Biodiversity of Agricultural Lands in Russia: Current State and Trends

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Content

The report reviews a specific, usually ignored aspect of agricultural lands existence - their role in biological and landscape diversity conservation.

Agricultural fields and other lands of agricultural significance comprise a considerable part of Russia's territory while their importance for the national economy and provision of its genuine independence and cultural identity is disproportionately high. At the same time these lands support the existence of rich biological and landscape diversity. Many biological species, ecosystems and even types of landscapes exist in Russia almost exclusively on agricultural lands. Moreover, agricultural lands' biodiversity directly depends on farming methods and land use peculiarities. And on the other hand agricultural value of fields (including soils fertility) is to a considerable extent determined by their current and former biodiversity. However, this fact is forgotten by society and is not taken into account either in political and administrative decisions in respect of Russia's agricultural lands or in their current use.

The report summarizes the impact of agriculture on biodiversity and the usefulness of biodiversity for commercial use of lands. Particular attention is given to the current situation and trends witnessed in the last decade. In accordance with the objectives of the report the political aspects of the problem of agricultural lands' biodiversity conservation are identified; most of them are due to the fact that this problem is completely misunderstood by society. Finally, the report outlines the position of environmental non-governmental organizations on the issue of agricultural lands' biodiversity conservation which was mainly expressed at the Pan-European High-Level Conference on Agriculture and Biodiversity (Paris, June 2002).

Agricultural Lands

In Russia, as in all other CIS countries, agricultural lands are identified by the law. All the lands in the country are divided into seven categories according to their target usage (under the RF Land Code, Art. 7), among which lands of agricultural designation amount to about 15 per cent. In their turn these include: *a)* agricultural lands; *b)* lands occupied by access roads and communication lines; *c)* lands covered by trees and bushes vegetation designed to ensure protection of lands from the impact of adverse (hazardous) natural, men-made and technogenic phenomena; *d)* lands occupied by closed water pools; and *e)* lands under buildings, constructions or installations used for production, storage and primary processing of agricultural products (RF Land Code, Art. 77). Of particular significance here are agricultural lands which occupy in Russia nearly 222 million ha (as of 1999). Under this term the RF Land Code understands lands directly used (or capable of being used) for the production of agricultural output.

The legislation in force limits the use of these lands are to agricultural production and its direct support alone forbidding all other types of their usage. These restrictions apply to all the lands of agricultural designation regardless of the form of property to such lands. At the same time non-use of agricultural lands is officially forbidden. Federal legislation envisages sanctions for inadequate use or non-use of these lands - up to withdrawal of such a plot of land (under the court order).

In contrast to other categories of lands the bulk of Russia's agricultural lands is formally privately owned (more than 62 per cent; 138.1 million ha out of the total area of agricultural land amounting to 220 million ha) and municipally-owned. In terms of operational land management (current decision-making) and its direct usage the picture looks somewhat different - the bulk of agricultural lands is managed by the elected bodies of small-scale groups (municipal entities of rural settlements and associations of land share owners - stock societies, agricultural production cooperatives, etc.). Only 20 per cent of these lands are managed more or less

independently by a private land user (owner or lessee)(and excluding leasing - less than 12 per cent) (State Report.., 2000).

One of Russia's peculiarities consists in the separation of forest lands from agricultural ones and of forestry from agriculture. The overwhelming majority of forests in the country are owned by the state forming the State Forest Fund. Mass cultivation of forests on agricultural lands is also considered as a non-targeted usage and is not allowed (except for field protection forest strips establishment). Accordingly the law also forbids the use of forest lands for commercial agriculture.

The possible nature of usage of each particular plot of land (as plowed field, pasture land, hay field, etc.) within the framework of the lands of agricultural designation is determined according to the land use pattern which is usually reviewed once a decade (in fact such a review is conducted less often) (the RF Land Code, Federal Law on Land Use Organization). In practice this restriction applies only to the transformation of plowed fields into fallow or pasture land. The land owner or user is usually required to request a permission from a local government body which passes a relevant normative act. The legal foundations of this pattern are relatively shaky but it actually exists in many Russia's agricultural regions.

For the survival of wild animals and plants the distribution of fields within agricultural lands is of particular importance. In the main agricultural regions of Russia one can identify four predominant types of such distribution which are dictated by natural and historic reasons rather than modern social and economic factors.

1. Prevailing large fields of cereals, corn and sunflower divided by geometrical net of man-planted and supported narrow forest strips or narrow boundary paths occupied by weed plants. Natural ecosystems are sprinkled with this matrices on the slopes of gorges, along forest strips edges, in near-valley low sands, around lakes, etc. Large sizes of fields (average field size amounts to 250-400 ha) correspond to large land areas allocated for the use of a single farm (with the average size of 5 000-10 000 ha). Animals survival requires that the internal areas of the fields are not easily accessed by people and are visited only in the course of technological operations conducted several times a year. After being converted into fallow lands these fields for a long time remain at the early stages of succession since their invasion from the outside by plants with late succession stages is complicated by the large size of fallow land. As fallow lands these internal sections of the field turn out to be even less accessible to people. This type is typical of the steppe zone. It is widely represented in Rostovskaya, Orenburgskaya, Samarskaya, Saratovskaya and Omskaya oblasts, in Stavropol'sky and Altaisky krais, etc.

2. Prevailing arid pasture lands usually established on sands and saline lands. Cereal fields are sprinkled with these lands tied to landscape lowerings or irrigated areas. Pasturing is usually unrestricted but organized by watering places distribution. This results in the emergence of territories rarely used by cattle together with the areas of increased pasturing load (near ponds and breeding camps). In general landscapes are dominated by semi-natural grasslands. This type is typical of the

semi-desert zone and partly of the dry steppe, e. g. in Republics of Kalmykiya, Tuva, Astrakhanskaya and Volgogradskaya oblasts, and Altaisky krai).

3. Fields of different sizes and forms alternate with the same heterogeneous blocks of forest (both with the area from dozens to thousands ha). Usually other semi-natural ecosystems are also tied to forest edges such as grasslands, bushes, grass swamps, etc. The ratio of plowed field and forest land varies approximately within the range from 1:4 to 4:1. Forests are usually characterized by a high level of fragmentation and unevenness and in most cases are entirely accessible to and usually visited by people and are usually used for cattle pasturing. At the same time due to the presence of forests (some of them belong to the Forest Fund) the share of semi-natural ecosystems within the landscape turns out to be relatively high. This type is typical of the forest-steppe zone, e. g. in Penzenskaya, Ul'yanovskaya, Chelyabinskaya, Kurganskaya, Omskaya and Novosibirskaya oblasts, Republics of Tatarstan and Bashkortostan, etc.

4. Fields and meadows previously covered by forest occupy 30-50 per cent of the territory while the rest lands are covered by forests the majority of which belong to the Forest Fund. Forests are frequently represented by large blocks and up-river and other wetlands are typical. Biodiversity of this territory mainly ensues from forests and wetlands (other than agricultural lands) rather than from agricultural fields, although many species use agricultural fields as important or even main habitats. This type is typical of humid regions of Russia, agriculturally developed as early as in the 13-15 centuries in Moskovskaya, Ryazanskaya, Pskovskaya, Nizhegorodskaya, Novgorodskaya, Tul'skaya oblasts, etc. (see Table 1).

Agriculture for Biodiversity

Agricultural practice and the ensuing agricultural landscapes in Russia provide some important opportunities and advantages for biodiversity conservation and certain species and ecosystems existence and survival.

1. A set of species, communities and ecosystems exist predominantly or exclusively on agricultural lands.

For example, such ecosystems as some varieties of plains and many variants of mountain steppes, all varieties of near-gorge blocks of forest, diversified thickets of mesoxerophite bushes of the steppe zone, as well as the bulk of lowlands grass-swamps and relic up-river wetlands of the Western Siberia, salt-wort deserts on waste saline lands located in the most northern part of Eurasia (Pre-Caspy and Western Siberia) are preserved today in Russia only on agricultural lands. Accordingly those varieties that are endemic to each of these ecosystems also occupy only agricultural lands.

According to preliminary estimates more than 6 000 species of plants, about 100 species of mammals, 150-180 species of birds and thousands species of insects and other invertebrates are connected with grasslands. Many of such species (including dozens species of vertebrates, hundreds species of plants and invertebrates) are limited in their area distribution to the territory of Russia and its neighboring countries of the former USSR - Ukraine and Kazakhstan. These species are undoubtedly of particular interest for Pan-Europe since they represent a unique element of its biodiversity. At the same time other species should be of special significance to it, particularly those species whose settlement area covers other European countries as well where these species are considered rare and endangered and the most viable populations of which exist in Russia (or other countries of the former USSR) and are tied mostly to agricultural lands. Examples of such species include such plants as Artemisia laciniata, Krasheninnikovia ceratoides are being protected in some European countries (for instance in Austria and Spain) (Blasco-Zumeta, Rivera, 2001; Retzer, 2002), but being common in Russia and Kazakhstan. Another species, such as Cram-

be koktebelica, Anthemis trotzkiana are equally rare and protected both in European countries (included in the national lists and/or Annex I to the Bern Convention) and in Russia and Ukraine (included in the National Red Data Books). Similar situation exists with many other animal species. For example, such species as bustard (Otis tarda) and little bustard (Tetrax tetrax) live in many European countries, are considered rare everywhere and are in need of protection (included in the IUCN Red List and Annex I to the Bern Convention). But only populations of these species in Russia, Kazakhstan and Ukraine, although being endangered, can be regarded as donors in respect of European ones (except for the Iberian peninsular). Details of the significance of Russia's agricultural lands for conserving populations of bird species being a priority for Europe are reflected in The Status of Biodiversity on Farmland in Europe (Birds) (STRA-CO/AGRI (2001)15) prepared by High-level Pan-European Conference on Agriculture and Biodiversity: towards integrating biological and landscape diversity for sustainable agriculture in Europe (Paris, 2002) (N. Szabolcs - although the authors of that report possessed the least comprehensive data on Russia).

2. Russia's agricultural fields play a key role in preserving populations of many species whose area distribution in general is not limited by agrolandscapes.

The most vivid example represent many bird species that nest and pass winter outside agricultural landscapes using instead fields and pastures as critically important stations for feeding, rest and migration. These include geese *(Ancer erytropus)* that nest in the northern latitudes and cranes *(Grus leucogeranus)* whose migration routes are made possible only by the existence of fields on which these birds feed during their migration in the Western Siberia and Zabaikalie. In other cases Russia's agricultural landscapes represent important places of winter period settlement (for example, for polar owl *(Nyctea scandiaca))* or are used as fodder stations during migration (for instance, by grey crane *(Grus grus))*. Finally, several relatively common species that live not only on agricultural lands still are the most numerous and most secure on these lands in Russia (for example, such bird species as *Crex crex*, *Merops apiaster*, *Upopa epops* and so on).

3. There are whole regions and even natural zones in Russia where agricultural landscapes turn out to be practically the only shelter for biodiversity.

The entire territory of Russia can be divided into several parts: humid (was originally occupied by various forests and swamps which to a different extent have been preserved up till now), dry (which includes natural zones of forest-steppes, steppes and semi-deserts), boreal (with the prevalence of tundra and forest-tundra) and mountainous areas. The modern agricultural belt of the country is tied to predominantly dry regions also covering the adjacent humid territories where forests have been logged long time ago (at different periods of time - from 14 to 19 centuries) and certain mountain ranges. It is in these regions that the main share of species and ecosystems biodiversity remains on farmlands forming part of agri-

cultural fields. For instance in Stavropol'sky krai and Rostovskaya oblast (with the total area of more than 167 thousand km^2) forests occupy less than 3 per cent and farmlands cover nearly 90 per cent of the total area while nearly a quarter of the territory of each of these regions consists of semi-natural agroecosystems such as steppe and meadows pastures and hay fields as well as fallow lands (Subregional.., 2000). The main ratios are typical of the most of agricultural regions of Russia. In this environment biodiversity of vast territories inevitably turns out to be tied to agricultural fields. Accordingly, the role of agricultural lands in preserving biodiversity of steppe and semi-steppe areas, as well as partially forest-steppe natural zones is of particular importance.

4. The significance of agriculture for those species and ecosystems which are not just connected with agricultural landscapes but strictly depend on a certain regime of agricultural activities is particularly high.

There are many well-known species and ecosystems whose very existence will be endangered in case of termination or drastic shift in the established practice of agriculture. As the most vivid example we can say that the globally endangered species of eagle (*Aquila heliaca* included in the IUCN Red List) in the European part of Russia and in the Urals is connected with pastures where ground squirrels and rooks are abundant, while low and rare herbs facilitate rodent hunting. Nests of this eagle are located near farms or summer breeding camps. The loss of cattle numbers and termination of its pasturing in many areas of the Southern Urals (Orenburgskaya oblast and Bashkortostan Republic) where the main nesting grouping of this species in the European Russia is located in the 1990s resulted in the reduction of the eagle numbers (Kariakin, 1998). *Chettusia gregaria* - an originally steppe species which after steppes deep plowing got used to nesting on overused pastures - depends on pasturing the same way (Solomatin, 1997). Another steppe species - bustard - after drastic reduction of natural habitats turned to mass nesting on plowed fields and now its well-being depends on the time-frame and technology of field works (Flint, Svinarev, 2000). On sites of steppe zone intensively used for pasturing many species of ephemeroid tulips, bird-latexes and hyacinths are maintained. In their turn insects feeding on them are related to these species. The populations of beatles *(Brachycerus sinuatus)* that feed on ephemeroid hyacinth species are tied in Rostovskaya oblast to pasture fields since pasturing contributes to the increase of yield of these fodder plants (Poltavsky, Arzanov, 1998). Genuine and particularly meadow steppes can serve as an example of a whole type of communities that became dependable on agricultural practice. Due to the lack of large wild herbivorous mammals the sustainable existence of real and particularly meadow steppes is possible only under a certain pasture load without which these ecosystems become susceptible to weeds invasion, overgrowth with bushes and loss the majority of native species while diversity of vegetation decreases through the subjugation of many groups of species (e. g. early spring ephemeroids).

Biodiversity for Agriculture

Biodiversity is widely used in the course of agricultural production as well as in the economy of local communities. In addition, natural ecosystems connected with agricultural landscape and biodiversity contained in them provide society with a number of services the importance of which can hardly be overestimated although it is rarely recognized and taken into account in the actual economic estimates. The main points are:

1. Natural and semi-natural ecosystems are widely used in Russia's agriculture as productive fields and are utilized directly for agricultural output production.

Semi-natural ecosystems continue to play an important role in agricultural production of Russia and several other former Soviet republics. In Kazakhstan their share amounts to 83.7 per cent, in Uzbekistan - 85.7 per cent, in Turkmenia - 97 per cent of the total area of agricultural fields. In the Russian territory there are more than 70 million ha of natural (semi-natural) fodder fields (excluding tundra reindeer pastures), which amounts to about 32 per cent of all fodder fields. They occupy the most vast areas in the dry zone of the country - 36 entities of the Federation fully or partially located in this zone account for more than 50 million ha of fodder fields (Table 2). Within Russia's territory there are 70 million ha of semi-natural fodder fields that amounts to 32 per cent of all agricultural lands, which cover the most considerable areas in the semi-desert and desert (8.2 million ha), steppe and forest-steppe (26.1 million ha) zones (see Table 2).

Natural fodder fields form the basis of the fodder base of Russia's animal husbandry providing up to 40-60 per cent of fodder, while in Kazakhstan meat animal husbandry is entirely based on natural (steppe and semi-steppe) pastures. They are particularly important for commercial breeding of sheep, goats and horses. It is the availability of vast natural pastures that determine specialization of animal husbandry in such regions of Russia as Republics of Altai, Buryatiya, Yakutiya and Kalmykiya.

In terms of costs the output of natural fodder fields is usually evaluated only for sale, while within the framework of the farms business activities it is frequently viewed as a fringe benefit (and only the cost of land "improvement" is evaluated). As a result the correct assessment of economic significance of fodder fields is complicated. Nevertheless, it is estimated that 1 ha of fodder fields in Orenburgskaya oblast produces 39 US dollars (calculated using the cost of a conventional fodder unit) worth of output (hay, phytomass intake). Assuming that this assessment is an average one for the dry zone of Russia we can assess the total cost of natural fodder fields output which will amount to 2 million US dollars per year. Of course this assessment should be regarded as very rough, although it is hardly overestimated (rather the opposite). Meanwhile it is considerably higher than the cost of the entire import of beef expected in Russia in 2003 (with the quota of 315 thousand tons at the average price of 1 000 US dollars per ton) (Beef, 2003) and is comparable with the average cost of annual consumption of wheat for the period of 1995-2001 (3.75 billion US dollars in terms of the average price of 100 US dollars per ton; http://www/grain.ru) or the average annual cost of the entire agro-industrial export of this country in 1994-1999 (1 281 billion US dollars per year; http://www.iet.ru/trend/10-00/11.htm).

Natural ecosystems and wild growing species of plants within agricultural landscape serve as melliferous herbs for domestic bees. Bee-keeping is a cost-efficient and growing branch of agriculture in Russia which seems promising to small agricultural farms. It has well-rooted traditions in many regions of the country. Different meadows, meadow and mountainous steppes as well as thickets of steppe bushes of *Fabaceae* and *Rosaceae* family are used as melliferous herbs plantations. We do not have a reliable estimate of apiculture output, although it is known that in 2000-2002 Russia annually produced about 54 thousand tons of honey (FAO data - www.fao.org), which in retail prices corresponds to approximately 540 million rubles (17.42 million US dollars) per year.

On the other hand, semi-natural ecosystems serve as habitat for many species of pollinator insects (first of all bumble-bees and single bees) providing pollination of agricultural crops (including fodder ones). Quantitative assessments for the country are unavailable, but in the world in general the importance of this component of agro-biodiversity is well-recognized at the international level which has been reflected in the development of a relevant process within the framework of the Convention on Biodiversity Conservation based on the International Pollinators Initiative (The San Paulo Declaration on Pollinators, 1998; see also Progress report.., 2001).

2. Natural ecosystems stabilize agricultural landscapes and ensure preservation of plowed fields fertility.

A major part of Russia's agricultural belt is characterized by solid agricultural landscape consisting mainly of single crop fields and rangelands while perennial plants and forest blocks are small in area and/or in numbers. With the increase in

aridity the share of semi-natural pastures hay-lands in the land fund increases as well: in the steppe and forest-steppe zones they occupy 17.5-43 per cent of the territory, in the dry steppe zone - 27-53 per cent, and in the semi-desert and desert zones - 68-71 per cent. On extremely dry territories semi-natural pastures form the main background in which plowed field, other fields and human settlements are sprinkled. In the steppe zone (landscape of the above-mentioned type 1) semi-natural ecosystems serve as almost the only barriers preventing soil erosion (enlargement of ravines, deflation), its salinization, loss of humus in the plowed field, rivers silting, etc.; only they (together with water ecosystems) ensure self-recovery of territories from the excessive amounts of mineral fertilizers and pesticides, support local water turnover in the landscape. Within agricultural landscapes of the arid zone (type 2) natural fodder fields occupying vast areas particularly determine the ecological status of territories. Therefore, natural ecosystems while performing multiple functions of agricultural landscape stability preservation actually determine the very possibility of agricultural production activities implementation on these territories. The costs of these services are practically never taken into account in the real economy, although some attempts have been made in Russia to evaluate them in a certain way.

In 1998 O.E. Medvedeva proposed a methodology, which S. Levykin used for steppe rangelands ecosystems of the Southern Urals. Proceeding from data on soils he calculated the costs of steppe anti-erosion functions. In the natural steppe turf-covered soil is practically unaffected by erosion and there are practically no humus loss. At present the total reserves of humus in the zonal southern chernozem soils averages 200 tons per ha, while its annual losses in the plowed field as a result of different types of erosion amount on the average to 1 ton per year. At the same time the costs of artificial humus recovery on the area of 1 ha is estimated at more than 103 thousand US dollars per year. Thus, the annual anti-erosion economic effect of steppe existence can be calculated as follows:
103 150 US dollars per year : 200 tons per ha = 515.75 US dollars per ha.

If we take capitalization into account this would amount to 64 448.75 US dollars per ha. It should be noted that this ratio is undervalued since the calculations do not take into account other harm caused by erosion besides humus loss (such as destruction of engineering facilities and communication lines, dust storms, shallowing and deterioration of watersheds quality and so on).

Agricultural crisis of the 1990s has demonstrated that natural ecosystems can play one particulatly important function: they provide a possibility of abandoned farmlands recovery (of non-productive plowed field and destroyed pastures). During this crisis from 3-4 per cent (in Rostovskaya oblast and Altaisky krai) to 70 per cent (in Tuva) of the total area of plowed field were abandoned which in Russian terms will amount to more than 10 million ha (http://rfdata.al.ru/rstat/). Farmers have no resources to ensure targeted recovery of semi-natural vegetation on these lands or at least for the establishment of sustainable perennial crops. In those places whe-

re relatively vast areas and high diversity of natural ecosystems was preserved before the crisis the recovery of fallow lands is relatively quick due to natural succession supported by the flow of seeds and resettlement of soil invertebrates from the adjacent natural sites. Expedient recovery is facilitated as well by the low speed of erosion on the abandoned plowed fields also due to the adjacent semi-natural vegetation. Quite different situation is seen in those places where landscapes were dominated by vast fields of cereals separated from each other by field protection strips of forest alone, preservation of which requires in itself regular investments. The lack of natural ecosystems in the immediate vicinity which could become the source for species resettlement has resulted in the establishment of long-term early succession ecosystems on vast territories - i. e. thickets of one or two year-old weeds growing in some places for nearly a decade. In contrast to normally recovering fallow lands these communities represent poor fodder fields and they are unable to effectively resist erosion processes and poorly recover soil fertility.

Availability of vast areas of fallow land together with the lack of natural ecosystems and biodiversity has been one of the main reasons of an unusually high increase in locust (Italian prus) numbers in 1999-2001 which has been regarded as a natural disaster in the steppe and forest-steppe zones of the European Part of Russia and Western Siberia. Locust development and feeding takes place mainly on fallow land but after maturing these species resettle on crop fields where they can cause considerable damage. This situation has been aggravated by the lack of locust natural enemies (predators and parasites) connected with natural ecosystems, which could put an end to locust outburst at an early stage. Taking into account that locust development has taken place particularly on slowly recovering fallow land and has been facilitated by the absence of the reserve of natural enemies the impressive scale of its outbreak can be related to a considerable extent to the extremely low share of natural ecosystems in the agricultural lands of the affected regions.

3. Natural ecosystems and wild species provide additional renewable resources for the agricultural territories.

Natural ecosystems and species within agricultural landscapes of Russia provide numerous additional resources the use of which highly benefits local communities. The types of such resources and the nature of their use depend on the local territories. One of the most valuable bioresources represent wild officinal plants. Many of such species are represented by rather numerous populations on vast territories which together provide a large volume of raw materials. The most well-known species include *Pentaphylloides fruticosa, Achillea millefolium, Adonis vernalis, A. villosa, Ephedra spp., Artemisia spp., Tanacetum vulgare, Salvia spp., Thymus spp., Zyzyphora clinopodiodes, Hedysarum theinum, Glycyrrhiza spp.* and so on. In the last decade a large market of officinal raw materials has developed in Russia with active involvement of several dozens of specialized enterprises. Unfortunately, in spite of wide manipulation of the concept of “environmental cleanness” this market is

far from being transparent and environmentally-friendly. It basic part (connected with primary commodities collection) is predominantly a shadow one. Enterprises employ local people as collectors remunerating them for plants collected at a minimum rate. Nevertheless, subject to its civilized development the market of wild officinal plants looks rather promising.

Another additional source of income represent food plants and mushroom. Up till now they have been used mainly by the local people themselves for their own consumption but can also serve as an important factor of recreational attractiveness for nearby tourism. In some places wild plant species such as reed *(Phragmites communis)* or cheegrass *(Lasiagrostis splendens)* which hold a dominant position in semi-natural ecosystems traditionally serve as the source of technological raw materials for the local communities and partially for the local industry. Thus, reed and cheegrass are used for mats while in Astrakhanskaya oblast reed is used for the production of construction blocks (kamyshit).

Biodiversity of agricultural territories serves as a recreational resource particularly for amateur hunting and fishing. Practically all Russian agricultural resources are at the same time hunting resources, attached to particular hunters' societies. The main game species include grey partridge *(Perdix perdix)*, grey hare *(Lepus europaeus)*, wild rabbit *(Oryctolagus cuniculus)*, roe *(Capreolus capreolus, C. pygargus)* which are predominantly connected with agricultural lands.

4. Biodiversity of natural ecosystems serves as the source of genetic material for agricultural development.

Within the territory of Russia and other republics of the former USSR (mainly in the Caucasus and Central Asia) there are places from which many cultivated crops varieties and domestic animals species originate. Emergence of vast areas of saline and sandy fallow lands in Russia in the last decade requires their expedient recovery. The most cost-efficient and ecologically justified method consists in the introduction of local non-alien species of fodder herbs in such places. Biodiversity of agricultural territories is the only source of such species. Russia has been gaining experience in introducing xerophite, halophyte and psammophite plants of natural steppe and desert ecosystems for a long time, although it is now that their use has become particularly vital. The main species that are currently used for the establishment of semi-natural seeded pastures and/or biological land improvement of saline lands in Russia are cereals *Agropyron cristatum*, *A. sibiricum*, *Psatirostachys juncea*, hazed *Kochia prostrata* and *Krasheninnikovia ceratoides*. At least another 15 species can be introduces in such a way in the nearest future (Shamsutdinov etc., 2001).

The most promising species to be introduced in these ecosystems (and sustained there) are many species of officinal plants which are now collected in large quantities within natural ecosystems. Increase of the share of cultivated raw materials is a way to improve transparency and control of officinal raw materials market. In Russia numerous attempts have been made with different degree of success

at commercial cultivation of different officinal plants. For instance, the largest consumer of officinal raw materials in the country - Krasnogorsky plant (located in Moskovskaya oblast) - operates mainly upon cultivated raw materials. In Republic of Altai the shift towards officinal plants cultivation has allowed several farms to establish an association of officinal raw materials producers, capable of confronting companies from other regions of the country which over-exploit resources within natural ecosystems.

5. Natural ecosystems are the reservoir of natural enemies of agricultural pests.

Russia's agriculture suffers from many harmful insects and fungi species that affect cultivated crops. In the last decade in the most regions of the steppe zone of Russia up to 3-5 per cent of all farmlands have been processed with insecticides in order to control Italian prus, which amounts to hundred thousands ha per year, approximately the same area has been subject to agro-technical means of locust control (*Calliptamus italicus* - Italian prus) and even larger areas have had to be surveyed for the presence of locust eggs' clumps (for instance, up to 3 million ha in Orenburgskaya oblast in 1999). The costs of pest control amounted to about 1 billion US dollars a year. Even higher losses agriculture suffers from such pests as meadow moth or tortilla-bug. At the same time these most dangerous agricultural pests have their own natural enemies - insects and birds connected with semi-natural ecosystems.

Even without specially designed measures to improve their efficiency natural enemies of pests are able to considerably reduce their numbers - thus in Saratovskaya oblast during the 1992 outburst a plan of locust control was cancelled due to the fact that starling flocks practically completely eliminated these insects, while in Novosibirskaya oblast after the 1999 outburst about 60 per cent of all Italian prus clumps were affected by vesicatory bugs and another 10 per cent - by diseases (Sergeev, 2002).

6. Carbon accumulation.

Carbon accumulation by natural ecosystems is usually considered applicable to forests and swamps. But in Russia's environment semi-natural ecosystems of agricultural landscape also make an important contribution in carbon accumulation. For steppe regions carbon accumulation quantity can be calculated using the data of carbon accumulated in humus. In meadow steppe the total inflow of carbon in humus from the air amounts to 26.3 centners per ha per year. From this amount 10.4 centners/hector per year are accumulated. Feather-grass steppe is characterized by a lower productivity and here carbon inflow in humus amounts to 14 centners/hector per year, while accumulation - to 4 centners/hector per year. With climatic conditions being the same one can say with a rather high degree of certainty that this accumulation is practically irreversible and unlimited in time. However in

order to calculate the costs for steppe zones it is practical to take the period of humus carbon accumulation of 131.2 years suggested in O.E. Medvedeva work (1998) and capitalization ratio - for 0.008. In such a case the volume of tied CO_2 can be calculated using the following formula:

G = 3.66C/R,

where G - quantity of CO_2, C - quantity of carbon, R - capitalization ratio.

G = (3.66/4 centners/ha) : 0.008 = 1 830 centners/ha (or 183 tons/ha)

In accordance with Kioto Protocol tying of one ton of CO_2 will cost from 10 to 50 US dollars. It means that the cost of this ecosystem service rendered by steppes on agricultural lands will amount from 1 830 to 9 150 US dollars/ha.

In contrast, the destruction of natural ecosystems actually leads to the increase of green-house gases emission. The volume of carbon emitted in the air for the last 150 years of intensive agricultural development of the forest-steppe zone of Western Siberia alone (a part of the territory of five entities of the Russian Federation) is estimated at 1 280 million tons (Titlianova, 2000).

Agriculture as the Source of Threats to Biodiversity

Agricultural production and related transformation of the territory create a number of more or less dangerous threats to Russia's biodiversity. Generally they are similar to the threats confronting other European countries which were demonstrated, in particular, in the discussion paper "Agricultural Biological Diversity" prepared for the First Intergovernmental Conference "Biodiversity in Europe" (Riga, March 2000) and in a number of analytical documents for the High-Level Pan-European Conference on Agriculture and Biodiversity (Paris, June 2002). Mainly it includes:

- plowing of all technically accessible territories which destroys natural ecosystems and their biodiversity on vast areas;
- soil erosion which destroys not only fields but natural ecosystems as well tied to unsuitable lands, fields edges etc.;
- degradation of semi-natural pustures due to cattle overgrazing;
- water basins eutrophication with organic substances washed from the fields and excess fertilizers;
- soil pollution with pesticides and excess mineral fertilizers;
- natural ecosystems fragmentation by fields and elements of infrastructure;
- disturbance and destruction of wild animals adapted to agricultural landscape during agricultural production activities;
- hydrological land improvement (irrigation) leading in the north of the agricultural belt to the destruction of wetlands and in the south - to wide secondary salinization of irrigated and flooded lands; in both cases their native biodiversity is lost;
- extinction of species regarded as agricultural pests including those species that previously caused damage to agricultural production but currently became rare (e. g. many souslik species);
- the change in the nature of afforestation of lands - forests along gorges slopes are logged on a wide scale in addition to the disturbance of hydrothermal and wind regimes this leads to the disappearance of rich biodiversity; these forests

are widely substituted by field protection forest strips which play a completely different part in landscape and do not support the majority of gorge species of plants and animals;

- penetration of alien species from agricultural fields into natural ecosystems which include not only alien species themselves but also such cynanthropies as weed plants, crows (grey and black crows, rooks), grey rat, etc.;
- destruction of key species of natural ecosystems.

Some of the above-mentioned threats together with several other factors form a complex threat of desertification of Russia's south. Desertification affects to a certain extent about 100 million ha of farmlands in 35 entities of the Russian Federation where about 50 per cent of the country's population is living. In the southern regions of European Russia the Chernozemel'ny area of Kalmykiya and plain areas of Dagestan were particularly affected by desertification. In these regions more than 70 per cent of the territory suffer from desertification, while in Astrakhanskaya, Volgogradskaya, Saratovskaya, Samarskaya oblasts and Republic of Tatarstan desertification affected up to 50 per cent of the total area. Currently these regions represent the hot-beds of man-induced desertification in Europe. In the Asian part of the country the threat of desertification is particularly acute in Altaisky krai, Republics of Tuva and Buryatiya (Desertification and Ecological Problems.., 2002).

The crisis of agriculture which has affected Russia in the last decade has temporarily alleviated and even withdrawn many of the most acute threats. As a result biodiversity connected with agricultural lands has received an opportunity to recover to a certain extent. However the current situation can neither be viewed as satisfactory, nor considered sustainable since it exists only as a transitional period phenomenon when weakened economy reduces the possibility of taking special nature protection measures in the face of further increase of economic load. Since 2000 growth of agricultural output has resumed (although at a moderate pace) and a new stage of land property re-distribution has begun which is already creating new threats to biodiversity connected with agricultural lands.

Modern Trends in Russia's Agriculture in Terms of Their Impact on Biodiversity

1. Denationalization of agricultural lands.

Since 1991-1993 reallotment of property to land used in agriculture (farmlands) has begun and continues. While before all land in Russia was owned by the state and could be allotted for use on different terms, now farmers have received titles to land shares ownership (to a plot of land of a certain area not designated on-site and unspecified as to the fields composition). However in the majority of cases the nature of land use remained practically intact. Same as before Russia's agriculture is absolutely dominated by collective farms, only now they have the form of stock-societies or production cooperatives, while plots of land used by them are not allotted by the state but represent the sum of the shares of all members of such cooperatives. Land resources of former collective farms are still under managed by collective farms' administration.

Serious changes have occurred in respect of lands which were transferred to and are managed by individual farmers (were received by them free-of-charge during privatization on the basis of documents for a land share or were later rented from collective farms). The intensity of agricultural production on plots of land belonging to individual farmers is considerably higher than that on collective farms' lands. However the share of individual farmers in Russia's agriculture is small and the total area of land used by them amounts to no more than 5.8 per cent of the total area of the country's agricultural land ("Regions of Russia.., 1999; http://rfdata.al.ru/auto/rstat/1101/110103.htm; http://www.raf.org.ru/sta220~5.htm), their contribution to agricultural production is disproportionately high.

Thus, in 2002 farmers accounted for 13.4 per cent of area under cereal crops (out of the total area covered by these crops in all categories of agricultural enterprises) (in 2001 their share amounted to 12 per cent), 24.5 per cent - by sunflower (2001 - 22.1 per cent) and 7.7 per cent - by sugar-beet (6.3 per cent). Nevertheless, the small share of land area managed by farmers is of particular significance. The largest share in the land owned by individual farmers is occupied by plowed

field, i. e. their impact on biodiversity is principally an indirect one (see below section devoted to plowed field).

Since 1999 we are witnessing a phenomenon of blocks of farmlands acquisition (usually leasing) by large investors - banks, oil-producing companies and so on. This process is first and foremost evolving within the limits of the steppe and forest-steppe zones of the European part of Russia - in Pre-Caucasus and Central Chernozemie where farming cost-efficiency is particularly high (which can be indirectly reflected in the cadastre assessment of lands and the size of land tax - see Table 1). For example, in Voronezhskaya oblast in 2002 a quarter of the entire area of plowed field was cultivated with the help of investors (http://www.AgroNews.ru - News, December 17, 2002). The role of large investors in the agricultural sector is also confirmed by the assessment carried out by the Institute of Agrarian Marketing according to which agrarian holdings in Russia produce 10 per cent of grain, 25 per cent of beef and 70 per cent of sunflower oil (http://www.vedomosti.ru - Ivanova, May 26, 2003). The implications of this phenomenon for biodiversity of agricultural lands are still unclear, although investments are made predominantly into plowed field.

In the process of denationalization large areas of land were allotted to municipal entities and are currently owned by rural administrations. The area of this category of lands is rather small, although they are important for biodiversity conservation since it is distinguished by a high share of semi-natural ecosystems (pastures, hay-fields). However the bulk of semi-natural ecosystems is considered privatized as all other agricultural lands and is used by collective farms.

Until 2003 turnover of plots of land of agricultural designation was legally complicated - in fact it was allowed in several regions alone (in Saratovskaya, Samarskaya and several other oblasts). However the total number of dealings with plots of land, for instance, in the period from 1996 to 1999 increased from 3.8 million to 5.2 million with the total area of land plots being the target of these operations increased from 20.5 million ha to 72.2 million ha. Nevertheless the majority of dealings with plots of land of agricultural significance (more than 99 per cent) until 2003 was related to land leasing.

Even with the adoption of the Land Code in 2001 did not change this situation. In 2002 a special law "On Lands of Agricultural Designation Turnover" was adopted. The analysis of the law and the experience of the regions where the land market exists suggests that new legal conditions will not be able to change drastically the situation with agricultural fields management except for near-urban zones of large cities and, possibly, several territories with particularly favorable conditions for agriculture (Northern Caucasus, Kuban', some regions of the Central Chernozemie).

In a more distant future the implications of genuine (in contrast to formal) privatization of agricultural lands for biodiversity are mixed. On the one hand, privatization usually results in drastic intensification of land use which always leads to the deterioration of naturally developed conditions for wild animals existence, decrease of the share of semi-natural ecosystems in the total land area and gene-

ral reduction of biodiversity. However, on the other hand, the emerging owners are potentially capable of ensuring a more responsible land use and have to follow the requirements set out in the legislation in force much more strictly. This creates pre-conditions for the establishment of a new responsible system of biodiversity protection on agricultural lands instead of a spontaneous one.

2. Change in the land use structure and dynamics.

Privatization is accompanied by considerable related changes - e. g. many large collective farms have been divided into several smaller enterprises (although the total number of farms increased only marginally - in 1990 there were 25.8 thousand state and collective farms, while in 1999 there were 26.9 collective farms of different legal forms and forms of property), many borders of farms and fields have changed (inter alia through the allotment of land to municipal entities and to the redistribution fund) and many new farms have emerged. Delineation of borders (and, consequently, boundary paths) between newly emerged land users creates conditions for the introduction of semi-natural ecosystems into agrarian landscapes. The distribution of intensiveness of the territories usage changes and new fallow lands emerge. At the same time quick changes in the forms and intensiveness of the land use often leads to the destruction of formerly sustainable semi-natural ecosystems. Thus, in 2002 one of the only virgin steppe land areas that had remained in Orenburzhskaya oblast in the course of the entire Soviet period was plowed.

3. Considerable decries of plowed field area and change in the regime of agricultural land use.

Since the early 1990s we have witnessed a mass abandoning of inefficient (low productive, remote from human settlements, inaccessible, etc.) plowed fields and their transformation into fallow lands or designation for perennial fodder herbs cultivation. This is in sharp contrast to the perennial stability of the plowed field areas and their outline in the preceding decades.

Due to a number of reasons this process has not been adequately reflected in the land accounting. Nevertheless, it is possible to assess the scale of reduction of the plowed field area. Thus in Bashkortostan Republic in 1994-1997 as much as 500 thousand ha of agricultural land were officially withdrawn from plowing. According to unofficial data (on the difference between the plowed field and crop field) about 2.4 million ha were not cultivated in Orenburgskaya oblast in 1999, i. e. were in fact transformed into fallow land.

This amounts to more than 38 per cent of the plowed field area in 1991 (at the same time according to the official data the plowed field area has decreased here during this period by only 2 per cent!). Probably, a more realistic assessment of the share of lands taken out of plowing for a long term (for 5 or more years) for the country in general amounts to 10 per cent of the 1991 plowed field area. In certain entities of the Federation this share has been considerably higher - as, for instance, in Repub-

lic of Tuva, where even according to the official data 30.8 per cent of the plowed field area was taken out of plowing by 2001 (from the 1990-91 level) (Regional report.., 2001). And alternatively in certain regions it was less than 2-3 per cent - especially in the Northern Caucasus republics (Adygeya, Dagestan, Kabardino-Balkariya), where the population density is well beyond average (for example, in Kabardino-Balkaria it amounts to 60 persons per square km, while for Russia in general this figure is 9 persons per square km) and farming efficiency is particularly high (Zhirugov, 1999).

In general this process is to be considered beneficial for the preservation of lands quality as well as for biodiversity conservation. Indeed, the practice of destructive and unproductive plowing of low-capacity, rocky, saline and other unsuitable for plowing soils has been halted which helped to preserve them from further degradation. The areas taken out of plowing pattern became the scene of recovering shifts. In places where these shifts were sufficiently quick semi-natural ecosystems of meadow or steppe type in the steppe zone or young forests consisting of small-leafed trees in the forest zone have emerged. Those fallow lands that had no opportunities for quick recovery were either designated for the cultivation of perennial herbs that play a vital role as habitat for many animal species, particularly mammals and birds that are rare and in need of special protection. Fallow lands that are rarely visited by human beings and have vast area possess high protective and fodder characteristics. They have considerably improved the conditions for survival on agricultural lands for such species of birds as bustard, little bustard, krasavka, pale harrier, several species of lark, black-headed bunting, etc, as well as such mammals as steppe pika, several species of souslik, etc.

At the same time in recent years (since 2000) we are witnessing a reverse movement - a part of formerly abandoned lands is being used for plowed field. For instance, in Orenburgskaya oblast in 2000 400 thousand ha of fallow land were again plowed (see Table 4). In 2001-2002 several leaders of the Russian regions officially announced their intention to return all fallow lands to plowing. For at least several entities of the RF (for example, Novosibirskaya and Saratovskaya oblasts, Republic of Tatarstan) this was announced as an already achieved target. However it is known that in the country in general and in the most important agrarian regions the sown area in 2001-2003 remained practically unchanged. In Russia it amounts to some 84.2 million ha. This fact as well as expert assessments show that only a certain part of fallow lands is being returned to plowing while another part is being used for other purposes (pastures, hay fields). Nevertheless, this trend raises considerable concerns over its possible implications for biodiversity and indirect functions of agricultural lands.

4. Drastic reduction in the numbers of livestock and changes in the species and variety composition and the forms of ownership.

As a result of the economic crisis the number of livestock has decreased while its species structure has changed (Subregional program.., Northern Caucasus.., 2000;

Subregional program.., Republic of Buryatiya, 2000; Subregional Program.., South of Middle Siberia.., 2000; Subregional Program.., Western Siberia.., 2000; http://server1.data.cemi.rssi.ru/icepweb/, http://agro.nso.ru/Stat/Zhivotn_pog.html, http://gras.oryol.ru/CARO/1999-07/18.html). In specific regions the situation varies considerably (see Table 5), but in general we can speak of a two/three-fold reduction of the numbers of cattle and of a ten-fold decrease in the number of sheep (and goats). The number of horses (which has initially been small) has not decreased much. Still from 1990 to 2000 the number of cattle decreased by 29 749 thousand heads or 53 per cent, horses - by 1 million heads (40 per cent), pigs - by 22 million 607 thousand heads (60 per cent), sheep and goats - by 43 423 thousand heads (75 per cent), birds - by 322 million (49 per cent). Since 1999 a moderate growth in the number of cattle as well as of sheep was noted which however was replaced by a new slow decrease in 2002-2003.

Due to the reduction in the numbers of cattle the load on semi-natural steppe, meadow and mountainous pastures has decreased. If before 1990 it was considerably higher than the permissible maximum (see above), by 2000 the majority of semi-natural pastures are subject to a load, which can be considered moderate or even extremely low for steppe ecosystems. It should be noted that this reduction has not been even but has been accompanied by redistribution of load within the total pastures area. The number of cattle summer camps and equipped water basins has decreased manyfold and as a result pasturing on some steppe pastures has completely stopped or has been carried out only on time-to-time basis, while the load on other parts has either decreased insignificantly or even increased.

Decrease in the pastures' load has allowed semi-natural herb ecosystems to recover on vast territories - primarily this is true of steppe and other semi-arid ecosystems, but also of bush thickets and even certain types of forests on agricultural lands. This in its turn has slowed down the speed of plowed fields soil erosion formerly being disastrous in certain regions (as, for example, in certain regions of Republic of Buryatiya). In some cases and for single species the decrease in the pastures' load has resulted in the deterioration of conditions for existence (see above in respect of dependence of such species as eagle, snake-eater, several species of steppe ephemeroids, etc.).

The ratio between the numbers of cattle owned by individual farmers and livestock belonging to agricultural enterprises has reversed. One of the main implications of this phenomenon has been manifested in a relative increase of load upon nearby pastures since individually owned cattle is rarely taken to remote rangelands. Moreover the share of mixed multi-species and multi-varieties herds has increased on pastures (including cattle, horses and sheep and goats of different ages and varieties), which has modified the nature of impact upon grasslands ecosystems making it more close to the impact of wild hoofed animals presumably inhabiting steppes before their human mass development.

5. Adequate fields turnover has been terminated.

By mid-1990s pastures and hay fields turnover has been terminated in many farms while crop fields turnover has been either terminated or limited to the most primitive forms. This has been the result, on the one hand, of the management crisis in agriculture and, on the other, by an attempt to meet requirements of the market (only those crops are preserved which are in high demand on the market - in the steppe belt these are primarily flinty wheat and corn). The emergence of vast areas of fallow lands and the lack of fertilizers has resulted in the revival of fallowing - i. e. plowing of fallow lands during two-three years and returning them back into fallow lands afterwards. All these changes have considerably modified the terms of existence of wild species inhabiting agricultural lands used.

6. The use of agricultural chemistry has decreased considerably.

Regular treatment of agricultural lands with pesticides, introduction of mineral fertilizers and chemical land improvement have been stopped as early as in the beginning of 1990. Thus, consumption of phosphorous fertilizers (supply of agricultural enterprises by domestic producers) decreased ten-fold - from 3.6 million tons in 1990 to 0.4 million tons in 1998 (Klassen, 1999). The aggregate consumption of fertilizers in the RF in 1992-1994 (data for the earlier are missing) has dropped four-fold - from 5.5 million tons to 1.5 million tons and stabilized near this level (FAO data - www.fao.org). Data on individual regions of the RF are even more spectacular. For instance, in the 1990s in Saratovskaya oblast the volume of mineral fertilizers used decreased from 45 to 2 kg per ha of plowed field, while that of organic fertilizers dropped from 1.5 tons to 150-200 kg (Concept of Development… of Saratovskaya oblast, 2000). In 1981-1985 in Republic of Tuva mineral fertilizers were introduced in the amount of 37 kg per ha, while in 1995-1999 - of 1.9 kg per ha and in 2000 they were not used at all (Regional Report.., 2001). The situation with pesticides is quite similar (although these data are not easily available). In part the only exception can be seen in the activities related to chemical control of locust herds conducted at a large scale since 1999 (for example, see Steppe Bulletin, 2000, No. 6).

It seems that this process has only one explanation - it is caused by drastic reduction of funds available to agricultural producers together with an expedient growth of "price scissors" between agricultural and industrial goods. Thus, until 1991 the countries of the EU and Eastern Europe showed similar pattern of mineral fertilizers usage - continued growth (from 20 kg per ha in the early 1960s to more than 70 kg per ha by 1980s). However after 1990 the countries of the former USSR reduced fertilizers usage by three times or more (FAO data), the countries of Eastern Europe - by more than two times, while in the EU the level of their usage stabilized at about 70 kg per ha (Hoogeveen et al., 2002). Similarly, in the 1990s in the EU there were no drastic fluctuations in the use of herbicides (on the average about 0.7 kg per ha). Obviously, it should be expected that with the improvement of the general economic situation a new increase in the use of agro-chemicals will take

place in the Russian agriculture - approximately up to the targets comparable with that of the EU.

It is evident that the trend of considerable reduction of chemical treatment is in itself beneficial for agricultural lands' biodiversity - particularly for species connected with plowed fields (which in the past bore the main load of chemicalization). In particular a considerable improvement of the state of populations of many species of insectivorous and granivorous birds has been noted (Belik, 1997, 2000).

7. Collapse of the state planning and land use control system.

Until the 1990s a system of rather strict control of the use of agricultural lands existed in Russia which, besides pure control, included monitoring of many physical and chemical soil parameters and regular centralized land use planning. After the 1990s this system has weakened considerably. At times control of the lands use has been totally lacking (particularly in the early 1990s). On the one hand this contributed to the above-mentioned transformation of fields into fallow land (in the steppe zone this has resulted in steppes restoration and in the forest zone - to fallow lands overgrowing with forest), and on the other - to plowing of remaining virgin steppe sites (like steppe fallowing - see above).

In fact this control is weak even today despite formal compliance with extraordinary strict lands accounting and extremely complicated permission granting procedure required for introducing changes in the way of lands use.

It is important to emphasize that the effect for biodiversity has turned out to be mixed. It is ironic that the collapse of the former system of land use regulation has rather improved the capacity of agricultural lands to perform all of their non-productive functions, including biodiversity conservation. The very situation of temporary lack of power in the field of agricultural lands use is beneficial for the establishment of a new and more biodiversity-friendly system of land use regulation. Unfortunately, in the last decade practically no steps have been taken in this direction (see below). Nevertheless, even now this opportunity should not be viewed as lost.

8. Forest dynamics within agricultural lands has changed considerably.

Planting of new field protection forest strips and care of the existing ones, in most of the regions, as well as control of the state of natural protection forests ('kolkys') have been terminated. In general until 1991 agro-forest areas improvement in Russia was carried out in 44 regions, while in the early 2000s - in 29 regions. The number of forest farms engaged in "protective forest cultivation" decreased from 440 to 300 and all of the 32 specialized agro-forest improvement stations seized to exist.

For several years (before the adoption of the Forest Code in 1997) the state of shelterbelt and 'kolkys' in many regions has been left practically uncontrolled since their legal status was not clear. In the Forest Code (1997) the legal status of forests

growing on agricultural fields was formally identified - these forests are included in the forest fund owned by the state, but are viewed as transferred to agricultural organizations for their indefinite usage. This partial solution resulted in a number of unsettled questions which are still pending. In particular it was not clear what agency should perform direct servicing of these forests (forest care, protection from fires and pests, current control of their use, etc.). Combined with the increased need of the population in firewood (due to irregular supply of gas and coal) this has provoked considerable unlawful cutting of trees in such blocks of forest.

On the other hand, in the humid part of the country (especially in the sub-zones of southern and moderate taiga) untreated plowed lands and unused fodder fields are quickly overgrown with small-leafed forests (dominated by aspen, birch, less frequently certain willow species, spruce, etc.). Thus in the last ten years the area of forests on agricultural lands in these regions has tended to increase. It should be noted that within these forests the share of young forests of early succession-cycle has augmented while their distribution among agricultural lands has become more mosaic.

9. Growth and commercialization of illegal hunting on agricultural lands.

In Russia in general and on its agricultural lands in particular the load of illegal hunting had considerably increased. A new feature of this phenomenon is the focus on export markets which results in the excessive (even in relation to a traditionally high level of local illegal hunting) withdrawal of certain species from nature. Species that inhabit agricultural lands include many of those that serve as the target of illegal hunting. They usually include rare and endangered species of mammals and birds and less frequently - reptiles. The most well-known case concerns saiga and falcon-baloban. These two species are in fact on the verge of extinction in Russia as a result of illegal hunting during the last decade.

Agricultural Biodiversity and Policy - Main Problems

Insensitivity of the land legislation in force to the challenges of agricultural biodiversity conservation

During the last decade privatization and involvement of agricultural lands in turnover was underway. It is evident in this respect that the land policy and legislation are critically important for the future of agricultural biodiversity. It is well known that in the course of Russia's history all land reforms resulted in drastic deterioration of the state of nature of agricultural landscapes (Ponomarenko etc., 1996).

During the 1990s practical implications of institutional changes in agriculture affected biodiversity in a rather complicated way but in general a positive effect prevailed related to the general deep crisis of Russia's agricultural production. It is expected that in the years to come this situation will reverse (see above).

Meanwhile the new land legislation which has been evolving in Russia during the past two years (similar to the previous one) does not practically take into account the existence of semi-natural ecosystems and related biodiversity on agricultural lands. It includes legal mechanisms aimed at maximum development of these lands but does not provide for measures which would ensure legal protection of agricultural biodiversity; the objectives of biodiversity conservation are not fixed within the state management of the use of agricultural lands. Thus certain provisions of the Land Code adopted in 2001 still envisage sanctions for the non-use of farmlands and uses the concept of "re-developed" lands ignoring the fact that in Russia there are practically no unoccupied lands suitable for new agricultural development but there is an excess of cost-inefficient agricultural lands the use of which is economically unprofitable and environmentally unsafe. The Code provides legally protected status to lands of agricultural designation limiting the possibility of their transfer to other land categories (e. g. for construction purposes). But at the same time the Code also restricts the possibility of their transfer to the category of lands of protected natural areas (it is not envisaged even in the list of possible exceptions, in which, for instance, preservation of cultural values and de-

velopment of mineral resources deposits are included). Unfortunately, the objectives of the use of agricultural lands set in the Code do not reflect the actual multi-functional nature of farmlands - they relate to agricultural output production alone. The proposed legal scheme of state control of the use of agricultural lands does not envisage the involvement of those bodies responsible for biodiversity conservation. We can state that in its present form the land legislation creates additional threats rather than contributes to the protection of agricultural biodiversity from those threats connected with land relation's reform.

State support of agricultural producers does not take into account the goals of agricultural biodiversity conservation

During the entire 1990s the Federal Government and particularly the authorities of Russia's regions conducted the policy of large-scale support of agricultural commodity producers. The main instruments of such a policy include subsidies and low interest loans for agricultural machinery, fertilizers and pesticides acquisition, setting fixed prices on fuel, regulation of grain market, policy of protectionism in respect of national commodity producers at the consumer market. In general state support is the most important instrument of agricultural sector management.

Unfortunately, the goal of agricultural lands biodiversity is not included in the set of the declared goals of this policy. Moreover, the analysis of regulatory acts passed within the framework of this policy demonstrated that in many cases its implementation leads to unwarranted losses of agricultural biodiversity since it stimulated economically inefficient actions contributing to nature destruction (e. g. excessive areas plowing).

Tax policy is not balanced in respect of agricultural biodiversity conservation goals

Tax policy in respect of the agricultural sector in general also falls within the framework of state support. The main tax burden here consists of the sum of land tax and several other taxes which since 2002 have been replaced by a single agricultural tax the size of which depends upon the area of land. It should be noted that the introduction of unified agricultural tax (UAT) was left at the disposal of the entities of the RF and until 2003 was conducted only in two predominantly steppe (and accordingly agrarian) regions - Altaisky and Krasnodarsky krais. It is possible that since 2004 UAT will be assessed using another tax basis without any relation to the cadastre cost of land.

Until recently a set of tax benefits was envisaged for agricultural commodities producers the system of which has been considerably modified but still exists in one way or another. The federal legislation provides for a possibility to impose tax benefits for taxpayers who ensure preservation of natural ecosystems on land which belongs to them (if they are registered as protected areas). Unfortunately, in practice these measures are never applied since specific benefits are to be es-

tablished at the level of the entities of the Russian Federation which is practically never the case. At the same time legislation contains certain provisions providing preferential taxation for land use contributing to biodiversity conservation (e. g. for new lands development) as well as penalties for the non-use of lands - and these measures are actually applied. Thus in reality the state tax policy is not integral and consistent in respect of agricultural biodiversity. In its present form it contributes to its degradation rather than to its conservation and protection.

Investments in agriculture and governmental policy in respect of investors ignores the goals of agro-biodiversity conservation

Investments in the agricultural sector become an increasingly more meaningful tool of its change. Potentially, governmental policy in respect of investors can considerably directly affect the state of biodiversity of agricultural lands and - in a longer run - the system of relations connected with it. However, public policy in this sphere can be hardly qualified as consistent and rational. On paper investors are being encouraged and the most favorable treatment for them is being declared. At the same time certain actual steps seem rather unfriendly for them. For example, in the 2003 draft law on UAT agro-holdings were actually excluded from the row of taxpayers, which were allowed to shift to UAT (although this has been compensated by considerable profit tax benefits).

In any case none of the steps taken by the state in respect of investors take into account the goals of agricultural lands biodiversity conservation (and do not become dependant of them). In fact this topic has been excluded from the state regulation in this sphere.

The state nature conservation policy in respect of agricultural lands is practically lacking

We are particularly concerned with the lack of understanding among legislative and executive authorities and national nature protection agency of the importance of agricultural lands for the national and European biodiversity conservation (genetic varieties, species and ecosystems). Russia is distinguished by a particular legal vulnerability of biodiversity of farmlands as compared to all other categories of lands. One possible explanation of this phenomenon is that the very fact of biodiversity presence on agricultural lands (and moreover of its high value and diversity of functions) remains unrealized and even practically unknown in Russia while biodiversity of forests, water basins, etc. is recognized and protected both by specific norms of the law and special order of management. The Russian legislation demonstrates an almost total lack of understanding of the fact that farmlands represent a complex phenomenon which includes elements of natural biodiversity inter alia as a necessary pre-condition for successful development of sustainable agriculture. Within the entire set of Russian regulatory instruments promulgated by the President and the Federal Government there is not a single document specifi-

cally devoted or indirectly referring to agricultural biodiversity. The only exception which just confirms the rule is the resolution of the Government on measures to protect animals in the course of production processes realization (of August 13, 1996, N 997), where agricultural production is referred to although not distinguished among others.

Understanding of the fact that agricultural biodiversity in Russia does exist as a single target of care and protection is lacking within the Ministry of Natural Recourses as well. In this Ministry there is neither specific mechanism nor other administrative instruments (such as a reporting form or budgetary item) intended particularly for agricultural biodiversity conservation. This is why interference on the part of nature protection bodies in the management of farmlands is reduced to a minimum - sometimes even in spite of the general environmental legislation in force. For instance, agricultural pest control in the majority of cases is conducted without ecological expertise required by the law - and not only on the fields but in the semi-natural ecosystems of agricultural landscape as well.

Environmental policy in respect of farmlands is limited to narrowly defined goals of soil fertility conservation and prevention from their pollution with pesticides. But even in this case the special nature protection agency keeps away from its practical implementation which is entrusted to other bodies. Work interaction among ministries in the field of agricultural biodiversity conservation exists only as an exception in some regions and completely depends on personal initiative of relevant officials.

In general we have to affirm regretfully that in Russia a conscious state policy in respect of agricultural biodiversity is lacking. The country also lacks administrative instruments for the implementation of such a policy. Moreover, up till now NGOs and particular experts remain the only public force recognizing the need of such a policy and such instruments.

Conclusion: Vision of Russian NGOs

Russia's agricultural lands are characterized by particularly rich and valuable biodiversity which forms a large share of the European agricultural biodiversity. The state of Russia's agricultural biodiversity is critically important for sustainable long-term conservation of many wild species and ecosystems in Europe in general. On the other hand Russia itself is objectively highly interested in conservation of this biodiversity not only in terms of its natural heritage but also because it is a direct source of a considerable share of agricultural output and a source of additional income of one of the most important and less protected social groups - farmers and because it supports all the aspects of agricultural landscapes stabilization without which the very existence of Russia's agriculture and rural population (comprising not less than 30 per cent of the total population of the country) would be highly problematic.

At the same time Russia's agricultural biodiversity until recently has attracted too little attention on the part of the state power and public agencies. Except for individual cases the legislative basis, administrative practice and internal financial policy of the RF leads to impoverishment and destruction of agricultural biodiversity rather than contributes to its conservation. This situation causes a wave of criticism on the part of national and international NGOs although even their understanding of the importance and vulnerability of agricultural biodiversity is far from being comprehensive.

European countries, organizations and the EU pay little attention to Russia's agricultural biodiversity as well. The approach taken by the Government of Netherlands which for at least a decade has been actively supporting efforts aimed at agricultural biodiversity conservation in Russia within the framework of bilateral relations can be seen as a promising exception. However these efforts, although highly important, cannot replace a balanced and targeted European policy intended to protect and conserve Russia's agricultural biodiversity as a critically important component of biodiversity of Pan-Europe. The need of such policy becomes

particularly urgent now that after a decade of crisis Russia faces the revival of agriculture, agricultural business and agricultural lands turnover.

Acknowledging the complexity of challenges that are facing us in this field we nevertheless consider it possible to identify at least basic practical steps, which, in our view, would contribute to agricultural biodiversity conservation in Russia. First presented at the Pan-European High-Level Conference on Agriculture and Biodiversity (Paris, June 2002) they were intended primarily for the European Union but are supplemented here and should be considered in a broader context.

1) Investment policy

- investments in agriculture and land market development in Russia should be linked with the state of agro-biodiversity as the basis of sustainable development of agriculture; they should also support and stimulate development of an ecologically responsible agriculture in Russia;
- biodiversity conservation should be included among the main criteria of investment targets selection.

2) Strengthening of Russia's involvement in the international programs concerning agro-biodiversity conservation

– development and implementation of a long-term international program on conservation in Russia of the elements of agro-biodiversity of European significance, including:

- establishment of a Pan-European ecological network, identification and conservation of the key territories that meet the criteria of the Emerald network, Important Birds Areas, Important Plant Areas, Prime Butterfly Areas, etc.;
- encouragement of Russia's join the Bern and Bonn Conventions, as well as the Global strategies on plants conservation and invasive species control and in Russia's accession to FAO;
- assistance in fulfillment of Russia's obligations on biodiversity conservation with the emphasis on cases related to agricultural land use management.

3) Development of a system of accounting of multiple functions of agricultural lands

- development of a system of payments for ecosystem services provided by semi-natural ecosystems existing on agricultural lands;
- development and legislative support of the opportunities to combine targeted uses of lands within a single plot of land;
- removal of legal obstacles and direct support of the establishment of non-state specially protected natural areas on the lands of agricultural significance.

4) Tax policy

- exclusion from the tax base of the land tax for the lands of agricultural significance which perform the function of biodiversity conservation, and for this purpose introduction of a form of accounting of this function of lands, for example using the legal concept of lands that are of nature conservation significance;

- elimination of tax benefits for the patterns of land use that objectively lead to the decrease in biodiversity;
- to consider a possibility of alleviating the tax burden of agricultural producers who take measures for biodiversity conservation on their lands not only through the land tax but also through certain federal taxes;
- to identify the objectives of tax policy in general in respect of agricultural land users and agricultural producers, which would include state support of activities in the field of biodiversity protection and conservation.

Annex

Table 1

The Results of the First Stage of Conducting a Cadastre Assessment of Agricultural Lands. According to the State (National) Report on the Status and Use of Lands in the Russian Federation in 1999/RF State Committee on Land Policy M.: Open Systems, 2000.

Entities of the Russian Federation	Cadastre cost, Rubles per hectares
Republics	
Adygeya	23 960
Bashkortostan	10 100
Buryatiya	4 090
Altai	3 270
Dagestan	12 080
Ingushetiya	9 410
Kabardino-Balkarskaya	19 600
Kalmykiya	2 380
Karachaevo-Cherkesskaya	13 270
Kareliya	5 510
Komi	4 090
Marii El	12 140

Table 1 (continued)

Entities of the Russian Federation	**Cadastre cost, Rubles per hectares**
Mordoviya	10 990
Sakha (Yakutiya)	400
Severnaya Osetiya-Alaniya	19 040
Tatarstan	11 020
Tuva	1 550
Udmurtskaya	8 580
Khakasiya	2 900
Chechenskaya	–
Chuvashskaya	14 950
Krais and Oblasts	
Altaisky	10 990
Krasnodarsky	43 560
Krasnoyarsky	7 190
Primorsky	10 000
Stavropol'sky	20 000
Khabarovsky	7 790
Amurskaya	6 140
Arkhangel'skaya	4 920
Astrakhanskaya	2 440
Belgorodskaya	20 490
Bryanskaya	10 460
Vladimirskaya	12 410
Volgogradskaya	7 990
Vologodskaya	7 660
Voronezhskaya	21 650
Ivanovskaya	11 020
Irkutskaya	6 700

Table 1 (continued)

Entities of the Russian Federation	**Cadastre cost, Rubles per hectares**
Kaliningradskaya	17 720
Kaluzhskaya	10 330
Kamchatskaya	2 670
Kemerovskaya	7 620
Kirovskaya	6 700
Kostromskaya	8 840
Kurganskaya	9 310
Kurskaya	18 940
Leningradskaya	23 000
Lipetskaya	16 010
Magadanskaya	400
Moskovskaya	33 030
Murmanskaya	400
Nizhegorodskaya	9 700
Novgorodskaya	7 620
Novosibirskaya	9 410
Omskaya	10 070
Orenburgskaya	7 490
Orlovskaya	15 440
Penzenskaya	9 970
Permskaya	6 470
Pskovskaya	19 170
Rostovskaya	13 040
Samarskaya	10 860
Saratovskaya	8 120
Sakhalinskaya	4 720
Sverdlovskaya	9 740

Table 1 (the end)

Entity of the Russian Federation	**Cadastre cost, Rubles per hectares**
Smolenskaya	9 830
Tambovskaya	16 200
Tverskaya	9 540
Tomskaya	5 080
Tul'skaya	15 310
Tyumenskaya	7 260
Ul'yanovskaya	10 030
Chelyabinskaya	9 370
Chitinskaya	3 300
Yaroslavskaya	12 310
Autonomous districts and oblasts	
Evreiskaya	3 890
Aginsky Buryatsky	4 190
Komi-Permyatsky	400
Koryaksky	400
Nenetsky	400
Taimyrsky	-
Ust'-Ordynsky Buryatsky	5 410
Khanty-Mansiisky	400
Chukotsky	-
Evenkiisky	400
Yamalo-Nenetsky	400

Table 2

Areas of Pastures and Hay Fields in Several Entities of the Russian Federation (Area and Percentage of the Total)*

Entities of the Russian Federation	Area of pastures and hay fields, thousand ha	Percentage of the area of farmlands	Percentage of the total area of the region
Republic of Tuva	3 507.0	87.52	20.21
Republic of Khakasiya	770.0	53.96	12.51
South of Krasnoyarsky krai	848.6	38.49	8.38
Republic of Kalmykiya	6 647.0	72.45	6.40
Rostovskaya oblast	2 610.5	30.55	25.86
Stavropol'sky krai	1 738.2	30.01	26.27
Altaisky krai	3 691.2	34.77	21.97
Novosibirskaya oblast	4 602.0	54.75	25.89
Chitinskaya oblast	3 360.4	50.00	8.00
Republic of Buryatiya	3 507.0	53.80	5.00

** Source - (see References 20-24).*

Table 3

Natural Fodder Fields in the Russian Federation (State Report on the Status and Use of Lands in the Russian Federation, 1999)

Entities of the Russian Federation	Areas of natural fodder fields, thousand hectares	Share of natural fodder fields out of the total land area, per cent
Republics		
Adygeya	93.90	12.05
Bashkortostan	2 856.80	19.99
Altai	1 633.60	17.58
Buryatiya	2 195.00	6.25
Dagestan	2 796.70	55.63

Table 3 (continued)

Entities of the Russian Federation	**Areas of natural fodder fields, thousand hectares**	**Share of natural fodder fields out of the total land area, per cent**
Kabardino-Balkarskaya	355.80	28.53
Kalmykiya	5 316.00	71.14
Karachaevo-Cherkesskaya	498.20	34.90
Kareliya	127.90	0.71
Komi	307.40	0.74
Marii El	138.60	5.93
Mordoviya	451.20	17.27
Severnaya Osetiya-Alaniya	189.30	23.70
Tatarstan	1 015.70	14.97
Tuva	3 517.70	20.86
Udmurtskaya	340.50	8.10
Khakasiya	1 181.30	19.19
Ingushetiya	105.30	29.02
Chechenskaya	615.90	39.36
Chuvashskaya	201.80	11.00
Sakha (Yakutiya)	1 499.00	0.49
Autonomous districts and oblasts		
Evreiskaya	235.70	6.50
Aginsky Buryatsky	849.90	43.38
Komi-Permyatsky	104.80	3.20
Koryaksky	41.80	0.14
Nenetsky	25.70	0.15
Taimyrsky	13.70	0.02
Ust'-Ordynsky Buryatsky	283.10	12.79
Khanty-Mansiisky	583.10	1.09
Chukotsky	8.50	0.01

Table 3 (continued)

Entities of the Russian Federation	**Areas of natural fodder fields, thousand hectares**	**Share of natural fodder fields out of the total land area, per cent**
Evenkiisky	5.40	0.01
Yamalo-Nenetsky	199.60	0.26
Krais and oblasts		
Altaisky	3 967.10	23.61
Krasnodarsky	598.50	7.93
Krasnoyarsky	2 138.40	2.95
Primorsky	774.20	4.70
Stavropol'sky	1 718.50	25.97
Khabarovsky	532.70	0.68
Amurskaya	946.90	2.62
Arkhangel'skaya	422.60	1.02
Astrakhanskaya	2 753.90	56.17
Belgorodskaya	455.70	16.79
Bryanskaya	554.40	15.90
Vladimirskaya	329.40	11.33
Volgogradskaya	2 825.30	25.03
Vologodskaya	575.00	3.98
Voronezhskaya	894.00	17.12
Ivanovskaya	235.70	11.00
Irkutskaya	685.40	0.91
Kaliningradskaya	405.60	26.82
Kaluzhskaya	365.90	12.29
Kamchatskaya	362.40	2.11
Kemerovskaya	1 041.30	10.88
Kirovskaya	773.40	6.42
Kostromskaya	314.10	5.22

Table 3 (continued)

Entities of the Russian Federation	**Areas of natural fodder fields, thousand hectares**	**Share of natural fodder fields out of the total land area, per cent**
Kurganskaya	1 521.50	21.28
Kurskaya	457.60	15.25
Leningradskaya	323.30	3.85
Lipetskaya	336.10	13.98
Magadanskaya	103.30	0.22
Moskovskaya	450.30	9.83
Murmanskaya	2.70	0.02
Nizhegorodskaya	849.90	11.09
Novgorodskaya	310.50	5.70
Novosibirskaya	4 520.70	25.43
Omskaya	2 361.10	16.73
Orenburgskaya	4 646.70	37.56
Orlovskaya	398.70	16.17
Penzenskaya	567.50	13.09
Permskaya	678.30	5.32
Pskovskaya	576.70	10.41
Rostovskaya	2 404.50	23.81
Ryazanskaya	769.20	19.42
Samarskaya	884.90	16.52
Saratovskaya	2 555.50	25.24
Sakhalinskaya	123.10	1.41
Sverdlovskaya	1 016.00	5.23
Smolenskaya	604.00	12.13
Tambovskaya	484.90	14.07
Tverskaya	884.80	10.51
Tomskaya	683.30	2.17

Table 3 (the end)

Entities of the Russian Federation	Areas of natural fodder fields, thousand hectares	Share of natural fodder fields out of the total land area, per cent
Tul'skaya	375.70	14.63
Tyumenskaya	1 662.40	10.38
Ul'yanovskaya	429.60	11.55
Chelyabinskaya	1 940.10	21.91
Chitinskaya	5 225.50	12.67
Yaroslavskaya	330.30	9.13

Table 4

Changes in the Size of Sown Area in the Russian Federation
http://server1.data.cemi.rssi.ru/icepweb

Entities of the Russian Federation	Years		
	1990	1995	1999
Altaisky krai	6 380.0	5 832.6	5 457.4
Orenburgskaya oblast	5 569.0	4 894.1	4 104.8
Saratovskaya oblast	5 564.5	4 438.4	4 190.4
Rostovskaya oblast	5 224.0	4 621.7	3 883.0
Volgogradskaya oblast	4 619.1	3 992.1	2 780.0
Republic of Bashkortostan	4 399.3	4 245.8	3 901.9
Krasnodarsky krai	3 902.6	3 747.8	3 663.7
Omskaya oblast	3 745.0	3 463.2	2 941.3
Novosibirskaya oblast	3 442.9	3 049.2	2 633.4
Stavropol'sky krai	3 433.9	3 268.9	2 896.3
Republic of Tatarstan	3 402.4	3 337.7	3 038.0
Voronezhskaya oblast	2 985.5	2 725.3	2 360.0
Krasnoyarsky krai	2 879.1	2 507.6	2 016.4
Chelyabinskaya oblast	2 694.3	2 431.8	2 058.3

Table 4 (continued)

Entities of the Russian Federation	1990	1995	1999
Samarskaya oblast	2 678.5	2 414.8	2 148.8
Kurganskaya oblast	2 640.3	2 094.8	1 772.5
Penzenskaya oblast	2 229.6	1 945.3	1 656.6
Kirovskaya oblast	2 193.9	1 838.1	1 672.4
Tambovskaya oblast	2 068.3	1 766.9	1 490.4
Nizhegorodskaya oblast	2 055.5	1 716.4	1 552.9
Kurskaya oblast	1 855.4	1 639.1	1 408.1
Permskaya oblast	1 850.3	1 501.9	1 318.7
Ryazanskaya oblast	1 687.0	1 407.3	1 109.8
Ul'yanovskaya oblast	1 643.8	1 567.4	1 314.4
Tyumenskaya oblast	1 634.3	1 296.8	1 184.3
Amurskaya oblast	1 623.5	1 082.1	793.7
Belgorodskaya oblast	1 586.2	1 498.9	1 442.3
Irkutskaya oblast	1 573.2	1 398.4	1 072.4
Orlovskaya oblast	1 568.5	1 369.5	1 144.9
Chitinskaya oblast	1 542.9	746.8	463.5
Sverdlovskaya oblast	1 516.3	1 334.1	1 205.0
Lipetskaya oblast	1 513.0	1 382.9	1 230.8
Tverskaya oblast	1 475.2	1 223.7	1 030.2
Tul'skaya oblast	1 448.0	1 295.5	1 011.1
Kemerovskaya oblast	1 447.0	1 275.6	1 160.8
Smolenskaya oblast	1 438.8	1 107.1	843.0
Udmurtskaya Republic	1 400.8	1 271.5	1 192.0
Bryanskaya oblast	1 292.0	1 169.6	936.1
Moskovskaya oblast	1 224.1	1 096.4	995.9
Respublic of Mordoviya	1 136.9	984.2	904.3
Kaluzhskaya oblast	918.9	754.3	561.3
Pskovskaya oblast	874.7	695.7	603.4

Table 4 (continued)

Entities of the Russian Federation	1990	1995	1999
Vologodskaya oblast	815.1	757.3	713.7
Chuvashskaya Republic	799.9	770.6	725.8
Yaroslavskaya oblast	768.9	671.0	608.0
Republic of Buryatiya	767.8	551.1	411.7
Primorsky krai	741.6	564.5	441.3
Republic of Kalmykiya	726.6	567.5	261.3
Kostromskaya oblast	661.7	575.7	498.0
Vladimirskaya oblast	643.6	553.4	490.2
Tomskaya oblast	622.9	549.2	494.6
Ivanovskaya oblast	609.2	528.2	455.5
Republic of Marii El	603.0	585.6	548.5
Republic of Khakasiya	597.7	520.3	378.9
Ust'-Ordynsky Buryatsky avtonomous okrug	513.7	463.5	339.7
Novgorodskaya oblast	484.8	371.8	294.9
Leningradskaya oblast	436.7	402.7	386.6
Republic of Dagestan	435.2	359.6	321.3
Kaliningradskaya oblast	416.3	349.6	267.7
Kabardino-Balkarskaya Republic	325.3	316.8	308.3
Astrakhanskaya oblast	324.0	218.5	106.0
Arkhangel'skaya oblast	295.1	273.3	219.7
Republic of Tuva	282.0	194.2	60.1
Republic of Adygeya	269.7	233.7	214.6
Republic of Severnaya Osetiya-Alaniya	205.8	192.5	185.7
Komi-Permyatsky avtonomous okrug	204.6	146.8	113.8
Aginsky Buryatsky avtonomous okrug	193.8	79.8	43.6
Karachaevo-Cherkesskaya Republic	192.3	155.2	132.6
Evreiskaya avtonomous oblast	146.9	121.7	82.3
Republic of Altai	146.5	132.1	104.2

Table 4 (the end)

Entities of the Russian Federation	1990	1995	1999
Khabarovsky krai	121.3	109.6	101.6
Republic of Sakha (Yakutiya)	107.5	81.4	60.8
Republic of Komi	100.5	99.6	85.3
Republic of Kareliya	82.8	77.3	67.6
Kamchatskaya oblast	64.9	54.8	32.3
Sakhalinskaya oblast	50.0	46.6	39.1
Magadanskaya oblast	36.5	22.7	13.7
Murmanskaya oblast	24.8	16.0	12.5
Khanty-Mansiisky avtonomous okrug	10.3	11.1	10.8

Table 5

Area of Plowed Field in Several Regions of Russia, thousand hectares*

Entities of the Russian Federation	In the early 1990s, thousand hectares	By the end of 1990s, thousand hectares
Kabardino-Balkarskaya Republic	318.8 (1990)	309.2 (1998)
Saratovskaya oblast	6 402.0 (1990)	5 246.0 (1999)
Altaisky krai	7 090.3	6 590.6
Orenburgskaya oblast	6 223.3	6 101.1
Rostovskaya oblast	6 080.5	5 962.6
Volgogradskaya oblast	5 870.5	5 704.5
Omskaya oblast	4 354.1	4 166.8
Stavropol'sky krai	4 077.4	3 888.3
Novosibirskaya oblast	3 916.6	3 662.2
Voronezhskaya oblast	3 235.0	3 066.8
Samarskaya oblast	3 107.9	3 062.7
Republic of Khakasiya	730.3	680.3
Republic of Tuva	432.6	130.1

** Source - (see References 10; 15).*

Table 6

Changes in Livestock Numbers in the Regions of Russia, thousand heads (except for Ingushetia and Chechnia Republics)
http://server1.data.cemi.rssi.ru/icepweb

Entities of the Russian Federation	Livestock number, thousands heads		
	1990	1995	1999
Republic of Bashkortostan	2 392.9	2 203.4	1 721.7
Rostovskaya oblast	2 112.7	1 237.9	631.8
Altaisky krai	2 042.9	1 558.1	1 102.4
Krasnodarsky krai	1 778.1	1 276.4	924.1
Orenburgskaya oblast	1 752.0	1 171.2	808.7
Omskaya oblast	1 655.5	1 198.1	734.4
Saratovskaya oblast	1 639	974.7	693.6
Novosibirskaya oblast	1 633.8	1 250.7	857.8
Republic of Tatarstan	1 573.2	1 471.6	1 190.3
Volgogradskaya oblast	1 521.8	920.4	542.6
Voronezhskaya oblast	1 389.3	996.5	673.4
Krasnoyarsky krai	1 302	944.7	683.4
Nizhegorodskaya oblast	1 264.3	873.2	654.6
Moskovskaya oblast	1 218.2	742.6	556.8
Chelyabinskaya oblast	1 198.2	858.2	606.8
Stavropol'sky krai	1 059.3	701.2	445.1
Kurskaya oblast	1 057.1	666.6	416
Kurganskaya oblast	1 028.6	641.1	430.7
Samarskaya oblast	1 012.3	679.5	458.2
Kirovskaya oblast	1 008.2	757.1	594.5
Belgorodskaya oblast	937.3	662.4	475.2
Tverskaya oblast	900.6	571.1	389.5
Tyumenskaya oblast	891.2	585.9	389.5
Ryazanskaya oblast	883.3	565.7	375.1

Table 6 (continued)

Entities of the Russian Federation	Livestock number, thousands heads		
	1990	1995	1999
Permskaya oblast	874.5	628.6	475.0
Bryanskaya oblast	874.1	565.1	354.9
Penzenskaya oblast	871.3	570.9	368.8
Sverdlovskaya oblast	845.2	596.2	478.7
Irkutskaya oblast	835.5	613.1	429.3
Chitinskaya oblast	801.0	558.4	463.1
Tambovskaya oblast	772.2	489.8	281.2
Smolenskaya oblast	766.1	474.9	299.6
Kemerovskaya oblast	764.6	519.0	367.6
Republic of Dagestan	743.4	691.0	634.3
Orlovskaya oblast	718.1	420.8	272.6
Ul'yanovskaya oblast	701.1	523.0	320.1
Tul'skaya oblast	677.1	459.3	294.3
Udmurtskaya Republic	674.7	563.3	476.3
Lipetskaya oblast	671.7	476.5	335.3
Respublic of Mordoviya	656.8	462.8	367.0
Vologodskaya oblast	613.3	438.9	329.5
Leningradskaya oblast	579.8	325.9	249.8
Republic of Buryatiya	559.1	392.7	334.7
Pskovskaya oblast	555.1	314.3	210.2
Kaluzhskaya oblast	545.0	361.4	225.0
Chuvashskaya Republic	526.1	431.0	343.9
Yaroslavskaya oblast	495.7	358.9	271.4
Kaliningradskaya oblast	467.5	270.6	165.9
Amurskaya oblast	458.6	254.9	149.7
Vladimirskaya oblast	457.8	303.2	227.1
Republic of Sakha (Yakutiya)	409.3	358.3	284.5

Table 6 (continued)

Entities of the Russian Federation	Livestock number, thousands heads		
	1990	1995	1999
Primorsky krai	406.4	196.2	124.7
Ivanovskaya oblast	390.7	255.5	186.4
Astrakhanskaya oblast	373.1	227.2	156.8
Republic of Kalmykiya	357.9	213.7	121.6
Arkhangel'skaya oblast	354.7	232.5	137.2
Novgorodskaya oblast	339.8	194.5	104.6
Kostromskaya oblast	339.7	254.3	185.6
Tomskaya oblast	338.8	256.9	184.5
Kabardino-Balkarskaya Republic	322.5	248.4	228.3
Republic of Marii El	321.8	263.6	212.3
Karachaevo-Cherkesskaya Republic	272.7	165.8	129.1
Ust'-Ordynsky Buryatsky avtonomous okrug	268.2	191.1	131.6
Republic of Khakasiya	257.8	179.1	137.1
Republic of Tuva	205.0	187.5	110.2
Republic of Altai	186.2	141.8	117.7
Republic of Severnaya Osetiya-Alaniya	178.0	147.7	128.4
Republic of Komi	173.5	126.4	84.3
Republic of Adygeya	154.9	99.9	73.1
Khabarovsky krai	131.2	77.0	61.9
Republic of Kareliya	126.3	82.1	57.1
Komi-Permyatsky avtonomous okrug	104.6	70.3	55.2
Aginsky Buryatsky avtonomous okrug	98.4	70.6	71.3
Sakhalinskaya oblast	96.8	45.7	27.2
Evreiskaya avtonomous oblast	96.6	56.7	22.8
Khanty-Mansiisky avtonomous okrug	64.3	40.3	20.0
Kamchatskaya oblast	63.4	29.8	12.2
Murmanskaya oblast	43.8	18.2	12.3

Table 6 (the end)

Entities of the Russian Federation	Livestock number, thousands heads		
	1990	1995	1999
Magadanskaya oblast	43.1	14.7	8.1
Nenetsky avtonomous okrug	9.1	5.3	3.9
Yamalo-Nenetsky avtonomous okrug	6.8	4.1	2.1
Koryaksky avtonomous okrug	4.3	1.5	0.7
Chukotsky avtonomous okrug	3.6	0.6	0.2
Taimyrsky (Dolgano-Nenetsky) avtonomous okrug	2.6	0.7	
Evenkiisky avtonomous okrug	1.8	1.1	0.9

Table 7

Change in Livestock Numbers in Several Important Animal Husbandry Regions of Russia, thousand heads

Entities of the RF	In the early 1990s	By the end of 1990s	Source
Astrakhanskaya oblast	1 426.8 (1990)	452.5 (1999)	http://www.adm.astranet.ru/doc_99
Orlovskaya oblast	231.9 (1991)	38.6 (1999)	http://gras.oryol.ru/CARO/1999-07/18.html
Novosibirskaya oblast	1 097.0 (1990)	248.1 (1999)	Subregional..., 2000
Chitinskaya oblast	2 836.2 (1991)	647.7 (1997)	Subregional..., 2000
Rostovskaya oblast	3 497.6 (1990)	487.3 (2000)	Subregional..., 2000
Altaisky krai	2 063.6 (1990)	308.4 (1999)	Subregional..., 2000
Stavropol'sky krai	6 370.6 (1990)	1 341.0 (2000)	Subregional..., 2000
Republic of Khakasiya	1 323.6 (1990)	138.1 (2000)	KhR Goskomstat data

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