

Managing Agricultural Resources for Biodiversity Conservation

Case study of Russia and CIS countries (Final Draft)

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Summary

A unique situation has now emerged in the territory of the former USSR when the old system of land management in many regions deteriorates and disappears while a new one has not yet started to emerge. In Russia and Kazakhstan vast territories of cultivated land are abandoned and this process continues to develop. At the same time in other CIS countries the problem of land insufficiency has emerged.

System crisis in agriculture has negatively affected the state of biodiversity. This is caused due to the following main reasons: increased forest cutting and poaching, soil erosion, small rivers basins drying off, water basins silting, loss of soil fertility, degradation of pasture fields in heavily inhabited areas. The way out of this situation is seen in conducting agricultural activities on the basis of ecological principles. In addition to the improvement of the ecological situation in the CIS countries this will make it possible to get maximum economic effect with low investments, which is extremely important in the present environment crisis.

Information on relationships between biodiversity and agriculture in Russia and CIS has become available recently. This is a serious impediment for biodiversity conservation.

CIS countries would be reviewed by regions as well but less in depth than Russia: Belarus, Moldova and Ukraine, Caucasus region (Georgia, Armenia and Azerbaijan), Central Asia (Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan, and Turkmenistan). Following is some basic information on the States.

Russia - the state covers the northern part of Eurasia. The area is 17 075 thousand sq. km. It borders with 13 seas. The area of wetlands reaches 1.8 million sq. km, while that of permafrost soils amounts to almost 65 per cent of the country's territory. In the plains territory ecosystems of 8 natural zones are represented: polar deserts, arctic and sub-arctic tundra's, forest tundra, taiga, broad-leaved forests, steppes, semi-arid territories. There are also a wide variety of soils: from arctic soil in the north to brown semi-desert soil and subtropical yellow soil in the south [13].

According to the UNEP criteria, 65% of Russian territories are considered to be untouched by heavy agriculture and have undisturbed ecosystems (most of Siberia, Far East, Arctic and sub-arctic). Around 20% of the territories were under intense agricultural influence, however the ecosystems which were partially reduced, still have the pot-life and the assimilation potential necessary for full compensation of the modern level of anthropogenous effects. The most man-induced transformation of biological and landscape diversity is typical in the regions of Northern Caucasus, Povolzhie, central part of the European Russia and south of Siberia [24].

Belarus is situated in the west of the Russian plains covering the area of 20759.5 thousand ha. Its territory is located at the juncture of two vast geobotanical zones - Eurasian coniferous forest zone (taiga) and European broad-leaved zone. In Belarus one can distinguish five landscape provinces: Poozerskaya, Predpolesskaya, East Belarus, Polesskaya and Belarus highlands [10, 28]. This testifies to the presence of large potential opportunities of the country's biological diversity conservation through the existing natural landscape diversity. According to the experts, in Belarus, mainly there are podzol and marsh soil types. Marshlands cover around 14% of the republic's territory. Overall the territory is divided into three soil-geographical zones: Northern (Pribaltic), Central (Belarus) and Southern (Poleskaya) [28].

Moldova is situated in the south-east of Europe, it borders with Rumania and Ukraine. The area of the Republic is 33 800 sq. km. Moldova consists of two natural zones: forest-steppe and steppe, which in turn include five landscape regions. The main ecosystems of the country are forests and meadows. The country's relief is a mountainous one and gradually lowers down from north-west to south-east. In the territory of the country one can distinguish different types of soils, especially chernozems (75 per cent of the total area) and gray forest soils (10 per cent of the total area). About 18 per cent of Moldova's territory is subjected to landslides. About 20-30

thousand settlements are regularly subjected to floods [12].

Ukraine is situated in the Central Europe occupying south-western and southern parts of the East European plains. The total area of Ukraine amounts to 603 550 sq. km. On the plains territory of Ukraine one can see three main natural zones: mixed forests (Ukrainian Polessye), forest-steppe and steppe. Ukraine's soils are very diversified - 650 types and sub-types of soils have been identified. The most fertile chernozems occupy about 60 per cent of all the country's agricultural lands, especially in the steppe and forest-steppe zones [14].

Caucasus region

Armenia. Territory amounts to 29.74 thousand sq. km. Seven main types of landscape are represented in Armenia on a comparably small territory at different altitude above the sea level. This is a country with rich diversity of biological species and landscape types which can be explained by the existence of a huge number of geological and altitude zones.

Armenia is extremely poor in productive and fertile lands. Over 14 genetic types and 27 sub-types of soil are identified in Armenia, which compose 8 altitude zones, and azonal soils are occurred as well. In the Ararat valley wet and rocky soils are also found. Armenia is an important center of endemism of wild forms of domesticated cereals [9].

Azerbaijan - Republic which occupies an area of 86.6 thousand sq. km on the western coast of the Caspian Sea, between Large and Small Caucas mountain ranges and Tashliky mountains.

This diversity is the outcome of a geologic history of locale and miscellaneous climatic conditions, which have created favorable living conditions and conditions for adaptation wide biodiversity [30].

Georgia is located in the southeastern part of Europe. In the north it is bordering with the Large Caucas range, in the south with the Small Caucas range and in the west with the Black Sea. The total area of the country amounts to about 69.500 sq. km. The main geographic elements include the Main Caucas range, inter-mountain lowlands, mountains of Small Caucas and South-Georgian volcanic highlands.

Natural ecosystems in Georgia are represented by the sub-alpine coniferous forests, meadows, lowlands, peat bogs, lakes, coniferous and beech by forests etc. Forests with high levels of species diversity (where deciduous forest dominates) cover 42,9% of Georgian dry land [27].

Central Asia

Kazakhstan. The area of the Republic amounts to 2 717.3 thousand sq. km. With

respect to landscape zoning in Kazakhstan on its flatland there are 5 types of landscapes – forest-steppe, steppe, dry steppe, semi-deserts and deserts, and in the mountains there are 7 types: nival, mountain-meadow, forest, forest-steppe, steppe, semi-deserts and deserts. In the north of the Republic there is chernozem zone. In the south there are chestnut soils (kastanozem), brown and gray-brown desert soils alternating with massifs of desert sand and takyr-soils.

Specific and valuable group of ecosystems is represented by forests and other terrains boarded with bush – soil preserving, pre-road, antierosive forest bands. In sub zones of the republic, there are more than 50 groups of agricultural forest ecosystems with their own set of forest species [31, 39].

Kyrgyzstan - continental country which is situated in the north-east of Central Asia. The area of Kirgizstan is 199.9 thousand sq. km. Due to landscape and microclimate diversity, the ecosystem frames are fairly wide: from deserts to deciduous and coniferous forests and alpine high-mountainous systems. This circumstance and its location at the joint of contrast biogeographic provinces have stipulated the complexity of its biogeographic pattern [32, 33].

In **Tajikistan** we can find contrast types of relief. Drastic differences in altitude, topography, climate and soils give birth to different types of natural zones: from the deserts of southern Tajikistan to the alpine zone on Pamir. Tajikistan is divided into five natural and climatic zones: northern, southern, central Tajikistan, eastern and western Pamir.

The mixed climate conditions and initial orographic pattern of Tadjikistan have stipulated the development of many types of land ecosystems and inland water bodies ecosystems. The country's territory has 25 types of ecosystems and many original local biotopes. [27, 37].

Turkmenistan is situated on the eastern coast of the Caspian Sea. Sand deserts Turan, Zaunguz and Karakum (Black sands), which altogether comprise 80 per cent of the territory, are located in the northern and central parts of the country. Mountains occupy less than 10 per cent of the territory, including foothills of Kopetdag, Khurasan, Guissar and Paropamiz range. Amudaria, Murgab, Tegjen, Sumbar, Chandyr and Atrek - these are the only rivers which form river valleys and oases that contain complex tugai ecosystems [34].

Uzbekistan. The territory is divided into two parts - lowlands and mountainous regions. Uzbekistan occupies the total area of 447.400 sq. km, including internal waters, mainly the Aral Sea. Diversity of Uzbekistan's ecosystems contributes to enormous biodiversity. The territory of Uzbekistan is mainly covered by deserts, semi-deserts and steppes and in the eastern part of the country - by mountains. Natural gardens and forests are less represented and are mainly irrigated artificially [36].

The impact of agricultural production systems in Russia and CIS countries on the conservation and use of biodiversity

Agriculture in Russian and other CIS countries currently is in the stage of stagnation. Switching of the population to reinforced exploitation of forests, the absence of measures of maintenance the soil fertility and fighting the erosion, destruction of animal and plant populations as the result of irrational and nonselective weed and pest control that harm agricultural and forest industries, including the usage of chemicals, change of habitats where organisms live etc. creates substantial threat to biodiversity.

The problems of agricultural affect on the environment, on top soil conditions and biodiversity in CIS as alike with the problems encountered on similar territories in Russia, as before the fall of the USSR, agricultural systems were practically identical.

The degradation problems include soil erosion and mass movement on agricultural and forestland, soil compaction; decline in soil fertility and salinization of cultivated land. In addition some soils are polluted by agro-chemicals, effluent from industry or mining, and waste from urban settlements.

The agricultural reforms have changed the normal pattern of grazing. Less animals graze the summer pastures with beneficial effects for the land as a consequence. The main reasons for this alleviation are: a general decrease in number of livestock and increased transport prices impeding transport of livestock over longer distances. It is common situation that pasturelands considerably suffered from over-grazing. As a result fertility of pasturelands has decreased (including the loss of valuable fodder species), soil are affected by erosion. The livestock may cause erosion of the soil when the stocking densities are too high and when the livestock enters the pastures in the early spring, when the vegetation is too fragile to bear the grazing animals. The compaction of the soil may be caused by grazing livestock, the use of heavy machinery in the fields or other vehicles crossing the land, particularly when the soils are wet. Compaction have an immediate negative effect on the agricultural production as reduced infiltration and aeration hamper growth of crops and other vegetation.

Hayfields, from which the grass is harvested annually, are in a similarly poor condition. Soil compaction is a particular problem due to early grazing of stock on pastures, which are still excessively wet from recent snow, particularly in the Mountain and Meadow Steppe Zone. Soil erosion is often concentrated in the vicinity of cattle tracks.

Despite of less accessibility as compared to lowlands, mountain ecosystems also experience considerable anthropogenous effect - agricultural (basically, overgrazing and cutting down of forest, as well as hay mowing), technogenic (roads, mining industry,), recreational. The ecosystems of pre-mountain regions, which in some cases were practically destroyed together with their primary flora and fauna complexes, have suffered the most.

The fight against "fields with low contours" which began in the USSR in the 1970s aimed at using powerful machinery on the fields and broad-catch cultivation tools resulted in the increase of crop rotation areas (with the medium area of 750 ha) and the total fields area. Expansion of the fields' area was carried out mainly through ravines filling and copse cutting. This in turn resulted in the liquidation of natural ecotons

where animals sought refuge and which served as an important factor of biodiversity conservation. This process encompassed Belarus, Russia, Ukraine and to a less extent other republics of the former USSR. At the same time in a number of regions the areas that are deserted and sparsely populated step-by-step transforms to the natural state.

Degradation of lands and reduction of biodiversity on the main part of territory of Russia and CIS have not reached critical levels, and with a sound system of economic activities it is possible to restore the state of environment and soils productivity to an acceptable level. Some comparison data¹ are shown bellow on diagrams 1, 2, 3 and 4 [29].

¹ In all diagrams data on Canada, the Netherlands and South Africa are given to compare the situation in agricultural sector of economy of Russia and CIS countries with such a situation in the developed countries.

Diagram 1.

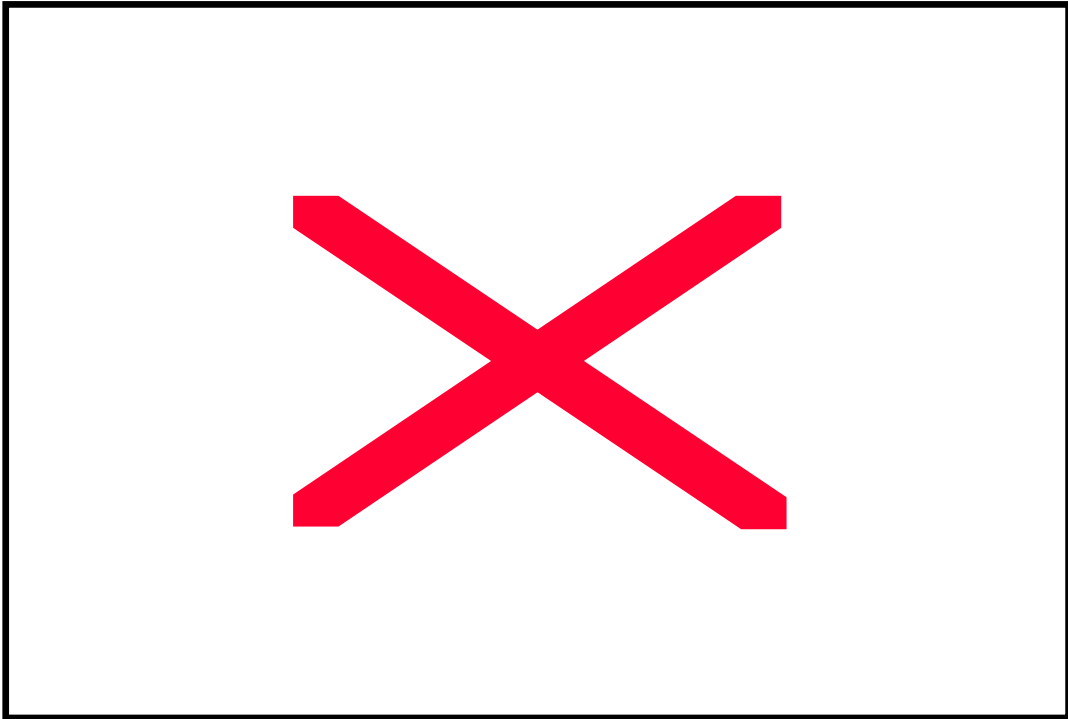


Diagram 2.

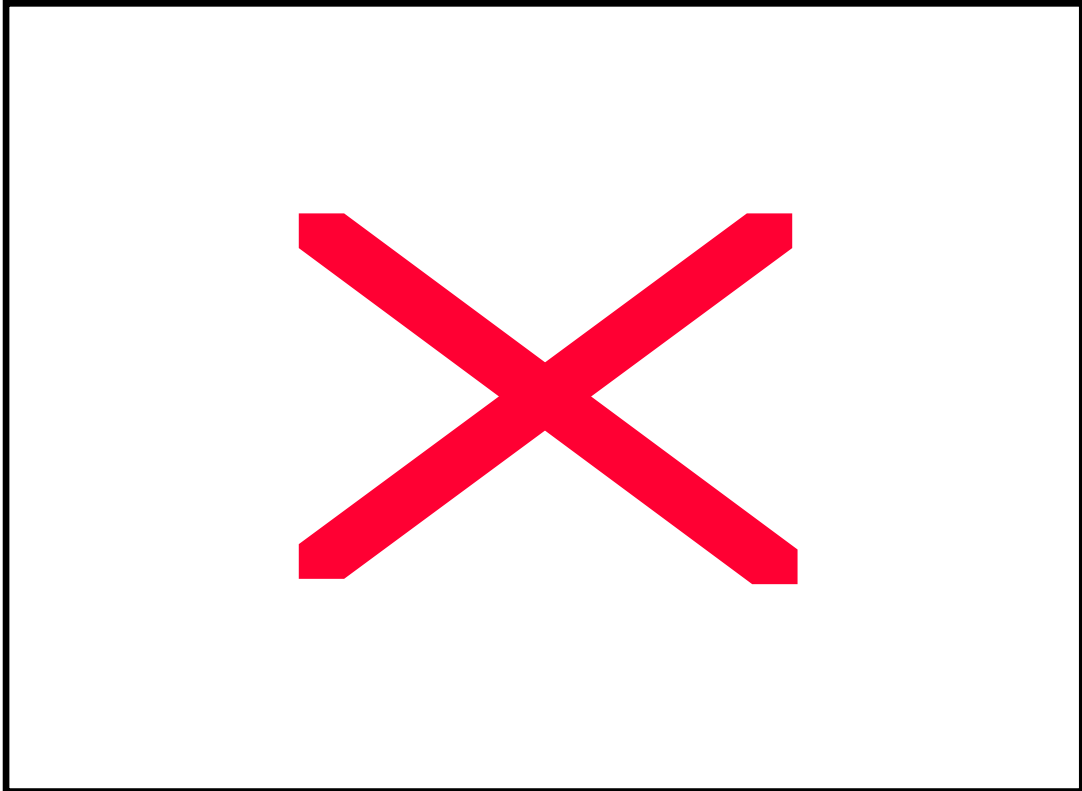


Diagram 3.

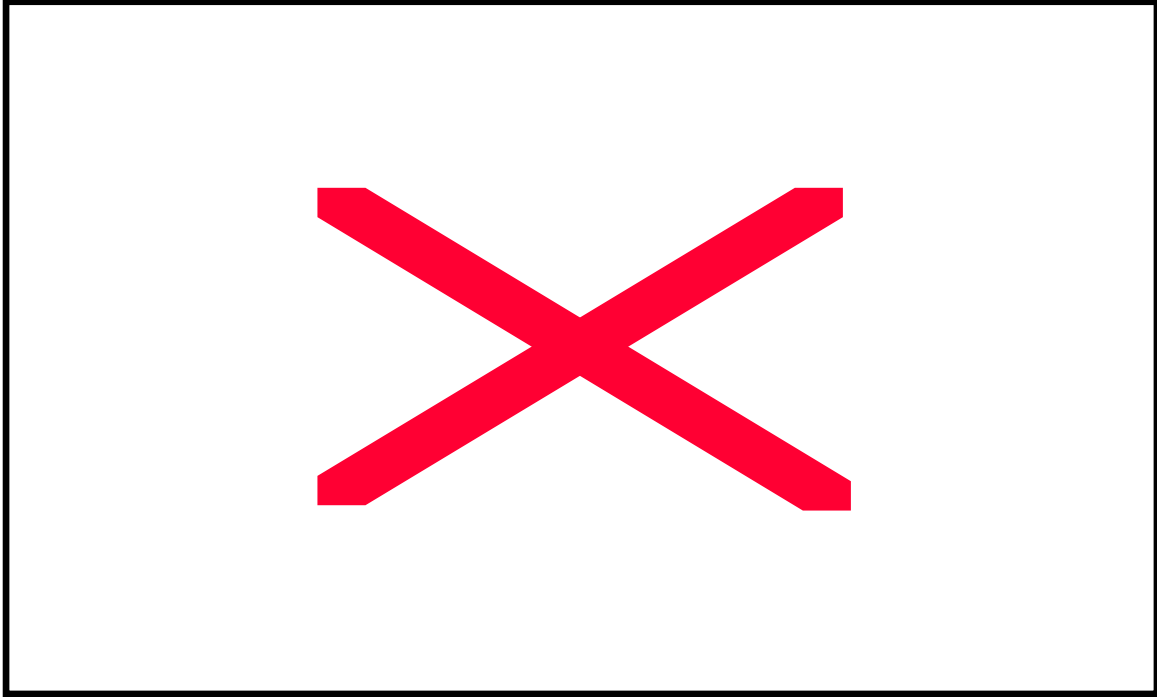
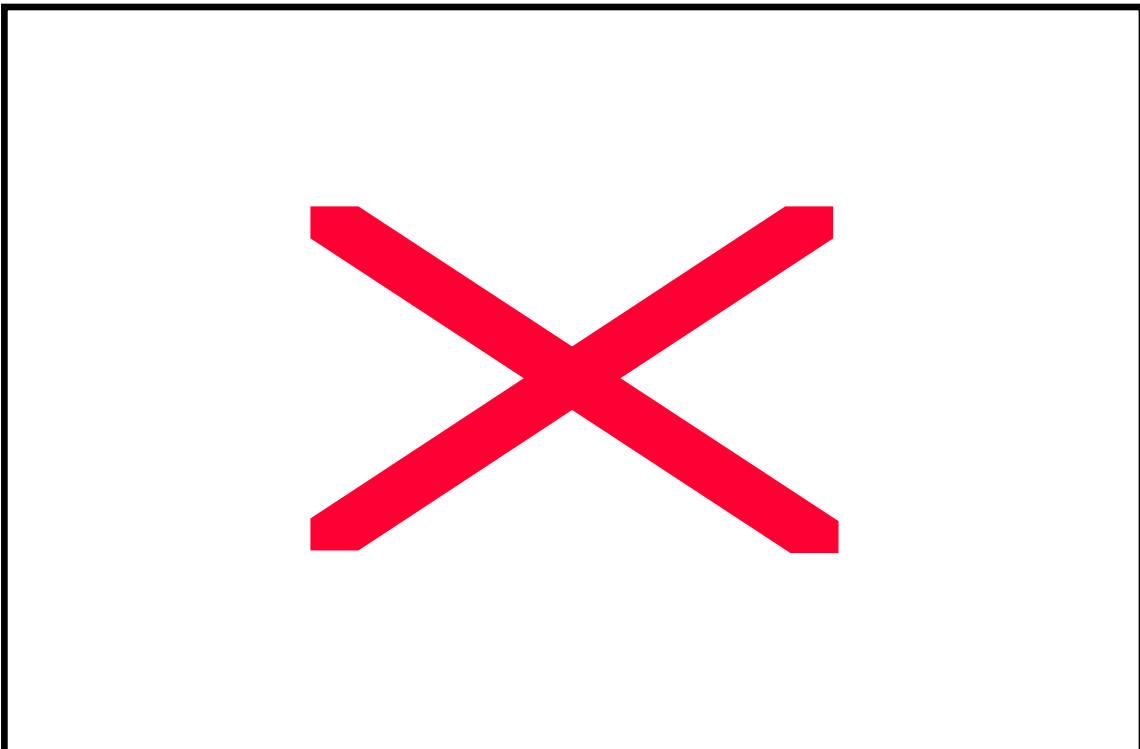


Diagram 4.



Russia. The level of agricultural exploration of Russian regions is uneven; the regions in the Center and South-European part of Russia are intensively used. The official data for 1997 shows that the main area of agro land makes up 2 215 thousand sq. km, 1 288 thousand sq. km were used as plough land. During the reformation period, which started around 1990, most of that land was abandoned and was no longer used in agriculture. There is no official data to back this up, but according to non-official data the loss of plough land by 2001 made up 300 thousand sq. km, the loss of hayfields, grazing and other agriculturally used lands increase this number. Main loss happened in Central Russia (non-Chernozem zone), however land is being abandoned in the Chernozem zone as well [24].

As the result of irrational land use, enormous anthropogenous loads, which exceed the threshold of sustainability, in semiarid and arid zones, desertification develops. Desertification has reached a considerable scale in Precaspian Region of Russia. It is especially intensive in Kalmykia, where 80% of the territory is undergoing this process, and 33% are desertified in strong or very strong degree. Desertification rapidly develops in Astrakhan region and Zabaikal, this process has also touched Stavropol Territory (Krai), Volgograd, Rostov, Saratov and a number of other regions (oblast).

The quality of surface waters of majority of water bodies in Russia, despite of decrease in production and reduction of the volume of pollutant dumps, still does not meet the normative requirements. Total amount of sewage annually being dumped into the surface water bodies in Russia in whole makes up more than 60 __³, including 22.4 __³ unrefined and strongly contaminated sewage. The toxic load of Volga exceeds toxic load of the rivers of other regions of Russia by 3,5 times. An enormous amount of biogenic elements is being washed off from agricultural lands into water basins every year. As a result we witness eutrophication of water basins; for example in Volgograd water storage basin each year in late summer we confront water "greening", which in its utmost manifestation leads in certain places to mass death of fish due to lack of oxygen in the water [43].

Belarus. Agrarian use of nature is among the most territorially pronounced factors affecting biological diversity of ecosystems. Biodiversity threats are such factors as extensive agricultural management, covering new natural territories each time, ecological unjustifiable versions of melioration marshland and exploitation of meliorated objects, violation of technologies of chemical and fertilizer application etc. [18].

Agricultural lands occupy 8 758.3 thousand ha or more than 40 per cent of Belarus' territory. Agrarian use of nature is the most ancient intensive type of economic activity, which has considerably changed the territorial structure, composition, and functional peculiarities of the Republic's vegetation cover.

Moldova. Today cultivated lands account for 75.6 per cent of the total area of the country and 64.5 of them are used very intensively. The zone of natural ecosystems does not exceed 20 per cent of the area of the country and they are scattered throughout the territory and in a degraded state [12, 22].

The main negative effects of agricultural activities include:

- active development of water erosion;
- inadequate use of chemicals in farming and gardening;
- reduction of humus content in the cultivated lands, degradation of their structure;
- at irrigated lands - soils slitization and salinization.

Ukraine. Agricultural lands take up 72% of the country's area, 69% of which are arable lands, including 54.4% of plough land, 1.6 % of long-term plantings, 3.8 % haymaking lands and 9.1 % of pastures. A considerable area (159 000 ha) is occupied with plowed fields contaminated by radiation which are not used in agriculture; this figure should be complemented by 161 400 ha of degraded lands [14, 26, 38]. Just like in other CIS countries, argolands are being reduced in Ukraine.

The problems of the impact of agricultural production system on biodiversity of Ukraine are similar to that of Russia in the similar natural zones. Chernozem soils prevailing in Ukraine have experienced degrading processes under the influence of agricultural activities [19]:

- humus concentration as a result of mineralization since its development has decreased on the average by 50 per cent;
- chernozem structure has worsened;
- many areas have been subjected to the effect of water erosion and deflation, for example in Vinitskaya oblast 31 per cent of the oblast's territory are affected by erosion processes (70 per cent of the territory). During one-year ravines of Kanev district destroyed and covered with water more than 250 ha of agricultural lands, etc.;
- irrigation leads to silting and slitization of chernozems.

The quality of main water source, Dnepr river with its cascade of water reservoirs, suddenly degraded (water color, increase of iron and manganese content, decrease of oxygen content), which harms the inhabitants of the water bodies.

Caucasus region

Armenia. Land, under agricultural use amounts to 1,391,400 ha or 47% of Armenia. As a result of extensive development of agriculture many natural landscapes in Armenia suffered considerable damage, the level of which is higher than in neighboring countries. At the present time 43 per cent of agricultural lands are being cultivated (0.6 million ha), while another 0.8 million ha are used as pasture lands and hay fields. The use and development of lands for agricultural purposes have resulted in the reduction and even disappearance of certain pasture habitats, as well as to large-scale pollution of environment. For an example, the extinction of forests, which overall are known for their high biodiversity level, can lead to destruction of fragile ecosystems water reservoirs and raise the possibility of floods [7].

During the last 70 years many places of residence in Armenia's semi-desert, steppe and wetlands zones were developed for cultivation, which resulted in the loss of several important regions and an increased danger to species. Unregulated lands irrigation had far reaching consequences. For example, 24 000 ha in the Ararat valley salinity increased sharply. Such factors as salinization, soils consolidation and excessive use of fertilizers and pesticides negatively affected soil organisms, which ensured soils fertility.

Agricultural production system of Armenia has caused great damage to biodiversity. The main effects of agriculture are as follows:

- change of habitats and destruction of natural ecosystems;
- over-pasturing (that influences the vegetation composition of pasture lands);
- soils degradation (including consolidation of soils and increase in salinity) and fertility reduction;
- use of pesticides and soils pollution;
- soils erosion (as well as an increased risk of landslides);
- pollution of water sources;
- proliferation of cattle diseases.

Azerbaijan. Nearly half of the county's land resources are used in agriculture. High concentration and overuse of pasture lands and uncontrolled forest cutting have resulted in erosion of 2.7 million ha of land.

Agricultural soils have been damaged by excessive and long-term use of chemicals (the result of a combination of ignorance, inappropriate planning, mismanagement of the land and the lack of monitoring of farming practice). Although since 1990 the use of fertilizers and other chemicals was drastically reduced the impact of the overuse continue to influence soils quality and, consequently, people's health.

Approximately 1.2 million ha are heavily saline, many lands are heavily depleted, many regions have suffered from erosion. Inefficient irrigation facilities on plowed soils continue to negatively affect soils quality.

The manufacturing volumes of food commodities currently make up only 50% compare to 1985 level [27].

Georgia. Agriculture in Georgia has a long history of existence and is distinguished with its variety of trends, including production of wine and citrus plants as well as grains.

Political and economic changes mostly effected the agricultural sector of the economy: in 1993-1994 agro production level fell to the third of what was produced in 1987, and the food manufacturing levels make up 10% of the level that was reached at the end of 1980's. A big number of small so called "subsistence farms" comprise the bulk of Georgia's agriculture. The majority of farms use their land mainly for cereals cultivation leaving.

According to the statistics, from all eroded land 378000 ha is used for arable lands, 650000 ha for haymaking and pastures and 87000 ha for the Black Sea coast, where the land is subject lateral erosion due to unshielded rivers. About 218000 ha (7.3 % of all

farmland) has exposed to salt, 109000 suffer from secondary water logging in connection with an obsolete system of irrigation and 175000 (5-9 %) - from drought [5, 11].

The use of fertilizers and pesticides has reduced due to their prices being too high for the local population. From the beginning of the transition period, the fertilizers use have been reduced by more than 50% and can no longer maintain soil fertility.

Over-pasturing represents a serious problem in mountainous regions where it leads to soil erosion and in the eastern and central parts of Georgia where it results in desertification.

Central Asia

The development of the irrigation agriculture has resulted in increase of irrigational lands in the region and increase of water use, which resulted in decrease of water supply to the Aral Sea. The most changes underwent: flatlands, flood-lands, which were used for irrigation, water and shore water ecosystems, the Aral Sea region.

Usage of pastures, occupation of the land with crops, improper storage, transportation and usage of agricultural chemicals, sewage waters from fields and cattle-breeding farms causes a considerable loss of agrobiodiversity in the Region [4].

Kazakhstan. The area of plowed lands in the country is about 29.1 million ha. As a result of large-scale plowing of land in the steppe zone the bulk of the types of steppe ecosystems is being destroyed which is accompanied by dehumification, soil erosion and depletion of biodiversity of natural flora. Ploughed up virgin lands of Northern Kazakhstan in the last 40 years have lost up to 30 % of humus because of their extensive usage.

At pasture lands which occupy an area of 132.6 million ha (plains, mountainous regions) over-pasturing reflects the main tendency of the lack of balance between reduction of the amount of fodder and the speed of its growth. In the environment of seasonal use of pasture fields the norm of cattle pasturing which is 2-8 ha per one sheep is exceeded in several areas in 2-6 times. Changes in the farming structure lead to complete degradation of pasture fields exploited during the whole year and pastures surrounding the remaining wells, as well as those which are located on saline plots of land. The desertification due to soil erosion, loss of humus and irrational use of pastures has enveloped more than 120 million ha, which essentially has changed the condition of biological resources (their habitat, number, productivity).

Considerable reduction of hay fields has resulted in the need to lie in hay on pasturelands, which depletes pastures. As a result of inadequate haying the varieties structure of meadows and typological diversity of ecosystems is simplified while there stability and the mechanism of self-reproduction are damaged [31].

Kyrgyzstan. The main negative effects of agricultural production systems on biodiversity are disappearance of steppes as a result of plowing and excessive number of

cattle on reduced area of pastures. Up to 25 per cent of pastures were practically lost because the load was exceeded 5-10-times.

At the moment there is not a single ecosystem on the territory of the country which isn't suffering from the men's activities. Pre mountain-steppes, tugaisky and marsh complexes in the Chuisky valley have practically disappeared, as well as dry steppes, semi-arid and arid ecosystems in the predfergansky zone. Due to heavy pollution the river basin ecosystems is also damaged. In many cases they have disappeared due to all the water being used to irrigation.

Dry-steppe and semi-arid ecosystems in pre mountain flatlands, mountain meadows, riverbanks, wood and shrub vegetation are undergoing the destruction from cattle. Excessive and unsystematic use of pasture resources (which make up more than 85 % of all agricultural lands) predominantly with the purposes of natural haymaking and animal pasturing has resulted in seal of soil and acceleration of soil erosion; degradations of a soil-vegetative layer of pasture zones and their mechanical trampling. The abrupt hillsides are covered with a grid of cattle tracks, wood and shrub vegetation is destroyed. More than 50 % of pasture lands (4,5 million ha) are considered degraded.

As a result of low irrigation culture and the lack of necessary draining systems, salt content increases on the irrigation lands. This is the issue for 20% of cultured land in lowlands of Chuiskaya and Ferganskaya valleys. Uncontrolled storage and use of dung is the reason for pollution of surface and ground waters with nitrates and bacteria [32, 33].

Tajikistan. Despite the fact that the most of the land is privatized, 25 % of arable lands (250000 ha) can be lost due to irrigate-meliorative systems being no longer used [27, 40]. The absence of a sufficient technical maintenance of these systems, on one hand resulted in water logging of several territories and on the other hand in no longer use of the systems.

Turkmenistan. In recent years a number of factors have contributed to the damage of environment and its biodiversity [34]:

- development and transformation of the areas of natural habitat, for instance loss of forests and bushes;
- soils erosion and salinization;
- use of rivers for irrigation and human activities;
- pollution of environment by pesticides;
- encroachment of herdsmen, etc. on protected territories;
- dams building.

Depletion of Turkmenistan's biodiversity occurs at the background of man-induced desertification of oases and mountainous landscapes.

Uzbekistan. 82% of agriculture land is used for cattle breeding for pastures and haymaking. Big part of this territory is natural pastures, only a small part of it is being irrigated. Only 10,8% of the republic's territory is used for crop growing.

The most vulnerable territories include: lowlands, flooded areas, regions near rivers adapted for irrigation needs, swampy areas, the region of the Aral Sea. Pesticides, fertilizers and other chemicals have polluted the bulk of water that reaches the Aral Sea. For a long time these chemicals were laying down on the sea floor. With the reduction of the size of the Aral Sea as a result of decreased in-flow of water from two main rivers - Amudaria and Syrdaria, polluted sea floor has become land and pollution started to spread into the air. The Aral Sea became heavily saline as a result of both decreased in-flow of water and heavy salinization of river waters due to intensive irrigation [35, 36, 37].

Summary of status and trends of key aspects of agrobiodiversity

Russia. The overall state of the species diversity can be considered satisfactory: large flora and fauna of all landscape zones in the country were preserved. Due to this fact, Russia continues to be one of the most important regions, which maintains the global species diversity. At the same time, some economic activities during second half of 20th century caused material breach of floristic and faunistic complexes in a number of regions, many species came to a critical state and were included in the Red Data Book.

Russia is the state, which contains the most forest: it contains 25% of the Earth's forest area and 26% of the world's undisturbed forest ecosystems. Despite of intensive exploitation, the forest ecosystems in Russia were better preserved, than in other countries in the world. During the last decade, due to a sudden decrease of agro production, forest territories have increased. However, intensive forestry in the past, especially in the European part of Russia, has resulted in essential impairment of forest, change of their age and natural pattern, change of forest formations and biodiversity reduction [13, 24, 25].

Around one forth of Russian territories are mountains: form the 83 subjects of Russian Federation, 43 subjects have mountain regions. Modern practice of mountain exploration leads to biota distraction, destabilization of mountain ecosystems and landscapes, biodiversity decrease.

Wetland ecosystems in Russia, compare to other types of ecosystems, have been transformed by humans in a great extent. Flood-lands, lakes and inshore sea ecosystems in western parts of the country have suffered to the greatest degree. In a zonal context plan the water-marsh ecosystems in arid and semiarid zones are most transformed.

One of the main problems in biodiversity conservation in tundra landscapes is decrease of natural pastures and discontinuation of paths of migratory of deer herds as the result of intensive development of the North.

Belarus. The evidence of biodiversity in Belarus is the 457 species of vertebrates and 20 thousand invertebrates. The main ecosystems are forest (35.5 %), marsh (19,9 %), meadow (15,8 %), bush (3,1 %). The ratio of the natural and anthropogenic formed ecosystems in the area take up approximately 55% and 45% accordingly. More than 42 per cent of wetlands and 50 per cent of meadowlands of Belarus have been subjected to

strong man-induced transformation.

The heaviest general damage to nature and ecological state of environment in Belarus was caused by Chernobyl nuclear disaster. As a result of the accident at Chernobylskaya APS in 1986 23 per cent of Belarus' territory was contaminated by radionuclides (with caesium-137 contamination density of 1 Ci/km²). The most negative effect on biological diversity at the species and ecosystems level was caused by hydro-technical land improvement, which was actively pursued in 1960-70s. All in all more than 2 641.8 thousand ha of agricultural lands were drained including 1 140.0 thousand ha - to be used as plowed fields. The most large-scale drainage of soils was carried out in Polesye. This has resulted in the destruction of natural ecosystems of the entire unique natural region [10, 18].

Moldova. Due to the geographic position the Republic of Moldova is a completely special biogeographic zone. Diversity and particular features of flora and fauna in Moldova are conditioned by the following factors: favorable geographic position, diversity of geological conditions, large soils diversity and preservation of water resources.

Moldova has 2 natural zones: forest-steppe and steppe, which in their turn include 5 landscape regions. Forest-steppe takes up the northern and central part of the republic and represents hilly flatland with defined change of flatlands and plateaus. The flora diversity of this zone is represented by different species of forest flora, as well as meadow and steppe flora. Common for the region soil: chernozem alongside with chestnut (kastanozem) and brown forest soil. Steppe lies in the south and south-east of the country and is categorized by smaller, as compared to forest, biodiversity. Steppe and forest-steppe elements can be seen here. Vegetation formation is categorized by ravine, grown in by oaks together with quarks, and meadows are common as turf cover [12, 22].

Ukraine. The steppe ecosystems are the mostly threatened in Ukraine. It takes place due to fragmentation of habitats, effects of agriculture, and development of infrastructure. The ecosystems of inshore and marsh lands are threatened by the development of cities and industry, recreational effect and pollution. In the south-east of Ukraine (where brown soils are prevailing) we witness the processes of decertification, while with irrigation - soils salinization [14].

The mountain ecosystems, in particular Crimean mountains, are under the effect of high-density population, recreation and negative consequences of economic crisis. In the Crimea the threats to biodiversity are caused by the following man-induced effects:

- over-pasturing of cattle endangering steppe and forest landscapes;
- soils erosion;
- pollution of agricultural territories with fertilizers and pesticides;
- salinization of irrigated soils, etc. [42].

Caucasus region

Armenia. A wide variety of habitats is found over the small territory of Armenia, including deserts, semi-deserts, alpine and sub-alpine meadows, steppes, forests, etc. Due to its position at the junction of three completely different bio-geographic regions, and to the mountainous nature of its landscape, the country hosts the therefore the highest biological diversity and number of endemic species of plants and animals in the Caucasus Region.

Permanent grassland is the most important livestock feed source in Armenia. Only 5% of grassland has been improved, and much of the remainder has been degraded due to poor management, including overgrazing, lack of rotation and general lack of maintenance.

Significant populations of animals of international conservation importance are found in Armenia, including Leopard, Striped Hyena, Brown Bear, Wolf, Wild Cat and the Mufflon, which is thought to be the wild ancestor of all domestic sheep. Armenia lies also along one of the main bird migration routes, and hosts 349 species of birds.

Finally an important feature of Armenia is Lake Sevan, the largest Alpine Lake in the Caucasus and one of the largest in the world. It hosts several endemic species of fish and it includes important bird areas along its shores [7, 9].

Azerbaijan territory has 4300 kinds of plants and 18000 kinds animals, distributed along nine climatic zones. 270 species of flora are considered to be endemics and are priceless genetic resources for the republic and the whole world. The area of forests takes up 11,4 % of all territory, but thus they have a high level of biodiversity [27].

Azerbaijan has established a network of protected areas to protect its most valuable and undisturbed biota. Protected areas are considered to be one of the most efficient tools to preserve ecosystems and genetic diversity of the Republic.

Georgia. Cultivated land suffers from effects of past and present activities. During 1936-1988 periods the areas of arable lands were reduced from 1270000 ha to 785000 ha. One of main reasons of this reduction was erosion. Cultivated lands suffer from considerable impact of erosion: in western Georgia mainly from water erosion while in the eastern part of the country - from wind one.

Factors that determine lands productivity include the structure of crops and the size of plots of land. Increased share of fields occupied by cereals, in particular, has contributed to the intensification of erosion. Similar negative effect is exercised by a drastic increase in the size of sunflower fields, which results in the depletion of humus layer. The bulk of fields were deprived of protective forest strips (which mitigated harmful impact of wind), cut by the local population due to a limited access to the sources of energy [5, 11].

Due to the low rainfall in the areas of the country, which are otherwise best suited to crop production, approximately half of the total cropland is served by irrigation

systems. In recent years, however the proportion of land actually irrigated has fallen, mainly due to poor maintenance of irrigation infrastructure and the high energy costs associated with pumping.

Central Asia

Due to the high complexity and contrast of geographical environment, there is a big concentration of species in Central Asia. From the natural factors, which influence biodiversity, continuing aridization of the climate in Central Asia and mountain region should be singled out. In many regions more than half of the energy demand necessary for heating and cooking is met through forest and shrub use. Collection of field flowers takes on big scales. The reserves of wild medicine plants are being threatened. Commercial snake hunting became more frequent, as well as hunting for predator birds and others animals. Existing and newly entered objects have no satisfactory refining facilities, which results in the environment pollution. A special hazard is introduced with ore mining. As outcome there is splitting and reduction of habitats, decrease in population and reproduction of species [4].

Kazakhstan.

The analysis by agrarian economists has shown, that the reform in agriculture basically came down to changes of forms of ownership on production means, liberalization of the prices and discharge of the government from interference in development of the economics. Since 1991 such policy has resulted in steady reduction of crops, decrease in cattle and bird numbers, constant decrease of crop and animal productivity, which in turn, has negatively effected food supply of the population.

Biodiversity of agricultural ecosystems is in need of additional assessment. In Kazakhstan there is a tendency towards reduction of agricultural lands and forest area. At the same time there is a considerable increase in territories occupied by large cities and suburbs.

Disappearance of many natural ecosystems in Kazakhstan's desert and steppe zones raises the problem of biodiversity rehabilitation and restoration of lost ecosystems, such as feather motley grass meadows, motley-feather grass steppes. The growth of many useful plants has slowed down and several varieties have been included in the Red Book. They include 21 varieties of eatable plants, 20 - medicine plants, etc. [31].

Kyrgyzstan has an important place in the world, being distinguished by its high concentration of plant and animal species, as well as the preservation of natural landscapes and ecosystems. Its territory has wide representations of natural communities: forests, shrubs, high-mountainous, middle-mountainous, low-mountainous meadows, steppes and deserts, water-marsh lands.

Forests make up around 4,2% of the Republic's territory and have an important role in biodiversity conservation and ecological stability. However, during the last 50 years the area covered by forests was constantly diminishing, due to non-systematic (including personal forest cutting) forest cutting especially for kapa preparation and high quality

nut timber, cattle grazing. The reduction of forest-covered areas in the republic is accompanied by a soil erosion, destruction of mountainsides and increase of landslides.

At the moment there are about 166 viruses and bacteria known, 3676 mushroom species and other lower plants, 101 species of protozoa, 10242 insects and other arthropods. Invertebrate fauna is not fully known [32, 33].

Tajikistan. Tajikistan's vegetation is rich and diversified; it includes many relict and endemic plants, although forests occupy less than 3 per cent of the country's territory. Cattle over-grazing and irrational use of land have resulted in serious degradation of lands initiating the process of deserts formation and modification of natural ecosystems. Intensive forest cutting and forest fires have contributed to the reduction of the territory covered with forest. This has negatively affected the number of birds and mammals residing there and has contributed to an intensive process of erosion and many natural disasters. Regulation of rivers has led to degradation of river and tugai ecosystems [4].

Turkmenistan. The decline of biodiversity in Turkmenistan takes place due to anthropogenous desertification of oases and mountain landscapes. At the moment negative anthropogenous influence has affected vast areas, creating ecological problems of desertification of 40 millions ha of land.

The ecological destabilizing of the environment is boosted in connection with decrease of ground water level (in some regions up to 1,26 m), technological loss of water from Karakumsky channel due to increase of irrigation, urban and industrial use [2, 34].

Uzbekistan. Uzbekistan's biodiversity is under a number of threats, and agrobiodiversity is under the greatest threat: first, due to the concentration of wild primo-genitors in particular parts of the world and their relation to particular ecosystems, second, due to decrease of genetic diversity in many agro species.

The main threats to Uzbekistan's biodiversity include the disappearance of habitats and their modification:

- use of new lands for agricultural purposes;
- use of natural territories for pastures;
- intensified desertification;
- increased load on pastures and their depletion by cattle;
- irrigation and plowing leading to salinization and withdrawal of soils from usage;
- construction of hydro-power stations;
- pollution by pesticides and heavy metals.

The quality of biodiversity in all territories of arable agriculture is very low due to almost full destruction of habitat as the result of irrigation agriculture, high scale use of chemicals, one-crop system, high salt content of lands, infiltration of resistant parasites and weeds. In most of pasture lands, where the extensive systems of animal industries are used, the habitats and ecosystem were considerably changed due to intensive

exploitation, but still preserve elements of the wild untouched nature. The value of biodiversity of irrigation plantations and fruit gardens is rather low basically because of them being located in the regions of intensive irrigation processing lands. The quality of biodiversity degrades from a large fraction of probability even inside their boundaries [36].

Approaches to the conservation and management of the following components of agrobiodiversity in Agricultural Plans and National Biodiversity Conservation Strategies

The time of economic and socio-political changes brings actual and potential threat to development of conservation and sustainable use of biological resources. The true meaning of bio resources is not appreciated and is not reflected in the modern politics and development plans in CIS countries, neither from the point of view of their role in supporting important ecological processes, nor from the point of view of their actual and potential use. To achieve sustainable development of the countries in the future it is necessary to give attention to the purposes of conservation and sustainable use of biodiversity and to include them in the national development plans with provision of organizational and financial resources.

Analysis of National Biodiversity Conservation Strategies showed that at the moment the common problems in the field of management and conservation of agrobiodiversity in CIS countries are:

- disturbance of natural biocenoses structure - deliberate and inadvertent introduction, and also self-migration of foreign species;
- spread of animal and plant diseases;
- infiltration into open agrosystems and natural ecosystems of generically modified organisms;
- eutrophication of water bodies;
- destruction of animal food resources;
- loss of unique landscapes (steppes).

Pollinators

Information of the pollinators in National Strategies is fragmentary and incomplete, however the positive affect of apiculture on biodiversity conservation was noticed. From the information in Strategies and Action Plans it is evident that the main way to the conservation and management of pollinator is the development, strengthening and achievements of a capital recovery factor of apiculture. It is not an easy task taking into the account that agricultural crisis in CIS countries. One of the main problems for apiculture development is the lack of organized sales system and product certification (honey, wax, propolisum, queen bee's milk). Overcoming the indicated difficulties will stimulate the recovery and increase the number of populations of natural pollinators, as well as the involvement of the agricultural communities in one of the sustainable and environmental kind of agricultural management of natural recourses.

According to experts' evaluations, at the moment there is no problem with deficiency of pollinators' in **Russia**. While developing the new plant conservation means the recommendations from Apiculture Institute on safety of pollinators' populations are taken into the account. Apiculture is especially developed in the south Siberia, in Altai and North Caucuses. The products of Russian apiculture are leaders in the world market.

As it was mentioned in [7], in **Armenia** bees have been kept in since ancient times, for the production of honey and beeswax, and around 130,000 bee-hives were recorded in 1994.

As it was mentioned in [32], prolonged use of chemicals and mineral fertilizers in **Kyrgystan** agriculture lead to decrease of useful soil microorganisms, pollinators, as well as other fauna representatives. In the Republic, apiculture was poorly developed, the useful characteristics of bees are not used to their fullest. The infectious and invasive bee diseases are widely spread as well.

Soil biodiversity

The condition of soil biodiversity in the republics of the former USSR have a lot in common. Most of the soil in Russia and CIS countries is eroded, where human activities are crucial and causing the non-rational use of soil, uncontrolled livestock grazing.

After the collapse of collective agricultural system and centralized distribution, the use of fertilizers and pesticides decreased to the fact that they are less affordable now to the agricultural communities. The inadequate fertilization not only has direct negative economic consequences of low crop production but may also have erosion as a secondary effect as the sparse vegetation provides less ground cover. Inadequate fertilization also gives rise to increased mineralisation of the soil organic matter and hereby generates degradation of the soil.

To save soil biodiversity it is necessary to provide rational relation of agricultural lands, and set different types of land use (agricultural, forestry, protected areas and etc.). All agricultural and nature conserving activities have to be strictly differential according to the zone and regional particularities of topsoil.

Some comparison data are shown bellow on diagrams 5 and 6 [29].

Diagram 5.

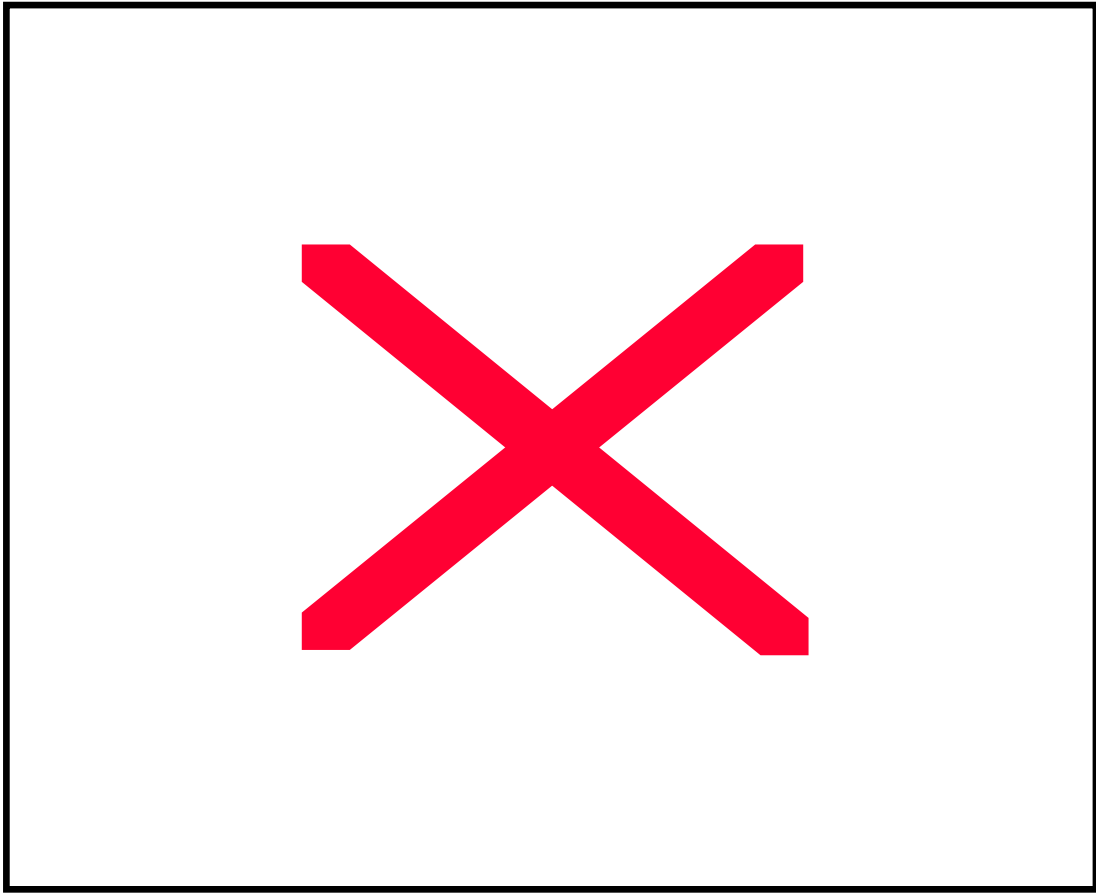
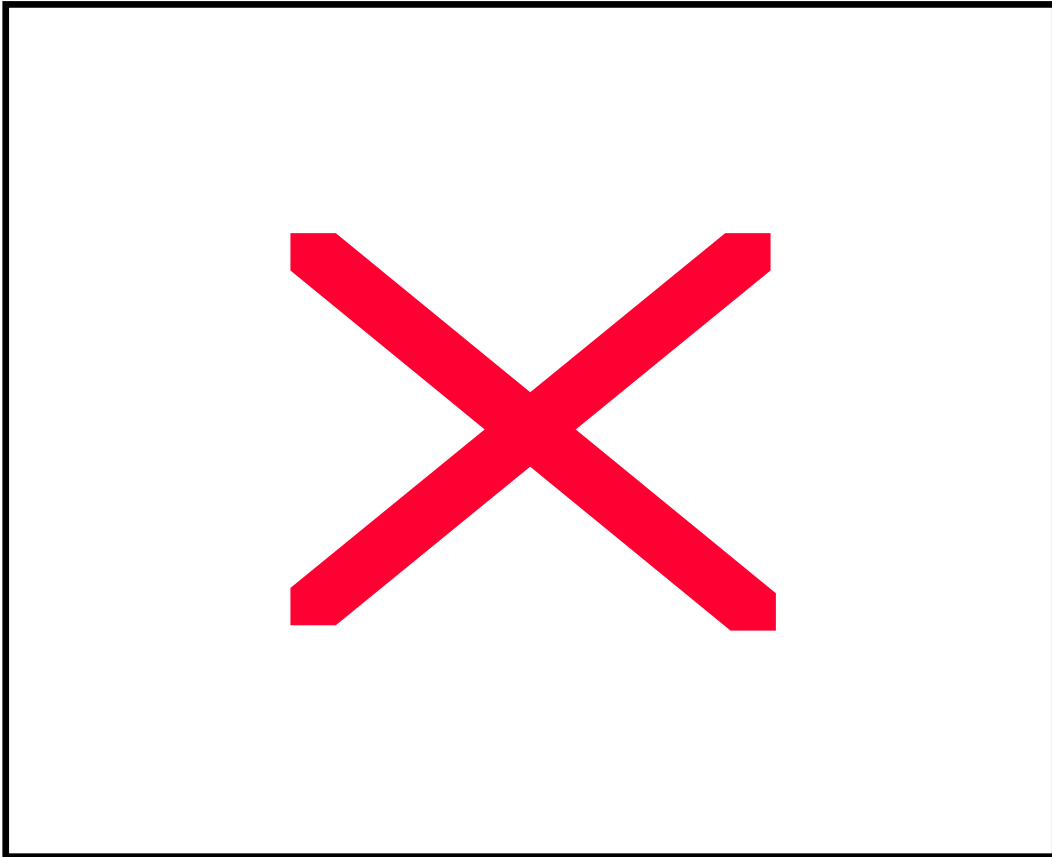


Diagram 6.



Russia. Soil conservation, as an important component of land ecosystems and main habitat for plants, animals and microorganisms, has to have a special place in the Biodiversity Conservation Strategy. The conditions of soil and soil biota in Russia are completely unsatisfactory, and in many regions of the country are even critical.

About 56% agricultural lands undergo water and wind erosion. Soil erosion susceptibility accrues from the north to the south up to the Chernozem zone and decrease in the chestnut soils (kastanozem) zone. In the European part of Russia soil is being washed away in great amounts in Central Russian Upland, High Zavgolie, Preduralie, Stavropol highland and Caucasus piedmonts. In steppe and dry steppe zones there is wind erosion, which is absent in the natural steppes [6, 13, 24, 25].

Uncontrolled use of mineral fertilizers and pesticides often lead to a sudden decrease of population microorganisms and zoofauna, which at the end leads to damage of modular condition of the arable layer [21]. But now there is no problem of overuse of mineral fertilizers and pesticides because of reasons mentioned above.

Caucasus region

Armenia. Biodiversity of Armenia [7] issues on soil microorganisms' conservation is

raised. Amongst such organisms, special attention is given to nitrogen-fixing (including nitrogen-bacteria, legume bacteria) and sulfate-removing bacteria. The later can be seen in wet soils with high levels of sulfates and organic matter. About 1000 kinds of bacteria, which can function in extreme conditions (hot, cold, salt environments etc.), are represented in Armenian State Bank of microorganisms.

The pattern of fertilizer use has changed considerably since the land privatization. The distribution system of fertilizers has undergone a complete change: fertilizers were formerly provided through state controlled corporations to state and collective farms according to defined needs. Now fertilizers are sold through small enterprises directly to the farmers in a market without control. Limited types of fertilizers of variable quality are available and the farmers generally have very limited knowledge about the fertilizer requirements of their crops. The consequence is insufficient fertilization resulting in an inferior crop production. Data on consumption since 1992 are uncertain and there is now much less control over imports and sales of potentially hazardous pesticides.

Land with stony soil characteristics are extensively found in Armenia demonstrating varying degrees of stoniness expressed by the accumulation of surface and/or subsurface layer of large boulders inhibiting agricultural production, not suitable for agricultural production.

Due to human influence some types of the soil as non-altitude gray meadows, meadow chernosem soils, saline-alkali soils have been originated. Saline alkaline soils cover 29,000 ha. To maintain the arable status of the soils it is necessary to maintain a continuous drainage, which requires pumping of drainage water. Approximately 6,000 ha. of salinated land is now utilised for aqua-culture [7, 9].

Biodiversity that provides mitigation of pests and diseases

Russia. In the Action Plan on Implementation of Main Directions of Agricultural Production Policy of Government of Russian Federation for 2001 the opening-up of the project of the governmental order of Russian Federation "On the statement of a rule about amplification of phytosanitary measures on protection of plants against a defeat dangerous and extra hazardous by the wreckers, illnesses and weed plants in Russian Federation" is stipulated (<http://www.aris.ru>).

According to the experts' evaluation, cutting down of forests, which almost replaced agricultural production in many regions of Non-Chernozem zone, leads to lowering of ground water level, siltage and desiccation of the small river basins, amplification of a wind erosion. Constant cut-downs of trees lead propagation of pests of healthy forests, which aggravates process of their degradation.

Deposits, that accumulated due to agricultural lands being neglected, during the first years of before the recovery of natural vegetation, are the source of weeds and rodents which cause natural-focal disease outbreaks. The absence of regular ploughing up leads to locust outbreak. The strong insecticides, which are used to fight it, kill the natural populations of insects. At the same time, the overall decrease of pesticide quantity used on fields leads to recovery of natural populations of insects, such as Carabidae and Stafilinidae, as well as birds which control the number of pests.

It should also be noted that in Russian as opposite to other CIS countries, there isn't a big problem with disease amongst monocultures, as mostly the crop rotation cycle here is being followed [6, 13, 24, 25].

Moldova. In Moldova a considerable damage to agrobiodiversity is caused by monoculture, which creates favorable conditions for pests' propagation [12].

Central Asia

Kazakhstan. There is an acute problem of crop protection from locusts. The main way of limitation of parasitic locusts number was and is a chemical method. For this purpose, in order to avoid pollution of territory by toxic oddments and price raise of the cost of protective measures, it is suggested to apply insecticides with long-lasting persistence.

After development 25 million ha of virgin and fallow lands in Kazakhstan on ploughed land on the edges of zones different types of a contamination were formed. On more fertile chernozems *Avena fatya* and *Conchus* dominates, on the chestnut soils (kastanozem) - *Agropyron ramosum*, *A. repens*. On soils in Aktyubinsk, Kostanaisky and Pavlodar areas *Salsola pestifer*, *Setaria glauca*, *S. Viridis* is dominant. The destruction of undesirable weeds by different herbicides can lead to soil pollution and destruction of fauna [31, 39].

Kyrgyzstan. In field-crop cultivation, gardening and forestry the most sustainable and secure measures against pesticides are connected with usage of natural species limiting their number. For example: in the 1970's the insecticides in Song-Kulskaya hollow were applied in big quantities for pasture protection against the grasshopper. As the result, due to the fact that the hollow is closed, the chemicals were washed off through stock waters into the lake Song-Kul and did a severe damage to fauna and flora of the lake [32, 33].

Uzbekistan. The use of pesticides in Uzbekistan essentially has decreased during the past years, mainly due to economical reasons. At the moment pollution threat by pesticides comes basically from sewage of different productions: pollution of stock waters from fields; air contamination through spraying of pesticides in atmosphere; direct application of chemicals to control algae and other organisms in water. Pesticide warehouses and airports for plane-sprayers are considered as local "hot spots" for pesticide pollution [35, 36].

Crop and livestock genetic resources

The expense and irregular availability of fertilizers and other agro-chemicals means that their use is usually well below recommended levels, leading to depletion of soil nutrients and reduced yields. These factors, combined with the decline of the irrigation systems due to poor maintenance and high operating costs, have resulted in a reduction in crop yields. Due to limited markets the decline in crop yields has happened, with the sharpest decrease in the yields of cereals and vegetables; the maintenance of orchards and vineyards has declined; production of such valuable crops as tobacco, geranium and sugar beet has stopped.

The main species of cultural plants are:

Grain - wheat, barley, oats, millet, corn, rice, buckwheat, peas, string bean, soya bean;

Technical - potatoes, cotton-plant (countries of Central Asia), sugar beet, sunflower, tobacco;

Vegetable - cabbage, horse-radish, radish, tomato, pepper, eggplant, carrots, parsley, fennel, cucumber, onion, garlic, beet, salad;

Melons and grounds - water-melon, melon, pumpkin, vegetable marrow;

Fodder - Lucerne, sainfoin, Sudan grass, rape;

Crop-berry - apples, pear, drain, peach, cherry, grapes, currant, strawberry, raspberry.

In the past in politics and practical approaches the importance of conventional cultures of agricultural plants and animals was underrated, which lead to wide replacement of these species with acclimatized exotic species, reduction and threat of extinction of conventional species. The variety of species and types is an indispensable condition for the development of an adaptive agriculture on the territory of CIS countries, which are distinguished by a wide variety of natural, social and economic conditions, determines capabilities of selection to quickly respond to ecological changes. The local species and types are essential elements of conventional culture of nature management; they represent "living cultural heritage ". The domestic animals are shown in CIS countries - sheep, goats, pigs, cattle, horses, camels, donkeys etc.

Two ways of conservation of crops and livestock genetic recourses mentioned in the National Biodiversity Conservation Strategies and Action Plans:

- **in-situ conservation**, which represents an indispensable condition for biodiversity conservation species and varieties for the preservation of typical agroecosystems, habitats and breeding conditions. One of the in-situ conservation ways is the territories of conventional management, where the import of alien to the territories species is prohibited. The in-situ conservation ways combine the problems of conservation and sustainable use local genetic animal and plant resources, conservation of local traditions of nature management, in a number of cases the task of natural ecosystems conservation (use of aborigine ungulates for grazing in steppe reservations (grazing is better than mowing, which is now being used));
- **ex-situ conservation**, which is considered to be especially important for rare

and endangered animal and plant species conservation. It helps to prevent the extinction of a particular part of their genepool. Seed bank provides long-term preservation of live-containing samples of germ plasma of a numeral amount of genotypes. Cell and tissue banks are used to preserve genepool of plants and criogenic preservation of practically any type of germ plasma.

Some comparison data are shown bellow on diagrams 7, 8, and 9 [29].

Diagram 7.

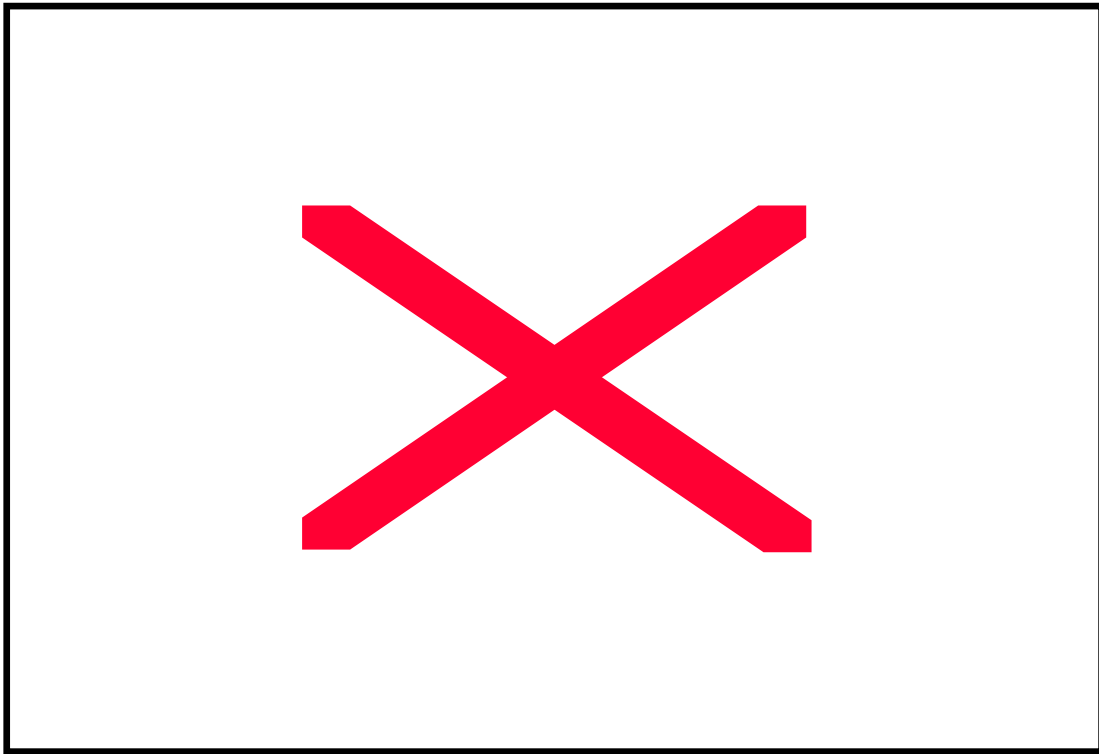


Diagram 8.

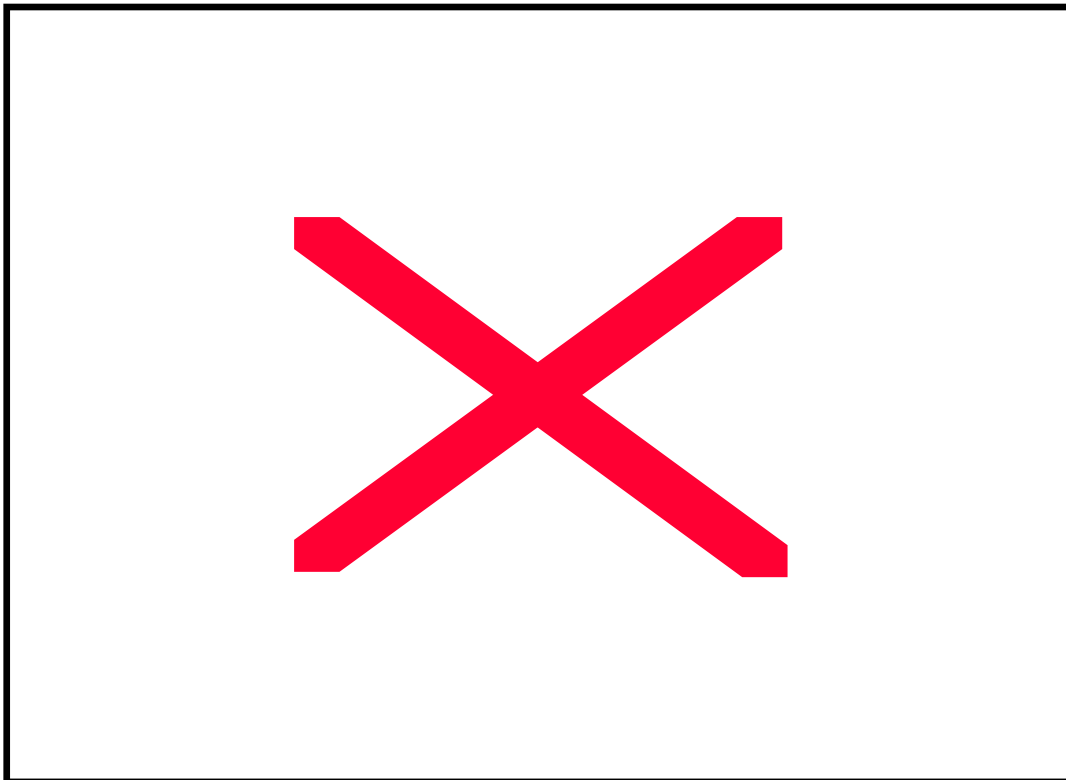
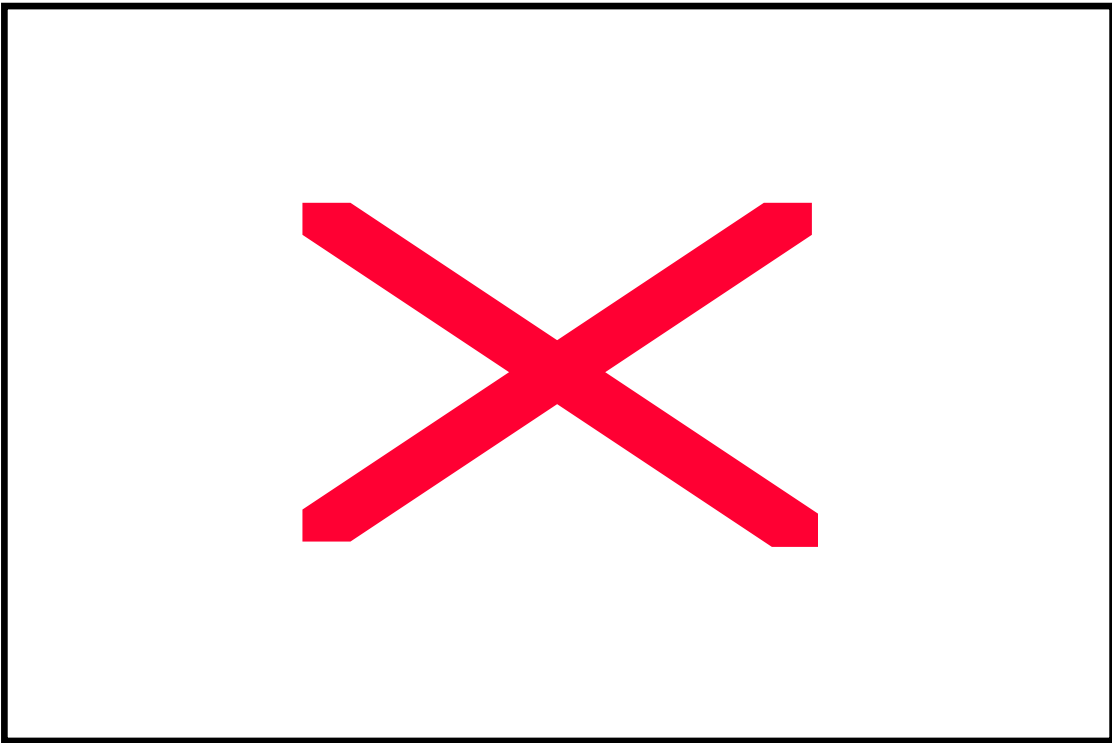


Diagram 9.



Russia. According to unofficial data, during the reformation years in Russia, the process of variety testing and selection was stopped. At the moment a number of Russian districts have deficiency problems with breeding producers and elicit seeds. There is a tendency towards renovation of plants and animal species due to import. Seed producing farms and the owners of producers become monopolies.

Wide introduction into agricultural practice of transgenetic new, and usually more productive and sustainable plant and animal species can lead to dislodgment of traditional species and breeds and to strengthening of chemically-technological anti ecological tendencies of development of agriculture.

National Biodiversity Conservation Strategy suggested the following ways to protect crop and livestock genetic recourses [24]:

- artificial breeding of natural populations;
- conservation in-situ populations of domestic animal and cultivated plants, maintenance of local populations in primary conditions of appearance and recreation of that particular species, varieties or form;
- preventing of hybridization with living changed organisms or carry of genes is important both for natural populations, and for the domestic animals and cultivated plants.

Belarus. The domestic animals by an expert evaluation are shown in republic as cattle, pig breeding develops, and during the last decades sheep breeding as well; the poultry-farming (hen, geese etc.) also takes one of the leading places in agricultural production systems. Genetic resources of different crops can be increased with the help of several

wild fruit bearing plants. The most important ones are domestic and forest apple trees, forest pear, plain cherry. All kinds of forest wild growing berries as a starting material for selection of immunity diseases, winter-hardiness, increase of the level of biologically active substances etc. [18].

Moldova. In the Republic of Moldova research in the field of biotechnologies and genetics began relatively not long ago. Till now in the Republic there is no information bank on genetic resources of the country. At the moment, the genetic resources of cultivated plants are stored in 11 research, scientific and educational institutions (storage of seeds, components of pollen and internal tissues in genetic data banks) [12, 22].

Caucasus region

Armenia is considered to be one of the centers of origin for wild ancestors of crops and livestock, and for the artificial selection of new varieties and breeds. This is based upon both the number of extant wild relatives of crop plants, and upon the number of varieties of different species occurring in the country. There are hundreds of species of wild relatives of domestic crops, such as wild ancestors of wheat, barley, rye, oats, and several fruit trees, such as grape and wild pear. These plant genetic resource have long been recognized as having unique and global importance for the conservation of agrobiodiversity. For a long period of time the country was a center for cultivation and selection of cultural plants and animals.

In the parts of the country below approximately 2000 m, conditions of low humidity and a high number of sunshine hours are favorable for a wide variety of crops. The most suitable natural zones for cropping are the steppe zone, characterized by well structured chernozem, and the semi-arid zone, with a high proportion of irrigated brown soils of alluvial origin.

Only 4.5% of agricultural land is under 'orchard crops', including grape vines, which have been of considerable economic importance. Since land privatization, these crops have been mainly produced on small farms operated by individual householders.

Approximately half of the agricultural land use comprises pastures. Livestock comprised approximately 55% of agricultural output during the 1980s, but rapid depletion of livestock herds following land reform resulted in crops accounting for 66% of output by 1993) (World Bank, 1995). By 1997 Armenia, the total number of livestock units had fallen to 594,100. This is equivalent to only 52% in 1986, with the biggest falls of the livestock population occurring in the pig, poultry and sheep population. The exception to this trend is the horse and donkey population, which has increased by 500% since Soviet times [7, 9].

Georgia is known for its viticulture and wine production. In 1980's grape and wine production was 20% of all agricultural activities and food manufacturing. During those times, Georgia was in the seventh place in the world with its tea plantation areas. However, the tea demand did not exceed 2% of all volume production. Most of it was

exported to the countries in Central and Western Europe and Mongolia.

Wheat is of particular interest to scientists taking into account the fact that the Southern Caucasus and Asia Minor are regarded as the place of its origin. There are 30 varieties and sub-varieties of wheat. Two of them - Makha and Sanduri are known to grow only in Georgia [11, 27].

Central Asia

Kazakhstan. Agrosystems of arable lands (about 29,1 million ha) are presented predominantly by monocoenosis with prevalence of kinds and sorts of plants cultivated through different ways of agro techniques. The cultivated plants in the republic are represented by numerous varieties, including Kazakhstan selection, which create intraspecific diversity of agrocoenosis. Since 1933 in the Republic there were more than 70 kinds of grain, 68 kinds of berry-bearing plants, more than 60 kinds of vegetable - melons and grounds cultures, 23 types of potatoes derived and localized. Alongside with plants from northern latitudes, there are southern warm-loving plants being grown in the conditions of green house [31, 39].

Uzbekistan. About 95% of agriculture gross domestic product is connected with irrigation agriculture. The main agricultural crop is cotton. Vegetables, fruits, grain and rice are some of the other important crops. To achieve self-sufficiency and independence from food point of view diversification of crop field pattern takes place, where the areas under cotton are decreased and the areas under grains are increased.

The biggest agricultural lands in Uzbekistan are used for pasture-grounds, which give the basis to develop sheep-breeding and astrakhan production [35, 36].

Diversity at the landscape level

The most effective diversity conservation measures at landscape level is the creation of protected areas. The republics of the former Soviet Union have inherited from the USSR the system of reserves in-situ.

Special group of landscapes is represented by ecosystems, created and regulated by men: ploughing lands, gardens, vineyards, forest-parks, soil protecting and highway forest belts, planting on technogenically-disturbed lands, reservoirs, improved pastures, agrocoenoses etc. Their diversity depends on economic activities and is determined by men.

Number of CIS countries has unique landscapes, which are under threat of disappearance – first of all, it is steppes. Steppes are the biggest natural object, which is on the verge of disappearing in Eurasia. Conservation of steppes is a priority of conservation policy in CIS countries.

Russia. In Russia steppes, more or less, have been transformed or destroyed by

humans. Today steppes are preserved as small-sized separate segments among landscapes taken under plough land, reservoirs, and infrastructure complexes. The steppes of the European part of Russia were explored from ancient times, and now they are practically completely altered (40-90 % - is ploughed). Towards the East, the steppe exploration decreases. In the East part of steppes, 20-30% are left unaltered. Without taking up extraordinary actions, the opportunity to restore steppes with their unique species diversity will be lost in the first part of 21st century.

Steppe regions are the main production bases for Russia. Russian chernozem, which is formed in steppes and forest-steppes during thousands of years, is Russian heritage. Steppe biodiversity conservation (natural and agricultural ecosystems) is necessary to preserve the fertility of this land, provision of local population with products and sustainable development of the country in whole [17, 25].

Russia has well developed net of protected areas. Federal Law on «Protected Areas» determines the following types of protected areas: federal nature reserves (territories of controlled access), including biospheric; national parks; state natural reservoirs (territories where separate species or ecosystems are preserved, with less limitations); natural monuments; dendrological parks and botanical gardens; health resorts and recreational zones.

National Strategy suggested the following ways of in-situ conservation [24]:

- conservation of rare and endangered species which are listed in Russian Federation Red Data Book;
- regulation of business around the exploited species;
- conservation and recreating of habitats, reconstruction of biotops;
- conservation of populations in protected areas.

Belarus. According to the level of man-induced natural resources transformations and the state of their biological diversity three categories of agroecosystems are distinguished in Belorussian landscapes [18, 28]:

- mildly transformed, very close to natural, but differing from them by mildly destroyed vegetation cover (fields in the form of fallow lands, natural meadows with moderate cattle pasturing and natural haying) - 7 per cent of the territory of the Republic;
- semi-natural, moderately transformed agroecosystems with a partially self-regulating regime of functioning and a low biodiversity level (improved haying and pasturing fields) - 22.7 per cent;
- drastically transformed, man-regulated with a low biodiversity level (plowed land, gardens, land used for subsistence agriculture), these are large agricultural territories - 70.3 per cent.

Ukraine. The law «On Reservation Fund (protected territories and subjects) of Ukraine» (1992) in paragraph 3 classifies protected areas and subjects. They are divided into two main groups: natural territories and subjects, and artificial objects and

complexes. The first group includes the following categories: natural reserve, biospheric reserve, national natural park, regional landscape park, reservoirs, natural monument, protected area. The second group includes: botanical gardens, dendrological parks, zoos, nature monuments of landscape architecture and gardening art. In Ukraine there is a policy of widening reserve lands and set reserves as a separate branch of nature conservation [26, 38].

Caucasus region

Armenia. The update situation of landscapes is the evidence of their agricultural overuse. The most cultivated lands are those in Shirak, Lori, and the Ararat Valley, as well as lowlands and midlands of mountain slopes. These are cultivated dry lowlands, which are characterized by high biological effectiveness. Less cultivated are those in high altitudes and slopes (Minor Caucasian ridged mountains, as well as volcanic high mountains).

Due to human interference natural landscapes of Armenia have been vigorously affected. For example, the area of forests in Armenia have been reduced by 10%. Among other crucial factors is the violation of cultivation rules for arable lands that continues to take place up to date leading to an intensive land erosion. In a number of slopes soil is completely removed, and thousands of hectares year-by-year become non-available for land-use.

The unwise use of pastures for livestock grazing resulted in some dramatic changes and degradations of landscapes. The slopes of mountains (3-50) being unevenly used for pasture of animals transformed into a tight net of serpentines and minor lowlands without any vegetation which makes 20-40% of meadows. The number of plants has extremely reduced in per square of vegetation cover [7, 9].

Central Asia

Kazakhstan. The steppe zone of Kazakhstan was transformed by activities of man the most. Expansion of ploughed lands during the cultivation of virgin lands (1954-1960) has fully destroyed the majority of main steppes types. 50-60% of dry steppes on flat territories are ploughed up. The rest steppe segments in these sub-bands, (stony steppes, steppe on salted soils) are considerably transformed as the result of overgrazing, and they considerably lost species diversity.

The fact of extinction of many natural ecosystems in forest-steppe and steppe zones in Kazakhstan calls for rehabilitation of biodiversity and recreation of lost ecosystems where the growth of many useful plants have significantly decreased. Plant layer underwent the most distraction in the foothill zone [31, 39].

Kyrgyzstan. In the Strategy and Action Plan on biodiversity conservation of the Republic of Kirghizstun the species conservation measures in-situ and ex-situ, sustainable use of biological and landscape diversity are stipulated [8, 32, 33]. In the republic at the moment there is a poli-functional system of territories and objects which

forms protected areas. However, they do not cover all the important ecosystems and are not located in all biogeographical zones in the country. Protected areas include only parts (islands) of certain ecosystems. Their territory should be expanded to provide for reproduction of the population of the most important species. The majority of species are in need of expanded territories and ecological corridors for passing to other territories - depending on the time of the year.

Practically all the main types of forests are included in specially protected territories. They concentrate the bulk of biological diversity and play an important role in maintaining ecological balance.

Unfortunately, the budget money, which has been set aside for nature reserves, all goes to pay off salary. Right now, there are no private investments, which can be used to preserve biodiversity conservation can benefit [15]. There aren't enough actions taken to support infrastructure.

Wild biodiversity in agro-ecosystems

Decrease of forest and shrub plant, ploughing up of big areas, draining water bodies and poaching cause a significant damage to the population of wild biodiversity and their habitats.

The conservation of the wild biodiversity is an important issue. This is most likely to succeed in protected areas (reserves and reservations). In addition, ex-situ conservation takes place in nurseries, seed banks, research laboratories and herbaria.

Main treats to species diversity in Russia and CIS:

- Destruction and disturbance of habitats;
- Environmental pollution;
- Excessive exploitation of natural animal and plants populations;
- Acclimatization and introduction of alien species, self-migratory invasive species, spread of animal and plant diseases;
- Chemically technological approach to agricultural management.

Russia. On Russian territory there are valuable points of view on biodiversity conservation - unique natural complexes, centers of endemism. For example, on a segment of meadow steppe in Kursk area floristic biodiversity reaches up to 100 kinds on 1 sq m.

Among the elements of wild biodiversity, which have adopted to the life in agrolandscapes of Russia, we should point out little bustard, which at the moment is a mass type of agrostepes, as well as great bustard, which prefers agrostepes than natural habitats.

The number of the only antelope in European part of Russia - saiga, was strongly reduced as the result of pasturable degradation. So, in Northwest Pre-Caspy there are 145 thousand heads in the herd, which is the lowest number in the last 80 years. The

consequence of agroecological crisis in South-east European part of Russia is the migration of saiga to highly populated regions, where they are threatened by poachers. One of the consequences of a stressful condition of herd becomes change of population structure - reduction of number of males reaching puberty that can threat reproduction.

Conservation ex-situ components of Russian biodiversity is reached through using a number of methods: collecting of cultivated microorganisms (usually related to genetic resources of microorganisms), collecting of plant and animal tissues, creating of gene and seed banks, artificial breeding and reproduction of animals, artificial plant cultivation for new introduction, collection of living organisms.

The collection of active cultures is done by research institutes of Russian Academy of Science, Russian Academy of Medical Sciences, Russian Academy of Agricultural Sciences, Ministry of Agriculture and etc. It is necessary to find to funds for the existing collection, to prevent their loss.

Botanical gardens collected sufficient collections of rare and endangered plants. Breeding of ex-situ animals in zoos, zoological gardens and aquariums includes breeding in captivity of rare species for reintroduction, breeding economically valuable species, management and breeding of animals for tradition and education. Low number of protected domestic fauna and insufficient number of zoological breeding centers is a serious problem. There is a lack of technological mess breeding of ex-situ animals for their reintroduction, as well as criobanks to preserve genomes of wild land vertebrates [6, 17, 24, 25].

Belarus. On the whole lands plowing, particularly with provisional draining, reduces the number of natural places of residence of many species of plants and animals, which ultimately results in the reduction of habitats and modification of their borders. On the other hand, in the new emerging agrocoenosis we witness the resettlement of both native and invasive species of the cultural landscape, as well as the change of their habitat [18, 28].

Moldova. Man-induced transformation of natural environment and disappearance of ecological niches of certain species of wild vegetation have affected biodiversity and reduced the numbers of certain species. Often there are no boundary paths between fields, and bushes and herbs thickets where field animals could find refuge have disappeared [20].

Caucasus region

Armenia appears to have been the source for a number of wild relatives of domestic livestock, including sheep. Since that period there is extensive evidence for artificial selection and the development of distinctive animal breeds in Armenia: the Causcasian breed of cow, native varieties of domestic sheep, 'Yerevan' chickens, native breed of rabbits ('Armenian marder'), Buffaloes bred, coypu. The following varieties and wild relatives of crops occur in Armenia: Cereals, Pulses, Fodder plants, Fruits and berries,

Vegetables and salad crops, Oil bearing plants, Wild edible plants [7, 9].

A wide range of wild plants are collected and used in Armenia, including:

- Over 200 wild plants are used for food in Armenia (such as hornbeam, and foxtail lilies, *Eremurus* spp.)
- A number of timber species are used for fuel, construction, and carpentry. Key species include oak, beech, and horn-beam.
- Around 10% of plants in Armenia are thought to have some medicinal value.

Azerbaijan. Flora and fauna support or have the potential to support many useful and valuable manufacturing. They include around 800 kinds of medical plants, 100 of which have industrial value.

Many of the varied ecotypes of the country are represented in the protected area system. Protected areas have proved effective in protecting such species as muflon, leopards and falcon as well as indigenous Iron Trees, Box Trees and Lankaran Persimmon Tree [30].

Central Asia

Decrease of natural forests and vegetation, drying out of the Aral Sea, which lead to big areas of salt deserts, cattle overgrazing, hydrological changes and such other factors lead to desertification in all Central Asian Republics. They had the most affect on Uzbekistan, Kazakhstan and Turkmenistan. Preserved territories, covered with natural and artificial vegetation can play an important role in decreasing the level of desertification.

In the desert zone, on accumulations ecosystems with nitrogen-loving plants are formed, and on secondary salted irrigated lands with silt-loving species. During the process of natural recreation of primary vegetation during 15-25 years or more it changes from annual to perennial sorts.

It is necessary to arrange activities on stabilization of already degraded territories with an perspective of their recovery there. However, the restoration process of soils in ecosystems after erosion and dehumification can take a very long time (till 50-100 years) or in some cases it is impossible [4].

Kazakhstan. At the moment in the Republic the development of desertification processes on ploughed lands happens on around 17 million. ha. On "wasted" plough land-reservoirs, abundant weed-grass vegetation accumulated, specific for particular sub-bands. The variety of accumulated vegetation is conditioned by nature of agricultural development and transformation of soils, including use of fertilizers, irrigation, methods of chemical protection from diseases, pests and weeds.

Saxauls take up a huge territory (more than 5 million ha) and belong to Forest fund. White saxauls (*Haloxylon persicum* comm.) represent the best pastures for year-round

usage. Unfortunately, they are being cut down for fuel, that results in deflation of soils [31, 39].

Kyrgyzstan. In the territory of Kyrgyzstan the riches of flora and fauna depend on the altitude. In the whole the Republic has favorable natural environment. During its long history the country repeatedly became the center of species formation for different groups and it appeared along the migratory paths of different regional floras and faunas originated in other parts of the Eurasian continent. On the Kyrgistan territory more than 200 species of medicinal plants are present.

However, permanently intensive process of anthropogenous environmental impact precludes the conservation of many animal and plant species in natural habitat. The development of high-mountainous zones lacking snow for cattle pastures has resulted in outcasting the wild animal species from their natural habitats and became a reason of reduction of their reproduction. Smashing of masonries eggs of scotomas has resulted in sharp reduction of steppe bird number. The certain species of wild medicinal plants are exterminated.

Farming and economical development of new areas (semi deserts, water-marsh lands), wide irrigation activities (specially in Issik-Kul, Chuiskaya valleys and southern regions of the country) have resulted in reduction not only vegetative layer with its rich structure, but also habitats of wild birds, mammals, such as badger, fox, musk-rat, steppe grapnel, steppe polecat etc. Uncontrolled use of marmots decreases the number of its population. It has resulted in migration of many animal species from one biocenoses to others, disturbance of biological balance and spread of infectious diseases.

Reduction and aging of forests, chemical forest plantation treatment, forest fires, 100% collecting of nut and economic development of mountain forests and wild berries have resulted in disturbance of their natural recovering, decreasing of number of useful insects, birds, wild animal species (bear etc.) and plants.

Continuing drying of climate and extension of a cultivated landscape determine an isolated location of the high-mountainous country surrounded by deserts and intrusion of species of southern origin, and also increase of the portion of species, typical for disturbed, natural and anthropogenous (created by the man) ecosystems [15, 32, 33].

Uzbekistan. In National Strategy ... [35] is noticed, that the existence of natural vegetation prevents or lowers soils erosion in all its forms. It is especially important for preventing sel in mountain regions, which cause big damage. On flat territories natural vegetation plays an important role in slowing down of surface wind and thus preventing wind erosions on irrigated fields and other land segments.

Traditional knowledge of agrobiodiversity

Russia. Agro facilities of pre-revolutionary Russia were extensive, and technologically outmoded. Thus the design of soil processing instruments corresponded not only to the properties of soils of different regions of Russia, but also took into the account ecological

conditions of each separate processed field. They said: " Each field loves its own plough ". For example, in Vladimir Opolie, on soils with rather sturdy humus horizon of plough were applied, they had more steep blade allowing to process soil deeper and to make full a revolution of seam.

One more positive example of conventional agriculture is conserving forestry. Forest bands are skeletons of agrolandscapes, they serve as corridors for many kinds of organisms and ecological net elements. A special attention is given to creation of ecological network strategies on biodiversity of Russia and Ukraine.

Changing of agriculture conducted during the Soviet period in the South of Russia, the replacement of conventional species agricultural animals was one of the reasons for desertification in the Region. The transition to sustainable use of natural resources in these regions should be implemented based on returning to ecological niche of adapted conventional species of the domestic animals, recovery of stock of unique species of Kalmyk fat tail sheep, Kalmyk camel, Kalmyk and Bashkir horse. The transition to conventional nature management and cattle breeding in Far North of Russia is a vital issue [3, 13, 21, 23, 25].

Kazakhstan. The spirits of wild nature had a big importance in the lives of kazakhs. Close contacts with nature lead to ecological thinking and respect for nature's laws among the people.

Traditionally in Kazakhstan there were tree types of agriculture: migrational, partially migrational and settled way of life, including mowing and grain farming. Migratory cattle breeding demanded certain knowledge and skills. To prevent soil erosion and to rationally use pastures, herds usually did not exceed 400-500 heads. Dry manure was used to heat the living space. In permanent settlements there were spring land preparations, ploughing and planting of grains. Mostly it was wheat, millet, barley and oats [31, 39].

Kyrgyzstan. People in Kyrgyzstan carefully treated the cattle grazing grounds, to preserve grass, they grazed mixed cattle (small-sized and large horned cattle, camels), have used migration on vertical zones, occasionally changing pastures and saving grass for winters, on camping usually they didn't leave behind domestic waste, carefully treated springs and water pools. They traditionally spared wood vegetation, using pressed dung for fuel. In places, where they grew grain, corn and other cultures, they cleaned springs, built of irrigation canals [15].

Policies, regulatory mechanisms and the implications of agricultural development plans on agrobiodiversity management

The Action Plans and Strategies of the CIS countries include a lot of similar measures, although there are differences in the scale of the problem elaboration. Depending on the main ecological problems of the region and economic priorities several different basic directions of the strategies are envisaged in the national plans.

Many national environment and biodiversity conserving programmes and strategies in

CIS countries contain relatively complete and scalene measure plans on preventing of ecosystem degradation. However in a number of cases these are the declarations of intentions. The implementation of these programmes is hindered by economical difficulties and nonperfection of state authority mechanisms. The state budget (the same as in private sector) does not have the capability to fully fund the nature conserving programmes. The funding of the government organizations, which is entrusted to control the conservation and rational use of natural resources, is extremely limited.

The advantages of Russia before other CIS countries in implementing sustainable agriculture management principles are defined by the territories, which can be used in agriculture, and by the diversity of natural conditions in those areas; by presence of the high quality specialists in agroecology.

Russia. National Biodiversity Conservation Strategy of Russian Federation, which will be finished in 2001, envisions provide for the following priorities and approaches to biodiversity conservation [24]:

- *Mainstreaming ecologically safe agrotechnologies, transformation from chemically-technological to adaptive type of agricultural development.* Here, the following actions should be taken: follow agrotechnologies, which is adapted to regional and local features of soils and climate; usage of plant and animal species and kinds, which are adapted to the local ecological conditions; maintenance and recovery existing forest belts (Stavropolie, Krasnodar Territory (Krai), Rostov Region (Oblast)); designing of ecologically sustainable agrolandscapes.
- *Preservation measures for soil ecosystems and their biodiversity.* In order to do that, it is necessary to ensure rational ratio of agricultural lands, stressing the protected areas. In different types of territory use (agricultural, meliorative-agricultural, pasture-cattle-breeding, forestry etc.) all economic and nature protection measures should be strictly differentiated according to regional features of topsoil.
- *Create a single governmental policy in the field of soil conservation.* Mechanism modification of interdepartmental coordination and approval of a comprehensive action plan in soil use and conservation.
- *Create a single governmental soil protecting monitoring system.* Developing of sections of a Land Cadastre of Russian Federation and subjects of Federation, related to protected soil objects.
- *Include the criteria of soil protection into the planed system of protected areas.*
- *Creating of soil reserves and soil natural monuments.*
- *Issuing Red Data Books on especially valuable and rare soils and their biota.* Include protected soil objects into management of the Ministry of Natural Resources of Russian Federation for organization of their straight line and indirect protection. Methods in-situ in the species conservation programmes.
- *Create a network of protected areas.* Due to highly explored steppe zones,

preserved areas of natural ecosystems can be preserved only as an ecological net. It is necessary to create new nature reserves in bordering regions (at administrative borders, or borders between different countries).

- *Widening of functioning diversity of protected area types.*
- *Forest ecosystem conservation measures.*
- *Setting up new field protecting forest bands (West-Siberian sector, Central-Selenginskaya trench in Buryatya), anti-erosive forest and bush bands (Central-Chernozem regions)*
- *Activities to stop sand formation in dry steppes and semi-arid territories (Buryatiya, southeast Stavropol, Kalmykia).*
- *Prioritized widening of protected areas system in the steppe zones.*
- *Protection of steppe ecosystem territories and their species diversity on the territories of military polygons.*

In the Federal Action plan on implementation of basic direction of agricultural production policy of Russian Federation for the year 2001, among other points has (<http://www.aris.ru>):

- Federal project development of “Increase of soil fertility during 2002 - 2010 years.”
- Activities on providing agroproduction complex with cattle based on financial leasing.

Belarus. Biodiversity conservation measures in the agricultural regions of the Republic will have to be developed in the following directions [28].

- Quality improvement of agricultural territories as animal and plant habitats through ecologization of their planning, combination of annual and perennial plants;
- Use of soil processing methods, which cause the least destruction and erosion, limiting an offset of fertile layer beyond the agricultural lands;
- Maximum prevention from erosive destructions and soil degradation, which increase the area of wastelands and which lead to exploration of new areas with natural plant life;
- Create new protective devices for agricultural machineries to avoid animal death in agrolandscapes;
- Put quotas on the use of toxic for living things agro chemicals, following the techniques of fertilizer application, avoid chemical dispersion by the means of aviation.

Moldova. The biodiversity issue is addressed in the National Environmental Strategy and Action Plan, which were approved in 1995. National Biodiversity Conservation Strategy

has conservation, restoration and rational use of the country's biodiversity as their goal, are currently in the stage of being developed [22].

The main measures for biodiversity conservation suggested in the official documents:

- Implementation of policy on nature conservation in all fields of economy;
- Public awareness on basis of ecology;
- Detection of ecological problems and drawing internal and external sources to solve them.

Ukraine. To stop further environmental degradation in Ukraine, State biodiversity conservation strategy is being developed [38]. To reach the strategy goals, it is suggested to further development of legislative base, concerned with conservation and use of natural resources. Due to this reason there were suggestions to change and add to the legislation, which relates to land, forest and water resources, as well as mineral, animal resources and resources in natural reserves.

Solving scientific, technical and other problems in the field of biodiversity conservation will help to create a consulting organization, which will include the officials from the applicable central and local executive bodies, leading scientists and NGO's representatives.

To conserve biodiversity, sustain its restoration and use, some research actions will be attempted. The methodological basis for this research will be the improved monitoring system, including census of natural resources, management of cadastres based on data banks and systems of geoinformation on biodiversity. To improve the quality of ecological education formation, information and educational centers will be created on the reservoir's fund territories.

Financing of biodiversity conservation measures will be done through funds of firms, entities and organizations, state budget of Ukraine, budget of autonomous Republic of Crimea, local budgetary funds and other sources, taking into consideration the economical capabilities of the country. The main source of financing the nature conservation activities should be money, which were received from use of natural resources.

Financial resources will be used to develop ecological network, which will do scientific research and monitoring, ecological education, implementation of particular biodiversity conservation projects in the regions, which from this point of view have a specific value.

Caucasus region

Armenia. Government of Armenia does not have a specific policy on land and land use, and this deficiency is seen as an impediment to the development of co-ordinated strategies for sustainable use, conservation and protection of land resources. Current policy on agriculture is aiming to raise the efficiency of farm production. This policy, which was formulated with the direct support of the World Bank, emphasis on market liberalization, privatization of services to farmers and of agri-processing enterprises, and of elimination of remaining subsidies to agricultural production. However, the inference

may be drawn that these reforms will lead to greater security of land tenure and improved efficiency of land use, which should, in turn, lead to better management and conservation of land resources [7].

Azerbaijan. The main attention in Azerbaijan is paid to the protection of environment from the influence of oil extraction and related production, preservation of the population of sturgeon in the Caspian Sea. There are certain trend to identify and pursue low-cost cropping techniques or other methods to restore soils, including reduction salinity and swamping.

The State need some legislative improvements – ratification of priority convention. Long term biodiversity conservation strategy in Azerbaijan, in particular modification of management and conservation of forests, preservation and restoration of soil fertility, has to focus on improvement of financial and technical support of the activities [30].

Georgia has joined the agreement on biodiversity in 1994. After joining the agreement, Ministry of an Environment of Georgia and a non-governmental agency "International center of recovery of species, whose existence is under a threat ", in cooperation with the United Nations Environmental Programme (UNEP) [5], have initiated the programme "Study of biodiversity in Georgia ".

At present time legislation, based on which land privatization is being carried out, and infrastructure of land use does not take into the account the mechanism of land restoration and measures to prevent soil erosion.

Central Asia

In the Republics of Central Asia main measures relate to problems of irrigational farming, soils salinization, contamination of environment by pesticides, the state of the Aral Sea [4].

Kyrgyzstan. In June 1996 Kyrgyzstan has joined the Convention on Biological Diversity.

Tajikistan. To reach the sustainable use of natural resources, to maintain the optimal conditions of land, forests, pastures, water resources, air, to conserve biodiversity, to improve people's health, in August 1997 the government adopted the State ecological programme of Republic of Tajikistan for the 1998-2008 period. The programme supports and original system of ecological division and covers 11 territories of natural complexes. The programme includes the description of stabilizing and nature improving mechanisms, and ways to improve each natural component separately.

Right now, in Tajikistan there are many intended measures on development of a National Environmental Action Plan (NEAP). In particular, many data and theme information on

the state of the environment, on environmental issues and rational use of natural resources were collected. To complete the development of NEAP it is necessary to find a sum of about 100 000 dollars [40].

Turkmenistan. Important acts include the ratification of the Convention on Biological Diversity (1996), Convention on combat of desertification (1995), Conventions on Climate Change (1995) and Ozone layer (1993). The ratification of CITES and RAMSAR Conventions is currently being under consideration. Turkmenistan along with other countries is working on Regional Environmental Programme in Caspy. Beside that, there is a GEF Project “Use of water resources and environment”, directed to the solving of problems of the Aral Sea.

Uzbekistan. National Strategy and Action Plan are the basis for implementing the governmental strategy. The programme includes a ten-year strategic plan, but will be completed by the first five years. The State Biodiversity Commission is responsible for implementing and monitoring the programme actions. The Academy of Science is the main organization responsible for consulting, research and monitoring [35, 36].

The main goals and tasks of the official documents:

- to create a sustainable system of protected areas, representing biodiversity of Uzbekistan ecosystems, taking up no less than 10% of the country;
- to create an organized and legislative base to develop and manage a widened and reorganized system of protected areas;
- to evaluate the transformations needed for efficient control of the widened and reorganized system of protected areas and to develop the programme of implementing the necessary transformations;
- to create a centralized database on biodiversity, which will be accessible for the interested people.

Constraints to the use of sound policies and practices

In the former republics of the USSR before the beginning of 1990 agricultural land belonged to collective farms. During last decade in some CIS countries land has been partly divided between farms. In other states this question is under consideration. Private land management lead to new legislative and social conditions for land use. It is still uncertain, what affect this will have on biodiversity: difficult economic conditions and lack of resources for land processing decreased the intensity of argoactivities. However, the absence of effective control for use of lands, which are in private property, can have more serious environmental consequences in the future.

Agricultural management in CIS countries takes place in a difficult economic conditions with limited access to agricultural inputs, poor credit terms, limited extension advice and usually very limited market for products.

The obstacles in the way of solving agroecological problems in Russia and CIS countries are as follows:

- inadequate mechanism of law enforcement;
- inadequate implementation of proprietary rights to land;
- crisis state of economy, particularly of agriculture;
- focus on resources production industries;
- poor knowledge among the local population in the main aspects of environmental protection,
- limited awareness of rights and responsibilities by land users;
- lack of clear policy and planning framework on land use.

Examples of best practice

Russia. Despite of all mentioned negative anthropogenous effects on soil, in arable fund of the country soils with high substantial or potential productivity dominate. The problem is in putting in order its exploitation.

One of the positive examples of integrating ecological ideas into agricultural sector is a programme approved by the Decree of the President of Republic of Kalmykia - the Presidential target programme "Restoration of conventional pasture animal industries" (2001 - 2010). Its main goals is: to preserve the land resources of steppe zones in the South of Russia; to create conditions for sustainable development of agrolands based on restoration of rational use – conventional pasture animal industry, revival of unique agricultural Kalmyk animal breeds. As a result pastures will be conserved and restored, the further desertification predicted. One more positive example on combat with desertification of lands is the National Action Programme of Dagestan Republic.

An evident achievement of agro-ecology in Russia is the application of soil protective systems of land cultivation. The introduction of an anti-deflator system of land cultivation in steppe regions is connected with the name of A. I. Baraev, who has creatively reviewed and adapted the experience of Canadian farmers to the conditions prevailing in Russia, Kazakhstan and Ukraine. The application of this system has made it possible to prevent a large ecological disaster caused by blowing dust, which started to emerge on virgin lands of steppe regions in the 1960s [3].

One of the examples of farms which actively introduce scientifically justified nature conservation system into agricultural production system is collective farm "Lenin's iskra" of Yadrinsky raion of Republic of Tchuvashiya (head of the farm - A.P. Aidak). The bodies of state environmental control have approved this experience; relevant materials have been sent to the territorial nature conservation organizations for studying and wide dissemination. This collective farm has received the status of a basic pilot farm for environment protection and sound use of nature. Re-training of the staff of these territorial bodies has been organized directly at the farm's facilities.

In collective farm "Dawn" in Arzgursky District of Stavropol Region (Oblast) the minimal soil processing with preservation of vegetative oddments during last 10 years provides productivity of winter wheat at a level 3 tons/hector. The agricultural artel "Podgornenskaya" in Georgevsky region, using aggregates AKP-5, AKP-2,5 and chisel

plough IF - 4,5, collects grain crops from 3.4 up to 4 tons/hector. The applying of zero soil processing has allowed farm "Novomariievskoe" in Shpakovsky District to receive a crop of winter wheat 4.1 tons/hector.

Scientists from Voronezhsky Agrouniversity developed a new ecological model of nature and soil conserving agriculture, which is implemented in collective farm "Druzhba" in Kantemirovsky district, in Voronezh Region (Oblast). Its main idea is rational organization of agricultural steppe landscape with forest bands and bush partitions and soil protective processing system, which will allow to annually achieve high sustainable crops and stop the erosion [17].

Protective foresting is the essential factor of sustainable agricultural management. Foresting has reached a special scope in 1948-1953, when forest band were created on the area of about 2,2 million hectors, but the majority of them has perished. Creation of protective forest bands was continued in 1987 and made up 5 million hectors. Now expansion of forest bands makes 11 thousand km [23].

On plowed fields where water erosion is observed an anti-erosion system of cultivation was applied which gradually developed into contour-land improvement system of soil cultivation, while the latter - into an adaptive-landscape one. Unfortunately, the adaptive-landscape system is in fact at the initial stage of practical development and verification of the efficiency of its elements in actual land cultivation. This system most fully reflects the ecological principles of land cultivation, which are so vital today; therefore we are hoping for its improvement and introduction in the nearest future.

The practice of economic motivation is aimed to prove economic advantages of ecological agro-production, as well as to develop clear practical recommendations in the field of ecological land cultivation and animal husbandry. Inter-regional public organization of ecological land cultivation "Econiva" supported by Heinrich Boll and Leben and Umwelt Funds develops and introduces a system of voluntary ecological certification, conducts active work aimed at disseminating the experience of ecological land cultivation and in particular issues its own magazine.

The practice of public awareness raising. The most vivid examples of practical solution of these issues include regular publication of Steppe Bulletin which is a quarterly magazine devoted to the practice of conserving steppe ecosystems and non-destructive use of nature in steppes. Starting from the year 2000 a similarly focused magazine "The Open Country" is being published in English.

Moldova. Moldova is planning to take part in the creation of trans-boundary Moldova-Ukrainian ecological network. There are many difficulties in its formation: the existing net of nature reservoirs is not sufficient enough, there is little relation between the Econet elements, some ecosystems are poorly represented and do not have a sufficient protection.

Caucasus region

Georgia. Some small projects were directed to support of a gardening among the

townspeople (Rustav, NACRES and others). Association of biofarmers "Elkana", begun its activity in 1993 from nine farms with total area of 900 ha and currently grew up to 150 farms and 5 great of farms (1200 ha), its main task is the development of organic farming. Positive local outcomes of the activity of similar kind are already evident, but overall there is not enough data to analyze social and economical impacts of these changes. Some experts suppose, that, by taking into the account the condition of agricultural quadrant the integrated technologies are most adequate.

Central Asia

In the framework of international programme on support of joint research on global cattle breeding of Central Asia from 1997 a project «Integrated methods for cattle breeding and pasture conservation in Central Asia» is being developed.

UNEP started a project, which is directed to strengthening abilities of Central Asian governments in planning the process of biological diversity conservation and activating their participation in implementing the All-European policy of biological and landscape diversity. While supporting IUCN-ERO there is a formation of the subregional programme for countries of the Central Asian Region.

UNEP financially supported the activities on making the text for Regional Convention on nature conserving cooperation in the Caspian Sea region.

Kyrgyzstan, Kazakhstan and Uzbekistan participate in the international project of the Global Environmental Facility on conservation of west of Tian-Shan biodiversity.

Kazakhstan. One of the examples of best practice in Kazakhstan is the creation of ecological net. First of all, forest ecosystems have to be included into the ecological net of the Republic, the creating of which encounters many difficulties, related to financial and bureaucratic issues, as well as to imperfection of legislative base [16].

Kyrgyzstan. As positive biodiversity conservation examples activities on artificial forest resources restoration can be considered, especially those in the fur-tree zone; reacclimatization and acclimatization of animals and plants; liquidation of a redundant network of highways and broad usage of animal-drawn transport; ecological tourism.

Positive aspect in conservation and rational use of biodiversity in Kyrgyzstan is the rational use of pasture resources by regulation of animal grazing, set periodic rest and deadlines of use according to years and seasons, organize sheep pasturing in order to fertilize pastures.

Results and lessons learned

Characteristic way of development of the former USSR republics in the past was the unbalanced approach, in which production, especially agro production, was given big attention without taking into the account the nature conserving issues and resource use,

ways which provide their restoration. The existing farming systems, without any changes, can not satisfy the demands of countries in the future. On top of that, these methods permanently damage the environment. In some cases, the physical limit has been reached in using some of the natural resources, for example water in arid regions.

Other important outputs on sustainable agricultural management to conserve biodiversity:

- specialization and spread of agricultural branches, water and forest farms according to agrolandscapes and natural ecosystems;
- setting up protected areas and artificially created ecosystems to recreate and conserve biodiversity;
- infrastructure and farm service modification in production, processing, storage and sell of plant and animal products.
- evaluation of different model farms among agricultural producers in new socio-economic conditions, taking into consideration biodiversity conservation demands.

Guidelines or policies that have resulted from this experience

Russia. The normative legal base on biodiversity conservation in Russia develops on the basis of the international agreements and conventions, in which Russia takes part. Fundamental laws, which are very important in natural conservation - "On environmental protection" (1991), "On animal world" (1995), "On protected areas" (1995). The legislative basis is in the stage of active formation and meets the main requirements of the Convention on Biological Diversity [6].

At the moment in the State Duma is the draft federal law "On soil conservation", which is invoked "to regulate relations in the field of soil conservation and is directed to prevent its degradation and pollution in order to maintain the soil fulfillment of ecological, natural regulation and economic functions".

Belarus. The concept of ecological policy in Belarus is defined by the Low on Environment Conservation (1992), Land Code (1991).

Moldova. In Moldova a whole block of laws on environmental and biological diversity conservation is adopted. Main laws on biological diversity:

- Law on fund of natural territories, protected by state (1998);
- Law on fauna (1995);
- Concept of hunting development (1998);
- Law on urban and agricultural green territories (1999);
- Law on environmental protection (1993);

- Law on natural resources (1997).

It is necessary to revise the existing environmental legislation in the issues concerning biological safety of the country, as well as the attitude towards use and management of genetically modified organisms.

Ukraine. After the declaration of independence of Ukraine in 1991, the Government of Ukraine has developed environment policy, directed to optimal management model in this field. The key elements of Ukraine environmental policy:

- Ecological standards, tolerance and conformity.
- Fines for pollution and environmental laws.
- Environmental overview.

The main law in Ukraine is Low on Environmental Conservation (1991), that became legislative base for nature conservation in Ukraine. Some other laws:

- Law of Ukraine on Reserve Fund, 1992.
- Land Code of Ukraine, 1992.
- Law of Ukraine on Environmental Evaluation, 1995.
- Law of Ukraine on Fauna, 1993.
- Law of Ukraine on Flora, 1999.

Caucasus region

Armenia. Article 10 of the Constitution of Armenia states “the state shall ensure the protection and reproduction of the environment and the rational utilization of natural resources”. GOA policies on environment, agriculture can guide strategies for land development and conservation.

The Land Code of 1991 lays down the conditions for land ownership and leasing, and the rights and obligations of the right holder. The Law on Real Estate (1996) strengthens the rights of the landholder, and defines rights of easement and mortgage conditions.

During the last decade a number of new biodiversity conservation laws in Armenia were approved, including the rules for protected areas (1991), statute about forests (1994), bill on principles of environmental protection (1991), bill on environmental impact assessment (1995). The fundamental laws and installations on biodiversity conservation and usage of natural resources in Armenia are more detailed in the First National report [7].

Central Asia

Kazakhstan. Main nature conserving documents of the Republic are the following laws: “On Environmental Protection” (1997), “On Protected Areas” (1997), “On conservation, use and restoration of animal world” (1993), Forest Code (1993). The

legislative system is currently in the process of modification and is being brought to the level of international nature conserving acts.

Kyrgyzstan. Ecological legislative system in Kyrgyzstan, related to biodiversity, includes more than 10 laws and 70 normative legislative acts, which have executive power. They regulate a broad spectrum of attitudes, related to biodiversity. Currently the local law on nature conservation is being actively reformed and will be reorganized with the reference to new economic relations. The law on fauna protection is in the stage of approval, the law on flora protection is currently being developed.

Normative legislative acts:

- Law on Environment Protection (1991).
- Law “On protected areas” (1994).

Tajikistan. The main legislative documents in the field of nature and biological diversity conservation are as follow: The Constitution of Republic of Tadjikistan, Law on Environmental Conservation (1993), Law on conservation and use of fauna (1994), Law on Protected Areas (1996), Forest Code (1993) and other normative documents, including the Law on state sanitation (1994), Law on resources (1994), Law on air protection (1996), Land Code (1992), Water Code (1993).

Turkmenistan. To conserve restore the animal world in Turkmenistan it is necessary to develop a scientific programme [2]. Plan species conservation follows the Law on rational use of plants. The legal status of protected areas is determined by the Law on nature conservation and by the Law on protected areas. There is also the Law on mineral resources, Law on agricultural communities and Law on environmental assessment. These laws represent first steps. A further installation activity of effective buffer zones, which can control the activity of men, is necessary. The governmental environment evaluation should be brought up to the international standards.

Uzbekistan. At the moment the ecological safety of people is guaranteed by the Constitution of the Republic of Uzbekistan. Law on use of animal world (1982); Land Law (1990); Law on Environment Conservation (1992); Law on Protected Areas (1993) were passed as well.

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