Sustainable development of rural areas, Russian issues

Maksim Diuldin¹²*, Natalia Bykova¹, Alexander Zhuchenko⁴⁵, Tatiana Rozhmina⁵, Alexey Cheremisin², and Franciszek Switala⁶

¹Peter the Great St. Petersburg Polytechnic University, St. Petersburg, Russian Federation
²All-Russian Research Institute of Phytopathology, Moscow Region, Russia
³St. Petersburg State University of Economics, St. Petersburg, Russia
⁴FGBNU "All-Russian selection and technological Institute of horticulture and nurseries", Moscow, Russia
⁵Federal Research Center for Bast Fiber Crops, Torzhok, Russia
⁶Samara Technical university, Samara, Russia

Abstract. The rural areas of Russia are characterized by a great variety of natural conditions, depending on their geographical location. This determines the historical economic use of these areas and hence the formation of certain types of agro-ecosystems. The rapid growth of cities in some regions of Russia has led to a marked disruption of life-supporting processes in the surrounding natural ecosystems, as well as in rural areas adjacent to cities and their agglomerations. From this point of view, it is important to find models for ecologically balanced rural development. Compared to "organic agriculture", it is a broader concept that may be closer to "sustainable" agriculture.

1 Introduction

Ecology is a science that explores the whole range of relationships between living organisms and their inorganic environments. Environmental studies focus on ecosystems and focus on the linkages between their organisms and the skewed components of the habitat. This applies to both natural and artificial ecosystems, including agricultural ecosystems. For agricultural activities, natural ecosystems are partially transformed into artificial (agroecosystems) or replaced to produce food, fibre and animal products. These agroecosystems can be treated in the same way as any other ecosystem [1-8]. An ecological approach to agriculture involves identifying the strengths of natural ecosystems for use in agro-ecosystems.

These strengths are criteria for the sustainability of rural areas, which is very important for Russia with its rather harsh climatic conditions. Rural areas (settlements outside urban areas) cover two thirds of the territory of the Russian Federation and are home to 39.9 million people (27 per cent of the total), as well as about 150,000 rural settlements.

It is necessary to consider the different parts of the socio-ecological system and habitats which are represented in a single scheme for different types of land and settlements from

* Corresponding author: diuldin@gmail.com
rural to urban. Many components are closely linked. The main components are the social and ecological system, the habitat, the socio-economic and the social and environmental environment. They contain a number of subsystems [4, 9-18]. In general, they are all parts of the biosphere.

- There are necessary factors to ensure the high quality of the rural environment: 
  Close to natural purity of air, water, soil;
- Ecological methods of farming; environmentally sound waste management; ecological satisfaction of labour needs;
- Meeting the needs for education and vocational development;
- Ethnic and ecological environment;
- Social, economic, social and psychological environment;
- Meeting environmentally sound information, spiritual and cultural needs;
- Ecologically clean, historically conditioned nutrition.

2 Methods

The functions of the natural and economic systems and the requirements of the environment are considered according to the type of system, the characteristic entities, the functions of the system and the requirements of the environment. They are shown in Table 1.

Table 1. The functions of natural-economic systems and requirements to environmental conditions

| Type of system       | Characteristic subjects                  | System functions                                      | Requirements to environmental conditions              |
|----------------------|------------------------------------------|-------------------------------------------------------|------------------------------------------------------|
| Residential zones    | Human, utilities, transportation         | Creation of appropriate ecological, economic and social environments | Compliance with sanitary-hygienic, medical-biological and aesthetic standards |
| Industrial zones     | Human, production facilities             | Provision of industrial and food products, facilities | Compliance with sanitary-hygienic, medical-biological and aesthetic standards for industrial facilities |
| Recreational area    | Recreation, recreational infrastructure   | Provision of rest                                     | Increased sanitary-hygienic, medical-biological and aesthetic norms |
| Agricultural zones   | Crops                                    | Provision of food, raw materials                      | Preserving the quality of the environment that provides environmentally friendly products |
| Environmental protection forests | The reference landscape | Functions of environmental protection and resource protection | Preservation of the landscape in a state close to natural |
| Protected areas      | The reference landscape                  | Preservation of natural gene pool                    | The preservation of the natural environmental background |
For example, residential areas [3, 6, 19-29], which include cities, towns and other types of settlements, correspond to such characteristic concepts as people, utilities and transport. In turn, the functions of this type of system can usefully be used to create appropriate environmental, economic and social environments. Finally, environmental requirements must comply with health, biological and aesthetic standards. Environmental management practices also include remediation of degraded land. Bio-positive landscape restoration as shown in figure 1 plays an important role.

Fig. 1. Variants of biopositive landscape remediation

a – building in a recess; b – reclamation of closed landfill or dump (with arrangement of insulating coatings, system for collecting biogas and leachate); c,d – building inconvenient places; e – creation of an artificial pond; f – organization of a sports complex in a recess; g, h – prosthetics and landscaping: 1-excavation; 2-building; 3-embankment; 4-drainage system; 5-dump; 6-cultivated plants; 7-seals; 8-anchors; 9-grid holding soil and vegetation.

Each option is landscape-specific and requires a set of strict conservation measures (for example, in the case of a landfill for solid domestic waste) or primarily health-improvement measures to create a more pleasant landscape. Targeted development should also be taken into account when planning bio-positive landscape restoration options. This is particularly important for the affected areas adjacent to agricultural land.
Depending on the components of the environment, environmental landscape restoration may be selected. These trends are related to different components of the geospheres [30-36].

Spatial planning is an important tool for the sustainable development of territories. The main purpose of territorial planning is to ensure the security and favourable conditions of human life in the conduct of economic activities and to limit the negative impact of economic and other activities on the environment. The protection and rational use of natural resources for the benefit of present and future generations, which is the essence of the sustainable development of the territories.

The main components of sustainable land development are land-use and development schemes, plans and regulations, which allow for the proper organization of the entire spatial planning process.

The sustainable development of the territories is determined by various aspects of human society and its relationship to the environment, as shown in figure 2.

![Fig. 2. The main components of sustainable development of territories.](image)

According to the experience of a country such as Sweden, the main existing spatial planning process with the potential to develop a landscape approach is Municipal Integrated Planning (MIP) [37-41], which can also be applied in Russia. The objectives of the MIP process and document are:

- a) Current and future land use;
- b) A tool for negotiations between local and national interests;
- c) A strategic, policy-based plan for the future direction and implementation of central directives.

Soil health management is critical to ensuring sustainable agricultural production and maintaining biodiversity. Components of different types of waste can cause soil damage. Fertilizers and pesticides have traditionally been considered an inevitable evil for industrial agriculture. While they remain critical tools for global food production, their undesirable consequences should not be overlooked, especially when sustainable agriculture is at the center of attention. In addition to a number of widely discussed and well-known adverse effects of chemical fertilizers and pesticides on the environment and human health, they have also been found responsible for strong effects on soil microbiological
properties. Considerable attention should be paid to organic farming. One of its branches is
known as permaculture (continuous farming). The application of the principles of organic
farming and permaculture would avoid many of the negative effects of chemicals [3,10, 33].

While the sustainable management of agroecosystems is still a work in progress,
significant progress has been made. These include the adoption by many farms of the
principles of organic farming and environmentally friendly methods of crop protection, and
the development of modern methods of recycling agricultural waste. All this creates great
prospects and opportunities to develop this industry with maximum profit for itself and
minimal risk to nature.

3 Results and Discussion

Based on the aspects of sustainable development considered, the land-use system should
include the characteristics of the following constituent elements (at least one of them):

a) The type of economic use of the particular plot (massif);
b) The type of legal regime of the parcel (or land);
c) The spatially limited area of the plot (massif) as part of the unified land fund of the
country;
d) An element of the environmental management system.

Consequently, land use tends to depend on the duration and type of rights, the type of
economic activity, its efficiency, spatial characteristics and many other factors. A system for
assessing damage from land degradation and pollution, based on the regulatory method,
where the amount of damage is linked to the legislated value of agricultural land, is subjective
and leads to the inadequacy of the damage determined to the actual extent of the harm caused.
Environmental damage from man-made effects in agriculture can be seen both in the direct
loss of agricultural products and in the reduction of the economic results of production on
contaminated land, and in the costs of compensation, aimed at restoring the damaged
fertility. Its value should therefore include not only the cost of repairing the damaged land,
but also the value of the fertility lost, as well as the loss of profit, i.e., the loss of income from
sales of the lost produce x [33, 42]. This makes it necessary to take a comprehensive approach
to determining the extent of the damage caused to agro-industrial production, so that the
principles of compensation for damage caused by man-made land pollution can be fully and
consistently implemented.

4 Conclusions

The current problem of greening land use is a global, human problem, as agricultural land
will remain the main source of food for growing populations for many years to come. Given
the limited availability of clean land for food production, it can be assumed that society will
be forced to use degraded and contaminated land for this purpose, although this will require
significant initial investment. In this situation, organizational and economic factors that
ensure the ecological stability of the use of contaminated land are becoming increasingly
important. But, at the same time, the theoretical and practical issues of the environmental and
economic use of technogenic contaminated areas, as well as the management of agricultural
production on these lands, the ecological security of the population and the sustainable
development of the territory require clarification with regard to regional land-use patterns.
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