. INTRODUCTION

The region of Javakheti in southern Georgia, at the border with Armenia and Turkey, belongs administratively to the province of Samtckhe-Javakheti and covers two administrative districts: Ninotsminda and Akhalkalaki (Map 1, Map 2). The entire area of the region comprises 2589 km² (ca. 3.8 % of the country's area), the entire population – 102,400 persons (1.9 % of the county's population)[The entire statistical data presented here was obtained within the framework of the present project. Other existing statistical sources (TM, 1994; Guretski, 1998) were used in order to adjust some important figures, including the total area of the district and population size]. The region lies in treeless mountain plateau with an average elevation ca. 2000 m, which represents the northern edge of volcanic uplands spreading through the western Armenia, eastern and central Turkey and southern Georgia. From the north, the region borders Borjomi district; from the west – Aspindza district; from the east – Tsalka and Dmanisi districts of Georgia; from the south, the region borders Turkey and Armenia. Javakheti has 99 settlements – villages and two towns – with population size varying between 80 and 15,000. The largest town (and an unofficial centre) is town Akhalkalaki (15,000) in its central part, in valley of the river Paravani. The region has over 100 natural lakes, mostly of volcanic origin, six of that have surface exceeding 5 km².

The region keeps a peculiar position in Georgian geography and economy by several social, ethnic, economical and ecological reasons.

(1) Even in comparison with the other regions of Georgia, it has particularly high percent of rural population (79 %, the average for Georgia ca. 47 %).

(2) The region is relatively poor. Major part of the population lives in stony single-floor houses, and a certain part of houses is built in a traditional way, with floor on the level of ground, and flat roof covered with the layer of soil with growing grass (Fig. 1). In spite of presence of available automobile roads, only each 10th family owns a car.

(3) Ethnic Armenians represent 90 to 95 % of the local population; up to the recent time, there was a significant population of Russian old believers ('Dukhobors') that continually leave the region during several last decades and especially in recent years. Currently, the Dukhobor population is represented by few hundred persons. Small population of Georgians live in Akhalkalaki district.

(4) The region has severe climatic conditions: and average temperature in July + 12 to + 16°C (in other relatively densely populated parts of Georgia + 22- +25°C), in January - 8° - 10° C (in other populated parts of the country - 2 + 5° C).

(5) The dominating landscape throughout the region is a treeless volcanic plateau (Fig. 2), whereas in most of other regions of Georgia forest landscapes cover a substantial part of the area.

(6) During the Soviet period, the region lied completely in a border zone, with necessity of special documentation to enter the zone, which made it strongly separated from the entire country's infrastructure;

(7) The region harbours six out of eight large (water surface over 5 km²) country's natural lakes. These lakes provide an important shelters for waterfowl birds, including several species that are found nowhere else throughout the country. Natural landscapes, including mountain steppe, alpine meadows, large areas covered with volcanic boulders and wetlands, cover over 70 % of the area of the region.

The Javakheti region represents an important natural heritage. Its landscapes, plant and animal populations deserve protection against increasing antropogenous pressure. However, complicated social-economic situation in the region makes realisation of conservation arrangements difficult; the ideas of organising protected areas is suspiciously met by a part of the local population. The current project aimed to analyse value of land subjects throughout the region from the social, economic and conservation points of view, in order to optimise planning of protected areas, and to involve the local population in conservation activities.

2. THE DISTRIBUTION OF TASKS AMONG THE TEAM MEMBERS

D. Tarkhnishvili carried out the general management of the project, co-ordinated work of team members responsible for social-economic and nature conservation issues, carried out the final analysis of the data and wrote major parts of the final report. He also provided the data on the species composition and distribution of amphibians and reptiles in Javakheti. O. Ginosyan and N. Ginosyan collected and prepared the complete data set on the economic and social issues within the framework of the project, which were provided by administrations of Ninotsminda and Akhalkalaki districts, village (Sakrebulo) administrations and collective farms of individual villages. A. Gavashelishvili, with help of Z. Djavakhishvili, M. Markaryan, and G. Darchiashvili, organised and carried out ornithological works within the framework of the current project, including bird summer and winter accounts, questioning and mapping nests for individual species. A. Kandaurov, on the basis of the entire data set, developed the PC- compatible Data Base, which includes several Exel Tables hyper-linked with a number of graphic files and Word documents (see the Zip-disc attached to this report). Moreover, he collected and prepared the data on the species composition and distribution of

mammals. I. Matcharashvili prepared and provided the data dealing with the social and economic structure of the region, as is coming from Tbilisi-located institutions (Department of Land Use, Ministry of Nature Conservation, statistical sources). N. Janashia carried out preliminary analysis of resources for Tourism development throughout the region.

3. METHODS AND APPROACHES

In the course of the project realisation, we collected and analysed three blocks of information: (1) social importance of land plots, owned by individual villages and administrative units of Akhalkalaki and Ninotsminda districts; (2) economic information about individual districts, towns, villages and administrative units, and economic importance of individual land plots, with an especial attention to agriculture; (3) importance of individual land plots and natural objects (lakes, wetlands, primary landscapes) from the nature conservation point of view.

3.1. Administrative structure and estimation of social importance for individual land plots.

The distribution of land plots between particular administrations and owners throughout the region is shown in Appendixes 1 and 2. The region is administered by two districts, Akhalkalaki and Ninotsminda. The major part of lands in each district are attributed to local administrative units ('sakrebulos'), unifying one or more neighbouring towns / villages. Ninotsminda district has ten sakrebulos, Akhalkalaki district – 32 sakrebulos. Most of land plots adminisered by individual sakrebulos are attributed to particular villages. Because in the Soviet time almost the entire land was owned whether by state ('sovkhoses') or collective owners ('kolkhoses'), it is even nowadays easier to draw borders of plots that belong to particular villages (formerly 'sovkhoz' or 'kolkhoz' lands) than to individual land-owners within the villages. However, an important part of the district's territory, mainly summer pastures, is attributed to neighbour or distant districts within Georgia and are directly administered by neither land owners from Akhalkalaki and Ninotsminda district.

We used two independent information sources for reconstructing the picture of the land ownership system throughout the analysed region. (1) Land Use maps, stored in the department of Land Use (Tbilisi), and prepared in late years of Soviet power (1989), i.e. before privatisation process have been started; (2) figures provided by individual sakrebulos and villages of Akhalkalaki and Ninotsminda districts in 1999-2001. Discrepancies between these two sources of information were taken into consideration when filling up the related database files.

In order to estimate social importance of lands attributed to a particular land user, following information was taken into consideration: (1) whether or not the land is owned by a local owner (village, sakrebulo); (2) size of the population that owns the plot (estimated as the number of people living in village / sakrebulo, irrespectively to the land area; (3) 'anthropogenous pressure' on the land, estimated as the population size per one hectare of owned land; (4) the degree of urbanisation, estimated as the portion of the population (partly) independent of the land use – i.e. people employed in non-agricultural sector of local economy; (5) the ownership structure, reflected in total and relative area of privatised lands with different destination and private livestock (Table 1) (the total list of social and economic characteristics of individual administrative units and villages given in the File 2 of the Data Base and in Appendix 1).

Table 1. variables estimated for 99 individual villages and administrative units of Akhalkalaki and Ninotsminda district. Some variables estimated only for villages of Ninotsminda district

Land Use Variables	Privatisation degree	Social / demographic variables
Total area administered (ha)	size and % of privatised area	population size
Agricultural lands, ha	% in private hands	number of families (Nin. only)
Pastures, ha	% in private hands	density / km² of owned land
Mowlands, ha	% in private hands	number of seasonal workers
Hay harvesting area, ha	% in private hands	state employees (Nin. only)
Potato culture, ha	% in private hands	private enterprises (Nin. only)
Grain culture, ha	% in private hands	
Other cultures, ha	% in private hands	
Cattle, number	% in private hands	
Sheep, number	% in private hands	
Horses, number	% in private hands	
Pigs, number		
Poultry, number		
Pine plantations, ha		
Lakes, ha		
Wetlands, ha		
Badlands, ha		

The enumerated variables were used in Principal Component Analysis (Manly, 1996), in order to outline variables responsible for highest degree of variation between individual land-

owners and to ordinate land-owners according to peculiarities of ownership and land use system.

3.2. Peculiarities of land use – economic characteristics

Agriculture is strongly dominating economic activity throughout the region. The general type of agriculture is caused by climatic and landscape peculiarities of Akhalkalaki and Ninotsminda districts. The entire region lays at high altitude (between 1900 and 3300m a.s.l). Climate is strongly continental and more severe than in the most of other regions of Georgia. Middle July temperature in lowest, densely populated parts of the region reaches 15°C, middle January temperature – 8°C, the average annual precipitation level – 400-500 mm (Djavakhishvili et al., 1964; Vladimirov et al., 1991)(Map 3). The landscape is primarily treeless mountain steppe or subalpine / alpine meadows. The region remained treeless since Ice Age (Margalitadze, 1977; Djanelidze, 1980) and currently existing pine forests (8650 ha) were artificially planted in 1930s-1950s. The dominating agriculture is potato (13,700 ha), grain and fodder crops (13,800 ha) (Appendix 1, File 2 of the Data Base). Non-arable lands are mostly used for hey harvesting or as summer pastures. The dominating livestock is cattle and sheep.

In order to outline variables with the highest input into the local variation of land use modes, we applied Principal Component Analysis (PCA) to 30 variables describing agriculture, ownership system and demographic characteristics of analysed villages and administrative units (Table 1). Output of the PCA was applied for estimation of 'agricultural value' of individual land plots and for ordination of land owners according to the dominating way of land use.

3.3. Landscape description

We summarised the existing data on the landscape geography of the Javakheti region. The sources used were: Atlas of Georgia (Djavakhishvili et al., 1964); water balance of Caucasus (Vladimirov et al., 1991); vegetation of Georgia (Ketskhoveli, 1959); topographic maps issued by the Ministry of Defence of USSR (1978), with scale 1: 50,000; land use mape issued by Land Use department of Georgia (1989). Basing of these sources, the information on the distribution of landscape (relief, altitude, dominating landscape types), climate (thermal regime, precipitation), agriculture (distribution of cultures) and ownership structure was summarised on the basis of individual land plots attributed to particular administrative units and villages.

3.4. Natural objects and animal populations

We outlined the following main types of natural landscapes throughout the study region: (1) natural lakes; (2) wetlands; (3) primary landscapes used as pastures; (4) primary landscapes not used for any economic purposes (mainly badlands and volcanic slopes of mountains from Samsari and Javakheti mountain ranges); (5) pine forest plantations. Individual land owners were ordinated according to the area and type of natural landscapes they own or administrate. We summarised existing data and applied additional field research in order to reveal the distribution of terrestrial vertebrates (amphibians, reptiles, birds, mammals) throughout the region, with special attention to species under conservation or protected by international low and large bird species, which presence could be an important factor for the development of nature-based tourism.

4. RESULTS AND DISCUSSION: SOCIAL-ECONOMIC CHARACTERISTICS OF JAVAKHETI AND LAND USE

4.1. Comparative analysis of the social and economic characteristics of Akhalkalaki and Ninotsminda districts.

Akhalkalaki district covers northern and western parts of the Javakheti region, Ninotsminda district – its southern and eastern parts. The total area attributed to either of the two districts is almost equal. Ethnic composition is relatively homogenous: ethnic Armenians represent ca. 90 % of the population of Akhalkalaki and over 95 % of Ninotsminda district. Rural population counts 78-80 % in both districts (Table 2). However, there are several important differences in social structure and economic life of the two regions. First of all, Akhalkalaki district counts twice more inhabitants than Ninotsminda and, correspondingly, population density is almost twice higher. This district is strongly oriented on agriculture, whereas in Ninotsminda district stock-raising is more important. In particular, pasture – dependent livestock (cattle and sheep) in Ninotsminda district counts twice more units per person than in Akhalkalaki. On the other hand, in Akhalkalaki the total area of grain fields more than twice exceeds those in Ninotsminda, and the area of potato fields – eight times (i.e. total area of potato culture per person in Akhalkalaki is four times higher than in Ninotsminda). The

number of pigs and poultry per person, which can indicate the degree of development of personal 'outdoor' agriculture, is comparable for the two districts (Table 2). An important difference between the two districts includes different dependence of the population on non-agricultural activities. Town of Akhalkalaki is twice larger than Ninotsminda and it seems to be that the town population is more dependent on non-agricultural economy, including trade, state employment, contract employment by the Russian military base, and seasonal works abroad. In particular, the number of workers seasonally employed in Russia comprises in this district 9 % of the local population, whereas in Ninotsminda district – less than one percent.

At last, Akhalkalaki district is much stronger subdivided administratively than Ninotsminda. In particular, it is divided into 22 administrative units (sakrebulos), whereas Ninotsminda district – in only 10 units. There are 65 land-owning settlements in Akhalkalaki and 32 – in Ninotsminda, despite the roughly same total area of both districts.

An important feature of Akhalkalaki district is very high (four times higher than in Ninotsminda) pasture areas attached to the villages of the region. The less dependence of this district on stock-breeding (in comparison with Ninotsminda) makes this figure difficult to explain. The actual reason lays in the land re-distribution in Akhalkalaki district in recent years. Notably, according to the land use maps issued by the State Department of Land Use in 1989, 33 % of areas of Ninotsminda district and 3.7% of Akhalkalaki (summer pastures used primarily for seasonal sheep pasturing, that lay at slopes of Samsari and Javakheti mountain ranges and along the Turkish border) is attributed to different regions of Georgia, in particular Sagarejo, Dedoplistskaro, Dmanisi, Aspindza and Marneuli. The information provided by local sakrebulo and village administrations of Ninotsminda district demonstrate some discrepancy with data provided by the Land Use department. In particular, according to this information, local villages own ca. 61 % of lands of the district, including 68 km² summer pastures (67 %, according to the land use maps). This is also the case for Akhalkalaki district. According to the data of Land Use department, the villages of the district own ca. 96 % of the district's lands, but according to the data provided by local authorities, the entire land administrated by Akhalkalaki is owned by local villages. This is highly at the expense of summer pastures situated at slopes of the Samsari mountain range at elevation over 2000-2100 m a.s.l., that according to 'central' sources are still attributed to different regions of the country. With agricultural methods currently exploited throughout the region, these lands can be used exclusively as summer pastures and essentially lie idle, because stock-breeding in the Akhalkalaki district is twice less intensive than in neighbouring Ninotsminda. Simultaneously, the legal basis of these displacement of the land property to the district's

villages remains unclear. It is unlikely that this change of land ownership was reflected anywhere in the country's land use archives. The pastures are not in private ownership (only 15 % of the districts area was in private use by 2000). The question needs further regulation and the interaction between the local and the country's authorities.

Another remarkable peculiarity of land use system in Akhalkalaki district, in comparison with Ninotsminda, is less clear land distribution between owners (villages), according to the 1989 Land Use Department data. Lands of several actually existing villages are often unified in a single collective farm, and it becomes impossible to formally distinguish between individual villages-owners, although the summary area attributed to individual villages is normally known by local authorities (see File 2).

Table 2.

Comparison of main geographical, social and economic characteristics of Akhalkalaki and Ninotsminda region. The data obtained from central sources – without parentheses, the data obtained from local sources – in parentheses.

	Akhalkalaki	**Ninotsminda**
Total area (km²)	1235 (1235)	1379 (1354)
locally administrated area	1189 (1284 (?!))	913.73 (816)
village pastures	571 (523)	68
total pastures	571 (523)	828 (606)
total population (1997)	69 103	37 895
total population (2000)	(67 300) (54.5 / km²)	(35 110) (43.02 / km²)
urban population (1997)	15 192	6 944
urban population (2000)	(12 055) (17.9 %)	(6 870) (19.6 %)
arable land	312 (2.5 %)	266 (1.9 %)
grain	(97)	(41)
potato	(122)	(15)
private land	(193) (15.6 %)	(91) (11.2 %)
cattle	(22 081)	(21 455)
sheep	(37574)	(51950)
horse	(386)	(435)
pigs	(1954)	(932)
poultry	(94626)	(26989)
seasonal workers	(6085)	(244)
hay	(6334)	(6020)

These objective and subjective differences between the two analysed districts are more likely connected with (1) differences in the local climatic conditions and (2) presence of the town Akhalkalaki, which is assumed as a non-formal centre of the Javakheti region (in spite of the formal urban status of Ninotsminda, inhabitants of this town are much stronger dependent on the agricultural economy).

Climate throughout the large part of Ninotsminda district is more severe, because ca. 70 % of the district lie at the elevation over 2000 m (in Akhalkalaki district, below 30 % lay above 2000 m). Markedly larger part of Ninotsminda (in comparison with Akhalkalaki) lies at above 2400 m (Map 4). Correspondingly, the average January and July temperatures in Ninotsminda are ca. in 2-4°C lower than in Akhalkalaki (and the annual precipitation level is 100-200 mm higher) (Djavakhishvili et al., 1964; Vladimirov et al., 1991; Map 3). This makes Ninotsminda region more oriented to stock-breeding in comparison with Akhalkalaki and less – to the cultivation of grain and potato; this also may be the most important factor causing low population density of Ninotsminda district.

The subjective differences include the historical dynamics of the local population. The Akhalkalaki district, being populated by Georgians and Armenians by the first half of XIX, was settled by ethnic Armenians from the neighbouring areas of Ottoman Empire in the second half of XIX century and after ethnic cleansing in Turkey in 1915 (Bagrationi, 1949; Guretski, 1998); The current ethnic structure remained relatively stable during almost the entire XX century. The Ninotsminda (formerly Bogdanovka) district was scarcely populated before 1830s, when members of Dukhobor religious sect (Russian 'old believers') were deported there from the central provinces of Russia by Tsar Government. The Dukhobors developed the economy strongly related with the cattle breeding and milk production, which remained dominated up to the current time, in spite of strong decline of the local Dukhobor population in 1980s and, especially, in 1990s. In contrast, the Armenian population of Akhalkalaki was developing first of all potato agriculture. The second important subjective factor, the existence of a local centre in Akhalkalaki, is connected with relatively high political activity of this district's population (Guretski, 1998), may be also an indirect reason of mentioned land redistribution between owners.

4.2. *The analysis of land use by individual sakrebulos of the two districts*

Principal Component Analysis (PCA) based on the 30 economic, social and geographic variables scored for 32 administrative units (sakrebulos), allowed to extract eight principal components with the eigenvalue exceeding unit (Table 3). First three PCA axes account 55 %

of the total variation. Along the first axis (23 % of variation) high positive loadings are demonstrated by the total agricultural area administered by a sakrebulo, the number of cattle and horse, the area of lakes, and the extent of privatisation of grain fields and hay harvesting

Table 3. Outcome of Principal Component analysis conducted for 32 administrative units of the Javakheti region. Loadings of individual variables on the first three PCA axes are demonstrated.

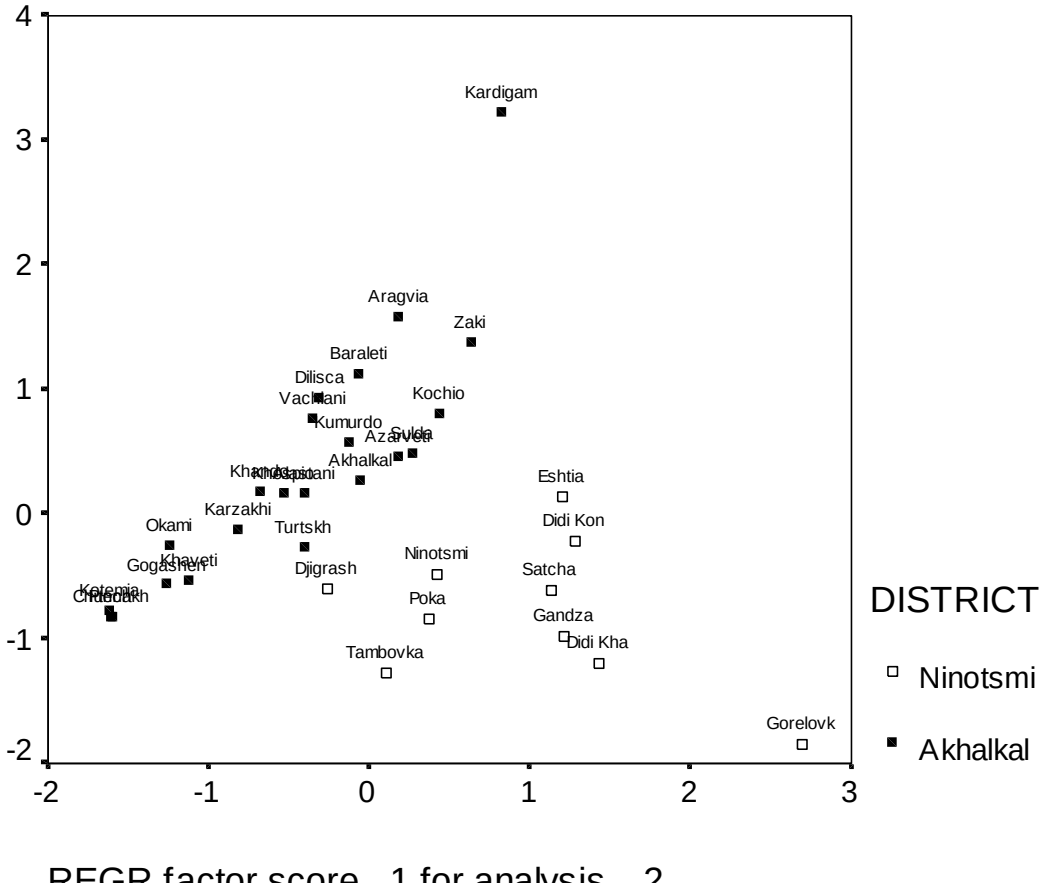
Variables	PCA axis 1	PCA axis 2	PCA axis 3
% variation	23.2	17.9	13.8
Total Area	.750	.137	-.349
% Private	.127	.616	.178
Population	.472	.498	.339
Density / Km²	.129	.258	.835
Agricultural Area	.300	.698	-.435
% Private	-.104	.060	.751
Pastures	-.084	.613	-.512
% Private	.160	.666	.161
Mowland	.384	-.001	-.416
% Private	.390	.088	-.121
Potato	-.183	.766	-.383
% Private	.735	.036	.507
Grain	.247	.593	-.357
% Private	.677	.071	.471
Hay	.624	.026	-.181
% Private	.538	.243	.527
Other	-.085	.058	-.328
% Private	.707	.161	.330
Cattle	.889	.043	-.203
% Private	-.651	.501	.131
Sheep	.631	-.157	-.223
% Private	-.090	.158	-.534
Horse	.757	-.248	-.388
% Private	-.696	.460	.129
Pigs	.260	.262	-.047
Poultry	.334	.797	-.057
Lakes	.573	-.505	-.079
Wetlands	.336	-.359	-.091
Forests	.379	-.314	.141
Seasonal Workers	.034	.731	.264

areas: in short, this axis reflects the size of the plot, area of wetlands and relative importance of pasture-based stock-breeding for the unit. Along the second axis (18 % of total variation), the extent of land privatisation dominates along with the size of potato fields, pastures and grain fields, the number of poultry and the number of seasonal workers. In short, this axis

reflects, on one hand, intensity of agriculture and degree of land privatisation, on the other hand – additional income of the local population. Along the third axis (14 % of variation) highest loadings demonstrate the population density, the proportion of private potato and the private hey harvesting areas. In short, this axis reflects population density and degree of privatisation of most important agriculture.

Scores of individual sakrebulo's at the first two PCA axes are plotted at Diagram 1. There are remarkable differences in position of administrative units from Akhalkalaki and Ninotsminda districts on the plot. First of all, sakrebulo's of Ninotsminda district, in average, demonstrate higher loadings along the first PCA axis, whereas sakrebulo's of Akhalkalaki district – along the second axis. Then, sakrebulo's of Akhalkalaki district, which demonstrate highest scores along the first axis, have also highest loasings along the second axis. In other words, largest administrative units with most developed stock-breeding in Akhalkalaki also have most developed potato agriculture and highest rate of land privatisation, while largest units in Ninotsminda are strongly specialised on stock-breeding and potato or grain agriculture plays in their economy not very important role.

Diagram 2. scores of individual villages of Ninotsminda district on the first two PCA axes provided by 32 economical, social and ecological variables.



The largest and most agriculturally developed administrative units of Akhalkalaki district are Kardigami (especially high loadings along the second PCA axis), Aragvia, Zaki, Baraleti, located in the northern part of the district adjacent to the automobile road crossing the Javakheti plateau. In Ninotsminda district, relatively high scores along the second axis demonstrate Eshtia and Didi Gondrio. Outstandingly high score along the first PCA axis (and, at the same time, lowest scores along the second axis) demonstrate the administrative unit Gorelovka, the largest land-owner of the region. This sakrebulo demonstrates both strongly developed stock-breeding and strong specialisation on this economic activity.

4.3. *Spatial distribution of important variables throughout the region*

Maps 4 - 9 demonstrate the spatial distribution of following important geographic, social and economic variables throughout the Javakheti region. (1) The altitude above sea level (metres) as a factor determining local climatic conditions and appropriateness of the land for agriculture; (2) population density (persons per km²), as a variable decisive in estimation of social importance of land; (3) scores along the first PCA axis based on 30 social, economic and geographic variables (see previous chapter), which reflects the intensity of pasture-based stock-breeding; (4) scores along the second PCA axis reflecting the intensity of arable-land-based agriculture and 'general' degree of land privatisation; (5) scores along the third PCA axis, reflecting the population density and degree of privatisation of most important agriculture – grain and potato; and (6) areas of wetlands (lakes and marshes) administrated by local owners. It is important to note that for the areas attributed to distant regions of Georgia (which obviously represent 40% of the area of Ninotsminda district and which status remains unclear for Akhalkalaki) some parameters could not be estimated directly. However, it could be safely assumed that population density at these plots is the lowest, scores along the first PCA axis – highest and along the second and the third axes – the lowest in the region.

The maps 4-9 demonstrate the following.

1. Map 4. Areas of relatively high altitude are concentrated: (a) along the southernmost part of Akhalkalaki district and the southern half of Ninotsminda (border line with Turkey and Armenia); (b) Along the eastern parts of both districts, in particular Samsari and Javakheti mountain ranges. Three out of six large lakes of the region (Tabatskuri, Paravani and

Madatapa) lay at elevations over 2000 m, being adjacent to Samsari and Javakheti mountains.

2. Map 5. The most densely populated (over 100 persons / km² are central parts of the region, from lake Khanchali in south to approximately village Turtskha in the north. The lowest population density (less than 15 persons / km²), except for summer pasture areas, is in villages located along the southern and eastern borders of the region and roughly (albeit not completely) coincide with areas located at elevation over 2000 m.
3. Map 6. The highest scores along the first PCA axis based on the analysis of 29* social, economic and environmental variables, which reflect relative importance of pasture-based stock-breeding (see previous paragraph) show the areas, located in the southern and eastern parts of the region, i.e. areas with lower population density lying at high altitude. In general, the area of Ninotsminda district shows higher scores than lands of Akhalkalaki district. The lowest scores has the western part of the region that lies in Akhalkalaki district.
4. Map 7. The highest scores along the second PCA axis (which reflects the intensity of agriculture and degree of land privatisation) highest scores demonstrate the area of town Akhalkalaki and, in general, central part of the region, with highest population density and relatively flat relief. Lowest scores along this axis have southern and eastern, high-altitude parts of the region, with the exception of the area of lake Paravani.
5. Map 8. The highest scores along the third PCA axis (population density and degree of privatisation of most important agriculture) have areas of towns Akhalkalaki and Ninotsminda, northern and north-western parts of Ninotsminda district, and sporadically distributed areas in the central part of the Akhalkalaki district.
6. Map 9. The highest density of lake and wetland areas is throughout the largest part of Ninotsminda district (including both low-and high-density areas), excluding the extreme northern part of the district. High amount of mountain lakes (not shown on the map) is also situated in mountain (eastern) part of Akhalkalaki district, including summer pastures in Samsari mountains attributed to distant regions of Georgia.

In short, the Javakheti region can be obviously separated into two part: (1) ‘north-western’ part, including the major part of Akhalkalaki and northern part of Ninotsminda district (mostly being concentrated in Akhalkalaki lands), with relatively flat landscape, lying at altitude 1800-2000m, high (over 15-20 persons per km²) population density, more urbanised population, and agriculture specialised on the potato and grain cultivation; (2) ‘southern and eastern’ part, including Samsari mountains in the east of Akhalkalaki district and southern and

eastern parts of Ninotsminda district (mostly concentrated in Ninotsminda lands), with mountainous volcanic landscape, lying at altitude above 2000 (and partly above 2400 m), low (below 10-15 persons per km²) population density, less urbanised population, and agriculture specialised on the pasture stock-breeding (cattle and, partly, sheep).

Largest density of wetlands (important from the conservation point, as we will see below) covers the area spreading through both 'social-economic' parts of the region but covers largely lands of Ninotsminda district.

4.4. *The analysis of land use in Ninotsminda district, on the basis of individual villages*

From the point of view on nature conservation, the most important are those areas, which: (1) have undisturbed or at least primary-like landscape; (2) have significant populations of plants and animals, especially declining species, regional endemits, and species protected by a state or international law. One should also take into consideration, that the planning and creation of protected areas should not conflict with social and economic interests of a local population, or at least potential conflict should be minimised. By this reason, the protected areas should preferably be (1) scarcely populated; (2) not used for intensive agriculture; and it will be very useful if (3) the creation of protected areas should provide possible benefits for the local population, such as development of nature-oriented tourism.

Large part of Akhalkalaki district is densely populated and the land is intensively cultivated. The proportion of primary landscapes is low. On the other hand, density of wetlands that can potentially harbour rare or protected animal populations is relatively low. Primary landscapes in the easternmost part of the district (Samsari ridge), although are under the district's authority, are partly attributed as summer pastures to distant regions of Georgia and not to the local villages. It is not likely that Samsari mountains play an important role in economy of the district's villages (except for hay harvesting, for which resources of Samsari summer pastures strongly exceed local needs). In contrast, the large part of Ninotsminda district is scarcely populated and is not intensively cultivated. Proportion of primary landscapes (mountain steppes, subalpine and alpine meadows, and stony slopes of volcanic mountains) is high. These landscapes are exploited mainly as summer pastures and for hay harvesting. Density of wetlands is high throughout the district's area. It is a high correspondence between land use data obtained locally and from the central sources. Although a substantial part of the district (ca. 33 %) is attributed to distant regions of Georgia, primary landscapes play also an important role in the local economy. By this reason, we applied a separate multivariate analysis to villages of Ninotsminda district. Variables used in this analysis were basically the

same as those applied for entire region (see above), but two additional variables available only for this district were also included: the proportion of state employees and the number of small private enterprises (shops, hostels, manufactures etc.).

The first PCA axis obtained for 32 study variables accounted 29 % of total variance. 15 variables demonstrated high (>0.5) positive loadings at this axis, including the area of owned lands, population size, size of arable lands, number of livestock, and the number of people employed in non-agricultural sector. In short, this axis can be used as an indicator of both size and prosperity of a settlement (in terms of land and livestock property). The second axis, accounting 14 % of the variance, demonstrates high loadings for population density and the proportion of privatised area, privatised cultivated land, privatised cattle and sheep. In short, it reflects population density and intensity of agricultural reforms (Table 4).

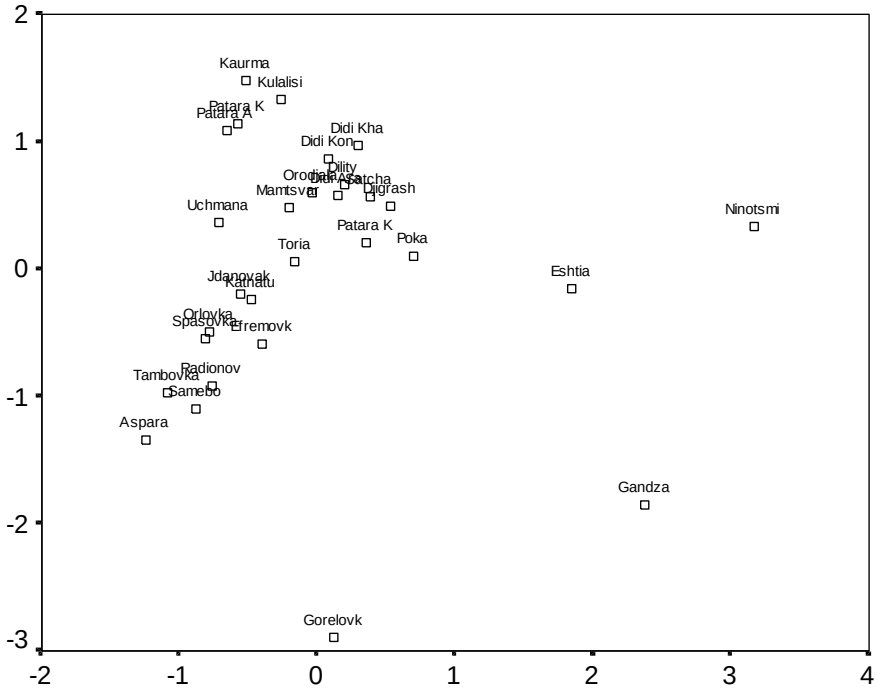
Table 4. Outcome of Principal Component analysis conducted for 32 villages of Ninotsminda district. Loadings of individual variables on the first three PCA axes are demonstrated.

Variables	PCA axis 1	PCA axis 2	PCA axis 3
variation, %	29.1	14.1	11.8
Total Area	.664	-.600	.366
% Private	.436	.759	.320
Population	.938	.057	-.114
Density / Km²	.731	.526	-.165
Agricultural Area	.658	-.611	.335
% Private	.457	.756	.354
Pastures	.530	-.065	-.724
Mowland	.587	-.062	-.386
% Private	-.096	.548	.187
Potato	.239	.001	-.091
% Private	.357	.372	.406
Grain	.833	-.033	.187
% Private	-.118	.149	.351
Hay	.911	.012	.090
% Private	-.263	.024	.495
Other	-.117	-.167	-.393
% Private	.222	.375	.201
Cattle	.835	-.276	.306
% Private	.145	.661	.032
Sheep	.542	-.235	.343
% Private	-.003	.575	-.351
Horse	.330	-.471	.229
% Private	.153	.427	-.304
Pigs	.559	.194	.160
Poultry	.623	-.082	.401
Forests	.727	-.223	-.224
Wetlands	-.162	-.131	-.360
State employees	.497	-.133	-.442
Seasonal workers	.670	.148	-.497

Private enterprises	.679	.028	-.509

Scores of individual villages along the first two PCA axes are shown in Diagram 2. 28 out of 32 villages of the district show low to middle scores along the first axis and middle to high scores along the second. Lowest scores along both the first and the second axis have villages that belong to Gorelovka and Tambovka administrative units, i.e. that lie in the eastern part of the district, in the neighbourhood of lakes Madatapa and Paravani. High scores along both axes has the town Ninotsminda and village Eshtia (central part of the district, north from the lake Khanchali) and high loadings along the first axis has village Gandza (between lakes Sagamo and Paravani). The position of village Govelovka is noteworthy to stress. The village demonstrates middle score along the first axis (describing size and prosperity of a village) and extremely low score along the second axis (density and privatisation). In this village, owning ca. 6 % of the district territory, live only ca. 1000 persons (3% of the district's population) and possibly even less, due to the continuing emigration of Dukhobors. Gorelovka is an administrative centre for six villages in the south-eastern part of the district, with the total population of 2463 (7 % of the district's inhabitants). This unit administrates 19776 hectares of land, which represents ca. 15 % of the district's area or 24 % of area owned by settlements of the district. Mostly, these lands are used as summer pastures, hay harvesting areas and mowlands, with only 174 ha (below 1 %) of arable lands (grain and potato cultures).

Diagram 2. scores of individual villages of Ninotsminda district on the first two PCA axes provided by 32 economical, social and ecological variables.



It is remarkable that two out of four large lakes/wetlands of the district (Sagamo and, especially, Khanchali) lie in areas of high population density and intensive agriculture.
Some additional information on the land use in Ninotsminda district see in the interim report of the current project.

4.5. *Land use in the area of Khanchali lake*

The fourth largest lake of the Javakheti region and the fifth largest lake of Georgia, Khanchali, lies in the central densely populated part of the Ninotsminda district (Map 10). Up to the 1961, Khanchali lake represented the shallow reservoir with water surface 1310 hectares and mean depth less than 1m. In 1961, it came a decision about foundation of the fishery farm. The Lake was artificially desiccated, hibernation channels were dig and overflow weirs were constructed. As of 1979, the lake was artificially desiccated and the bottom was for ploughed up. The lake remained without water between 1980-1985. Currently, ca. 425 ha of the lake area (less than a half) is filled in water. The lake however requires an attention as an important habitat of nesting and migratory waterfowl birds.
The total number of villages, located around the Khanchali lake and economically dependent on the lake, according to different local institutions, varies between 8 and 10, and they belong to six sakrebulo's: the town Ninotsminda and village Khojabegi (Ninotsminda sakrebulo), Didi Khanchali and Patara Khanchali (Didi Khanchali), Diliti, Didi Gondrio, and Mamtsvara (Didi Kondrio), Djigrasheni (Djigrasheni), Kaurma (Eshtia), Orjolari (Satkha). Villages Khojabegi, Patara Khanchali and Diliti (Dilif), and town Ninotsminda, which own the desiccated part of the lake, may potentially depend on the lake. According to some reports of local officials, villages Jigrasheni and Mamtsvara use the water from the lake for irrigation, but this information was not supported by detailed investigation (Tarkhnishvili et al., 1996).
The most important economical argument for keeping the Khanchali lake in its current, semi-desiccated state, is the income from cultivation of fodder crops on the desiccated part of the bottom. According to the official documentation, 700 hectares of desiccated bottom of the Khanchali lake is used for cultivation of different kinds of agriculture, mainly fodder crops, and grazing cattle. These 700 hectares are formally attributed to four villages: 300 hect. - village Diliti (Dilif); 200 hect. - village Hojabegi; 100 hect. - village Patara Khanchali and 100 hect. - town Ninotsminda. Thus, besides of the town Ninotsminda, three villages with approximate population number 4,500 can response negatively on the reconstruction of the

lake which (potentially) can cause some economical loss for these villages. However, our investigation done in 1995-1996 (Tarkhnishvili et al., 1996) revealed that the economic importance of the lake is strongly overestimated by local authorities. In fact, only the population of the village Diliti (over 1500 persons, see File 2 of Data Base) vitally depend on the harvesting fodder crops from the dried bottom of the lake. On the other hand, only 300 out of the 700 ha used by this village is officially attributed to Diliti farms, and strong deviations from land use regulation are observed.

Therefore, although the lake Khanchali, although situated in densely populated part of the Javakheti plateau, does not play itself an important role in the local economy, being in the area of interest of a single village Diliti with population of 1517.

4.6. *Land use in Javakheti region: conclusive remarks*

The basis of economic life of the Javakheti region is agriculture. It provides main income to over 80% of the region's population. The basis of non-agricultural economic activities include small business, seasonal work abroad (mainly in Russia) and employment by Russian military base (mainly town Akhalkalaki, comprising ca. 15 % of the region's population). The main agricultural activities include cultivation of potato and grain (in particular barley), and pasture-based stock-breeding (mainly cattle and sheep). The central and western parts of the region, where whether urban population dominates or potato cultivation is the dominating way of land use, are relatively densely populated. In peripheral parts of the region, including mountains of Samsari and Javakheti and the ca. 10 km wide belt along the border with Turkey and Armenia, pasturing of cattle and sheep (e.g. use of non-transformed landscapes) dominates in the local economy. The population of these areas is scarce. An important natural resource of the region are wetlands and lakes, concentrated mostly in the southern half of the area (Ninotsminda district). However, this resource is not intensively used. Fishery provides certain income to villages that are situated at lakes Sagamo and Paravani (Ninotsminda district), and melioration of the lake Khanchali allows inhabitants of a single village to use the lake bottom as area for cultivation of fodder crops.

The distribution of lands among the villages is uneven. Large portion (over 15 %) of the entire region's land is attributed for summer pasturing to different districts of eastern Georgia, although in Akhalkalaki district the data on the land ownership system are controversially. Along the southern part of the region, large parts of non-transformed landscapes are administered by Kartsakhi and Gorelovka administrative units, that comprise in sum less than 3 % of the region's population (below 3000).

5. RESULTS AND DISCUSSION: NATURAL LANDSCAPES AND BIODIVERSITY OF JAVAKHETI

5.1. *General description of natural landscapes*

The current landscape of Javakheti was formed as a result of Pleistocene and Holocene volcanic activity (Janelidze, 1980). The region remained treeless at least throughout the Holocene time (Margalitadze, 1977). Therefore, the antropogenous changes of Javakheti landscape were limited by transformation of original mountain steppes and subalpine meadows into arable lands, erosion caused by overgrazing and plantation of pine forests throughout limited areas within the region. Mainly landscape transformations took place in the second half of XIX and throughout the XX century.

Indigenous landscape remained throughout the region include: (1) non-cultivated plots of mountain steppe at elevation over 2000 m, situated in the southern part of Ninotsminda district and in surroundings of Paravani lake; (2) subalpine and alpine meadows in Samsari and Javakheti mountains; (3) stony slopes of volcanic mountains and subnival zone of Samsari and Javakheti ridges, with bushes of *Rhododendron caucasicus*; (4) large (over 1 km²) lakes of volcanic origin (Tabatskuri, Kartsakhi, Khanchali, Madatapa, Sagamo, Paravani) with adjacent wetlands; (5) pit wetlands in the southern part of Ninotsminda district and (6) alpine lakes of Samsari mountain ridge (Fig. 3 - 8) (Map 11). The best preserved primary landscapes are restricted to mountains of Samsari and Javakheti (because of high elevation and complicated relief making difficult development of cultivated or urban landscape), and hilly part along borders with Turkey and Armenia (because of formal restrictions in the border zone during the Soviet period). The overall area of primary landscapes (including summer pastures, non-agricultural lands, wetlands and forest plantations) reaches over 50 % in both Akhalkalaki and Ninotsminda districts. Pastures comprise the largest portion of these landscapes.

5.2. Fauna of the Javakheti region

According to zoogeographic subdivision of the Caucasus (Gajiev, 1986), Javakheti belongs to the Sevan Asia Minor sub-province of the east Mediterranean province. Animal species that are found in the area make it similar to adjacent regions of eastern Turkey and western Armenia. Moreover, some species declining in other parts of the Caucasus are here relatively common. A few vertebrate species are endemic to the region and some adjacent areas of Turkey and Armenia. In further sections, the main source of information comprises our field

work in the framework of the project 'Land use and nature conservation in Southern Georgia', along with preliminary data obtained in the period 1993-1998. Additional sources of information provide Matcharashvili et al., 1999; Tarkhnishvili et al., 1996 a, b.

5.2.1. Amphibians and Reptiles. 13 species of amphibians and reptiles are found in Javakheti, including green toad (*Bufo viridis*), two species of frogs (*Rana macrocnemis* and *Rana ridibunda*), six species of lizards (*Anguis fragilis, Lacerta agilis, Darevskia valentini, D. nairensis, D. armeniaca* and *D. unisexualis*), 4 species of snakes (*Natrix natrix, N. tesselata, Coronella austriaca, Vipera dinniki* complex. *Rana macrocnemis* is represented with the subspecies camerani endemic to southern Georgia, Armenia and eastern Turkey (Tarkhnishvili et al., 1999). *Vipera dinniki* is endemic to the Caucasus region. All four species of Lizards *Darevskia* are endemic to southern Georgia, Armenia and eastern Turkey, and the major part of the range of *D. valentini* and *D. armeniaca* lies on Javakheti plateau. The distribution of endemic species of lizards and snakes is restricted to stony alpine formations concentrated along Javakheti and Samsari ranges and southern border of the region. *D. nairensis* and *D. unisexualis* are recorded exclusively for the southern limits of Javakheti plateau (Map 12). The distribution of Dinnik's otter remains unclear but most possibly it can be expected in the same formations as rock lizards. The rest of amphibians and reptiles are relatively evenly distributed throughout the region.

5.2.2. Mammals. 33 wild species of mammals are recorded or expected (according to a general distribution and ecological preferences of a species) for Javakheti plateau. Among them, there are five species of Insectivores, four bats, twelve rodents, one hare, nine carnivores, and two ungulates (Table 5). However, both ungulates, lynx and bear are scarce visitors in this treeless region. Among mammals with relatively large body size, there are notable European hare (*Lepus europaeus*); *Vormela peregusna*, badger *Meles meles*, otter *Lutra lutra* (Carnivora: Mustelidae); fox (*Vulpes vulpes*) and wolf (*Canis lupus*) (Carnivora: Canidae). Hare, fox, and wolf are spread throughout the entire region, whereas Vormela peregusna is recorded only at the border with Armenia (surroundings of the lake Madatapa).
Four mammal species from Javakheti are declining throughout Georgia: hamster *Cricetulus migratorius*, wolf, otter, and *Vormela peregusna* (Chatwin et al., 1997). Three species are found throughout Georgia only in the region: *Nannospalax neringii, Vormela peregusna* and *Sicista armenica*. Nine are species endemic to Caucasus: *Nannospalax neringii*, hamster *Mesocricetus brandti*, voles *Terricola daghestanicus, Terricola nasarovi* and *Chionomys*

nivalis, birch mouse *Sicista armenica*, shrews *Sorex caucasicus, Neomys schelkownikowi*, mole *Talpa levantis*. Habitats of the most of these species are concentrated along the southern border of the region and in Samsari and Javakheti mountains, although *N. neringi* and *V. peregusna* do not live in Akhalkalaki district (Map. 13).

Table 5. Mammals of the Javakheti Plateau. Sources of knowledge: PO – Data of the team members; Rep – reported by settlers; Bibl – according to bibliographic sources; Supposed – possible presence (as coming from the geographic / ecological preferences of a specoes.

Species	PO	Rep	Bibl	Supposed	distribution
1.Erinaceus concolor	+	+	+		everywhere
2.Lepus europaeus	+	+	+		everywhere
3.Nannospalax nehringi	+	+	+		southern part
4.Mesocricetus brandti	+		+		southern/eastern parts
5.Arvicola terrestris		+	+		everywhere
6.Ondatra zibethicus	+	+			all lakes
7.Microtus arvalis	+		+		everywhere
8.Terricola(daghestanicus)	+		+		southern/eastern parts
9.Mus musculus domesticus	+	+	+		settlements
10.Apodemus (sylvaticus) sp.		+	+		everywhere
11.Rattus norvegicus		+	+		settlements
12.Canis lupus	+	+	+		away from the c. part
13.Vulpes vulpes	+	+	+		everywhere
14.Ursus arctos		+			southern part
15.Lutra lutra		+			lakes
16.Martes foina	+				eastern part
17.Meles meles	+	+	+		everywhere
18.Mustela nivalis	+	+	+		everywhere
19.Vormela peregusna	+	+			Madatapa lake
20.Lynx lynx		+			southern part
21.Sus scrofa	+				southern part
22.Capreolus capreolus		+			southern part
23.Crocidura spp.			+		unknown
24.Neomys shelkownikowi			+		everywhere
25.Sorex caucasicus			+		unknown
26.Talpa levantis			+		everywhere?
27.Cricetulus migratorius			+		western part
28.Chionomys nivalis			+		eastern part
29.Rhinolop. ferrumequinum				+	everywhere?
30.Pipistrellus kuhli				+	everywhere?
31.Pipistrellus pipistrellus				+	everywhere?
32.Plecotus austriacus				+	everywhere?
33.Sicista armenica				+	eastern part?

5.2.3. Birds. This group requires special attention, because it includes most of rare, endangered, or protected by law species, along with those included in different international agreements on the nature protection. As a whole, there are recorded 142 bird species (Table *). 83 of those species breed in Javakheti, the rest of 59 species are migrants, summer visitors

or their status remains unclear. 83 species, including 39 nesting birds, are waterfowls. Most numerous groups of waterfowls are Charadriiformes (30 species, including 10 nesting) and Anseriformes (24 species, including 10 nesting). Seven species are of global conservation concern, among those two are nesting in the region: *Pelecanus crispus* (lake Kartsakhi) and *Crex crex* (all major reservoirs). 19 species are of European conservation concern, among those nine nest in Javakheti: *Pelecanus onocrotalus* (lake Kartsakhi); *Ardeola ralloides, Tadorna ferruginea, Anas strepera, Anas querquedula, Aythya fuligula* (lakes along the southern border of the region); *Netta rufina* (lakes Kartsakhi, Khanchali and Madatapa); *Melanitta fusca* (lakes Tabatskuri, Madatapa, Khanchali, Kartsakhi, with largest population at lake Tabatskuri); white stork *Ciconia ciconia* (concentrated in southern part of Ninotsminda district, with the clear population source (ca. 30 nesting pairs out of 60) in village Gorelovka (see also Tarkhnishvili et al., 1996).

Table 6. Birds of the Javakheti plateau. Ecological status: NB – all nesting birds; YR – nesting birds remaining in the region throughout year; YV – year-round visitors, non-nesting; SV – summer visitors; MG – migrants, visiting the region during passage. Conservation status: WC – birds of global concern, EC – birds of European concern, GD – rare or declining in Georgia (only nesting species).

GROUP	Total No	NB	YR	YV	SV	MG	WC	EC	GD
all species	142	88	17	1	2	45	7	19	5
waterfowls	83	39	3	1	2	43	7	19	5
	8	6	0	0	0	2	2	1	2
Ciconiiformes	9	3	0	0	2	7	0	6	1
Gruiformes	4	3	0	0	0	1	2	0	2
Anseriformes	27	10	1	0	0	17	3	12	0
Charadriiformes	39	15	1	1	0	24	0	0	0
Galliformes	1	1	0	0	0	0	0	0	0
Falconiformes	5	4	0	0	0	1	0	0	0
Passeriformes, cuckoos, owls etc.	49	47	14	0	0	2	0	0	0

Javakheti region is the only area in Georgia where breeding populations of species such as grey crane (*Grus grus*; ca. 10 nesting pairs), *Ciconia ciconia* (ca. 60 pairs), *Pelecanus onocrotalus* (ca. 50 pairs), *Pelecanus crispus* (20 pairs), and *Melanitta fusca* (150 to 200 nesting pairs) are found. Two first species live southern part of the Ninotsminda district, near lakes Khanchali, Bugdasheni and Madatapa; Pelicans build up a colony at the lake Kartsakhi, in south-western part of the region; and *Melanitta fusca* forms breeding populations in most of major lakes, with the centre at the lake Tabatskuri (northern part of Samsari mountains,

Akhalkalaki district). At last, harriers *Cyrcus aeroginosus* (ca. 100 pairs) and *Cyrcus pygagrus* (20 pairs) also nest in surroundings of major lakes of the region (Fig. 9). In conclusion, most of conservation-important nesting birds of the region are found in its southern part (Ninotsminda and, partly, Akhalkalaki district), with highest concentration at lakes Madatapa, partly – Khanchali and Kartsakhi, at lesser extent in its central and northern parts (lakes Tabatskuri and Paravani). For more detailed information on the birds of the region, see File 3 of the Data Base.

In conclusion, the analysis of the distribution of primary landscapes and animal populations (including those of declining, protected by law and endemic species) throughout the region demonstrates the highest importance of southern and eastern parts of the region from the conservation point of view. These parts of the region are the same as those with lowest population density, the lowest degree of land privatisation and the economy oriented on pasture-based stock-breeding. Ninotsminda district is more important than Akhalkalaki district, because it has vast majority of wetlands and wetland-associated nesting populations of waterfowls; on the other hand, Akhalkalaki district has high proportion of undisturbed primary landscapes, mostly covering Samsari mountain range (Map. 2).

6. MAIN THREATS TO THE LOCAL NATURE

As it comes from the data described in Chapters 4 and 5, large parts of the Javakheti region still preserve primary landscapes and ecological systems. Arable lands represent only 22% of the local landscape. Major part of non-transformed landscapes (54% of the total area) is used as summer pastures. Natural lakes and wetlands cover ca. 93 km² (3.5 % of the region's area). Potential and actual threats to the natural landscapes and animal populations can be subdivided into six groups.

1. Direct transformation of natural landscapes, including ploughing up virgine land and urbanisation.
2. Overgrazing or other increase of pressure on natural landscapes.
3. Pollution (primarily lakes, rivers and wetland areas).
4. Transformation of lake ecosystems via introduction of non-native fish and mammal species.
5. Direct destruction of lakes and wetlands, including melioration and desiccation.
6. Unlimited hunting.

Below, we overview relative importance of each of these six reasons.

6.1. *Direct transformation of landscape*.

As it was demonstrated in Chapter 4 of the present report, arable lands are concentrated in central, western and northern parts of the region, with relatively flat relief and the altitude usually not exceeding 2000 m. It is unlikely that high-mountain areas and stony landscapes currently used as summer pastures are intended to be ploughed up in observable future. The average birth rate (3.63 persons per family – our data) throughout the region, together with continuing emigration process, makes the local population relatively stable if not slowly declining (especially at the expense of migration from the town Akhalkalaki) (Table 2). In these conditions, it is unlikely also creation of new settlements or increasing of urbanised areas. The potential threat can be related with reconstruction works on automobile and railway roads in the southern part of the region and construction of oil pipelines at its northern edge, although these works possibly will not touch substantial areas of primary landscape. Most real potential threat can be uncontrolled activities on privatised or leased lands, such as an attempt of creation of trout farm at the alpine lake Levangel, that was accomplished with partial destruction of both lake and surrounded terrestrial ecosystem (see below) or creation of quarries in southern part of Ninotsminda district: this business is among traditional ones for the region providing large part of the country's building stone, and creation of new quarries in virgin lands at the south and the west of the region can be potentially an important threat for the local ecosystems.

6.2. *Overgrazing*

An extensive sheep-pasturing provides a serious threat for alpine landscapes throughout the Georgia (Tarkhnishvili & Kikodze, 1996). Overgrazing results in the errosion of grassland landscape, succession and decrease of the diversity of alpine vegetation, decline of the diversity of animal species. It seems to be that the pressure on the pastures of Ninotsminda district is not evenly distributed. In southern part of the district, cattle-breeding is dominated. Cattle pasturing is not resulted in such a strong landscape transformation as sheep pasturing and plant associations of the southern part of the region appear to be relatively well-preserved. In Samsari mountains, only relatively small area used by distant regions of Georgia (less than 4 % of the district's area) is used for sheep pasturing. Consequently, alpine landscapes of Samsari ridge remain in relatively well conditions (Fig. 10). In contrast, overgrazing can provide a certain problem in summer pastures of Javakheti mountains used by shepherds from

Sagarejo district (Fig. 11). It seems however that the pressure on the local landscape by pasturing sheep did not sensitively increase during the last decades.

6.3. *Pollution*

Currently, a developed industry that can potentially cause substantial pollution of the environment, is practically absent from the region. The local industry is mostly concentrated in the town Akhalkalaki, that lies in setting of arable lands and does not have any important lakes or wetlands in the close neighbourhood. Pollution caused by existing quarries in the southern part of the Ninotsminda district deals so far with very limited areas. However, the pollution by agricultural fertilisers and human life products appears to be an important factor for the lake Khanchali surrounded by settlements with the total population of 13,000, including the town Ninotsminda.

6.4. *Introduction of non-native species*

This factor is quite important for all major lakes of the region. Up to the late 1950s to 1961, the aquatic fauna of the local lakes remained largely undisturbed, although fishery provided certain income to populations of villages located at lakes Tabatskuri, Khanchali, Sagamo and, especially, Paravani, since the areas were populated (fishery at the lake Paravani was indicated by Georgian medieval chronicals – see for instance Bagrationi, 1949). The lakes were populated by local fish species, of which an economic interest had three species - Salmo fario (lake form), Leuciscus cephalis orientalis, and Barbus lacerta cyri. From ca. 1957 to 1961, fishery farms were created at lakes Tabatskuri, Khanchali, Sagamo and Paravani. In early 1960s, Coregonid fish species from the northern Russia, along with Carp (Cyprinus carpio) were introduced in all large lakes except Kartsakhi. Later, the crucian carp (Carassius carassius) from the southern Russia spread over lakes and ponds of the country, including all lakes of the region located at elevation below 2100 m. As a result, the fish fauna was completely changed in all lakes of Javakheti (Table 7).

Table 7. Ichtiological fauna of largest lakes of Javakheti plateau

Lake	Original fish species	Species composition for present times
Tabatskuri	*Salmo fario*	*Coregonus albula, C.albula ladogensis, C.peled, C.lavaretus, Salmo fario, S.ischan*
Paravani	*Leuciscus cephalis orientalis, Varicorhinus capoeta, Barbus lacerta cyri, Salmo fario*	*Coregonus albula, C.albula ladogensis, C.peled, C.lavaretus, Cyprinus carpio, Carassius carassius, S.ischan, Leuciscus cephalis orientalis, Varicorhinus capoeta, Barbus lacerta cyri?, Salmo fario?*
Sagamo	*Leuciscus cephalis orientalis,*	*Coregonus albula, C.albula ladogensis, C.peled,*

	Varicorhinus capoeta, Barbus lacerta cyri, Salmo fario	*C.lavaretus, Cyprinus carpio, Carassius carassius, S.ischan, Leuciscus cephalis orientalis, Varicorhinus capoeta, Barbus lacerta cyri?, Salmo fario?*
Khanchali	*Leuciscus cephalis orientalis, Varicorhinus capoeta, Barbus lacerta cyri, Salmo fario*	*Carassius carassius*
Madatapa	Supposedly:*(Leuciscus cephalis orientalis, Varicorhinus capoeta, Barbus lacerta cyri, Salmo fario)*	*Carassius carassius, Leuciscus cephalis orientalis, Varicorhinus capoeta, Barbus lacerta cyri, Salmo fario*
Kartsakhi	Supposedly:*(Leuciscus cephalis orientalis, Varicorhinus capoeta, Barbus lacerta cyri, Salmo fario)*	*Coregonus peled*, Supposedly:*(Leuciscus cephalis orientalis, Varicorhinus capoeta, Barbus lacerta cyri, Salmo fario)*
Bugdasheni, Akhmaz	Supposedly:*(Leuciscus cephalis orientalis, Varicorhinus capoeta, Barbus lacerta cyri, Salmo fario)*	*Carassius carassius;* Supposedly:*(Leuciscus cephalis orientalis, Varicorhinus capoeta, Barbus lacerta cyri, Salmo fario)*
Levangel (2500m a.s.l)	No fish	*Salmo fario*

It is notable that currently in lakes Khanchali and Madatapa, from the introduced fish species, remained only less valuable Carassius carassius. Recently, this species populated also the lake Kartsakhi located at the border with Turkey. It is not excluded that fast increase of the crucian population triggered appearance of some waterfowls unknown from the region before the recent time, in particular two species of Pelicans that currently nest at the lake Kartsakhi and feed throughout all important lakes of the Ninotsminda district.

The only wide-spread non-native wild mammal is *Ondatra zibethicus*, which was introduced in the lake Khanchali in middle 1980s and currently is found in the most of water reservoirs of Javakheti (although does not reach adjacent lowland parts of Georgia where climate is significantly warmer than in Javakheti). The extent of influence of this species on the local ecosystems remains unclear, although it seems to be unimportant in comparison with the direct antropogenous influence.

6.5. *Direct destruction of lakes and wetlands*

This factor provided dramatic degradation of ecosystems of the lake Khanchali in the near past. There are real threats that similar problem can appear in the near future for at least two other lakes: Madatapa and Bugdasheni. The history of the destruction of the Khanchali lake is worth to describe in finer details (see also Tarkhnishvili et al., 1996). Up to the 1961, the lake had water surface 1310 hectares and mean depth below 1m. The lake harboured a number of migratory waterfowls, the most numerous of that was greylag goose Anser anser. In 1961, it

was decided to create the experimental fishery farm. The main recreational works were conducted in 1963/1964. Lake was artificially desiccated, hibernation channels were dig and overflow weirs were constructed. In 1964, the lake was filled in and three fish species (*Cyprinus carpio, Coregonus albula, C. albula ladogensis*) were introduced. Although the lake provided certain profit by fishery, in 1968 the fishery farm was closed, and the lake was artificially desiccated. Since 1968, the lake was a property of the Department of Fishery of Georgian SSR. However, the lake remained largely unused and the natural recreation of the lake have been started. Leuciscus cephalis re-colonised the lake. Slow natural succession continued until 1979.

As of 1979, it was projected to desiccate the lake and plough up the bottom area. The lake was again artificially desiccated, and remained without water between 1980-1985. At the same time, the lake was divided into two parts by an artificial dike. In 1985, channels were closed and the south-eastern half (425 hectares) was filled in water for "carrying the ecological balance and use for fish-breeding". The dry section of the lake bed was used for cultivation of forage crops. Potatoes were unsuccessfully tried to cultivate as well. Currently, the lake stays largely desiccated and periodically its south-eastern part is filled in water. Periodical desiccation regularly causes extinction of large number of waterfowls nesting at the lake's eastern edge. Potentially, similar threats remain actual for the lakes Bugdasheni and Madatapa, where uncontrolled manipulation with channels and dikes causes strong fluctuations of water level. Certain part of the population inhabiting villages near the lake Madatapa support the idea of artificial desiccation of this lake (currently harbouring the largest populations of many waterfowls throughout the region) and use its bottom for fodder crop cultivation. For details dealing with the land use at the Khanchali lake and recommended approaches for the reconstruction of the lake, see Tarkhnishvili et al., 1997.

6.6. *Hunting*

Currently, it seems unlikely that hunting represents an important threat for the local fauna, although both hunting of waterfowls and terrestrial animals (primarily foxes, partly wolves) takes place and hardly is regulated by law. Species hunted for commercial purposes (fox and musk rat) remain common throughout the entire region, and the number of commercial hunters is low. The influence of hunting on waterfowl populations is hard to estimate, but it does not seem to be particularly high. An important problem can be collecting waterfowl eggs by villagers at Khanchali lake. This problem exacerbates the influence of artificial desiccation of the lake on the nesting bird population.

In conclusion, among potential threats for the local nature the most important role plays artificial transformation of lakes and wetlands, which can dramatically influence the local bird fauna. Other factors (except perhaps overgrazing) remain rather potential. However, economic development of the Javakheti region can quickly increase actuality of factors such as urbanisation, pollution and ploughing up virgin landscape.

7. PERSPECTIVES OF THE REGIONAL DEVELOPMENT AND NATURE CONSERVATION IN THE JAVAKHETI REGION

There are two important problems related with planning of protected areas and realising measurements for conservation. The first is a potential conflict between the economic interests of the local population and the limiting or excluding of land use throughout the protected area. The second is scarcity of financial resources necessary for the arrangement of protecting measurements. Both problems are actual for the Javakheti region. This relatively poor region almost exclusively depends on the agriculture and limiting of land use throughout significant areas can potentially harm the local population. The ethnic specificity of the region further complicates this difficulty, because the local population often looks on the centre-based initiatives with certain suspicions and, in its turn, the government of Georgia is careful in its interruption to the regional matters by the same reason. Moreover, there are not free resources neither in the centre nor locally, which could be invested into the organisation and sustaining of protected areas throughout the region. On the other hand, Javakheti provides an important natural heritage such as primary mountain grassland landscape and wetlands, which cover over 70% of the entire area, six large natural lakes, an unique volcanic landscape, and a number of animal populations, including 26 protected bird species, declining species of mammals and birds, and endemic species of amphibians, reptiles and mammals. For conservation of this heritage, the creation of protected areas or areas of limited agricultural use is important, because of the existing and potential threats to the local nature (Chapter 6).

7.1. *Areas most important for conservation*

Those include first of all primary landscapes in the southern and eastern parts of the region, including the entire area of Samsari and Javakheti mountains (Chapter 5). The second important point is conservation of largest natural lakes and wetlands, concentrated in

Ninotsminda district, including its densely populated central part (Map 9). Largely, the key areas for conservation lay at elevation over 2000 m and are scarcely populated (density below 15 persons per km²). The dominating economic activity in these areas are cattle pasturing (southern part of Ninotsminda district and the area between Javakheti and Samsari mountains, including the lake Paravani), hay harvesting (parts of the Samsari range attributed to villages of Akhalkalaki district) and sheep pasturing (Javakheti mountains, south-western part of Akhalkalaki district and, partly, Samsari mountains (Chapter 4). Wetlands and lakes away from this 'main' area of primary landscapes, first of all Khanchali, lie in setting of intensively cultivated area, although the lake itself does not play an important role in the local economy (Tarkhnishvili et al., 1997). The ownership system varies between different parts of the area destined for the protection (Map *). The eastern part of the Ninotsminda district (Javakheti mountains) and southern part of the Akhalkalaki district are attributed as summer pastures to the distant districts of Georgia. Unfortunately, it was not possible within the framework of the current project to estimate even approximate number of sheep actually grazing throughout these areas. however it is noteworthy to stress that these parts of the region have little connection with the local economy. The southern part of the Ninotsminda district is used for pasturing cattle and harvesting hay by *** villages of Ninotsminda district. However, more than half of these areas, including the lake Madatapa and its surroundings, are owned by a single administrative unit (Gorelovka) with the total population of 2000. The village Gorelovka itself (1060 persons) and village Sameba (84 persons). Subalpine meadows in Samsari mountains are used for hay harvesting by ** villages of Akhalkalaki district with the total population of ***. Khanchali lake is surrounded by settlements with the total population of 13,000.

7.2.*The potential conflict situations*

The potential conflict situations in case the mentioned areas will be destined for protection, include: (a) limiting of pasture-based stock-breeding, unacceptable for those villages which are dependent on this economic activity and for sheep-owners from the distant regions that use summer pastures in Javakheti; (b) reconstruction of the lake Khanchali which can affect village Diliti strongly connected with cultivation of fodder crops on the dried lake bed. Important to note that in different protection-important areas the nature of conflict can be different. Areas attributed to the distant regions of Georgia have little importance for the local economy. Consequently, the potential conflict will be with the limited number of sheep owners. These conflicts could be relatively easy settled because they have rather purely

economic ground without strong social consequences. Areas attributed to numerous villages of Akhalkalaki district and south-western part of the Ninotsminda district, in terms of the population size connected with these areas, are most important (the entire population connected with these areas exceed **** .). It can be assumed however that use of the mentioned areas is not a dominating factor of the local agricultural economy. The areas are used extensively, exclusively for hay harvesting. Largest part of the area is not privatised or destined for privatisation in the near future. Hay harvesting has limited effect on the local landscape, and it is not essential to exclude this way of land use even if the Samsari mountains will be turned to the protected areas system. The areas in the south and south-east of Ninotsminda district, administrated by the village Gorelovka, provide the most important source of income for ca. 1300 inhabitants of three villages from this administrative unit. However, the most important agricultural activity in this area is cattle pasturing and hay harvesting, which does not strongly affect the local landscape. The last, possibly most expected conflict includes dissatisfaction of the part of the population from villages neighbouring Khanchali lake, in case of the reconstruction of this lake. This conflict and potential ways of its regulations are described in Tarkhnishvili et al. (1996).

7.3. *Minimisation of the potential harm to the local population*

This strategy should combine two approaches: (a) creation of the net of strictly protected areas with the minimal or no economic importance and (b) flexible approach to the degree of conservation, with different conservation status attributed to different parts of the landscape mosaics.

Landscape plots that are in fact completely or almost completely excluded from the economic use, represent an important part of the 'conservation-important' areas. They include: (1) stony conglomerations; (2) Rhododendron bushes; (3) ravines; (4) narrow river canyons; (5) pine plantations; (6) swamps. These landscapes cover up to 200 km² or almost 10 % of the region's area. At the same time, edge habitats such as bushes, ravines and canyons, forest plantations and wetlands, and stony mountain slopes, maintain highest level of species diversity, first of all highest diversity of amphibians, reptiles and mammal species. The potential problem in case if these landscapes will be under protection as opposed to the rest of the landscape is the fragmentation of natural habitats. The plausible net connecting individual virgin plots in Ninotsminda and Akhalkalaki district is shown on Map **.

Large part of 'conservation-important' landscapes is used as summer pastures. We assume this way of activity should be rather monitored that prohibited, which excludes potential

conflict situations. The pastures can be included in the buffer zone of the protected area where land use will be limited for summer pasturing and hay harvesting. Such an approach will find support in the largest part of the local population connected with stock-breeding, especially if creation of the buffer zone will be accomplished with privatisation of pastures or other legal attribution of pastures to stock-owners. Simultaneously, it is necessary to estimate the actual pressure of the landscape and develop system of limitations that restricts such a pressure to the existing level or the level insignificantly exceeding the existent one. The problem connected with the reconstruction of the lake Khanchali can be resolved by re-distribution of existent hay harvesting areas among the villages (Tarkhnishvili et al., 1997).

7.4.*Potential benefits to the local population connected with the creation of the system of protected areas in Javakheti*

The creation of the system of protected areas in Javakheti region can potentially provide significant benefits to the local population. They include: (1) development of nature-based tourism (in particular bird-watching at the lakes of the region and mountain tourism in Samsari mountains) in the region, which can provide additional income to villagers and trigger the development of tourism infrastructure; (2) creation of jobs dealing with the service / management of the protected areas; (3) regulating the land property system via legal attributing of subalpine pastures to stock-owners. On the other hand, we understand that these benefits can hardly significantly influence the income or employment rates for the entire population of over 100,000 inhabitants. In this respect, several villages which economy is closely related with pasturing can provide a social basis of supporting the idea of creation of protected areas in Javakheti. First of all, these are villages of Goerelovka administrative unit, including Gorelovka itself, Efremovka and Sameba. Total population of these three villages comprises ca. 1500. In addition, the population of the village Kartsakhi (Akhalkalaki district) can be involved in the nature conservation activities. The development of nature-based tourism will provide certain advantage also to the part of the population of the town Ninotsminda. At last, villages located at the western slopes of Samsari ridge can benefit from the mountain tourism in the region. These are in particular villages Samsari (*** administrative unit) and *** (*** administrative unit), with the total population of ****.

Nowadays, the tourism business in Javakheti region is developed even less than in the rest of Georgia. A single hotel in Ninotsminda is currently in state below any standards and persons visiting the region for business needs prefer overnight in Akhalkalaki. The latter town has currently ca. 15 private hotels (usually ‘bed-and-breakfast’- type) that are used by Georgian

officials visiting the town, business visitors and Russian officials visiting the military base in Akhalkalaki. The hotels are relatively comfortable, usually with 5-10 two- to three-person rooms, carpet floor, shower rooms and breakfast room, equipped with petrol-generators for providing non-interrupted electricity supply and hot water. An average price per a two-person room varies between 15-30 USD per day, depending on the location of a hotel and a season (in winter period prices go down). Potentially, similar hostel network could be developed in the town of Ninotsminda and villages of Gorelovka administrative unit. An estimated initial capacity of bird-watching tourism in the region is limited by 200-300 visitors per year. For villages of Gorelovka and Sameba such a number of tourists could provide a significant additional source of income.

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REFERENCES

Bagrationi, V., 1948. The description of the Georgian Kingdom. Tbilisi Univ. Press, Tbilisi (in Georgian)

Chatwin, M. E., Kikodze, D., Svanidze, T., Chikvaidze, J., Gvritishvili, M. and Tarkhnishvili, D. N. (Eds.), 1997. Georgian Biodiversity Country Study Report, 1996 (the UNEP biodiversity country study programm). Tbilisi, Noah's Arc Center for Recovery of Endangered Species.

Djanelidze ChP. 1980. *Palaeogeography of Georgia in Holocene*. Tbilisi, Metsniereba (in Russian).

Djavakhishvili AN, Aslanikashvili AF, Dzotsenidze GS. 1964. *Atlas of the Georgian Soviet Socialist Republic*. Head Department of Geodezy and Cartography of the USSR. Tbilisi - Moscow (in Georgian).

Gajiev, F. A., 1986. Animals. In: Gabrielyan, G. K. (ed.), Physical Geography of Transcaucasus. Erevan Univ. Publ., Erevan.

Grossheim, A. A. (1948). "Vegetation cover of the Caucasus", MOIP, Moscow (in Russian).

Guretski, V., 1998. The question of Javakheti. Caucasian Regional Studies, 3 (1).

Ketskhoveli, N. N., 1959. Vegetation of Georgia. Tbilisi, Acad. Sci. Georg. SSR Publication (in Georgian).

Manly BFJ. 1994. *Multivariate Statistical Methods. A Primer*. 2nd ed. Chapman and Hall.

Ministry of Defence of the USSR, 1978. Topographic maps, scale 1. 200 000.

Margalitadze NA. 1977. The history of vegetation of Javakheti Upland and Tsalka Plateau in Holocene (South Georgian uplands). In. *Palinologicheskoe Issledovanie v Gruzii*. Tbilisi, Metsniereba (in Russian).

SPSS for Windows, Release 9.0.1. 1999. SPSS Inc. Chicago, Illinois.

Tarkhnishvili, D. and Kikodze, D. (Eds.), 1996. Principal Characteristics of Georgian Biodiversity. Authors: J. Badridze, A. Bukhnikashvili, N. Dekanoidze, A. Gavashelishvili, Z. Gurielidze, A. Kandaurov, D. Kikodze, I. Matcharashvili, T. Svanidze, D. Tarkhnishvili. - Natura Caucasica (Tbilisi), 1(2): 1-46.

Vladimirov, L. A., Gigineishvili, G. N., Djavakhishvili, A. I. & Zakharashvili, N. N., 1991. Water balance of the Caucasus and its geographic conformity to natural laws. Tbilisi, Metsniereba (in Russian).

Appendix 1. Administrative units and villages of Javakheti analysed within the framework of the project, with some important characteristics of the population, ownership structure and dominating agricultural activities. More complete information given in File 1 of the Data Base.

distr.	sakrebulo	village	Area ha	private	populat.	pastures	potato	grain	cattle	sheep
N	Didi Kondrio	Didi Kondrio	2406.77	423.00	1452	400.00	100.00	159.00	850	463
N	Didi Kondrio	Pat. Kondrio	1463.10	232.00	622	0.00	38.00	52.00	295	529
N	Didi Kondrio	Dility	2346.46	496.00	1517	0.00	57.00	76.00	938	2467
N	Didi Kondrio	Mamtsvara	2307.74	273.00	776	400.00	49.00	283.00	401	297
N	Didi Kondrio	Kulalisi	1268.00	304.00	816	0.00	50.00	82.00	416	567
N	Eshtia	Eshtia	6059.97	1032.00	3432	300.00	230.00	607.00	2061	5600
N	Eshtia	Uchmana	1706.95	157.00	498	0.00	29.00	43.00	185	555
N	Eshtia	Toria	1590.35	223.00	645	180.00	34.00	82.00	450	414
N	Eshtia	Kaurma	1185.78	175.00	490	0.00	25.00	87.00	385	492
N	Gorelovka	Gorelovka	7611.64	136.40	1065	0.00	6.00	30.00	1984	1993
N	Gorelovka	Spasovka	2383.02	145.00	355	0.00	10.00	51.00	585	149
N	Gorelovka	Orlovka	3154.10	103.00	290	0.00	3.00	23.00	483	189
N	Gorelovka	Efremovka	1877.87	52.00	136	738.00	2.00	0.00	127	81
N	Gorelovka	Jdanovakan	1963.41	187.00	523	0.00	2.00	47.00	502	685
N	Gorelovka	Samebo	2785.71	38.00	84	0.00	1.00	0.00	114	2
N	Satcha	Satcha	3988.93	772.00	2173	0.00	60.00	300.00	867	2354
N	Satcha	Didi Arapali	1790.21	268.00	976	200.00	23.00	141.00	359	962
N	Satcha	Pat. Arapali	1280.75	187.00	565	0.00	16.00	39.00	232	1000
N	Satcha	Orodjalar	2284.44	476.00	1421	0.00	60.00	180.00	516	1060
N	D.Khanchali	D.Khanchali	2335.04	593.00	1559	0.00	50.00	77.00	1002	1735
N	D.Khanchali	P.Khanchali	1827.28	269.00	681	300.00	30.00	127.00	698	9234
N	D.Khanchali	Katnatu	1277.49	101.00	292	150.00	12.00	82.00	328	564
N	Djigrashen	Djigrashen	2625.18	515.00	1223	700.00	97.00	221.00	622	1168
N	Djigrashen	Pat.Khorenia	0.00	14.00	104	0.00	2.00	2.00	561	80
N	Gandza	Gandza	9527.50	1162.00	3343	400.00	77.00	619.00	1745	10837
N	Gandza	Sagamo	0.00	0.00	154	0.00	1.00	2.00	178	545
N	Poka	Poka	3846.56	615.00	2242	0.00	12.00	165.00	1529	4440
N	Poka	Vladimirovka	0.00	16.00	154	0.00	1.00	0.00	156	591
N	Tambovka	Tambovka	2552.82	33.00	298	0.00	0.00	67.00	383	1489
N	Tambovka	Aspara	1626.30	5.00	87	0.00	0.00	29.00	233	486
N	Tambovka	Radionovka	2077.88	6.00	267	1255.00	340.00	36.00	261	812
N	Ninotsminda	Ninotsminda	4407.27	662.00	6870	1782.00	39.00	369.00	2009	110
A	Khando	Khando	2492.00	1023.00	2221	662.00	558.00	367.00	701	72
A	Alastani	Alastani	5846.79	424.00	1008	2141.00	230.00	167.00	483	664
A	Alastani	Gokio	512.00	176.00	553	0.00	258.00	128.00	203	482
A	Alastani	Varevani	629.00	365.00	811	0.00	238.00	176.00	341	197
A	Turtskh	Turtskh	948.13	409.60	1680	249.60	176.70	126.60	415	0
A	Azarveti	Azarveti	4979.00	497.00	1204	2465.00	216.00	122.00	594	1700
A	Azarveti	Bornasheti	336.00	242.00	593	0.00	121.00	72.00	217	415
A	Azarveti	Godalari	334.00	246.00	500	0.00	123.00	76.00	279	343
A	Azarveti	Lomaturtskhi	274.00	205.00	426	0.00	127.00	87.00	213	0
A	Baraleti	Baraleti	9040.65	369.00	1029	4838.00	310.00	201.00	376	615
A	Baraleti	Merenia	311.00	199.00	1072	0.00	122.00	81.00	275	211
A	Baraleti	Ikhtila	672.00	381.00	1279	0.00	333.00	183.00	191	377
A	Baraleti	Didi Samsari	321.00	162.00	446	0.00	84.00	144.00	234	254
A	Baraleti	Pat. Samsari	484.00	216.00	576	0.00	160.00	147.00	131	184
A	Kochio	Kochio	6689.15	247.00	598	3988.00	103.00	87.00	270	130
A	Kochio	Bejano	381.00	381.00	1022	0.00	189.00	96.00	475	1798
A	Kochio	Agana	189.00	189.00	718	0.00	98.00	61.00	225	448
A	Kochio	Alatumani	193.00	191.00	839	0.00	70.00	83.00	248	384
A	Kochio	Modegami	99.00	99.00	265	0.00	44.00	21.00	199	71
A	Kochio	Sircwa	45.00	45.00	165	0.00	24.00	16.00	132	0
A	Zaki	Zaki	7664.45	314.00	968	4065.00	123.00	129.00	395	320
A	Zaki	Bukhasheni	209.00	173.00	885	4.00	67.00	73.00	356	275
A	Zaki	Gomani	370.00	329.00	1735	77.00	141.00	93.00	520	890
A	Zaki	Balkho	276.00	241.00	774	68.00	78.00	89.00	217	630
A	Zaki	Olaverti	325.00	217+53	1025	53.00	118.00	97.00	248	4300
A	Zaki	Trcna	71.00	53.00	236	0.00	39.00	28.00	123	4
A	Kotemia	Kotemia	1837.52	217.00	265	563.00	357.00	275.00	122	250
A	Kardigami	Kardigami	8375.70	732.00	2339	4347.00	153.00	122.00	562	0
A	Kardigami	Kulikami	456.00	431.00	2196	0.00	166.00	176.00	678	219
A	Kardigami	Khulgumo	366.00	334.00	1540	0.00	145.00	141.00	347	0
A	Kardigami	Abuli	289.00	233.00	737	0.00	162.00	89.00	395	1755
A	Kardigami	Takhcha	168.00	48.00	144	0.00	105.00	55.00	76	322
A	Kardigami	Buzaveti	195.00	124.00	346	0.00	86.00	70.00	152	727
A	Aragvia	Aragvia	7406.20	478.00	1366	2955.00	360.00	216.00	406	14
A	Aragvia	Orja	487.00	380.00	1048	0.00	178.00	184.00	305	112
A	Aragvia	Korkhi	530.00	430.00	1087	0.00	201.00	176.00	341	235
A	Aragvia	Totkhami	437.00	153.00	331	0.00	155.00	172.00	128	94

A	Aragvia	Majatia	621.00	496.00	1621	0.00	247.00	176.00	392	44
A	Khospio	Khospio	4080.46	247.00	395	2117.00	134.00	133.00	128	184
A	Khospio	Martuni	294.00	137.00	341	0.00	110.00	130.00	101	201
A	Khospio	D.Khorenia	298.00	247.00	416	0.00	121.00	116.00	105	275
A	Khospio	Bavra	427.00	390.00	1097	0.00	155.00	162.00	217	296
A	Dilisca	Dilisca	4670.13	1661.50	3700	1567.50	913.00	820.00	823	689
A	Chunchkha	Chunchkha	1747.94	146.00	386	869.00	262.00	147.00	332	505
A	Ptena	Ptena	1462.80	433.00	322	707.00	223.00	103.00	280	67
A	Vachiani	Vachiani	5437.01	794.00	2338	2238.00	520.00	472.00	1172	45
A	Vachiani	Chandura	703.00	278.00	646	0.00	300.00	201.00	350	70
A	Vachiani	Murjakheti	353.00	170.00	387	0.00	121.00	89.00	300	130
A	Kumurdo	Kumurdo	3928.00	917.00	3080	1794.00	502.00	431.00	1600	4970
A	Kumurdo	Kirovacani	407.00	195.00	600	0.00	169.00	140.00	?	?
A	Okami	Okami	4217.90	282.00	585	2079.00	345.00	244.00	989	1097
A	Okami	Kartsep	362.00	68.00	193	0.00	128.00	146.00	?	?
A	Okami	Azmana	260.00	71.00	166	0.00	95.00	101.00	?	?
A	Gogasheni	Gogasheni	2225.20	250.00	400	895.00	228.00	220.00	223	817
A	Gogasheni	Apnia	363.00	106.00	222	0.00	147.00	140.00	187	161
A	Sulda	Sulda	7199.75	474.00	1112	4116.00	267.00	203.00	910	1279
A	Sulda	Dadaeshi	635.00	507.00	1004	0.00	225.00	213.00	528	1659
A	Sulda	Bazali	225.00	89.00	314	0.00	68.00	61.00	178	148
A	Sulda	Myasnikiani	183.00	52.00	261	0.00	87.00	71.00	101	329
A	Karzakhi	Karzakhi	9619.79	242.00	978	6036.00	229.00	239.00	770	3100
A	Karzakhi	Pilipoca	606.00	178.00	82	0.00	199.00	196.00	150	400
A	Akhalkalaki	Akhalkalaki	9650.37	24.00	12055	131.00	12.00	9.00	188	0
A	Khaveti	Khaveti	4012.70	89.00	377	3291.00	73.00	71.00	484	1972
A	Khaveti	Davnia	133.00	63.00	138	0.00	60.00	51.00	?	?
A	Khaveti	Erinjia	64.00	23.00	57	0.00	33.00	22.00	?	?

Appendix 1 (Continuation)

Appendix 2. Sample of raw data on the economical/ social status of individual villages / administrative units of Ninotsminda district (prepared by O. and N. Ginosyan). First four columns indicate lands administrated by individual villages, the last column – lands administrated by the administrative unit (Sakrebulo) of Satkhe, including four villages.

	Satkhe	D. Arakali	P. Arakali	Orodjalar			Satkhe Sacrebulo (total)
Agricultural Lands	3500.24	1654.15	1209.90	2077.26			**8441.55**
incl. Sow Land	772	518	182	476			
incl. Private	772	268	182	476			
incl. Potato	60	23	16	60			
Grain	300	98	39	180			

Hay	410	146	126	235			
Other Cult.	2	1	1	1			
Cooperative	-	250	-	-			
incl. Potato	-	-	-	-			
Grain	-	43	-	-			
Hay	-	205	-	-			
Other Cult.	-	2	-	-			
Pastureland	-	200	-	-			
Incl. Private	-	-	-	-			
Cooperative	-	200	-	-			
Mows	-	130	5	-			
Incl. Private	-	-	5	-			
Cooperative	-	130	-	-			
Free agricultural lands	2728.24	806.15	1022.90	1601.26			
Non-cultivated lands	562.9	126.06	72.76	208.51			
TOTAL AREA (Hect)	***3988.93***	***1790.21***	***1280.75***	***2284.44***			***9344.33***
Livestock	***3231***	***1406***	***1238***	***1620***			***7495***
Cattle	867	359	232	516			
Incl. Private	867	359	232	417			
Cooperative	-	-	-	99			
Sheep	2354	962	1000	1060			
Incl. Private	2354	962	1000	1060			
Cooperative	-	-	-	-			
Horse	6	5	1	12			
Incl. Private	6	5	1	5			
Cooperative	-	-	-	7			
Pigs	4	80	5	32			
Incl.Private	4	80	5	32			
Cooperative	-	-	-	-			
Poultry private	1463	326	545	635			2969
Population	2173	976	565	1421			5135
Families	616	238	158	390			1402
Seasonal workers (Russia)	7	9	4	15			36
Private business owners	3	-	-	1			4
Cooperative workers	-	2	3	4			9
State officers							140

Fig.1: new and old-style house

Fig. 2. Typical landscape

: (1) non-cultivated plots of mountain steppe at elevation over 2000 m, situated in the southern part of Ninotsminda district and in surroundings of Paravani lake; (2) subalpine and alpine meadows in Samsari and Javakheti mountains; (3) stony slopes of volcanic mountains and subnival zone of Samsari and Javakheti ridges, with bushes of *Rhododendron caucasicus*; (4) large (over 1 km²) lakes of volcanic origin (Tabatskuri, Kartsakhi, Khanchali, Madatapa, Sagamo, Paravani) with adjacent wetlands; (5) pit wetlands in the southern part of Ninotsminda district and (6) alpine lakes of Samsari mountain ridge (Fig. 3 - 8)

Fig. 9 . Birds

Fig. 10. Samsari landscape

Map 9. Distribution of natural landscapes

Map 10. findings of amphibians and reptiles.

Map 11. Findings of rare mammal species

Map 12. Nesting sites of Ciconia ciconia, Grus grus, Pelecanus onocrotalus and Melanitta fusca.