

Dmitrij KAEKHTIN, Roman NIKOLAEV, Oxana PUSHKINA
Saint Petersburg State University, Russia

Svetlana VOROBIEVA
Saint-Petersburg Herzen State Pedagogical University, Russia

THE SEEDED RURAL MEADOWS OF NORTHWEST PRILADOZHIE: A VALUABLE FOOD RESERVE FOR THE SUSTAINABLE DEVELOPMENT OF LOCAL DAIRY STOCK BREEDING

The transition to a market economy in Russia has been accompanied by negative effects resulting from the interaction between humans and nature. This is happening in all fields of economic activity, including agriculture. The tendency of people to obtain a fast profit from agricultural land results in its irrational and non-systematic use in all regions, including the North-West of the European part of the Russian Federation.

The rural economy in this region is historically and geographically based on dairy stock breeding. The basic food supply for the cattle is formed by seeded meadow lands. Meadows can be used for pasture and haymaking. But regular use and care are necessary for the maintenance of high productivity and valuable floral diversity of grasslands, and the absence of these measures are leading to the degradation of meadow lands. This process is typical of the cattle-breeding regions of the North-West, including the Leningrad region and the Republic of Kareliya, in connection with the difficult economic situation within the agricultural sector. This process is of economic, social and environmental importance. Meadows are not only a valuable food reserve for the sustainable development of stock-breeding, but also a major component of the environment and also gene pool for valuable wild and cultured plants. Therefore, research on the present state of meadows in the Leningrad region are very relevant. The impartial assessment of the

degree of aggravation of cultured grasslands will enable planning measures regarding the recovery of their environmental potential, maintenance of their qualitative condition and high productivity, and also enable making economic forecasts. It is necessary to search for a compromise between the environment, economics and sustainable development of local dairy stock breeding.

The wide tracts of meadows in the northern part of the Karelian Isthmus (so-called Northwest Priladozhie) were selected as the object of research. This territory belongs to the Priozersk district of the Leningrad region and the Lakhdempokhia district of the Republic of Kareliya. The users of this agricultural land are the agricultural company «Agro-Energo», St.-Petersburg State University (SPbSU) and private farmers.

By origin, the majority of the grasslands (88%) of this region are secondary. They arose after a phase of cutting down and burning woodland in the period of primary agriculture. In order to create meadowlands, woodland, which were covered predominantly by dene gray-alder groves and mixed sorrel forests distinguished mostly by fertile soils, was destroyed [The Current State..., 1986]. A small proportion of the meadows in Prilanozhie (12%) were formed by the desiccation of swamps and draining of lakes with the aid of drainage ditches. Natural grasslands are found on the shores of rivers and lakes. Their area is 0.1% of the total area of meadows. This is connected to the youth of river valleys and limnetic hollows. Thus, the meadows of Northwest Priladozhie occupy low lying land [Kozlova, 1956].

Despite the fact that the meadows on the Karelian Isthmus appeared a long time ago, the first measures to improve them were conducted at the end of the XIX century. At that time, the territory of the isthmus was a part of the Great Principality of Finland that was included within the structure of the Russian Empire as an autonomous region with very broad rights. At that time, agriculture was not advanced, three land types were differentiated: arable land, natural meadows and pasture. However, the transformation of arable lands into pastures began during this period, since the grain economy could not provide the increasing population with food under the rather severe conditions of nature in the region. This predetermined the rapid development of stock breeding and dairy facilities, including some commercial (in some country-seats), in the 80s and 90s of the XIX century in Finland (including the Karelian Isthmus) [The Current State..., 1986]. Good food reserves were required for stock breeding. At those times, the grasslands were very intensively cultivated and were meliorated – the seeding of valuable forage grasses was carried out: the clovers, *Pleum pratense*, *Alopecurus pratense*, *Festuca rubra*; the soils were enriched by mineral fertilizers; melioration

measures were permanently implemented; a network of drainage ditches intersected each meadow tract at a frequency of up to 10–12 meters. Great attention was paid to the improvement of seeded meadows used as haymaking and pasture for a long time. All these measures resulted in increasing the mean productivity of grasslands from 1.5 t/ha (1910) to 3–4 t/ha of hay (1940). The area occupied by seeded meadows also increased. By 1940 more than half of the area of arable land in Finland (including the Karelian Isthmus) was occupied by seeded perennial grasses, in Northwest Priladozhie this proportion reached 75% [Kozlova, 1956].

In 1940 after the Soviet-Finnish war, the territory of the Karelian Isthmus became part of the USSR, according to the peace treaty signed between Finland and the Soviet Union. It is necessary to note, that the industrialisation of agriculture in Finland began only after the Second World War, therefore the territory of the Karelian Isthmus was naturally not affected. Small farmstead predominated there. In the 40s and 50s (with the arrival of Soviet authority) collective farms and state farms were founded on the Karelian Isthmus. Large areas of land were set aside for these facilities and intensive production on large-scale enterprises and industrialization of agriculture began. However, this did not result in a qualitative improvement of the grasslands or increase in their productivity. This fact is connected with the inefficient ways of production used. At the end of the 50s and beginning of the 60s the state appraised the state of meadows that had been in use under Finnish rule and were now used by Soviet collective farms and state farms. Researchers ascertained that the quality of meadows had noticeably worsened. Drainage ditches in meadows were overgrown with bushes and trees, valuable forage grasses had almost disappeared, productivity of seeded grasslands had fallen to 2.5 t/ha, and of natural meadows to 1.5 t/ha (less cultivated fields – 0,7–1 t/ha). Experts stated that 60–70% of meadows required radical improvement. In Northwest Priladozhie the situation was better. However, melioration was required on 70% of grasslands [Nitsenko, 1964]. Few measures were made in subsequent years and the quality of meadowlands worsened and practically no research was conducted on them.

Despite such poor care, the meadows have been populated by robust semi-natural flora and have not lost many of their useful properties that have been even more emphasized their natural and economic value. Therefore, in the middle of the 90s investigations on some of the tracts of meadowlands, which belong to SpbSU began. In 2000–2001 the research carried out by teachers and students of the Department of Biogeography and Nature Protectio, SPbSU and Institute of Geography SpbSU were

expanded to meadow lands belonging to the agricultural company «Agro-Energo» and private farmers.

This research included fieldwork and laboratory data processing. The descriptions of meadow tracts Northwest Priladozhie (Leningrad region and Kareliya) are made over an area of 180 km² by a reconnoitering survey method. The territory investigated is characterized by a clearly visible relief form, an outcrop of granite rocks (selges) on the surface. There are no large areas of flat surfaces and any flat areas are usually occupied by river and limnetic terraces. The soils of this territory are varied from low-massive on plateaux (selges), to medium-massive in the depressions between selges. The humus horizon on such types of soils is well advanced as a rule, soil reaches stone, in which there are heavy mechanical fractions. With respect to the relief of the territory, there are many types of water basins, but the main one is run-off water from declines in depressions. Therefore, the meadows of this region are characterised by their small sizes (the maximum length being a few hundred meters) and small distance between them. Hence, their total number is rather great. The meadows are situated in almost continuous chains along the numerous water (lake-river) systems in this part of the Karelian Isthmus stretched, as a rule, from Northwest to Southeast (current of traffic from glaciers). In the spaces between these systems, forests and swamps predominate, and sections of grass vegetation are met extremely rarely here and only in a zone of former or modern economic activity.

From one to ten descriptions of meadow vegetation were made in each meadow tract. 82 vegetative habitats were described. They were grouped into 23 categories [Vorobiova, 2002]. The floral diversity of the meadow tracts is rather great. There were grassland habitats with 42 species of herbaceous plants and normally 25–30 species were reported. 133 species of plants including herbaceous plants, bushes and trees, including cultured (for example, apple-tree, lilac) were observed on meadowlands in total. The herbaceous species of plants detected in the observations of these habitats were arranged into the following groups: grasses, leguminous, herbs, and sedges. The grouping was according to the nutritious value of plants. The following species were most commonly observed [Ilyna and Gannibal, 2001]:

Grasses: *Deschampsia cespitosa*, *Agrostis tenuis*, *A. gigantea*, *Festuca pratensis*, *F. rubra*, *Phleum pratense*, *Alopecurus pratensis*, *Dactylis glomerata*, *Poa pratensis*, *Digraphis arundinaceae*, *Calamagrostis epigios*, *C. neglecta*;

Leguminous: *Trifolium hybridum*, *T. medium*, *T. pratense*, *Vicia cracca*, *V. sepium*, *Lathyrus pratense*, and *Amoria repens*;

Herbs: *Angelica sylvestris*, *Anthriscus sylvestris*, *Ranunculus acris*, *Alchemilla vulgaris*, *Artemisia vulgaris*, *Filipendula ulmaria*, *F. denu-data*, *Aegopodium podagraria*, and *Taraxacum officinale*;

Sedges: *Carex acuta*.

Analysis of the obtained data indicated that grass prevailed in just over 40% of meadows, as did herbs. 11% of meadowlands were dominated by leguminous plants. Two meadow tracts were dominated by sedges, but they represent the natural flood meadows of the littoral of Ladoga Lake. Among grass meadows, tussock (*Deschampsia caespitosa*) is the most common species. It the dominant or co-dominant species on 40% of such meadows. This indicates the high humidity level in a high proportion of meadows, which could result in water-logging in the future. Grasslands predominated by nutritious grasses (*Alopecurus pratense*, *Phleum pratense* etc.) are rather common (35%). Among herb meadows, grasslands with so-called «edged» species or transciant meadow-wood (ekotone) species prevail. As a whole, among the species of plants detected on the meadows, about 55% are «edged» and weeds. There are real meadow species – 7%, and seeded (which were specially seeded by Finns to improve herbage) – 14%. Among the rare leguminous meadows, clover predominates – 78%. Different species of clover can dominate. Leguminous plants were found in practically all the meadows investigated and sometimes can form a considerable proportion of the flora.

Now we shall consider the condition of meadows (Figure 1). From an economic point of view, all the grasslands in this areas can be divided into two groups: meadows regularly used for haymaking and pasture and meadows seldom used or not used in agricultural rotation (including adapted for other requirements). These groups cover meadows belonging to large and small-sized farms.

Grasslands from the first group are commonly observed. They are placed, as a rule, in depressions with a rather small declination and occupy rather large territories. There are good roads to them. This is important for their economic usage. Perennial agrophytocenosis with nutritious grasses (*Phleum pratense*, *Dactylis glomerata*, *Alopecurus pratensis*) and leguminous (*Lathyrus pratensis*, *Vicia cracca* and clovers) are characteristic of this group of grasslands. Mowing is carried out on them (a minimum of once a season), parts of them are used as pastures, sometimes by the inhabitants of neighbouring settlements. It is necessary to note, that the drainage ditches of these grasslands are often overgrown by trees and bushes. Also, border areas of meadows neighbouring forests are overgrown with bushes; in some cases the invasion of of trees was observed to be recent. The grasslands used for pastures are characterised a low level of biodiversity and low-level productivity.

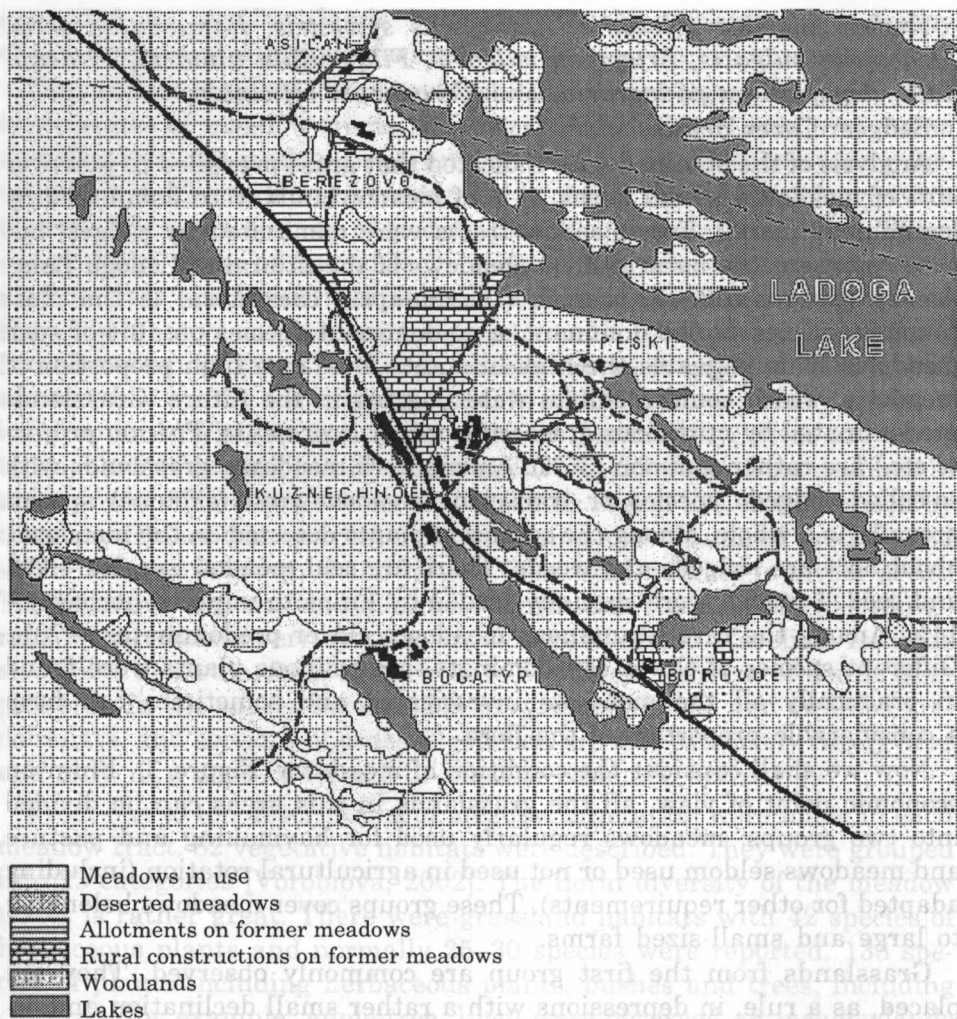


Fig. 1. Present state of seeded meadows in Northwest Priladozhie

The meadows of the second group (unused) are also very common and the total area occupied by such meadows has continuously increased, which is connected with the worsening of economic conditions. Such meadowlands are rough (*Festuca rubra*, *Anthoxantum odoratum* are prevalent), grasslands subject to humidity (the tussock, sedges etc.), meadows with ruderal vegetation, and also other types. These meadows are characterized by heavy growth of bushes on the edges and weak growth in the centre. Trees can be observed on the edges and in the central part also. Drainage ditches are overgrown by trees and bushes ev-

erywhere, and also by moisture-loving tall herbage. These meadows are remote from main roads, and they represent "islands" of herbaceous greenery among forests. The roads to them are damaged, in some places bridges across rivers have been destroyed. The same concerns are also relevant to meadowlands, which were given away by the state during the transformation as allotments to the local residents at the beginning of the 90s. Whole settlements have already been constructed on them and they are practically lost to agriculture. Many meadowlands, rented out as allotments, at present are deserted and overgrown predominantly by weeds. The quality of such meadows has significantly worsened. These meadow tracts are normally close to settlements.

Thus, we can make the following conclusions about the condition of meadows:

1) Meadows in use in a system of agricultural rotation. In general, they are characterized by unsystematic usage. With respect to haymaking, the optimal mowing regime is not observed, neither clearing trees and bushes from meadows and ditches nor the seeding of nutritious grasses are carried out. Fertilisation is not practised. The pastures are under an excessive load, due to a lack of knowledge regarding reasonable levels of grazing that results in the impoverishment and reduction of vegetative cover, aggravation of the physicochemical properties of the soil, water-logging and oligotrophization. These can be observed on grounds of large-scale enterprises, and small private farms. There is a positive side – products are more ecologically pure from unfertilised grounds.

2) Unused meadows. Former grasslands, on which rural settlements have been built, are lost to agriculture, as already noted above. The meadows, which are now occupied by deserted allotments, are characterized by a predominance of ruderal green in the flora. Their environmental and economic potential is highly disturbed. Deserted grasslands in forest tracts are in a transient state between meadows and forest. However, valuable species of plants are still present in such habitats and the process of transition is not irreversible yet.

However, not everything is so bad. Despite poor usage, the Northwest Priladozhie meadows have not perished yet. These habitats, containing a large cross-section of leguminous and grasses, are an economic resource, though the seeding of nutritious grasses has not been carried out and drainage ditches have not been cleared of bushes in the majority of cases. Such grasslands give on average up to 1,5–2 t/ha of natural feed [Ilyna and Pankratova, 1998]. They require the realisation of a policy, which will promote rural development in the Leningrad region and Re-

public of Kareliya, as the agriculture of the North-West starts to come out of crisis.

1) A fuller inventory of meadowlands in Northwest Priladozhie, the compilation of a map of their distribution and functional condition is indispensable. It is necessary to list the species of plants present on meadows, to define their frequency and projected frequency. This will enable the making of general forecasts concerning the further development of meadow phytocenoses.

2) The making of grass stands, which provide the greatest stability to outside influence from climatic, soil and other factors, on meadows of high productivity is necessary. However, traditional melioration works are needed also, because of the high investment cost to be returned in a short period. Combining these measures will increase the positive effect.

3) It is necessary to analyze the meadows in the inventory and to define: which of them can be eliminated from rural rotation without great damage to nature and the economy. The use of several meadows in rotation is indispensable to the intensification of rural production and decreasing expenses.

These are several measures, which will produce an effect in the not very distant future. Such operations will not demand huge costs and the profit from them is obvious. It will allow the sustained development of dairy stock breeding and an intensification of production, which will allow reducing the involvement of natural biogeocenoses in the field of its activity. Meadows will be conserved as exotic, semi-natural communities valuable to humans.

Literature

- Ilyna, I.S., Gannibal, B.K. (eds.), *Elaboration of the Scientific Framework for Creating Ecological Ways in Different Native Zones*. Saint Petersburg, Federal Direct Program "Integratsiya", Project aM 0244, 2001.
- Ilyna, I.S., Pankratova, A.O., "Phytocenotical and Ecological Diversity of the Meadows of Northwest Priladozhie", *Vestnik SPbSU*, 7 (1), Saint-Petersburg, 1998.
- Kozlova, G.I., "Some Preliminary Conclusions about the Meadows of Karelian Isthmus", *Vestnik LSU*, 18 (3), Leningrad, 1956.
- Nitsenko, A.A., *Geobotanical Subdivision of the Leningrad Region*. Leningrad, Leningrad University Press, 1964.
- The Current State and Development of Finland's Agriculture*. Helsingfors, 1986.
- Vorobiova, S.A., *A Study of the Upland Meadows Diversity with Aim of it's Protection*. Saint-Petersburg, 2002.