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**CONSEQUENCES OF THE VIRGIN LAND MEGAPROJECT:
A VIRGIN LAND SPACE AND ITS DEVELOPMENT**

Abstract. The results of studies of the eastern sector of Eurasia's steppe zone from the Volga region to the Altai on the subject of the dynamics of the steppe titularity are presented. The rapid and almost complete replacement of zonal steppe ecosystems on the plains with grain fields, which was produced by the Soviet Virgin Land Megaproject, formed a specific virgin space in the steppe zone. As a result of subsequent transformations, it developed into a post-virgin space, then transformed into an agro-export one. The leading factors of the formation of these spaces, their main qualitative characteristics, and specific features are described. The totality of the Virgin Land megaproject and the mass abandonment of fields, which has shown the self-restoring potential of the steppes, are considered as a unique experiment in the renewal of steppe grass stands. Taking into account the existing and new trends, we suggest an outline of the transition to a compromising space organized according to the principle of optimum economy and natural communities.

Keywords: virgin lands, virgin land space, secondary steppes.

Introduction. The largest state megaproject in history for the one-time plowing of grasslands that became known as the Virgin Land Campaign took place in the middle of the 20th century in the eastern sector of Northern Eurasia's steppes and became the most important factor in the transformation of the steppes, which still determines their fate. The history, essence, and consequences of the Virgin Land megaproject have been studied by us for 30 years, and new generalizations and reassessments were carried out for the next anniversaries of the Virgin Land Campaign. At the moment, large-scale studies dedicated to the 70th anniversary of this project are being completed. The research is based on: fundamental ideas about the history, essence and consequences of virgin campaigns in the grasslands of the Holarctic of the 19th–20th centuries; observations of the realization of the potential for the restoration of steppe ecosystems in the 21st century and systematization of its regional manifestations; information about the

cores of virgin and secondary steppe ecosystems; ideas about the dynamics of bioclimatic potential and soil fertility, technological equipment of agriculture and prospects for the introduction of modern nature-like technologies; notion of trends in the status of steppe life and diversity, cooperation on cross-border Russian-Kazakhstan steppe protected areas, the achievements of the project to reintroduce Przewalski's horses in the Orenburg region, the potential of the growing integration of the Volga-Ural populations of saiga antelope in the steppe modern agrolandscape [1-13].

Methods. The main results were obtained using a systematic approach by methods of field geographical research, comparative historical and comparative typological analysis, interviewing, expert and logical generalizations.

Results and discussion. Assessing the intensity of landscape transformations, primarily due to the virtually complete loss of zonal steppe ecosystems on the plains, we came to the idea of steppe biological titularity. We mean by this the geographical analog of dominance in ecology – a vivid expression of the presence of a species in the landscape, which is one of the main signs of its physiognomy. Our research has confirmed the high self-restoring potential of some titular steppe species and determined it of others, and it is the potential that has reinforced our idea of steppe titularity. The main natural titles of the steppes include steppe species of genera: feather grass (*Stipa*) – generally a recognized cultural, geographical, and botanical symbol of the steppes, fescue (*Festuca*), tulips (*Tulipa*), marmot (*Marmota bobac*), steppe species of ground squirrels (*Spermophilus*), saiga (*Saiga tatarica*), roe deer (*Capreolus capreolus*) (considered as a forest-steppe and steppe gazelle), little bustard (*Tetrax tetrax*), bustard (*Otis tarda*), steppe species of the lark family (*Alaudidae*) and diurnal birds of prey, the locust family (*Acrididae*), etc. The titular species are capable of rapid self-restoring and, when the optimal number is reached, they are usually in the field of view of the observer.

A distinctive feature of modern steppes is the replacement of natural titles with anthropogenic ones: agricultural – grain and oilseed crops, cattle, pigs, chickens; and nomadic – adaptive breeds of horses, sheep, goats, camels, and cattle. The main problem of the steppes is competition, the structure, and the alternation of natural and anthropogenic titularity, although the inherent property of the steppe as a landscape is permanent variability. So for 70 years after the Virgin Land project, the space of its implementation has changed its quality three times. Using the above concept of biological natural and anthropogenic titularity of steppes, we develop the theory of steppe physiognomy according to Alekhin [14, 15] and the landscape theory of the steppes by Chibilev [16, 17].

The replacement of natural and nomadic titularity with agricultural one took place in different ways: on the European territory of Russia (ETR) it was a long gradual process (18-19 centuries), to the east of the ETR the transformation took place instantly, in 1954-1956. The steppe titularity in the subzone of chernozems and dark chestnut soils in the Trans-Volga, South Ural, West Siberian, and North Kazakhstan steppes had been replaced by agricultural one for three years of the implementation of the Virgin Land megaproject.

The idea of large-scale one-time development of virgin steppe lands in the Trans-Volga region, the Urals, and Western Siberia did not belong to N. S. Khrushchev, under whose leadership the Virgin megaproject was implemented. This idea originated during the resettlement movement for the Volga in the 19 century and was partly implemented by the Stolypin reform, after which significant reserves of arable land were retained. The Soviet agrarian science of the early 1930s in the person of N. I. Vavilov and Tulaykov, who advocated the development of 11–11.7 million hectares of chernozem soils in the east of the steppe zone, was interested in these reserves. They were actively opposed by T. D. Lysenko offered to rely on the creation of new more productive varieties, rather than expanding the area [18]. In 1941, the idea of a virgin megaproject became particularly relevant due to the temporary loss of the main granaries of the USSR; an expedition led by A. A. Grigoriev was conducted, the result of which was the basis of the plowing of 13 million hectares of virgin lands with the best bioclimatic potential in 1943 [19]. Thus, the line of geography was close to the positions of agricultural sciences.

The virgin land idea was implemented in the 1950-s with the maximum possible hyperbolization. By the decision of the country's leadership, the plowing plans immediately reached 30 million hectares, and taking into account future fallows, they were brought to 40 million hectares, and this plan was exceeded due to increased obligations at the level of foremen and even machine operators. For the introduction of land into arable circulation, the initiative of the lower management level, or even ordinary performers, was enough. The Virgin Land megaproject (1954-1963) was accomplished as the most ambitious in terms of

plowing volumes: 43 million hectares were plowed, 16 million hectares of which were in the RSFSR, and 25 million ha in the Kazakhstan SSR. Also, it was scaled according to the terms of implementation: the main lands, over 36 million hectares, were plowed in just three years, which tripled the scientific justification [20, 21]. In the RSFSR, the largest scale of plowed lands was in the Altai Territory (2.9 million hectares) and the Orenburg Region (1.8 million hectares) [22], which also became at least twice the excess of the scientifically based plan.

The negative consequences, primarily agroecological, were caused not so much by the idea of a Virgin Land megaproject itself, as by a three-fold excess of a scientifically based plan. Potentially unproductive lands were plowed and are still officially listed as arable; the titular steppe landscape was purposefully selected and plowed. It was this hyperbolization of the virgin idea that turned the steppe zone into a zone of grain fields throughout the entire space of the implementation of the Virgin Land megaproject, transformed the steppe into a kind of landscape coma, in which it has remained for more than 40 years. Therefore, we were primarily interested in the reasons for such an excess of scientifically based plans; after searching for it, we found that the hyperbolization of the virgin idea was not voluntarism, but a consequence of fulfilling a wide range of strategic tasks, including beyond agriculture, to which the megaproject was directed [11, 12].

The negative consequences of the virgin megaproject appeared almost immediately after its completion and were recognized as its initiator, but there was no strategic decision to reverse the withdrawal of agriculture from the high-risk zone. During an interview with the *New York Times* dated 02/23/1964, N. S. Khrushchev admitted that the part of the former virgin lands affected by erosion would be transferred to pastures, and state efforts would be redirected to more favorable regions for agriculture [23]. However, it was at this moment that a change of leadership took place in the country again, and instead of fundamentally correcting the consequences of the Virgin megaproject, a period of inertia came: by the mid-1970s, more than 5 million hectares of chestnut soils were plowed; the state supported the use of land plowed during the megaproject for agriculture through subsidies.

The state response to the negative consequences of the Virgin megaproject included mainly soil protection measures; from 1966 to 1970 several state decisions were issued on urgent measures to protect soils from wind and water erosion, on the prospects for the development of land reclamation and redistribution of river flow. Plans for large-scale protective afforestation, regulation, and accumulation of water runoff are being put forward again, that is, the ideas of the so-called "Stalin's plan for the transformation of nature", which in 1954 was rejected in favor of a Virgin Land megaproject, are being returned.

Due to the intensity and speed of the transformation of the landscape throughout the geographical space covered by the Virgin megaproject, and the actual transformation of the steppe zone into a zone of grain fields for some years, we consider this geographical space as a virgin one from the standpoint of geography and steppe studies. According to the territory of the implementation of the Virgin megaproject, the main core is located in the Trans-Urals, Western Siberia, and Central Kazakhstan with a length of about 2000 km and a width of about 700–800 km, and two wings are in the virgin space. The Trans-Volga Cis-Ural wing from the Volga to the foothills of the South Urals has a length of about 800 km and a width of about 100–200 km. The Central Siberian wing consists of the island steppes to the east of Altai, including the Daurian steppes.

The speed and scale of the Virgin megaproject, the unfavorable climate for agriculture, and the lack of resources caused the main contradictions and tension of the virgin space, which became its "congenital defects". The harvest years generated no fewer problems than the lean ones: there was an acute shortage of resources and infrastructure for record harvests. The instability of land use, which gave rise to its unprofitability, required additional government spending, but contrary to economic logic, no adjustment of the structure of land was discussed until the end of the 1980s. The problems of the land structure specified by the Virgin Land Campaign were political, and for the first time were recognized only at the sunset of Perestroika by the development of projects for the transformation of unproductive lands in 1989, which remained unfulfilled.

The main problems and contradictions of the virgin land space were:

– the steppe space was developed not progressively or frontally, but simultaneously by a continuous sampling of lands of easy development – steppe plains;

- plowing of 20 million hectares of chestnut soil and subsequent plowing of 5 million hectares of land on light chestnut soils with low bioclimatic potential;
- the production yield is 2–3 times lower than the biopotential;
- high losses;
- planned indicators exceeding the capabilities of the land with the technologies of that time, human and other resources;
- at the end of mass plowing, the tendency of the slow growth of arable land areas with instability and a wide amplitude of fluctuations in productivity and gross yield;
- the resources of the titular and economically valuable types of steppes have suffered fundamentally, many of which have been listed in Red books;
- the main core of the Russian–Kazakhstan virgin land has released at least 1 billion tons of CO₂ into the atmosphere over the years of its existence [24];
- politicization of the space and structure of farmland with an economic and political attitude to get grain at any price

By the 1990s, all the signs of the ecological and economic crisis of the steppe zone having the character of a challenge were observed in the virgin land area. Nevertheless, thanks to the state monopoly on export (the impossibility of mass export of saiga antlers), the virgin space acted as a seasonal area of saiga, whose population reached a maximum of 1.5 million heads [17, 25, 26, 27].

The virgin space existed from 1954 to 1994, including the years of the Virgin Land megaproject and several years of inertia in the 1990s. With the beginning of reforms, instead of scientifically based optimization [17], a spontaneous transformation of this space began due to: a fundamental decrease in state support for agriculture, radical economic reforms with the reorganization of Soviet virgin land agricultural enterprises socially oriented by the land reform. Under the influence of these factors in the post-Soviet virgin land in the late 1990s, there was a sharp reduction of acreage, and in Kazakhstan the liquidation of the majority of virgin state farms, with the transition of tens of millions of hectares into a deposit without phytomelioration; virgin lands began to regenerate the post–virgin space.

So, the post–virgin space began its existence with an arable respite for the steppes lasting 10–20 years. We consider this respite, a Virgin megaproject, and decades of its support as a unique, extremely expensive joint natural–anthropogenic experiment to determine the self–restoring potential of the steppes. From these positions, we are sincerely grateful to the authors of the Virgin megaproject and subsequent reforms. Radical political conservatism and radical political reformism collided around land use in virgin lands in a short period. The clash of forces made the land reform such that it was impossible to remove unproductive lands from arable, especially to carry out costly phytomelioration and lose them as arable in such an expensive way. The reduction of arable land in the structure of the land share would infringe on the rights of the shareholder, hence the decision: to let these lands be temporarily overgrown with weeds and steppe grasses, which happened. On this contradiction, the post–virgin land space was formed.

This space provided an opportunity to study the potential of self–restoration of steppe title species in modern conditions: climate change, lack of phytomelioration of arable land, and increased CO₂ concentration. The titular steppe biota has shown the properties of aggressive intruders, occupying thousands of hectares in a few years, mainly where favorable conditions have developed. In the first stage, steppe phytocenoses were quickly restored in the untilled areas where the seed fund was formed; in the second stage, seeds from this fund spread to the surrounding fallows, fundamentally changing the course of successions. The restoration of steppe vegetation was followed by marmots, little bustards, and other steppe animal titles. By analogy with secondary forests, we called such ecosystems "secondary steppes", which were left without saiga, whose resources came to a minimum due to poaching for horns provoked by the abolition of the state monopoly on exports and the opening of foreign markets.

We recognize the secondary *Stipa lessingiana* steppes as a unique product of the virgin megaproject and a landscape symbol of the post–virgin space (figure 1).

After a decade of the existence of the post–virgin space at the beginning of the 21 century, Russia and Kazakhstan have begun to implement several agricultural projects aimed at involving steppe fallows in circulation. Limited financial resources stretched the liquidation of deposits for 10–15 years. For 2020, contradictory data on 16–35 million hectares of deposits are given for Russia. Fallows are returned to circulation mainly by agricultural holdings that can apply modern agricultural technologies to large areas.



Figure 1 – Secondary *stipa lessingiana* steppe in the Trans–Volga Cis–Ural wing of the post–virgin land space. June 2020

In 2022 there was a sharp increase in demand for steppe arable land, prices for the remaining land shares in some post–virgin regions increased 10 times.

For the Russian part of the core of the post–virgin space with an area of 20 million hectares, U-shaped covering northern Kazakhstan with decreasing bioclimatic potential (BCP) from north to south, we have carried out geographical differentiation and developed ways to optimize land use. We distinguish three segments of the Russian part of this core: the northern latitudinal with the highest BCP, the western meridian (Orenburg), and the eastern meridian (Altai). The western and eastern segments coincide in the direction of the reduction of the BCP but have geographical differences. In the Orenburg segment, the Ural Mountains are on the path of atmospheric moisture transfer, in the Altai sector, the mountains, on the contrary, contribute to additional moisture. In the western segment, there are mainly loamy soils and steppe plains at altitudes of about 350 m. In the eastern segment, soils are mainly of light mechanical composition at lower altitudes with greater water absorption and somewhat better conditions for agriculture and afforestation.

Our scheme of structural optimization of the post–virgin space is based on the principle of using the best land for intensive grain production technologies (northern segment) with a decrease in the share of arable land in the landscape as the BCP decreases in the western and eastern segments (figure 2).

In the Trans–Volga Cis–Urals wing of the post–virgin space in the border Belyaevsky district of the Orenburg region in 2010–2015, we singled out a site of the Orenburg State Reserve "Preduralskaya Steppe" with an area of 16.5 thousand hectares where a project for the reintroduction of Przhevalsky's horse was implemented. Currently, Przhevalsky's horse population has reached 70 individuals. In the same wing, the transborder Volga–Ural saiga population (2015–2022) has been fully restored on the territory of Kazakhstan, which regularly comes to calving in the border areas of the Russian Trans–Volga region [1, 28, 29]. In the Daurian steppes of the Central Siberian wing, thanks to cross–border cooperation in the field of nature protection, migrations of the growing Mongolian population of the dzeren have been restored in the 21 centuries [30].

The redistribution of farmland, the use of modern technologies, and the support of the state reduce the tension of this space in comparison with the virgin but do not eliminate it due to the factor of droughts and the factor of falling prices in the harvest years, which is new concerning the virgin space. The virgin land is more dynamic under the influence of two leading factors: fluctuations in weather conditions and climate, and fluctuations in acreage in combination with the spread of sunflower and other crops.

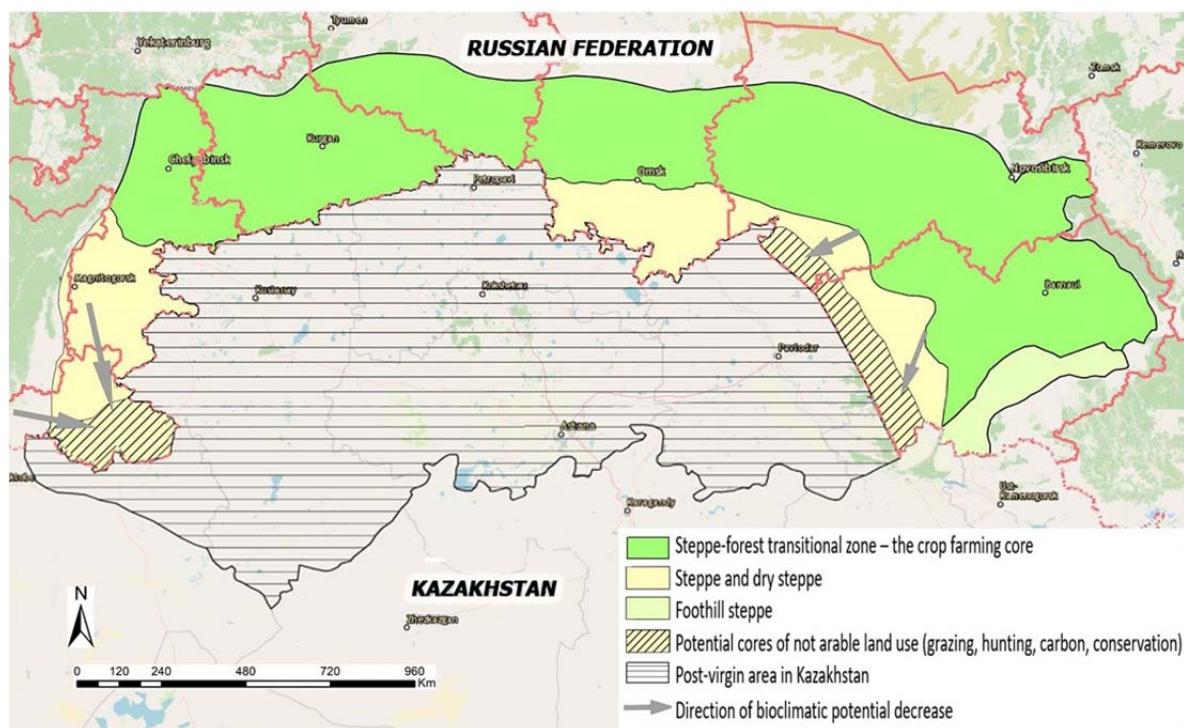


Figure 2 – The Russian post–virgin space of the Urals and Western Siberia, and a schematic diagram of its structural optimization

In this work, the main focus was not on the number of plowed and decommissioned lands, but on the search and fixation of a certain quality of self-restoration of steppe ecosystems to the level of secondary steppes. Therefore, the areas of such can only be estimated by us in an expert way. For example, for virgin areas of the Orenburg region in 2021, we estimated the area of secondary steppes as no more than 280-300 thousand hectares, although the area of maximum land outflow from arable land at the beginning of the 21st century was in the range of 1.4-1.6 million hectares. Currently, the bulk of deposits in the Orenburg region has been put back into circulation, today there are no more than 4 million hectares of deposits, half of them are secondary steppes, and such lands are located mainly in the southern and southeastern regions of the region. The main parameters of the dynamics of arable land at the turn of the 20th and 21st centuries. As experts, we will take the virgin regions of Kazakhstan – West Kazakhstan Region, Aktobe, Kostanay, North Kazakhstan, Akmola region, Pavlodar region, East Kazakhstan, Karaganda. We take two Russian regions bordering with Kazakhstan as model post-virgin ones: Orenburg (in the west), Altai Territory (in the east) in relation to Northern Kazakhstan. So, the maximum arable land in the virgin area fell at the beginning of the 1990s and amounted to about 30 million hectares. The maximum drop in acreage was at the beginning of the 21st century – to less than 14 million hectares, or more than twice. Then there was a steady restoration of acreage to the level of 18 million hectares for the first half of the 2020s. At the same time, the main grain-growing regions of Northern Kazakhstan, such as Kostanay, North Kazakhstan and Akmola, have practically restored the acreage, and they are sowing about 15 million hectares. The greatest reduction in acreage and, accordingly, the greatest potential for self-regeneration of steppes remains in the West Kazakhstan region (under a deposit of more than 1.5 million hectares), in the Aktobe region – about 2 million hectares, in the Pavlodar region – 2 million hectares of deposits, in the Karaganda region - about 1 million hectares [24].

We have studied the specific contrasts and oscillations in the post–virgin land space. As an example, we will consider the border contrast of the Alexandrovsky–Gaysky district (RF) with its developed adaptive meat cattle breeding and the Kaztalovsky district (RK) with the growing Volga–Ural saiga population reaching its maximum. Within the virgin land's Pervomaisky district of the Orenburg region (RF), two adjacent protrusions of the territory separated by the Chagan River sharply contrast: the western protrusion, difficult to access, is the secondary *Stipa lessingiana* steppe, the accessible eastern one is plowed as much as possible.

A striking example of oscillation (alternating arrangement of opposite states on different sides of the axis border) is the Svetlinsky (RF) and adjacent Aitekebiysky (RK) districts. In 1998–2008 the Svetlinsky district was characterized by a slight reduction in arable land, the Aitekebiysky one – a sharp reduction at 200 thousand hectares with rapid restoration of steppe vegetation and marmot resources. From 2015 to the present, the Aitekebiysky district returned the former acreage, the resources of the marmot were fundamentally reduced, and the Svetlinsky district reduced the acreage by the same 200 thousand ha, on which the processes characteristic of the Aitekebiysky district had taken place 10 years before [31, 32].

The post–virgin area is fundamentally more covered by the territorial protection of steppe ecosystems. In 2010–2016, with the support of two Global Economic Fund (GEF) steppe projects, new steppe protected areas were created in Russia and Kazakhstan, a population of Przewalski's horse was created in Russia, and saiga was revived in Kazakhstan. This space will go down in history as the arena of a global experiment that left a mark in fundamental science, arable respite, the dynamism of land, climatic fluctuations, the spread of innovative technologies, the growth of yields and gross yield, the development of steppe protected areas, the return of Przewalski's horse and the restoration of saiga.

Since the 2020s, with the Earth's population of 8 billion people, a pandemic, and other global changes, a trend of rising world food prices has developed, which has intensified the plowing of fallows in the post–Soviet space, including post–virgin lands. In the Russian Federation, the "State Program for effective involvement in the turnover of agricultural land ..." has been launched (approved by the Decree of the Government of the Russian Federation No. 731 of 14.05.2021) – in fact, Virgin Land Campaign–2. Already in 2022, Russia has obtained the highest grain harvest in history – 153 million tons, and a high sunflower harvest. The growth of global grain needs motivates the Russian Federation to increase the export potential for grain, which in the coming years is projected at about 60 million tons. The Russian Federation has already become a world leader in the export of wheat and sunflower, the production of which is specialized by the post–virgin space. Under the pressure of these factors, this space evolves into a new quality, acquiring virgin features in the monotony of agricultural landscapes and a high degree of plowing. There are new properties – an expressed export orientation and the spread of intensive farming technologies, the availability of credit, financial and other resources, and the likely end of the era of arable respite, after which the ecological reserves of steppe biota populations will not find a place. In confirmation, we note that the long–expected simplification of the change of the type of permitted use of farmland, in which steppe studies saw a tool for optimizing the structure of farmland, due to the above factors, on the contrary, only legalized the plowing of forage lands that were not in demand due to the stagnation of animal husbandry.

In the western and eastern segments of the core of the post–virgin space, as well as in both of its wings, at the end of its existence, the chances of survival of the remnants of secondary steppes are still preserved, but they are increasingly acquiring the features of anthropogenic relics of this space.

The above allows us to recognize that the post–virgin space is on the transition to the neo–virgin lands or **agro-export**. The current trend contributes to repeat the landscape–ecological crisis of the steppes in new conditions, and the consequences may be more tragic than the previous crisis, up to the complete loss of the steppes due to the loss of self–restoring potential, as it happened in the ETR. According to our observations, repeated plowing of secondary steppes reduces their self–restoring potential. Perhaps this is due to the climate, the exhaustion of the seed supply in the soil and in the surrounding areas, and other patterns of the ecology of the steppe vegetation cover, perhaps not yet known.

In the agro–export space in the conditions of "Virgin Land Campaign–2", the problems of restoring priority species of steppe ungulates (saiga, Przewalski's horse, dzeren) should be solved within the framework of the national project "Ecology" and the implementation of the "Strategy of Socio-Economic Development of the Russian Federation with Low Greenhouse Gas Emissions until 2050" (approved by the Decree of the Government of the Russian Federation No. 3052-p from 29.10.2021).

In conclusion, we note that a further increase in gross yields and export potential for grain in the agro–export space, due to the exhaustion of territorial reserves, should be achieved through technological re–equipment with the production yield reaching the boundaries of biopotential and higher with the priority of Russian developments. The yield increase reserve is estimated to be 2–3 times higher than the existing production yield [4]. Accordingly, with the transition to advanced technologies of seed production and agriculture, gross yield in Russia can reach 300 million tons with the release of at least 10 million

hectares of unproductive arable land for animal husbandry, the restoration of resources of red book and priority species, carbon deposition, rural and ecological tourism.

At the background of the approaching crisis of the steppes and the technical possibilities of its prevention, it is possible to predict an increase in the social order for the restoration of steppe ecosystems providing various ecosystem and other services. As the practice of the project style of development has shown, the optimal mechanism for fulfilling such an order would be a "Steppe National Project" or a steppe component of national environmental or agricultural projects. The successful implementation of such a project will facilitate the transition of the agro-export space into a new compromise economy and natural communities organized according to the principle of optimum, taking into account the costs, crises, and challenges of all three previous spaces.

Conclusion. Steppe titles as a rule have a high self-restoring potential and manifest the properties of an aggressive intruder. The properties of the aggressive intruder in the titular biological species have become a leading factor in the development of a number of specific features of the post-virgin land space. We recognize secondary *Stipa lessingiana* steppes as a landscape symbol of post-virgin land space. The concept of natural and anthropogenic biological titularity of the steppes develops the theory of steppe physiognomy according to Alekhin [14-15] and the landscape theory of the steppes by Chibilev [16-17]. The geographical space covered by the virgin land megaproject, due to the actual transformation of the steppe zone into a zone of grain fields for some years, should be considered a virgin. As a result of socio-economic reforms, the virgin space was transformed into a post-virgin space as rapidly as it arose. The post-virgin space has become the arena of a global experiment to assess the self-restoring potential of steppe ecosystems in modern climatic conditions. In modern conditions, steppe titles in the post-virgin space have shown a high potential for self-rehabilitation by creating millions of hectares of secondary steppes. Projects, including those supported by global environmental funds, to create a population of Przewalsky's horse in the Orenburg region, the restoration of saiga in Kazakhstan, and the restoration of populations and migration routes of the dzeren in Mongolia and Russia have been successfully implemented in the post-virgin space. The growth of world food prices inevitably contributed to the activation of the transition of the post-virgin space to the agro-export one. In the agro-export space, the still relatively widespread secondary steppe ecosystems tend to turn into rare relics of the post-virgin space. The potential of grain yield growth in the agro-export space and the continuing self-restoring potential of the titular steppe biota determine the possibility of transition of the agro-export space into a compromise one that meets the ideals of global food security and preservation of the optimum resources of the titular steppe biota.

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«ТЫҢ» МЕГАЖОБАСЫНЫҢ САЛДАРЫ: ТЫҢ КЕҢІСТІК ЖӘНЕ ОНЫ ИГЕРУ

Аннотация. Еділ бойынан Алтайға дейінгі Еуразия далалық белдеуінің шығыс секторын дала титулдылығының динамикасы бойынша зерттеу нәтижелері берілген. Кеңестік тың игеру мегажобасымен жүзеге асырылған жазықтардағы аймақтық далалық экожүйелерді астық алқаптарымен тез және толық дерлік ауыстыру далалық аймақта ерекше тың кеңістікті қалыптастырды. Кейінгі қайта құрулардың нәтижесінде тыңнан кейінгі кеңістікке, кейін агроэкспорттық кеңістікке айналды. Бұл кеңістіктердің қалыптасуының

жетекші факторлары, олардың негізгі сапалық сипаттамалары мен өзіндік ерекшеліктері сипатталған. «Целина» мегажобасының үйлесуі мен даланың өзін-өзі қалпына келтіру мүмкіндігін көрсеткен егіс алқаптарының жаппай бас тартуы дала шөптерін жанартудағы бірегей тәжірибе ретінде қарастырылады. Қолданыстағы және жаңа тенденцияларды ескере отырып, оңтайлы экономика және табиғи қауымдастықтар принципі бойынша ұйымдастырылған ымыралы кеңістікке көшу схемасы ұсынылады.

Түйін сөздер: тың, тың аймағы, қосалқы дала.

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ПОСЛЕДСТВИЯ МЕГАПРОЕКТА «ЦЕЛИНА»: ЦЕЛИННОЕ ПРОСТРАНСТВО И ЕГО ОСВОЕНИЕ

Аннотация. Представлены результаты исследований восточного сектора степной зоны Евразии от Поволжья до Алтая на тему динамики степной титульности. Быстрая и почти полная замена зональных степных экосистем на равнинах зерновыми полями, произведенная советским целинным мегапроектом, сформировала в степной зоне специфическое целинное пространство. В результате последующих трансформаций оно превратилось в постцелинное пространство, а затем трансформировалось в агроэкспортное. Описаны ведущие факторы формирования этих пространств, их основные качественные характеристики и особенности. Совокупность мегапроекта "Целина" и массового отказа от полей, показавшего самовосстановительный потенциал степей, рассматривается как уникальный эксперимент по обновлению степных травостоев. С учетом существующих и новых тенденций предлагается схема перехода к компромиссному пространству, организованному по принципу оптимальной экономики и природных сообществ.

Ключевые слова: целинные земли, целинное пространство, вторичные степи.