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National Action Programme to Combat Desertification

Introduction

The last decade of the 20th century (1991-2000) was the warmest period in the second millennium. In this context, a monotonous decline in precipitation is seen as an indication of the initial stage of desertification. This process will further deepen and accelerate as a consequence of a spectacular increase in man-induced negative impacts (wood felling, accelerated soil erosion, etc.).

For Georgia desertification represents not only an environmental, social or economic, but also a climatic problem. Climate warming poses a serious threat to the Caucasus glaciers, as it causes melt due to high temperature, low relative humidity and fall in solid atmospheric precipitation. In case these processes take on a systematic character, they will cause an accelerated glacier retreat and obviously lead to serious climatic change, first local and then regional. The Caucasus ecological balance is clearly under threat, the more so if the processes become irreversible. It is anticipated that in Georgia, just like in the whole region of the Caucasus, the period up to 2050 will see a significant decrease in annual river runoff (50-150mm/year). The effect of warming will presumably be different in western and eastern regions of Georgia. In eastern Georgia, a rise in ambient temperature over the first half of this century may reach 2^0C, while in western Georgia open to the constant influence of the Black Sea it will only reach 1^0C.

Although Georgia does not lie in the immediate proximity to deserts, in the event of systematic dry spells certain regions located in the eastern part of the country (Gare Kakheti, Kvemo Kartli) may confront a real danger of local desertification. In addition to these regions, there may exist other areas vulnerable to desertification, whose timely identification is important if effective action to combat desertification is to be ensured.

Therefore, comprehensive study of droughts and desertification, and elaboration of a long-term strategy and plan of action to combat desertification is one of the most urgent problems for our country.

Georgia became a party to UNCCD in 1999. The creation of the National Action Plan to Combat Dsertification was coordinated by the Ministry of Environment and NACRES (Noah's Ark Centre for the Recovery of Endangered Species) was designated to develop the actual document.

Georgia's National Action Programme to Combat Desertification relies on programmes developed, and opinions expressed, by the Institute of Hydrometeorology of the Georgian Academy of Sciences; the Vakhushti Bagrationi Institute of Geography of the Georgian Academy of Sciences; the V. Gulisahvili Institute of Mountain Forestry of the Georgian Academy of Sciences; the Institute of Geophysics of the Georgian Academy of Sciences; the Research Centre "Stikia"for Natural Elemental Processes and Engineering geo-ecology under the State Department of Geology; the Department of Meteorology, Climatology and Oceanography of the Tbilisi State University; the Georgian Academy of Agriculture and its institutions; the M. Sabashvili Scientific Research Institute of Soil Science, Agrochemistry and

Melioration; the Scientific Research Institute of Livestock Farming and Forage Production; the I. Lomouri Scientific Research Institute of Farming; the Scientific Research Institute of Horticulture, Viticulture and Wine-Making; the N. Kanchaveli Institute of Plant Protection; the Scientific Research Institute of Radiobiology and Ecology; the Chair of Soil Science of the Georgian State Agrarian University; the Georgian State Department for Protected Areas; the Institute of Water Utilities and Engineering Ecology of the Georgian Academy of Sciences; the Ministry of Agriculture and Food of Georgia; the Ministry of Environment and Natural Resources of Georgia, as well as local government bodies.

The national plan of action to combat desertification describes general guidelines and mechanisms to be considered in future. At the same time, it does not list specific measures to be taken in every concrete case, as many of them require consistent scientific examination.

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Part I
General Provisions
Chapter 1.

Strategic Principlesto combat desertification

Georgia' strategy to combat desertification shall be based on the following principles:

It is necessary to identify basic regional causes of desertification in Georgia, as well as their contributing factors, and to design such practical measures and inputs that are essential for combating desertification and mitigating the effects of droughts;

Decisions shall be taken on the strength of firm scientific evidence (the principle of reasoned and informed decisions);

In order for the action to combat desertification to be effective, it is necessary to carry out systematic research and monitoring;

Preventive measures shall be taken without delay when there are reasonable grounds for concern that there is a risk of desertification, even when there is no conclusive evidence of causal relationships (the precautionary principle);

Action to combat desertification shall be based on the conservation of biological diversity and landscape protection;

Projects that may have a potential negative environmental impact shall necessarily envisage environmental impact assessment (the principle of avoidance);

Activities that cannot be avoided, and are particularly damaging for the biological diversity and landscape, shall be carried out in less risky areas (the principle of translocation);

In the event it is impossible to avoid detrimental effects of physical changes in areas of special value in terms of their biological diversity and landscape, they shall be balanced by compensatory conservation measures (the principle of ecological compensation);

Action to combat desertification shall make use of the best available technologies and methods of environmental protection; provision of access to technologies and transfer of technologies represent important elements of action to combat desertification;

In respect of any action that triggers off desertification processes, control costs and damages shall be paid by the responsible party (the polluter pays principle);

Action to combat desertification shall involve local public, land owners, academic community, other stakeholders and civil society groups (the principle of transparency and public participation);

A special role in the action to combat desertification shall be assigned to the Government of Georgia, aware of its ultimate responsibility for the protection of the country's biological health for the present and the coming generations.

Chapter 2
Main Objectives of the NAP to Combat Deserttification

The Programme aims to:

- **Identify territories under threat of desertification and define their areas;**
- **Take action to combat desertification through sustainable use of natural resources, adequate planning and conservation activities;**
- **Engage competent authorities and institutions in the action to combat desertification;**
- **Develop international cooperation and partnership in order to enhance the action to combat desertification.**

Part II
Main phisical-geograhical factors influansing on the desertification proceses and the most sensitive areas
Chapter 3
Physical and Geographic Features of Georgia:

Georgia lies in the south-eastern part of Europe.

Georgia is bordered in the north by the Russian Federation, in the east by Azerbaijan, in the south-west by Turkey and in the south by Armenia. On the west it is bounded by the Black Sea. Georgia has the following geographic co-ordinates: in the north – latitude $43^0$35' north, longitude $40^0$23'east; in the south - latitude $41^0$02' north, longitude $46^0$30' east; in the west - latitude $43^0$23' north, longitude $40^0$00'east; and in the east - latitude $41^0$17' north, longitude $46^0$44' east. Georgia covers 76.3 square kilometres. Total length of Georgia's borders is 1968.8 km, of which 1660.4 km is land border.

Georgia's geographic location has given rise to a remarkable variety of landscapes. Roughly two thirds of its territory is highlands. Georgia's main orographic features include: the Greater Caucasus, the intermontane structural depression that is crossed by the Likhi mountain range and divided by it into the Kolkhida and Iori lowlands, the Meskheti and Trialeti ranges (part of the Lesser Caucasus highlands) and the South-Georgian volcanic upland plateau. The highest peaks of the watershed Greater Caucasus range in the territory of Georgia rise to over 5000 metres and are covered by eternal snows and glaciers. Intermontane structural troughs vary in topography and feature plains, plateaus, ridges and upland tablelands. The Likhi range links the Greater Caucasus and the Meskheti range. At the same time, it is the prime factor responsible for highly contrasting topography in western and eastern Georgia.

Climate

Georgia's climatic diversity is determined by its location at the northern rims of the subtropical zone between the Black and the Caspian Seas on the one hand, and by its particularly complex topography, on the other. Numerous mountain ranges differing in height and direction play an important part in moulding the climate. The Black Sea and the Caucasus range significantly influence local climatic conditions. The Caucasian barrier protects Georgia from cold air intrusions from the north, while the influence of warm, moist air from the Black Sea moderates temperature fluctuations and is conducive to high precipitation rate, especially in western Georgia.

Formation of climate is influenced by atmospheric processes that evolve in the territory of Georgia and its neighbouring countries, and typical of moderate and subtropical belts. Arctic and tropical air masses, both sea and continental, are also important. During the warm season, convectional processes play their role in shaping the weather. It is to be noted that the territory under study shows highly contrasting air temperatures.

The interaction of circulation, radiation and orographic factors in the territory under review gives rise to fairly sharp contrasts in terms of humidity. Maximum precipitation zones vary from 300-500 mm to 3500 mm in western Georgia, and from 1200 mm to 3500 mm in eastern Georgia.

The combination of complex orographic conditions and prevailing atmospheric circulation processes is responsible for a highly specific rainfall pattern over the year: western Georgia receives the most precipitation in winter or in autumn seasons, and minimum rainfall - in spring or in summer seasons; while in eastern Georgia the maximum precipitation is observed in spring or summer, and the minimum – in winter.

The highly rugged terrain transforms general atmospheric circulation in a specific manner, and gives rise to enough variation in numeric values of various meteorological factors to permit clear classification into three different climatic regions in the territory of Georgia.

In terms of solar radiation regime, Georgia constitutes part of the subtropical zone. By the pattern of atmospheric circulation and the related weather conditions, Georgia is divided into two circulation climatic regions and one subregion: 1. maritime subtropical humid climate region (western Georgia); 2. transitional subtropical-to-continental climate region (eastern Georgia) and transitional arid subtropical-to-moderately humid climate subregion (the central steppe part of the southern highlands).

Inland Water

Georgia has 26060 rivers, of which 99.4% are small rivers not exceeding 25 km in length. Average density of river net in western Georgia is 1.07, and in eastern Georgia – 0.68 km/km^2. The maximum value of river net density in Georgia is found in Ajara. Historical annual average river discharge in Georgia totals 66 km^3, of which 75% is formed in western Georgia and is part of the Black Sea basin. The remaining part of the river discharge is formed in eastern Georgia and heads for the Caspian Sea. As much as 15% of river runoff in the territory of Georgia enters the country from beyond its borders. Mean runoff height in western Georgia rises to 1300 mm, whereas in eastern Georgia it is 400 mm.

Georgia, like any mountainous country, shows distinct vertical zonation of the runoff. Waters are especially abundant in the western part of the near-crest belt of the Caucasus and in Ajara mountain belt slopes facing towards the sea. Here annual discharge reaches 4000 mm. South-eastern regions of Georgia are arid; annual discharge only reaches 50 mm. Georgia rivers, for the most part, show a mixed feeding pattern; they are fed by snow, rainfall, glaciers and ground waters.

Feeding by melt water grows with increasing altitudes. Small rivers in the Black Sea coastal zone are almost exclusively fed by rainfalls. River basins at high elevations of the Caucasus significantly rely on glacier flows that sometimes account for over 50% of water fed to rivers.

River runoff regime is highly diverse too. Small rivers in the Kolkhida lowland show frequent flood flows throughout the year. Middle-elevation basins are characterised by spring flooding caused by the melting of snow in the period starting in the later half of March and up to mid-May. Floods at glacier-fed rivers are prolonged.

The low water phase is equally interesting. The study of low water season is of special importance as it gives an insight into the resource limits of rivers which is often a factor determining a marginal usage norm for river resources in power generation, irrigation and farming.

The most abounding in waters among Georgian rivers is Rioni (western Georgia). It empties into the Black Sea an average of 403m^3 per second, i.e. average annual discharge of 12.7 km^3 . Its main tributaries are Kvirila (1.9 km^3), Tskhnistskali (2.5 km^3), Tekhuri (1.0 km^3), Khanistskali (0.7 km^3), and others. Other rivers in western Georgia are Bzybi (3.0 km^3), Kodori (4.1 km^3), Enguri (5.9 km^3), etc.

The major river in eastern Georgia is Mtkvari (Kura) and it has the largest basin. Its average discharge near Tbilisi is 203 m^3/sec, i.e 7.2 km^3 annually. Noteworthy among its tributaries are Didi Liakhvi (1.4 km^3), Ksani (0.4 km^3), Aragvi (1.8 km^3), Paravani (0.6 km^3), Ktsia (1.6 km^3). Rivers Tushetis Alazani, Terek, Arkhotistskali, and Arghun flow on the northern slope of the Caucasus.

Mudflows deserve special mention, as they periodically move huge masses of mud-rock. A classical case of mud stream in Georgia is Duruji that flows into river Alazani near Kvareli, posing a constant threat to the town.

Lakes

Georgia has over 860 lakes, most of them very small. Total water stock in lakes is 0.72 cubic km. The largest lake in Georgia in terms of its water area is Paravani (37.5 square metres), while Ritsa is the deepest of Georgia lakes.

Glaciers

The spread of modern glaciers in the territory of Georgia is due to specific atmospheric processes, relief morphological and morphometric parameters and their functional interaction. The main foci of glaciation are related to the watershed Great Caucasus range and the Kazbegi mountain massif.

Georgia has 786 glaciers occupying about 559,9 square km. The largest glaciers occur in river Enguri basin: notably Lekzyri, Tsanneri, Tviberi, Adishi and others.

Warming of the climate over the globe, including the Caucasus, has brought about contraction of glaciers. In 1890-1980 the glaciation area in Georgia decreased by 9.5%.

Subsurface waters

Georgia shows a remarkable diversity of underground waters both in terms of their depth and occurrence form, and their physical and chemical characteristics. Intermountain bands are mostly characterised by artesian aquifers. The Caucasus and the Meskheti-Trialeti folded zones mostly have water-table wells. The karst zone is characterised by subterranean streams and vauclusian springs. Georgia is notable for the number and diversity of its mineral springs – roughly 2000, of which 1700 are natural water-table outcrops. Borjomi, Sairme, Nabeglavi, Zvare, Lugela, Skuri, among others, are well known.

Landscapes

Georgia exhibits a wide variety of natural landscapes - from semidesert landscapes (eastern Georgia) and humid subtropics (the Kolkhida lowland) to perpetual snow and glacier (glacial-nival) landscapes. Similarly to most other mountainous countries, Georgia shows a marked alteration of natural components with height, and hence, vertical zonation of landscapes, with a full range of diverse landscape belts. There are over 100 various types, subtypes and kinds of landscapes in Georgia.

The landscapes in eastern Georgia are more sensitive to modern climate changes than those occurring in western Georgia, which is evident from a significant rise of temperature indicators and a certain decrease in atmospheric precipitation. Therefore, primary attention should be given to desertification processes in eastern Georgia.

Soils

Variation in soils permits classification into three basic soil regions – western, eastern and southern. The western region is dominated by swamp and subtropical podzolic soils in lowlands, red and yellow soils at foothills, as well as mountain-forest and mountain-meadow soils. The eastern region is characterised by cinamonic meadow-cinamonic, grey-cinnamonic, meadow grey-cinnamonic and black soils. Eastern part of eastern Georgia shows the occurrence of humus-sulphatic soils. Saline soils are frequent in the Taribana-Natbeuri, Marneuli and Gardabani plains, as well as in Eldari, though they mostly occur at the left bank of river Alazani (near Tsnori). The southern region shows frequent occurrence of black earth soils. Brown soils prevail and they mostly occur at elevations of 1000 to 1800 m above sea level. At elevations over 2300 m above sea level mountain-meadow soils are dominant.

Ecosystems

Georgia, with its relatively small territory, has a remarkable diversity of ecosystems, which is due to a combination of numerous factors – the country's complex topography, climatic specificities and geographical location, among others. Georgia has in its territory four Eurasian bio-geographical regions: Mediterranean, North-Boreal, Irano-Turanian and Kolkhetian. The rugged terrain and complicated

configuration of mountain belts has given rise to geographical and ecological isolation of the ecosystems. Considerably different climatic conditions in eastern and western Georgia resulted in differences between the ecosystems occurring in these territories, which is evident in the pattern of vertical zonation. In western Georgia there are five basic vertical belts: forest (at altitudes between sea level and 1900 m), subalpine (1900-2500 m), alpine (2500-3100 m), subnivean (3100-3600m) and niveal (above 3600 m). Eastern Georgia has six belts: semidesert, arid plain and arid thin (light) forest (150-600 m), forest (600-1900 m), subalpine (1900-2500 m), alpine (2500-3000 m), subnivean (3000-3500m) and niveal (above 3500 m).

Georgia displays ecosystems that are exceptionally important and unique from the standpoint of biodiversity: namely, peat bogs, Kolkhetian polydominant forests with evergreen underwood, subalpine crooked forests, flood-plain forests, alpine meadows, caves, gorges and defiles, coniferous, deciduous, arid light forests, steppes (secondary), and others. It is to be noted that Kolkhida represents a refuge of Tertiary flora and harbours rich dendroflora of the Tertiary Period: 88 species of trees and brushes.

Human activities have substantially affected Georgia's ecosystems, causing a significant contraction of the areas under forests and semiarid foothills vegetation, emergence of post-forests meadows, cultivated plantations and fields. Natural and relatively unaffected ecosystems' distribution is inversely proportional the distribution of population in an area.

Chapter 4.
Georgia's Arid and Semiarid Regions - Areas that Are the Most Vulnerable to Desertification

The process of desertification stems from both natural and anthropogenic factors. The most important among natural factors are those related to climate, hydro-geology, morphodynamics and soils.

Georgia's arid and semiarid regions are especially sensitive to desertification. These include the south-eastern part of Georgia – the districts of Dedoplistskaro, Sighnaghi, Sagarejo, Shida Kartli. Therefore, this document will mostly focus on these regions. However, it is important to emphasise the need to look into the impact of desertification processes in Akhaltsikhe, i.e. in the Meskheti trough, and to identify and study all areas vulnerable to desertification.

Chapter 5.
Characterisation of arid and semiarid territories

The climate has a subtropical character with certain features of continentality, relatively dry in winter and hot in summer. Average annual precipitation reaches 450 mm, which is typical of Georgia's semidesert and steppe zones. Maximum rainfall is observed in April, May and June, which is followed by a drought period. In the hottest months (July and August) the temperature reaches $33\text{-}35^0$ C. Snow cover is low and unstable.

These territories include Shida Kartli, Kvemo Kartli, Iori upland plateau, Alazani plain, Gombori range and Eldari plain regions.

Shida Kartli has a thorn steppe landscape of moderately dry subtropical plains. It exhibits a flat plain terrain, gently undulating in some parts, dissected by river valleys and dry ravines and constructed of Quaternary (alluvial and diluvial) sedimentary deposits. Surrounded by high mountains, it has a dry subtropical climate. Average annual temperature is 9-11^{0}C, August temperature ranges between 20-22^{0}C. Absolute temperature minimum is –26, -31^{0}C, while temperature maximum ranges between 35-40^{0}C. During the vegetation period, the sum of temperatures above 10^{0}C totals 3200-3800^0. Annual precipitation reaches 500-800 mm. Dry spells are frequent. Humidity index is below 1. Snow cover does not last long. The prevailing winds are from the east and from the west.

The Kvemo Kartli lowland is bounded on the north-west, south-west and north-east by the Trialeti and Loki ranges, the eastern spur of South-Georgian volcanic highlands and by the Iori upland plateau. In the south-east it extends into the territory of Azerbaijan. The landscape is characterised by a terraced, gently sloped flat plain topography constructed of sediments transported by river Mtkvari (Kura) and its tributaries Khrami and Algeti, and in the south-eastern part – of Pliocene and Lower Pleistocene marine deposits, lacustrine and alluvial clays and sands. Chestnut soils (that in places are solonetzic and saline) exhibit the beard grass steppe, thorn bushes, and semidesert vegetation.

The Kvemo Kartli lowland is unprotected from the east and thus open to intrusion of air masses. It has a dry subtropical climate. Annual hours of bright sunshine reach 2500 due to minor cloudiness. Average annual temperature is 12-13^{0}C, with July and August being the hottest months (23-25^{0}C, sometimes even more). The maximum temperature is 40-41^{0}C. During the vegetation period, the sum of temperatures above 10^{0}C totals 3700-4200^0. Annual precipitation ranges between 400-600 mm. The southern part is the driest and the most drought-afflicted area of the Kvemo Kartli lowland. Here evaporation is significantly higher than precipitation. Snow cover is rare.

The Iori upland plateau exhibits steppe and arid forest and brushwood landscapes of dry subtropical plains and hilly areas, with typical highland and hilly terrains, anticlinal ridges and intermontane plain troughs, plateaus sand dry gorges and ravines. It has a dry subtropical climate with cold winters and hot dry summers. Average annual temperature is 10-11^{0}C. The maximum temperature is 40^{0}C. During the vegetation period, the sum of temperatures above 10^{0}C totals 3200-3800^0. Annual precipitation is 400-500 mm. Humidity index is below 1. Westerly winds are predominant, and the strongest winds blow in winter. These climatic conditions give rise to steppe and semidesert vegetation, at times to arid light forests and thickets of underbrush spread on thin and medium-thickness black, chestnut, saline and forest grey-cinnamon soils.

The Alazani or Kakheti plain is bounded on the north, west and south by the Greater Caucasus and Gombori range foothills, and the Iori upland plateau. It is characterised by flat plain topography constructed of Quaternary alluvial and proluvial sedimentary

deposits with thick alluvial cones at peripheries created largely as a result of mudflows. Alluvial non-calcareous, meadow carbonate, partly salinized and black soils nurture thorn meadow-steppe vegetation. Plain forests have been preserved in some places. The climate is moderately humid subtropical, with hot summers and mildly cold winters. Average annual temperature is 11-13^{0}C. Absolute temperature minimum is –26, -31^{0}C, while temperature maximum reaches 400C. During the vegetation period, the sum of temperatures above 10^{0}C totals 3500-4200^0. Over most of the territory annual precipitation reaches 800-1300 mm. Continuous snow cover is not always a case, and is 5-15 cm thick when present.

The Gombori range is bounded on the north-east by the Alazani plain, and on the south-west by the Iori valley and Iori upland plateau. Close to river Shakhvetila, its north-western end merges into the Kakheti range, a spur of the Greater Caucasus. The south-eastern end of the Gombori range is located close to town Sighnaghi, where it steeply slopes, changes into a fold and gradually merges into the Iori upland plateau. Mount Tsivi has 1990 m in height. Average temperature is 11-12 ^{0}C at 600-800 m and it falls to 9^{0}C at 1160 m. During the vegetation period, the sum of temperatures above 10^{0}C totals 3500-4200^0. Annual precipitation is 600-700 mm, and in the crest-line zone it reaches 1000 mm. Fogs are frequent, and mountain type winds are distinct.

The Eldari plain has a semidesert plain-lowland landscape, characterised by a gently sloping aggradation plain, weakly dissected, with a coating of materials drifted by river Iori . During the vegetation period, the sum of temperatures above 10^{0}C totals 4200^0. Annual precipitation is 300 mm. Annual average temperature is 13 ^{0}C. Evaporation stands high, which results in a low index of humidity (about 0.3). The landscape exhibits real semidesert features. It is covered by grey-brown soils and xerophilous plants (absinthium and beard grass).

In terms of their geological structure, eastern Georgia upland plateaus represent the spreading area of Tertiary and post-Tertiary rocks. Rock outcrops in the form of sandstone, argillaceous and gypsiferous rocks and their alternation of beds are widespread on Gareji, Shiraki, Eldari, and river Iori left bank elevated slopes. At the same time they display fairly loose Tertiary conglomerates and carbonate rocks. In addition, loessial and loess-like deposits are frequent in occurrence, being of particular importance for this region as one of the main pedogens. Through diluvium and proluvium processes, these latter form a loose bedded mass, with a high content of carbonate lime and gypsum. High gypsum content in lowlands is testimony to its lacustrine origin, and hence soils found here are heavily salinized. It is to be noted that in some areas gypsum content reaches 50%.

Soil

By their topographic features, climatic, vegetation, pedogenic and geological factors, the soils found in Georgia's arid and semiarid band represent part of the soil region of eastern Georgia and its intermontane trough and upland soils subregion. The territory under study is part of the desert and plain soil zone. It mostly displays black, grey-cinnamonic, meadow grey-cinnamonik and alkolired soils. The areas show variation of carbonate lime content depending on strata, which is doubtless determined by the character of the pedogenic deposit and its lime content, also by the pattern of CaCo3

leaching out from upper strata and its washing over the underlying beds. Lime is frequently absent from upper strata, and its content significantly increases with depth.

Soil moisture level in the 0-30 cm deep layer where the major part of herbaceous plants' root system is distributed – a typical distribution for arid and sub arid zones - is extremely low, not exceeding 10-12%. The lowest soil moisture level is observed in the upper horizon (0-10 cm), which is very desiccated, especially in summer dry-weather period. In lower strata, with increasing depth (10-20cm and 20-30 cm horizons) soil water content slightly increases, although overall it is still low.

Flora

The territories exhibit plant communities typical of steppe, arid open woodland, semidesert and, in places, desert. In addition, they support vegetation of contaminated areas, flood-plain forest vegetation, shibliak type brushwood, etc.

There is a wide occurrence of various phytocenoses typical of arid zones: *Botriochloetum*, *Stipeto-Botriochloetum*, *Pistacieto-Juniperetum*, *Botriochloeto-Paliureto-Pistacietum*, *Artemisietum*, *Artemisieto-Salsoletum*, *Salsoleto-Artemisietum*; *Festuceto-Stipetum*, *Stipeto-Festucetum*, *Botriochloeto-Astragaleto-Paliuretum*, *Botriochloeto-Spiraeeto-Paliuretum*, *Botriochloeto-Cotinetum*, *Salsoleto-Artemisietum*; *Bromopsietum*, and *Botriochloeto-Artemisietum*.

Also, there occur fragmentary associations, such as *Paliurus spina-christi - Botriochloa ischaemum – Stipa stenophylla*; *Juniperus foetidissima – Astragalus microcephalus*; *Paliurus spina-christi – Cotinus cogyggia - Stipa stemophylla*; *Stipa capillata – Andropogon -Iischaemum* and others.

Two species are particularly active in terms of phytosociology: *Botriochloa ischaemum* and *Artemisia fragran*). The former is the dominant edificator of steppe type vegetation, whereas the latter is the dominant edificator of deserts and semideserts. Specific vegetation characteristic for solonetz soils is found on considerable areas. *Pistacia mutica* is more or less regularly dispersed over the whole area of the river Iori basin, however it forms typical assemblages on alluvial cones, riparian terraces and undulated terrain. Pistachio often occurs in complex with Christ's thorn and juniper on a dissected terrain of foothills and mountain slopes.

It is noteworthy that endemism of the ecosystem's flora is determined by 41 species, which is a fairly high indicator for arid zones of a similar type. It is important that most species are paleoendemics, among them species dating even from the Cretaceous.

Fauna

The region's invertebrate fauna is very diverse. Warm and dry climate, diversity of the plant species, stony and sandy loam soils create favourable conditions for invertebrate species diversity. Most of them are nocturnal. Especially numerous are orthopterans: (crickets, grasshoppers, and locusts).

Insects also present an interesting picture. The ecosystem supports 133 of 360 insect species found in Georgia (i.e. 37%), of which 24 are rare and endangered species (listed in the USSR Red Data Book), and 45 species are Caucasian endemics. In this context, such rare butterfly species as *Aporia crataegi (L.), Iphiclides podalirius, Papilio machaon, Papilio alexanor, Coenonympha saadi, Pseudochazara mniszechii (Led*), deserve very special attention, with the latter species being, in addition, a Georgian endemic.

The number of fish species is roughly 33. The region is not rich in amphibian fauna that is represented for the most part by 4 species: *Bufo viridi)*, *Hyla savignyi, Pelobates syriacus*, and *Rana ridibund***).**

The region has a fairly rich reptile fauna, of which it might be well to point out the *Eryx jaculus*, *Eumeces schneideri*, *Elaphe longissima*, *Testudo graeca* – all are species listed in Georgia's Red Data Book.

The region displays a very rich birdlife of recorded 241 species, of which 6 are listed in the IUCN Red Data Book, and 9 – in Georgia's Red Data Book. These are *Phalacrocorax pygmeus*, (LR), *Egretta alba*, *Gyps fulvus*, *Aegypius monachus* (LR), *Gypaetus barbatus*, *Haliaeetus albicilla* (LR), *Aquila heliaca* (VU), *Francolinus francolinus*, *Tetrax tetrax* (LR), *Aythya nyroca* (VU), *Perdix perdix*. Feather game mostly include representaives of the *Phasianinae* family: *Phasianus colchicus*, *Perdix perdix*, *Coturnix coturnix*, *Alectoris chukar*, and *Francolinus francolinus*.

Recorded representaives of the class Mammalia include 53 species, including: order *Insectivora* – 6 species of 3 families; order *Chiroptera* – 12 species of 2 families; order *Lagomorpha* – one species of one family ; order *Rodentia* - 15 species of 6 families; order *Carnivora* - 14 species of 6 families, order *Arctiodactila* –3 species of 3 families. These are: *Barbastella leucomelas, Miniopterus schrebersi, Myotis dasycneme, Myotis emarginatus, Nyctalus leisleri, Rhinolophus hipposideros, Rhinolophus mehelyi, Crocidura suaveolens, Mesocricetus brandti, Suncus etruscus, Alactaga spp. Hystrix indica, Cervus elaphus, Gazella subgutturoza, Sus scrofa, Felis silvestris, Hyaena hyaena, Lutra lutra, Lynx lynx, Ursus arctos.*

Chapter 6.
Factors Contributing to Desertification in Arid and Semiarid Areas

1. Natural factors

Climate:

The totality of atmospheric variables in the area under study creates a conducive environment for desertification processes. Among natural factors frequent drought episodes are of special importance. Dry spells are extended over the spring and summer seasons, during which time precipitation is significantly lower than the normal, whereas air temperature is very high. These factors lead to soil desiccation, creating conditions detrimental for normal growth and development of plants. The territory is characterised by frequent winds and presumably high evapotranspiration.

Geology:

Geologically the area is mainly represented by sandstones that in places present effective pictures of eolian erosion. Southern slopes display outcrops of loose conglomerates that easily disintegrate into unconsolidated rock detritus of diverse petrography. Conglomerate outcrops, almost fully decomposed, widely occur in the upper part of the Gareji steppe. These conglomerates feature thick loam layers of different colours – from almost white to brownish red and crimson. All these factors influence the soil structure and its thickness.

Soils (edaphic factors):

The most important of edaphic factors is the salinization of soil. Saline and solonetzic soils cover a total area of 205 thousand hectares in Georgia's semidesert areas. Saline and solonetzic soils mostly occur at the right bank of river Alazani, in the foothill plain of Shua-Iori, the sloped plain of Gardabani, in the Eldari and Taribani massifs. Distribution by administrative districts looks as follows: Sighnahgi district – 54 thousand ha, Dedoplis-Tskaro – 47 thousand ha, Sagarejo district – 22 thousand ha, Gardabani district – 40 thousand ha, Marneuli district – 32 thousand ha. On a percentage basis, Gurjaani accounts for 7.6 % of saline lands, Sighnaghi 34%, Dedoplistskaro 25.3%, Sagaredjo 18.1 %, Marneuli 30.3%, Gardabani 42.6%, Lagodekhi 1.3%, and Bolnisi 0.4%.

A major factor contributing to the desertification process is the slope grade responsible for soil cover removal and rock exposure, giving rise to erosion processes. It might also be well to point out water resistance of base rocks and specific physical features of their resistivity to erosion-gravitation processes.

2. Erosion processes

Among contributors to desertification, erosion processes deserve special notice. Erosion is the result of both natural and human factors.

The territories under study mostly exhibit sandstones. Soils form a cohesionless stratified mass that easily disintegrates. In some locations slopes display outcrops of easily decomposing loose conglomerates, which means that due to its natural structure the soil occurring in the region is prone to erosion. Other causes of natural erosion are wind and water. In the territory of Georgia, processes typical of erosion by wind mostly occur in the eastern part of the country. Strong winds blow off the soil upper, humus layer, affecting soil productivity. Presently, 105 thousand hectares of cultivated lands in Georgia's arid and semiarid zones is exposed to erosion by wind: the territory comprises 18 administrative districts (Khashuri, Kareli, Tskhinvali, Akhalgori, Kaspi, Mtskheta, Gardabani, Marneuli, Bolnisi, Sagarejo, Gurjaani, Dedoplistskaro, Tetritskaro, Dmanisi, Akhaltsikhe and Akhalkalaki).

As much as two-thirds of the areas that have suffered from water erosion are found in western Georgia. Soil characteristics (its structure, hydrological features – water permeability, water loss) combined with water and wind, represent natural causes leading to erosion.

Human activities represent another cause of, and contributor to, erosion processes.

1) Uncontrolled woodcutting (arid light forests and flood plain forests)

Over the last 10-12 years woodcutting has significantly intensified. Local residents, lacking any other sources of fuel, gather firewood for heating purposes. In some instances, flood plain forests are cut down and the cleared land is used for sowing.

2) Mismanagement of cultivated lands

Cultivation of unsuitable lands that fail to produce economic effects is extremely damaging for the plant cover and leads to serious deterioration of vegetation. It is to be noted that the Soviet-era practice of ploughing every plot of land passable for tractor ended in a severe economic damage. Such areas appeared to support the occurrence of desert and semidesert vegetation, as desert floristic elements could always develop on denuded surface of ploughed and degraded lands better than other vegetation.

3) Overgrazing

It should be noted that, historically, the territories under discussion have seen changes both in range management techniques, and in grazing pressure in terms of sheep numbers and stock density. In the pre-Soviet period the centuries-old traditional system of range management based on plot rotation and pasture change had been applied, providing for sustainable use of pasturelands.

The period following Georgia' sovietization showed incompatibility of traditional sustainable pasture management practices with the economy evolving under the new system. Traditions of private ownership of land and community-based land use were abolished, despite the fact that they provided for an adequate response on the part of pastoralists to mitigate pernicious effects of erosion. It is in this period that the process of range degradation in arid and semiarid ecosystems started. However, traditional practices of pasture rotation and herding were not revived. Certainly, sheep migration has not ceased, with the difference that now the stock of sheep in the region is much greater, as certain numbers of sheep are driven to this area from the adjacent territories in Azerbaijan. According to the available data, sheep are driven from summer pastures starting from September and are kept in these areas until April next year. The result is severe erosion process.

Extensive grazing pressure over years leads to depletion of original grass cover, its alteration and degradation, shrinkage of grass-covered areas, which eventually gives rise to soil erosion and salinization. It should also be noted that excessive sheep stocking on rangelands results in phytomass accumulation in the surface soil layer. The greater the stocking of a range, the thinner is the layer and the closer to the surface is the phytomass. When this is the case, soil is easily degradable.

4) Artificial fires

In order to improve range vegetation, shepherds regularly set fires. Fires are provoked spontaneously (disregarding specifics of locations and their size) starting from the later half of February and is observed on a mass scale in the first half of March. Spontaneity of the process is well illustrated by the fact that shepherds set fires not only on rangelands but on flood plains as well. Fires destroy grass that sprouts in February, during the vegetation period.

5) Construction of irrigation and other land-reclamation schemes disregarding the soil physical and chemical properties

In the areas where slopes were irrigated for agricultural purposes (especially in highland areas), bad irrigation practices have resulted in soil washout: dissolved gypsum together with clay is washed down gradient and accumulates in relatively plain places. Also, there occur crystalline gypsum aggregates. Such places do not support vegetation, which leads to soil erosion.

Chapter 7.
Arid and Semiarid Ecosystems

Desertification trend is observed over fairly large areas of the territory's ecosystem: the Chachuna steppe, foothills of the Kotsakhura range southern face, the Iori steppe, the Eldari lowland, the Taribana depression, Natbeuri, the Chatmi depression, on river Iori terraces (downstream of the Dali water reservoir), foothills of the Kotsakhura range western part (between the oil well and the Chachuna steppe), etc. Small spots of desertification are found in the pistachio light forest complex. Intrusion of desert elements is even found in flood plain forests.

A considerable part of arid and semiarid ecosystems is *per se* a rare biotope for Georgia (arid light forests, semideserts and desert elements), for which reason certain species in Georgia are only observed in this territory: Levantine viper, francolin, striped hyena, goitred gazelle.

The ecosystem provides refuges for rare communities that do not occur in other areas. It harbours such coenoses as *Salsoletum-Kalidiosu)* and *Salsoletum – Anabasiosum.* They are spread locally in assemblages of semidesert and steppe plants, and have so far been known only from the Eldari lowland. These coenoses comprise the following species: *Salsola dendroides, Kalidium caspicum* and *Anabasis aphylla*.

24 insect species occurring in the region were listed in the USSR Red Data Book, among them: *Papilio machaon, P. alexanor orientalis, Iphichlides podalirius, Utethesia pulchela, Arctia caja, Coenonimpha saadi*, and others. From among rare vertebrate species it is necessary to point out a number of species listed in the Red Data Book of Georgia: *Pelobates syriacus*, *Eryx jaculus*, *Eumeces schneideri*, *Elaphe longissima*, *Haliaeetus albicilla*, *Aythya nyroca*, *Perdix perdix*, *Mesocricetus brandti*, *Suncus etruscus*, *Nyctalis leisleri*, *Lutra lutra*, *Hyaena hyaena*, *Lynx lynx*, *Gazella subgutturosa*, *Cervus elaphus.*

Among small mammals, the following are rare and endangered species: *Sorex volnuchini*, *Crocidura leucodon, Allactaga elater, Cricetulus migratorius, Allactaga willamsi,* and others.

Some birds and small mammals are rare on a global scale as well, and are listed in the IUNC (International Union for the Conservation of Nature and Natural Resources) Red Data Book *Phalacrocorax pygmeus* – (LR); *Aegypius monachus* - (LR); *Haliaeetus albicilla*-(LR); *Aquila heliaca* – (VU); *Aythya nyroc)* – (VU); *Rhinolophus ferrumequinum* – (LR.cd); *Rhinolophus hipposideros* – (VU.A2c); *Barbastella barbastellus* – (VU.A2c); *Driomys nitedula* – (LR.nt), and others.

Below is a summary of desertification indicators identified in the territory under consideration:

Desertification indicators	
Flora	Lost of plant species richness, degradation of plant community, invasion of desert and semidesert plant species (*Salsola spp, Artemisia fragans, Gamantus pilosus etc.*) *)* and communities *(Artemisietum, Artemisieto-salsoletum, Botrichloeto-artemisietum etc.).*
Fauna	Disappearance of certain insect-eaters and rodents, for instance white-toothed shrew *(Crocidura leucodon),* social vole *(Microtus socialis),* Volnuchin's shrew *(Sorex volnuchini);* occurrence of five-toed jerboa *(Alactaga spp),* that is typical of desert landscapes
Edaphic factors	Destruction of soil surface layer, soil salinization and sodification

Chapter 8.
Analysis of Anthropogenic Factors Occurring in Arid and Semiarid Areas

Historically Eastern Georgia's semiarid zone – from the Gombori range front slopes, the Iori upland plateau and its adjoining territories, to the confluence of the Alazani river and Iori river – represented Georgia's winter pasture. Over the last ten years (i.e. over the timespan when livestock from Georgia are not driven to winter pastures in Kizlyar) there has been increased concentration of livestock in the areas, and grazing pressure on the territory has grown twofold.

Extensive sheep grazing over years is detrimental for the ecosystem, leading to depletion, alteration and degeneration of grass cover, decrease in its projection range, soil erosion and salinization, spreading of bad lands, almost complete disappearance of pistachio arid light forest fragments, degradation of floodplain forests, disturbance of phytocoenoses structure, deterioration of plants' vital capacity.

Soil erosion is spectacular, reaching disastrous proportions: the most visible symptoms are the destruction of soil surface layers and the increase in the content of salinity-causing minerals in soils. Erosion, for its part, severely affects vegetation and, consequently, the biomass production in the area. For this reason sheep tend to move to the immediate proximity of river banks. Not infrequently, soil surface is degraded even in such "impenetrable" coenoses as *Botriochloeta*. It should be particularly emphasised that the impact of grazing is particularly damaging in spring

season when plants undergo new vegetative growth. In this period sheep cease to graze on *Artemisia fragrans* – (a dominant edificator of desert and semidesert vegetation) and *Botriochloa ischaetum* – (a dominant edificator of steppe vegetation), and feed almost entirely on green material of the new vegetation. The most severe damage is caused to forbs that are especially valuable as they contribute to enrichment of pastures and improvement of plant cover structure (obviously, the biomass is richer and more nutritious). After the livestock are driven to summer pastures, plants fail to complete their full annual vital cycle. Their vegetative and reproductive renewal is very limited, and hence, phytocoenoses are deficient and simple. The process recurs constantly, every year, leading eventually to an irreversible depression of vegetation.

Sheep overgrazing impairs bird life, too. It is most damaging for ground-nestling birds, such as pheasants (Phasianidae), for during their reproduction period the sheep are still present in the region causing an overwhelming destruction of grass cover.

A study of small mammals shows that *Microtus socialis* – a species typical of fields, has become rare, which is indicative of the area's degradation. At the same time, the territory is the home to numerous colonies of sand rats that only inhabit sagebrush coenoses that in themselves are testimony to degradation. The eastern part of the area widely supports semidesert elements, as evidenced by the presence of *Allactaga williamsi, Allactaga elater*.

It is important to note that natural factors responsible for vulnerability to desertification take on added significance when viewed against the backdrop of man-induced stress. The current extent of negative human impact (sheep-breeding, farming, mismanagement of biological resources, woodcutting, inappropriate irrigation practices, etc) goes beyond the scope of ecosystem's resistivity (capacity to sustain itself), leading to more or less irreversible processes of degradation, reflected by impaired productivity of the ecosystem and declining plant viability, marked desertification processes (intrusion of desert elements can even be observed in flood plain forests), soil erosion and salinization. The vulnerability of various components of the ecosystem, including species and individual coenoses, results either from one specific factor, or the interaction of factors. For instance, woodcutting and grazing are cited as major causes of, and contributors to, the degradation of flood-plain forest. In the Chachuna preserve and the adjoining flood plains, to these factors must be added the disturbance of water regime caused by the Dali reservoir. The main factors contributing to the vulnerability of numerous animal life populations are poaching and sparsity of nutrition. Among industrial activities in the region, oil production poses the greatest potential threat, both in terms of it being a disturbing factor, and also from the standpoint of the possible risk of oil spills. Thus, it is obvious that the ecosystem is vulnerable mainly to man-induced factors, whose impact is particularly strong when coupled with various natural factors and global processes of climate warming (aridization).

160 thousand ha of salinized and solonetzic soils is subject to amelioration and agricultural development, which is not the case on the remaining 45 thousand ha, as complex relief conditions make any land reclamation activities either difficult or impossible.

By melioration measures, areas with salinized and solonetzic soils fall into two main groups: a) areas that require only chemical amelioration and culture technique inputs; areas that require comprehensive agronomic and hydrotechnical amelioration inputs: drainage network, spot grading, chemical amelioration as required, and ablution – 45 thousand ha.

Among the salinised soils mentioned, saline-alkali and meadow alkali-saline soils of the Alazani valley right side and the Shua-Iori foothill plain are notable from the standpoint of their reclamation and development complicacy.

The Alazani valley and the Shua-Iori foothill plain exhibit a number of adverse factors, among them: lack of natural drainage and a high ground water table, coupled with strong mineralization; high degree of salinization; unfavourable water transmitting properties and physical characteristics of soils; heavy-textured granulometric composition, dense structure, high proportions of ultramicropores responsible for low water permeability. The process of terrain salinization is intensive and in the upper 0-1m layer soil salinity is over 2%. Most common is chloride-sulphate salinization, less common is sulphate salinization – mostly sodium sulphate, calcium sulphate or magnezium sulphate, or natrium salinization.

The difficult socio-economic situation in Georgia over the last years has significantly aggravated ecological problems in the country: in the zone of irrigated agriculture, water utility and land reclamation projects were completely destroyed causing irreparable damage to Georgia's agricultural sector, which makes it difficult to combat the effects of dry spells and leads to intensification of desertification processes in these areas.

It is critical to rehabilitate the existing water utility and land reclamation projects in ameliorated areas and engage in extensive studies, through mobilisation of funding, to identify effective measures to combat soil salinization.

Chapter 9.
Analysis of Economic Sectors

Agriculture and livestock breeding

By specialization in farm production, the eastern and south-eastern parts of Georgia represent part of the zone of arable farming (grain crops, viticulture) and livestock farming (cattle breeding, sheep breeding). Such zonation is based on the availability of similar natural conditions (climate, arid and semiarid landscape, soils, etc.) and economic parameters (land economics, volume of production, product cost, etc.) in the region (Gardabani, Sagarejo, Sighnaghi, and Dedoplistskaro districts).

Total cultivated area in the region is 99538 ha, including:

District	Crop area (ha)	Productivity (c/ha)	Cultivated area under grain crops and leguminous crops (ha)
Gardabani	38900	9.0	15650
Sagarejo	29800	6.5	10774

Sighnaghi	40199	4.5	14614
Dedoplistskaro	55834	7.9	25000

Livestock numbers in the region, as of 2001:

District	Cattle (numbers)	Pigs (numbers)	Sheep and goats (numbers)
Gardabani	34966	5497	35412
Sagarejo	20460	8510	37520
Sighnaghi	6426	4998	15450
Dedoplistskaro	18792	13407	35700

Mining operations

The 90-ies saw renewed oil exploration that had been conducted on a minor scale in the Soviet time. Frontera Resources resumed oil operations in the region. According to the company, the main target area comprises 6 sites located in the following fields: Taribana, Mirzaani, Nazarlevi, Baida, Kilakupra and Mtsare-Khevi. Over 25 years the company expects daily production from these wells to reach 25-30,000 barrels of oil, and intends to increase the number of wells to 20.

Transport and Communications

The region has a developed network of road and railway transport, though power shortages have led to the latter's sporadic operation. Postal system and cable transmissions operate over the entire region.

Part III

National Plan of Action to Combat Desertification

Chapter 11.

1. ***Identification of desertification-prone territories in Georgia based on the analysis of factors and processes causing desertification, and comprehensive mapping with physical-geographic, geo-ecological and other thematic maps drawn up***

   Expected outcomes:
   Thematic maps drawn up
   Tentative budget[1]:
   150 000
   Implementation timeframe:
   2003-2005

2. ***Identification of drylands in Georgia, and evaluation of the impact of global circulation, radiation and human factors on drought occurrence processes***

   Expected outcomes:
   Database created
   Tentative budget:
   60 000
   Implementation timeframe:
   2003-2005

3. ***Evaluation of the impact of climatic and hydro-meteorological changes on desertification of drylands, crop distribution and crop yield***

   Expected outcomes:
   Database created
   Tentative budget:
   100 000
   Implementation timeframe:
   2003-2006

4. ***Construction of physical and mathematical models of drought and desertification processes, and drought prediction***

   Expected outcomes:
   Desertification model constructed and forecasting methodology developed
   Tentative budget:
   150 000
   Implementation timeframe:
   2003-2006

[1] Budget shown in USD

5. ***Elaboration of drought early warning system***

Expected outcomes:
Drought early warning system created
Tentative budget:
100 000
Implementation timeframe:
2003-2005

6. ***Combating drought and desertification by hydro-meteorological, hydrotechnical amelioration and agro-meteorological techniques***

Expected outcomes:
Relevant programme developed
Tentative budget:
80 000
Implementation timeframe:
2003-2005

7. ***Study of historical dynamics of climatic elements and parameters in the region under review, both during summer seasons and vegetation periods***

Expected outcomes:
Detailed information collated
Tentative budget:
50 000
Implementation timeframe:

8. ***Identification and mapping of likely zones of desertification***

Expected outcomes:
Map developed with the use of geographical information system (GIS)
Tentative budget:
40 000
Implementation timeframe:
2003

9. ***Determination of hydrological regime of arid lands water resources and their change trends***

Expected outcomes:
Databases and thematic maps created using geographical information technologies
Tentative budget:
70 000
Implementation timeframe:
2003-2005

10. ***Assessment of water resources deficit in arid lands and its possible variations***

Expected outcomes:
Detailed information collated
Tentative budget:
80 000
Implementation timeframe:
2003

11. Assessment of subsoil main structural parameters (arable lands, rangelands, forests, etc.).

Expected outcomes:
Detailed information collated
Tentative budget:
100 000
Implementation timeframe:
2003-2004

12. Developing a theoretical model of the soil desertification process

Expected outcomes:
Theoretical model developed
Tentative budget:
70 000
Implementation timeframe:
2003-2005

13. Study of population numbers, dynamics (birth and mortality rates), density and migrations

Expected outcomes:
Detailed information collated
Tentative budget:
50 000
Implementation timeframe:
2004

14. Evaluation of landscape and geographical conditions of land desertification and mapping of ecological stress

Expected outcomes:
Database and map developed using a geographical information system (GIS)
Tentative budget:
80 000
Implementation timeframe:
2003-2004

15. Study of natural and man-induced processes of land damage and desertification (water and wind erosion, mudflows, irrigation erosion, wood clearing, mining and quarrying, etc.), systems analysis, risk projection

Expected outcomes:
Risk projection guidelines approved
Tentative budget:
60 000
Implementation timeframe:
2003-2005

16. Study of soil and ground composition, condition and physical-mechanical properties, and zonation of territory by erosion risk

Expected outcomes:
Database and map developed using a geographical information system (GIS)
Tentative budget:
50 000
Implementation timeframe:
2003-2004

17. Elaboration of a regional model framework for combating land desertification and stabilisation of biospheric processes

Expected outcomes:
Regional model framework developed
Tentative budget:
70 000
Implementation timeframe:
2005

18. Elaboration of a long-term national programme for prevention and/or reduction of land degradation / desertification, and promotion of sustainable development

Expected outcomes:
National programme to prevent degradation/desertfiication and promote environmental sustainability
Tentative budget:
30 000
Implementation timeframe:
2003-2004

19. Identification of vulnerable areas and elaboration of rehabilitation action plans

Expected outcomes:
Database and map developed using a geographical information system (GIS), management plan approved
Tentative budget:
60 000
Implementation timeframe:
2003-2005

20. Identification of affected areas and detailed mapping

Expected outcomes:
Database and map developed using a geographical information system (GIS)
Tentative budget:
100 000
Implementation timeframe:
2003-2004

21. Selection of pilot project locations and implementation of pilot projects based on the principle of sustainable use of natural resources

Expected outcomes:
At least 5 pilot projects implemented
Tentative budget:
2 000 000
Implementation timeframe:
2004

22. Elaboration of an integrated plan for reclamation of desertified areas

Expected outcomes:
Plan approved by the Government of Georgia
Tentative budget:
500 000
Implementation timeframe:
2003-2005

23. Soil reclamation study of desertification-threatened areas and detailed mapping of salinized and solonetzic soils groupings for agronomic amelioration purposes

Expected outcomes:
Detailed map of salinized and solonetzic soils groupings for agronomic amelioration purposes developed
Tentative budget:
500 000
Implementation timeframe:
2003-2005

24. Inventory of soils affected by open-cast mining and their recultivation methods

Expected outcomes:
Inventory made, database created
Tentative budget:
500 000
Implementation timeframe:
2003-2005

Chapter 12.
Economic Mechanisms to Combat Desertification

1. ***Study of the impact of economic policies and economic activities on desertification processes***

   Expected outcomes:
   Impact of economic policies and economic activities determined, relevant methodology developed
   Tentative budget:
   100 000
   Implementation timeframe:
   2003

2. ***Definition and evaluation of damage caused by desertification***

   Expected outcomes:
   Desertification-caused damage defined and assessed, relevant data published
   Tentative budget:
   100 000
   Implementation timeframe:
   2003

3. ***Estimation of funding necessary for reclamation of lands affected by the desertification process***

   Expected outcomes:
   Budget of expenditures for land reclamation drawn up
   Tentative budget:
   50 000
   Implementation timeframe:
   2003

4. ***Evaluation of funds required for reclamation of lands affected by the desertification process and determination of economic leverage to mobilise funds***

   Expected outcomes:
   Economic leverage necessary for land reclamation and rehabilitation defined
   Tentative budget:
   50 000
   Implementation timeframe:
   2004

5. ***Monitoring of existing projects and programmes to combat desertification***

   Expected outcomes:
   System to carry out project monitoring established
   Tentative budget:
   500 000
   Implementation timeframe:
   2003-2006

Chapter 13.
Preserving Biological Diversity Against the Background of Desertification Processes

1. ***Defining the status of plant species facing the threat of extinction and/or severe genetic erosion on the basis of threat category criteria established by the International Union for the Conservation of Nature and Natural Resources (IUCN)***

   Expected outcomes:
   Threat categories under IUCN criteria established for 50% of plant species occurring in Georgia
   Tentative budget:
   200 000
   Implementation timeframe:
   2004-2005

2. ***Identification of plant communities facing the threat of extinction / degradation caused by desertification (including rare, relict, primary and the related, particularly sensitive communities, and globally important communities)***

   Expected outcomes:
   50% of threatened plant communities identified
   Tentative budget:
   300 000
   Implementation timeframe:
   2003-2004

3. ***Elaboration of a programme for conservation of rare, endemic and relict species critically threatened by desertification, and its initiation***

   Expected outcomes:
   Commencement of conservation activities for 30% of critically threatened species
   Tentative budget:
   1 000 000
   Implementation timeframe:
   2003-2005

4. ***Elaboration of a state programme for protection of endangered biomes and conservation of plants and plant communities***

   Expected outcomes:
   State programme developed and implementation mechanisms defined
   Tentative budget:
   100 000
   Implementation timeframe:
   2003-2004

5. ***Identification of hotspots, determination of ways and means to conserve them and initiation of activities***

Expected outcomes:
Hotspots identified, conservation management plans developed and hotspot conservation activities commenced
Tentative budget:
2 000 000
Implementation timeframe:
2003-2004

6. ***Elaboration and implementation of a state programme for conservation of flood-plain forests***

Expected outcomes:
State programme developed, conservation work commenced
Tentative budget:
1 000 000
Implementation timeframe:
2003

7. ***Establishment of plant and animal life indicators of desertification, and their monitoring***

Expected outcomes:
Indicator types established, monitoring commenced
Tentative budget:
500 000
Implementation timeframe:
2003-2007

8. ***Elaboration of a state programme for conservation of arid forests***

Expected outcomes:
State programme elaborated
Tentative budget:
1 000 000
Implementation timeframe:
2003

9. ***Ecological assessment and mapping of plant communities in the areas threatened for desertification.***
Expected outcomes:
Ecological maps have been created for 50% of the area.

Tentative budget:
200 000
Implementation timeframe:
2003-2005

Chapter 14.
Raising Public Environmental Awareness

1. ***Improving the level of environmental education among public***

Expected outcomes:
Popular reference books, booklets, brochures, posters, leaflets, etc. on environmental education issues published. Series of meetings and seminars held
Tentative budget:
100 000
Implementation timeframe:
2004

2. ***Publication of country-specific and Caucasus region information bulletins***

Expected outcomes:
At least 10 bulletins published
Tentative budget:
100 000
Implementation timeframe:
2005

3. ***Promotion of new local NGOs establishment and enhancement of existing NGOs***

Expected outcomes:
Strong NGO network
Tentative budget:
200 000
Implementation timeframe:
2004-2005

Chapter 15.
Monitoring of Desertification

1. ***Improving the existing legislation, assignment of functions among relevant agencies***

Expected outcomes:
Normative and regulatory acts adopted by Georgian legislature, with clearly defined goals and objectives of monitoring, responsible agencies and their functions
Tentative budget:
50 000
Implementation timeframe:
2003

2. ***Identification of governmental and non-governmental organisations to be responsible for, and involved in, the monitoring, and their capacity-building***

Expected outcomes:
Series of trainings held, equipment procured and special staff trained
Tentative budget:
1 000 000
Implementation timeframe:
2003-2007

3. ***Developing a unified monitoring methodology***

Expected outcomes:
Unified monitoring methodology published by the Ministry of Environment and Natural Resources of Georgia
Tentative budget:
50 000
Implementation timeframe:
2003

4. ***Making an inventory of data gathered up to the date by various departments and institutions of the Georgian Academy of Sciences, NGOs and other agencies, and*** incorporation of the available data into a databank

Expected outcomes:
Databank created, incorporating the totality of the obtained original data; the data are updated on a regular basis
Tentative budget:
100 000
Implementation timeframe:
2003-2004

5. ***Continuous exchange of monitoring information (via the Internet, various publications, etc.) between the Ministry of Environment and Natural Resources of Georgia and all interested agencies and other stakeholders***

Expected outcomes:
Annual monitoring report prepared and published by the Ministry of Environment and Natural Resources of Georgia
Tentative budget:
500 000
Implementation timeframe:
2005-2007

Chapter 16
Desertification and Agriculture

1. ***New registration and certification of pasturelands, identification of resources, determination of appropriate grazing pressure norms, rehabilitation of degraded pasturelands***

Expected outcomes:
New registration and certification of winter and summer pastures performed; appropriate grazing pressure norms established for 50% of pasturelands;
Rehabilitation of degraded pasturelands with the use of phyto-engineering techniques
Tentative budget:
5 000 000
Implementation timeframe:
2003-2007

2. ***Elaboration of a programme for rehabilitation, protection and sustainable use of Georgia's traditional agriculture, with active involvement of grass-roots organisations***

Expected outcomes:
Programme for rehabilitation, protection and sustainable use of Georgia's traditional agriculture prepared
Tentative budget:
100 000
Implementation timeframe:
2004-2007

3. ***Promotion of agriculture-related traditional expertise, research, and relevant programmes***

Expected outcomes:
Continuous streamlining of traditional expertise base, reintroduction of traditional crops /species in farms
Tentative budget:
500 000
Implementation timeframe:
2004-2007

4. ***Elaboration of cultivated land management guidelines and plan***

Expected outcomes:
Management guidelines and plan approved by the Government of Georgia
Tentative budget:
100 000
Implementation timeframe:
2003

Chapter 17.
INTERNATIONAL AND REGIONAL COOPERATION

1. ***Regional conference on combating desertification with participation of Southern Caucasus states***

   Expected outcomes:
   Conference convened with participation of the three states
   Tentative budget:
   100 000
   Implementation timeframe:
   2005

2. ***Design of a joint strategy to combat desertification***

   Expected outcomes:
   Strategy for Southern Caucasus states approved by the three countries
   Tentative budget:
   100 000
   Implementation timeframe:
   2005

3. ***Cross-border cooperation, including for the purpose of establishing trans-boundary protected areas***

   Expected outcomes:
   Trans-boundary protected area establishes, joint monitoring carried out
   Tentative budget:
   5 000 000
   Implementation timeframe:
   2005-2006

4. ***Familiarisation with the international experience of combating desertification through trainings and study tours***

   Expected outcomes:
   Trainings and study tours organised
   Tentative budget:
   200 000
   Implementation timeframe:
   2005