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Introduction

Sustainable agriculture: Why we are concerned today

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I.

In the 2020 special issue of the *Russian Journal of Economics* (RuJE) "Challenges for Russia's agriculture,"[1] it was stated: "The main challenge to global development today is the requirement for sustainable development of all spheres of human activity, including in agriculture" and "The main obstacle to the sustainable development of agriculture in Russia is, of course, the 'resource curse': the availability of vast land and water resources and relative biodiversity do not yet pose an urgent need for the country to preserve them" (Serova, 2020). This issue of RuJE is focused on some key areas of sustainability of agriculture in the world and in Russia.

Sometimes, sustainable agriculture is considered only as a kind of climate smart one. However, this is only part of the story. Sustainability in its simplest definition is a way of development, which maintains resources for future generations. This concept addresses not only climate change, but also the awareness of limited resources.

In order to feed the growing population and, what is even more important, the one which is getting wealthier, humankind needs more resources if it uses conventional agricultural technologies ("business as usual"). More land, more fresh water, and more energy will be needed to meet global food (and fiber) demand. In the mid-20th century it was possible to find virgin lands (the Soviet Union's development of Virgin lands demonstrates that),[2] and there was nearly no shortage of fresh water. Nowadays, the extension of lands for agriculture is possible mainly at the expense of forests, which is highly undesirable from the environmental point of view. The scarcity of fresh water has become a big challenge in many regions: total annual water withdrawals per capita in two

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1 https://rujec.org/issue/2828/

2 In the last two decades, croplands area increased by 4.2% while forest land area decreased by 2.3% (FAO, 2021).

decades fell notably in almost all regions of the world (especially in Central Asia and North America; FAO, 2021b). Limits to energy supplies are also a modern challenge for humankind's development today.

The situation regarding limited resources for agricultural production is aggravated by the progressive deterioration in their quality through intensive use. In accordance with the latest FAO (2021b) publication, 34% of global lands are classified as moderately to highly degraded. Global agriculture withdraws more than 70% of all surface and groundwater, first of all for irrigation. Agriculture is mainly responsible for water pollution.[3]

Climate change also affects resources for agricultural production. Thus, precipitation is likely to become more frequent, intense and heavier in the near future. This will lead to landslides, erosion, and floods. Higher sea levels are already leading to salinization and erosion of costal lands (IPCC, 2021).

Towns are the major competitors for key agricultural resources — land and water. The rapid development of global towns diminishes the resources for agriculture. In addition, the sustainability of agriculture seriously depends on biodiversity (which is a reservoir for genetic resources), and in accordance with FAO estimates, "traditional indigenous territories" are home to 80% of the world's biodiversity."[4]

The aforementioned challenges are not a manifestation of the Malthusian theory new edition; this is a call for a new paradigm of development. This is why the concept of sustainable agriculture was brought to the international agenda. Among 17 Sustainable Development Goals (SDGs), adopted by the United Nations in 2015, the second calls for ending all forms of hunger and malnutrition by 2030 and the promotion of sustainable agriculture.[5]

In order to produce food in a sustainable way humankind should (i) protect and enhance natural resources, (ii) increase the productivity of using these resources, (iii) enhance the resilience of human and natural systems and (iv) be able to govern these new challenges in an optimal way. Innovative technologies and the cultivation of workers capable of using them will allow the world to dramatically increase the productivity of available inputs and use them in the most protective way. Nowadays, we can already see how agribusiness is becoming one of the most innovative industries: IT technologies, biotech, nanotechnologies, new chemical achievements and other technologies are already being introduced into real food production. Precision agriculture allows for a dramatic decrease in the use of chemicals but also an increase in their efficiency. Socially responsible chemical companies are developing new generations of fertilizers and pesticides, and agriculture is increasingly using organic fertilizers and pesticides. New technologies allow for enhanced water productivity and savings in water. Breeding and new feeding technologies can help to decrease emissions from cattle husbandry.

Over the last thirty years, the productivity of using resources has become the major source of growth. This means that agriculture has already been adapting for using higher technology and inputs (Fig. 1).

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[3] "Currently, it is estimated that some 2,250 km^3/year of effluent is discharged into the environment, 330 km^3/year as urban wastewater, 660 km^3/year as industrial wastewater (including cooling water) and 1,260 km^3/year as agricultural drainage" (FAO, 2021b, p. 21).

[4] https://www.cnbc.com/2020/07/24/how-the-growth-of-towns-and-cities-has-impacted-the-countryside.html

[5] https://sdgs.un.org/goals/goal2

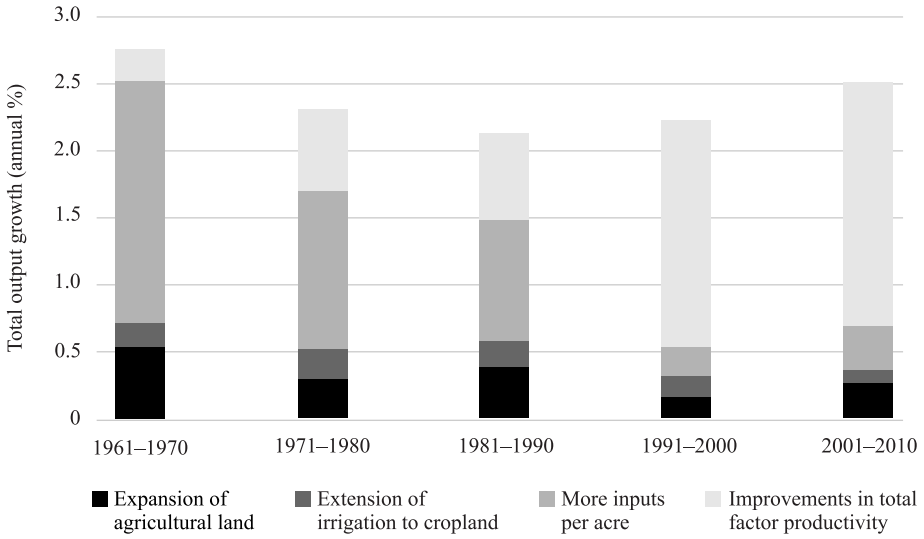

Fig. 1. Total factor productivity growth in world agriculture, 1961–2010.

Source: FAO (2021b).

Agriculture is accused of being the second biggest (after energy) industry emitter of greenhouse gases (see, e.g., Ritchie and Roser, 2020). New technologies are required to reduce the carbon footprint of agriculture and food industry. At the same time, one should be aware that agriculture in a broad sense (including forestry) is the only industry, which not only emits greenhouse gases, but also sequesters them. It means that new technologies are needed to enhance this proficiency in agriculture. Thus, carbon farms are being broadly spread around the world; with special agricultural practices, they allow for sequestering atmospheric carbon into the soil and in crop roots and leaves. The European Commission has adopted a new "Farm to Fork Strategy," which promotes carbon farming. The United States is to adopt a "Growing Climate Solutions Act," also focused on supporting carbon farms. In Russia, one of the biggest fertilizer manufacturers FosAgro has agreed with Vologda oblast and Russian Academy of Sciences to make this province agriculturally carbon neutral, as well as establishing a carbon farm there which will sequester 0.7 million tons of carbon annually.[6]

This new approach to agriculture allows for reducing greenhouse gas emissions: in 2000–2018 the share of this sector in terms of global emissions fell from 24% to 17% (Fig. 2).

In accordance with FAO estimates,[7] one third of total food production globally is wasted or lost. This means an extremely inefficient use of resources — natural, human, financial — and hence is a huge manifestation of insatiability of food systems. In addition, food loss and waste (FLW) is the biggest source of carbon emissions in the world. Therefore, reduction of FLW was included in the Agenda 2030 (UN, 2015). All UN members undersigned the commitment to reduce FLW per capita by half by 2030, but its measurement has been a global problem up to now.

[6] https://www.phosagro.ru/press/company/fosagro-i-ran-na-konferentsii-po-uglerodnoy-neytralnosti-obyavili-o-zapuske-proekta-po-sozdaniyu-kar/ (in Russian).

[7] https://www.fao.org/food-loss-and-food-waste/flw-data

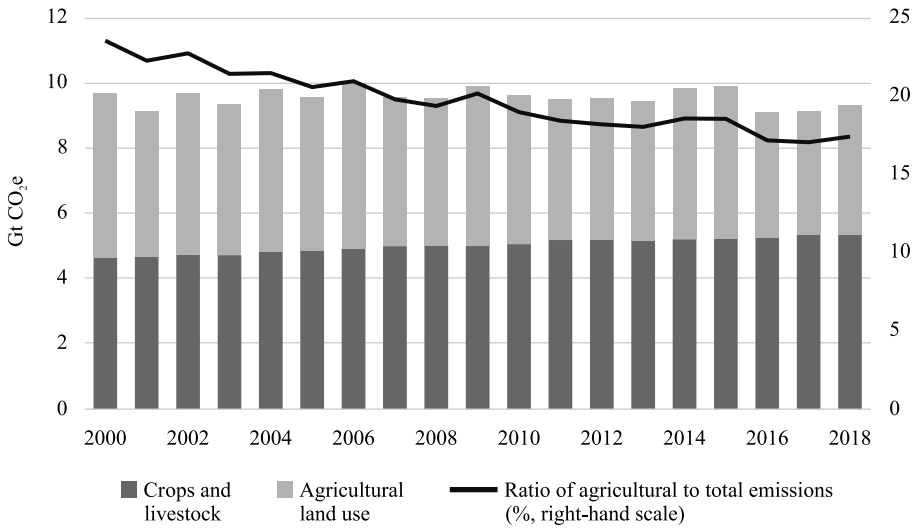

Fig. 2. Annual emissions from crops and livestock and related land use, and the share of agriculture in global GHG emissions from all sectors, 2000–2018.

Source: FAO (2021a).

Russia is a resource-surplus country, so the challenges of sustainable development are not always viewed in the same way as in other parts of the world. Sometimes producers think that the problem lies somewhere in the developing world, and it does not concern Russia. But the country is greatly affected by global warming, although it is not always clear how it will influence Russia's agriculture (FAO, 2021a).

Sustainability in agriculture is not only a public concern. It should also be a concern for business. Thus, it is worth recalling how disregard for the principles of sustainable technologies led to disasters even in developed countries and backfired on agribusiness itself. Examples are the soil catastrophe of the 1930s in North America (Dust Bowls),[8] and the aquaculture crisis in Chile (2009–2010).[9] Another example from the history of the USSR: the desiccation of the Aral Sea due to non-sustainable irrigation practices.[10]

In addition, an increasing constraint on food marketing today is that global food consumers are paying more heed to the conditions of food production. Surveys show that Russian consumers are also starting to pay more attention to this (Saleem ur, 2019; IFIC Foundation, 2019; etc.). Thus, ignoring the requirements of sustainability could become a barrier not only in international markets but also in domestic markets for Russian agri-food producers.[11]

II.

This issue has been designed to show different aspects of sustainability in food production and present the views of international and Russian experts. All the authors

[8] See, e.g., https://www.history.com/topics/great-depression/dust-bowl
[9] See, e.g., Ibieta (2011).
[10] See, e.g., http://www.ciesin.org/docs/006-238/006-238.html
[11] https://www.fao.org/russian-federation/news/detail-events/en/c/1440657/

are respected and well-known experts in their fields. But, as a guest editor, I am especially pleased to present two distinguished contributors among them.

Joachim von Braun is an internationally recognized agricultural economist, who has been working at the global level for many years on the issues of food security and sustainability. Currently, he works as a director of a department of the Center for Development Research at the University of Bonn and as a president of the Pontifical Academy of Sciences. For many years he worked at the International Food Policy Research Institute in Washington, serving as its director general at the end of his term. He was a member of scientific boards of numerous universities and research centers all over the world. In 2021, he was appointed to chair the Scientific Group of the UN Food Systems Summit 2021.

Margaret Zeigler is currently an interim president of the Supporters of Agricultural Research Foundation, a non-profit, non-partisan coalition of partners representing more than 6 million farming families, 100,000 scientists, hundreds of colleges and universities, consumers, veterinarians, and others in the USA, which is aimed at promoting agricultural research in the USA and all over the world.

This issue opens up with a paper by Alisher Mirzabaev and Joachim von Braun on "*True cost of food and land degradation*," which addresses the problem of sustainability in agriculture. Based on the example of land degradation due to intense production schemes, the authors explore the possibility to assess externalities from food systems in order to propose solutions for addressing their negative social welfare effects. It is a promising economic approach, especially because of the importance of soil preservation as one of the elements of a sustainable paradigm in agriculture.

As mentioned above, the major way to cope with challenges of limited resources for food production is to raise productivity through innovative technologies in agriculture and total food systems. The next three papers address various aspects of this theme.

Margaret Zeigler and Ann Steensland in their paper "*Participatory farmer research and exploring the phytobiome: Next steps for agricultural productivity growth*" demonstrate through broad international data how innovations in various areas of food systems lead to growth in total factor productivity. They also underline the importance of participatory approach for research in innovation. It is especially important that the most advanced technologies remain available, not exclusively for the biggest companies but also for SME in food systems. The participation of SME producers involves local breeds in breeding and increases genetic diversity, making it easier to adapt new breeds.

In their paper "*Russian agricultural innovations prospects in the context of global challenges: Agriculture 4.0*" Nadezhda Orlova and Dmitry Nikolaev consider the inclination of Russia's agribusiness towards innovations. Based on an in-depth survey of the biggest Russian agribusiness companies, the authors explore the major causes, priorities and constraints on investment in innovative technologies. The main conclusion of the paper is that agribusiness companies consider innovative development as a basic way to achieve competitiveness.

Marina Petukhova on the basis of the analysis of Russia's grain sector dynamics in her paper on "*Innovative development of the Russian grain sector*" points out the key R&D developments which have underlined the notable increase in grain yield and prioritizes the direction of technological trends in this sector for the im-

mediate short term: biotechnologies accelerating breeding; precision farming; biological and organic farming as well as advanced technologies phytomelioration.

Greenhouse gas emissions are one of the important aspects of sustainability of agriculture. Measuring their volume is still a pending research issue. The paper "*Environmental tradeoffs of agricultural growth in Russian regions and possible sustainable pathways for 2030*" by Anton Strokov and Vladimir Potashnikov explores several databases and different methods to assess the ecological impact of agriculture in various Russia's regions and make some scenario forecasts up to 2030.

The last paper in this issue "*Ways to monitor FLW: Review and recommendations on data collection and reporting for the Russian context*" addresses the problem of food loss and waste. The international team consisting of Ekaterina Galaktionova, Melanie Kok, and Hilke Bos-Brouwers analyzes the situation regarding FLW in Russia and tries to apply the international experience (most notably, one of the global champions in FLW reduction — the Netherlands) to the Russian case.

As a guest editor of this issue of RuJE, I want to cordially thank the distinguished researchers who agreed to contribute their papers. I am sincerely grateful to the reviewers, who helped the authors to improve their papers. I do hope this issue will contribute to our better understanding of various aspects of sustainability in agriculture and help in meeting this global challenge.

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