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**Terres, sols et peuples : expertise agricole et pouvoir
(xix^e - xx^e siècles)**

Introduction

Expertise And The Quest For Rural Modernization In The Russian Empire And The Soviet Union

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EDITOR'S NOTE

Translated from German by Bill Templer

- 1 The project of modernity is generally associated with industrial and urban contexts.¹ Yet the belief that the world can be transformed through knowledge, technology and reason has left clear marks beyond the classic laboratories of modernity. In rural regions, it manifested itself in the implementation of ambitious agricultural programs and gigantic infrastructure projects. Such endeavors brought about both adventure and risk, promising unseen triumphs and foreshadowing ecological disasters and social upheaval.²
- 2 Within a few generations the intended consequences of rural modernization and its collateral damages radically transformed agricultural production and the rural way of life. Concealed behind our daily bread today lies a wide range of different forms of expertise. In the 20th century, Frank Uekötter writes, “land has become a key resource in agriculture that has left no area of agronomy untouched, and has even been able to relativize land ownership as a classic social determinant in rural society.”³ Multiple instructive questions spring from the insight that in Russia and the Soviet Union in particular, knowledge was seen as a decisive precondition for increases in yield and rural development. The answers to those questions provide new perspectives not only on scientization and modernization within national states but also on transnational interactions and interdependencies—thus contributing to the global history of agriculture, science and environment.

Rural modernization : Better and bitter harvests

- 3 The concept of “rural modernization” addressed in this special issue should not be understood in the sense employed by American social scientists such as Walt W. Rostow, who in the decades of the Cold War drew a link between modernization, democracy and capitalism. In this way, Rostow tried to persuade governments in non-European countries of the validity and value of the Western model of a progressive transition from traditional agrarian society to industrial modernity.⁴ Rural modernization as used here refers to the *attempt* to transform the rural economy and natural spaces through science, technology and reason, and thus to make them useful for society.
- 4 The diverse programs for implementing modernity in rural contexts ranged broadly from ideas about an agrarian order based on small farms, where education and science constituted the decisive forces driving rural development, to cooperative models of economy and society, extending on to dreams of agriculture organized by the principles of Taylorism and Fordism.⁵ During the interwar period, industrial agriculture served as a benchmark for modernization that transcended economic systems and ideologies.⁶ With a robust faith in the power of progressive technology and efficient management, American agronomists traveled to the Soviet Union in the belief that collectivization had put the country on the threshold of a modern rural economy.⁷
- 5 In the decades after World War II, the success of the Green Revolution appeared to confirm the superiority of industrial agriculture.⁸ Following record harvests in Southeast Asia, genetically modified grain varieties and chemical fertilizers were introduced globally to raise yields. Enthusiasm for scientifically grounded and highly technologized farming nurtured the fervent hope among many in the East and West, as well as in the North and South, that it would now be possible to overcome global hunger and social barriers to growth in their own countries. However, it soon became apparent that shifting “food’s frontier”⁹ brought substantial ecological implications and went hand in hand with violent interventions in existing agrarian systems. Consequently, ever more attention was paid during the final decades of the 20th century to the “broken promise of agricultural progress.”¹⁰ This gave rise to dismay and lasting disillusionment.¹¹
- 6 The rural dimension of the project of modernity shaped the history of the Russian Empire and the Soviet Union in particular. The continental climate, with its sometimes extremely cold and long winter periods and regular droughts, made agriculture vulnerable and harvest yields extremely volatile. At the same time, agriculture was central to developing the national economy as a whole. In the 18th and 19th centuries, the exports of agricultural products (flax, hemp and, later, grain) stimulated the expansion of trade, industry and market relations.¹² Agriculture remained a dominant sector in the Russian Empire, still accounting for 51 % of the national income in 1913. Russia played a leading role on the emerging world grain market until Stalinist collectivization.¹³ In the Soviet Union, urban populations did not exceed rural populations until 1962.¹⁴ In many cases, rural development programs accompanied the consolidation of imperial rule beyond the political and economic centers. Within the largely agrarian peripheries the implementation and strengthening of central state authority often required far-reaching settlement and colonization.¹⁵ For that reason,

rural regions became a regular focus of state activity in the late 19th century.¹⁶ After the 1917 Revolution, Russian policymakers grew more convinced that the social order could be designed and transformed by subjugating nature. Large-scale construction sites became significant arenas of modernity, even in scarcely developed villages and remote natural spaces. Those cases exemplified the state's imperative of rigorous expansion and growth and its striving for political dominance, economic power and cultural hegemony.¹⁷

Land : The economic resource

- 7 Since the Neolithic Revolution, human community has simply been unthinkable without agriculture and animal husbandry for the production of food, energy and materials. The pivotal role of land often triggered social confrontations.¹⁸ Oral agreements, written rules and visible markers such as fences served to defuse one of the oldest social causes for conflict. The precise regulation of land access—and in many cases water access—led to comprehensive bodies of law whose aim was to provide a legal foundation for using this scarce and contested resource. While being both a creative and destructive cultural force, land laws are so basic a phenomenon that they arise even where there is no state to enforce them.¹⁹
- 8 Land enclosure was central to rural development in England during the early modern period. In the mid 18th-century, the government intensified support for the removal of common property rights and the consolidation of fields to make the land more profitable. Contemporaries and historians alike have regarded enclosure, which was often enforced against the will of the rural population, as a precondition for England's agricultural and industrial "revolutions." However, it has been shown that in the end productivity and yields were not necessarily higher on enclosed lands.²⁰
- 9 The close relationship between property and power had a technological dimension as well. To better demarcate and secure the land, the Americans Lucien B. Smith and Joseph F. Gidden independently from each other invented barbed wire in the second half of the 19th century. Its technical simplicity, low production costs and multiple uses contributed to the triumph of the "devil's rope" in prairie fences, battlefield trenches and all manner of detention camps. In the case of agriculture, barbed wire proved to be not only an effective means of border demarcation but also functioned as a political *dispositif* of separation, driving the dynamics of inclusion and exclusion, conquest and subjugation. As modernity's veritable crown of thorns, barbed wire has remained a simple yet effective means of power in the control of space and land, livestock and people.²¹
- 10 All attempts at regulation notwithstanding, land has repeatedly been an object of social confrontation and dispute. Russian and Soviet history highlight these dynamics most notably. From the abolition of serfdom under Alexander II to the Stolypin Reform and the Revolution of 1917, the search for an expedient apportionment of land was a topic of intense debate, affecting legislation, politics, philosophy, and even literature.²² In his short story "How Much Land Does a Man Need?" (1886), Lev Tolstoy sought to determine how much land was actually appropriate for a farmer.²³ The Stolypin Reforms, which aimed at overcoming communal practices of land use in open fields, pursued an "administrative utopia" of a rationally ordered rural economy. The peasants' fields were to be clearly separated from one another and agriculture was to

be optimally adapted to the demands of the market.²⁴ After the February Revolution, when peasants began to appropriate landowners' land, politicians and scientists sought to create rules and regulations to curb the chaos in the villages.²⁵

- 11 During the Soviet period, the rejection of “bourgeois” relations of ownership and the dream of large-scale enterprises shaped agrarian discourse and agrarian policy. While the coercive collectivization of the village at the beginning of the 1930s was driven by the wish of the Stalinist elite to subjugate rural regions, the belief in economies of scale determined Nikita S. Khrushchev's ultimately unsuccessful amalgamation campaign.²⁶ Up until the Soviet Union's end, officials in the Party and the government continued to debate on how much farmland should be allotted to individual households for independent agricultural production.²⁷

Soil : The natural resource

- 12 While land is an economic and political category, soil stands for the “uneasy relationship” between agriculture and the natural environment.²⁸ Farming often reduces the productive capacity of the soil ; processes of degradation, especially as a result of erosion, salinization and compression, lead to losses in agricultural surface area. This affects not only individual farmers and local communities ; in extreme cases soil degradation can trigger famine, mass migrations and wars over land and water. That is why the UN Food and Agricultural Organization declared 2015 the International Year of Soils, seeking to raise awareness about the importance of soil for global food security, the preservation of biodiversity and the stabilization of the climate.²⁹
- 13 The problems identified by the United Nations are by no means new. In recent years, fascinating yet disquieting studies have acknowledged soil as a defining factor of human history. In his influential environmental history of the 20th century, John R. McNeill stresses that the “earth's skin,” which is rarely more than hip-deep, takes centuries to build up but only a short time to degrade through inappropriate land use. The thin fertile crust of the earth is “the basic of human survival, the source of sustenance for plants, the foundry of life.”³⁰ The geo-morphologist David R. Montgomery has emphatically warned that “we are skinning our planet.” In his cultural and social history of soil from ancient to modern times Montgomery identifies soil as “our most underappreciated, least valued, and yet essential natural resource” and argues that more historical research is urgently needed in order to illustrate that social orders “rely as much on soil conservation and stewardship as on technological innovations.”³¹ Using the example of dust storms, a special issue of *Global Environment* has recently demonstrated that soil degradation is a promising field of research. Its history still has to be written, with narratives mirroring the ambivalent experiences of both destruction and revitalization, as well as of ignorance and betterment. Without any doubt, studies on soil exhaustion provide instructive views on the interconnections between agrarian, cultural and environmental histories.³²
- 14 In Russia, the management of soil has been a concern for intellectual and political elites since the 19th century. The pioneering soil scientist Vasilii V. Dokuchaev (1846-1903) sought more appropriate ways to farm the fertile black earth and semi-arid regions. He argued that the steppe environment suffered from widespread soil erosion and a growing vulnerability to aridity because settlers ignored local environmental constraints.³³ The “Great Stalin Plan for the Transformation of Nature of 1948”—at that

point the “world’s largest ecological engineering project”³⁴—borrowed from Dokuchaev’s idea to afforest the steppe, providing for the planting of huge shelterbelts, the development of protective tree lines and the stabilization of sandy soils.³⁵ Two years later, a further series of decrees ordered the construction of dams and hydroelectric power plants as well as a huge network of irrigation canals on the Volga, Don and Dniepr. Celebrated as the “The Great Stalin Construction Works of Communism” (*Stalinskie Velikie Stroiki kommunizma*), these projects sought to transform the entire south of the Soviet Union by means of an “ecological revolution” in “flourishing stretches of land.” In the end, the plan proved abortive due to its overblown scale and the absurdities of the Soviet command economy.³⁶

- 15 Yet failure could also inspire debates about more careful ways to use the soil. In the 1960s, Khrushchev’s Virgin Land Program sustained a heavy setback due to severe dust storms. In light of the environmental effects of the expansion of farming in the steps, Soviet agronomists drew from Canadian experiences with dryland farming, non-inverting tillage, contour plowing and the beneficial role of stubble and crop residues. Lamenting that Soviet agriculture seriously lagged behind in soil conservation, they started to introduce measures similar to those employed in the North American prairies and to produce farm equipment modeled on Canadian prototypes.³⁷
- 16 Closely related to the careless use of soil were Soviet endeavors in irrigation. They illustrate the constraints on agriculture stemming from climatic and other natural conditions. The second half of the 20th century has been called “irrigation’s modern era.”³⁸ Over the course of fifty years irrigated agricultural land increased worldwide from 100 million to 271 million hectares. At the beginning of the 21st century, around 20 percent of the agricultural land was under artificial irrigation, providing over 40 percent of total global agricultural yields.³⁹ In the second half of the 20th century, the south of the Ukraine and Russia and the dry zones of the Soviet Central Asian republics became prominent showplaces of the hazards of large-scale irrigation. The water diverted into open fields often washed salt into the topsoil from the earth below. It accumulated in the roots of arable crops, causing significant losses. As a result, more agricultural land was ultimately lost than proved possible to regain through improvement projects. Irrigation, once promising, turned out to be a threat.⁴⁰

People : The social resource

- 17 Soil has been cultivated in many different ways through history, yet land was often worthless without the people who worked on it.⁴¹ Until the end of serfdom the wealth of a Russian landowner was measured not by the land he possessed but by the number of “souls” he could call his own.⁴² After the emancipation of the serfs, the government, private companies and settler communities relied on a large workforce for agricultural production. In the Tsarist period the allotment of land and taxation exemptions for colonists were central for farming in remote regions.⁴³ As part of the Stolypin agrarian reforms and the construction of the Trans-Siberian Railway, the Tsarist government promoted the resettlement of peasants to the fertile steppe regions of western Siberia. Between 1897 and 1911, 3.5 million persons left the European part of the Empire in a scramble for land handed out by the government. They reclaimed areas that for centuries had been used by Kazakh and Kyrgyz nomads for grazing their cattle herds.

In 1910 the Siberian peasants increased butter production and achieved a notable grain surplus, which served to boost Russian agricultural exports. At the same time, the nomads were pushed southward as the new agricultural production threatened their way of life.⁴⁴

- 18 During collectivization, peasants and nomads were forced onto collective farms, where they often lived in extreme poverty as cheap and ready labor. This merciless exploitation of the village was what enabled the massive transfer of resources from agriculture to the industrial sector. Because kolkhoz peasants were no longer permitted to migrate legally into the cities after 1932, many used semi-legal ways to leave their villages. Due to this continued subjugation by the Soviet party state, rural residents dubbed the Stalinist collectivization the “second serfdom.”⁴⁵ In addition, the authorities willingly used forced labor in the Stalinist period. Millions of people were compelled to work the land and tend to the animals—in Gulag camps, special settlements and labor battalions.⁴⁶ After 1953, the Soviet leadership relied on large-scale campaigns, such as Khrushchev’s Virgin Lands Campaign, instead of forced labor to mobilize workers for their ambitious agricultural projects.⁴⁷
- 19 Ever since their coming into power, the Soviet government had claimed to seek a balance between urban and rural regions. But differences in living standards and income remained so great that ever more kolkhoz members turned their backs on the countryside for better jobs in industrial urban areas. In the 1970s, thousands of villages disappeared from the map, while Soviet agriculture faced a constant shortage of young specialists. Despite full-bodied party conference resolutions and governmental decrees, mechanization and electrification in many places were delayed and the great leaps promised never came.⁴⁸

Expertise : Turning visions into practice

- 20 Equipped with specialist knowledge and skills, experts played an important role in pre-modern societies. Their number was small, though, hence their influence was limited to certain professional fields.⁴⁹ With the rise of modernity, the state’s growing aspirations to intervene in every sphere of social and natural life enhanced the role of professional political advisors. Scientization and rationalization pluralized expertise and increased the numbers of experts significantly. As social change accelerated since the 19th century, political and economic elites sought to back up their decisions by qualified opinions, which lent political importance and social prestige to scientists, engineers and professional administrators. These experts “were not only entirely self-motivated and self-created ; rather, they were shaped by their interactions with political and social actors.”⁵⁰ They furnished those in power with tools for thought, arguments for decisions and scripts for action.⁵¹ As a result of their growing influence, scientific advisors were even labeled as the “fifth branch of government.”⁵² Indeed, there is good reason to describe the 20th century as the century of the expert.⁵³
- 21 The management of land, soil and people required knowledge about agriculture as well as about the social and natural characteristics of rural regions. Knowledge also served to legitimize any attempts to transform nature and landscapes. But knowledge alone did not suffice to reshape rural regions in accordance with the demands of modern economies and modern states. It also had to be administratively regulated and contained, to be recognized as a relevant resource and systematically implemented into

practice. Decisive for this transformation of knowledge into expertise was the belief that the world could be refashioned. “Generated in the framework of the relationship between science and power, with its own claims of validity and forms of representation,”⁵⁴ expertise is not merely an attribute of especially educated or experienced individuals. It also enables humans to transform physical and social environments.

- 22 In 2002, the German historian Margit Szöllösi-Janze called the agrarian sciences “one of the last really large unexplored ‘blind spots’ in the sphere of the history of science.”⁵⁵ Since then a lot has changed. Recent studies have shown that agricultural sciences and their related disciplines became important political resources in the 18th century, facilitating the integration of rural spaces into national economies and state bureaucracies. Initially, scientific societies played a key role in the generation of agricultural knowledge.⁵⁶ As the demand for products from plant cultivation and animal breeding increased with urbanization, so did political and popular interest in soil and life sciences.⁵⁷ The great leap in scientization at the end of the 19th century established new institutions and organizations and introduced new methods of cultivation and farm machinery that brought an upsurge in agrarian knowledge production.⁵⁸
- 23 Calculability and efficiency were considered decisive prerequisites for the realization of a rural modernity. Economic success should no longer depend on the vagaries of the weather or an allegedly incompetent rural population. Instead, efficient forms of organization, scientifically grounded prognoses and technical innovation promised to predict agricultural yields and to guarantee reliable rates of growth. Scientists and engineers found a new role in society as experts, opening the door for them to embark on the reordering of agrarian economy and village life.⁵⁹
- 24 In the Tsarist Empire and the Soviet Union, the production of knowledge about the rural peripheries was bound up inseparably with the integration of those regions and with the wish for more predictability in agricultural production.⁶⁰ Beginning in the early 19th century, agrarian experts were needed for the “scientization of the social”⁶¹ as well as for the “industrialization of nature.”⁶² After Alexander II’s Great Reforms, specialists found new career options in the bodies of local self-government (*zemstvo*) and, after the Russian Revolution of 1905, in educational institutions, associations and cooperatives. They advised the rural population on agricultural questions, collected extensive data on rural living standards, carried out experiments and championed hygiene standards.⁶³ The peasants in turn increasingly made their voices heard beyond the village, eventually making their way into elite discourse.⁶⁴
- 25 At the same time, numerous forums for scientific exchange, such as scholarly conventions, periodicals, agricultural schools and traveling exhibitions promoted the flow of information and the popularization of knowledge.⁶⁵ The Russian Empire and early Soviet Union were fully involved in the transnational circulation of agrarian knowledge and practices.⁶⁶ In the Paris World Exhibition of 1889 and 1890, the Russian pavilion’s 280 exhibits on soil science enjoyed great public interest.⁶⁷ In the following decades, the soil scientist Vasil’ii V. Dokuchaev, the geneticist Nikolai I. Vavilov, the landscape geographer Lev S. Berg and the economists Aleksandr V. Chaianov and Nikolai D. Kondrat’ev became internationally recognized authorities in their disciplines.⁶⁸

- 26 The supplementation of generalists by well-trained specialists, which had started in the late Imperial period, accelerated after the 1917 Revolution.⁶⁹ The Bolsheviks abolished the public sphere and subjected scientific expertise to state control.⁷⁰ The fate of numerous Soviet specialists showed that the power of experts depended on whether they were recognized by the ruling elites. Experts were likely to become targets of critique when reality could not be reordered as planners envisioned. During Stalinism many fell victim to state terror.⁷¹
- 27 The repression of prominent agronomists went hand in hand with the rise of the Soviet biologist Trofim D. Lysenko. With the aid of Stalin's personal backing, Lysenko promulgated his pseudo-scientific theory of heredity at a specially convened congress of the All-Union Lenin Academy of Agricultural Sciences in August 1948. In show-trial style the congress branded genetics a "bourgeois pseudo-science." Promoting the idea of "creative Darwinism" Lysenko became the "virtual dictator of Soviet biological and agricultural science."⁷² Lysenko's career proves that in the Soviet context "scientificity" (*nauchnost*) and ideology were often closely linked. Thus, "expertise was [...] not first and foremost a technical question, but a political one, including its symbolic dimensions as well as its presentations."⁷³ At the same time, Lysenkoism illustrates the nexus between competence and arrogance that is a common feature in the history of expertise.⁷⁴
- 28 Subjugation and repression were not the only features of the relationship between experts and the state in the Soviet Union. In the post-Stalinist period, scientists of the rural areas, especially ethnologists, geographers, sociologists and soil scientists, reconsolidated their disciplines and entered the arena of international scientific communities.⁷⁵ During the years of perestroika, well-known agronomists rose to the circle of advisors of Mikhail S. Gorbachev. This development challenges "the image of specialists as passive policy actors, dependent entirely upon the Soviet leadership." Instead, as Neil J. Melvin argues, it points to the "cumulative significance of specialist participation" in challenging existing basic concepts. In the area of rural policy, the fundamental contribution of experts that began long before 1985 was "to redefine the scope of the policy issues, to significantly shape the broad outlook of the elite on the nature of the countryside and its problems."⁷⁶

The agrarian paradox : Harvest failure and ecological devastation

- 29 In contrast to scientific projections and political recognition of expert knowledge about the countryside, the economic and ecological outcomes of rural modernization were often disappointing. The devastating famines of 1891/92, 1921/22, 1932-34 and 1946-48 revealed rural inefficiency, disorganization and political failure.⁷⁷ Despite periods of accelerating agricultural growth,⁷⁸ the level of agricultural production and the living standards in rural peripheries remained low relative to Western Europe and the United States, causing constant headaches for the authorities. Rural peripheries remained an important field of politics up until the late Soviet period.⁷⁹ In the 1980s, with an almost limitless supply of funds, the Soviet countryside witnessed "the highest food-and-agriculture subsidy known in human history."⁸⁰ Nonetheless, the agricultural sector remained the veritable Achilles heel of the economy. Beginning in 1963, the Soviet Union depended on ever more grain and meat imports from capitalist countries

to compensate for frequent crop failures. Given that the Soviet Union possessed the world's largest area of arable land, this was a major embarrassment for the country's leadership.⁸¹ In frustration, Mikhail Gorbachev, the last Soviet Kremlin leader, candidly described Soviet agriculture as a "hopeless liability on the national economy, a sort of bottomless pit absorbing immense resources."⁸²

- 30 Authorities often tried to compensate for poor production with the unrestrained deployment of heavy machinery and chemicals and the expansion of cultivation areas. This went along with massive environmental damage and serious health problems for millions of Soviet citizens.⁸³ A state commission report in 1993 noted that since the 1950s a fourth of the land under cultivation had been eroded on the territory now belonging to the Russian Federation. As a result, a third of the fields and meadows was lost or severely damaged.⁸⁴ The most dramatic proof of the disastrous consequences of Soviet agricultural policy has been the steady shrinkage of the Aral Sea after its tributaries were diverted for cotton irrigation.⁸⁵
- 31 The tension between the scientization of rural affairs on the one hand and regular crop failures and massive environmental destruction on the other raises questions around which this special issue centers. What did political elites and experts understand by rural modernization? Did experts assist the authorities by providing them with detailed knowledge and improvement proposals within already defined frameworks? Or did they conceive of new programs, set new aims and mark out new paths? Was expertise more than a source of legitimacy and argumentative arsenal for the authorities? What relevance did the ruling elites ascribe to scientific knowledge and engineering expertise for the implementation of their agenda? Invariably associated with these questions are others: What impact did politics have on the scientization of rural affairs? What were the consequences of the pursuit of modernizing policies for the rural population? Was reliance on expertise a reason for the undesirable developments and setbacks in agriculture?
- 32 Linking agrarian and environmental history with the history of sciences and politics, the case studies contained in this special issue show how knowledge was transformed into expertise and the role played by experts in the attempts to modernize the Russian Empire and Soviet Union. The authors explore how researchers and engineers acted in science, politics and the public sphere, and describe the strategies they used to gain recognition beyond their professional communities as mediators between the state and rural society. In doing so, the authors illuminate the creative power of expertise as well as its institutional, political and environmental limitations.

Regulating land use

- 33 From the Great Reforms in the mid-19th century to the end of the Soviet period, the codification of landed property and the distribution of land were repeatedly focus of intense scientific and political debate. Three articles in this special issue show that the surveying, categorization and allotment of land occurred at the interface of power, economy and morality. Officials, experts and the rural population legitimized their ideas with arguments about economic necessity and social justice. Even so, complex property relations and local interests frequently blocked the path toward realizing an ideal rural order. The legal, economic and moral dimensions of land use were intrinsically intertwined, in theory as well as in practice.

- 34 In his contribution, Igor' Khristoforov shows that the promotion and enforcement of private property rights proceeded sluggishly up until the late imperial period. After the Great Reforms, the state claimed an increasingly prominent role in rural peripheries of the Empire. With the establishment of private land ownership, however, this claim was not enforceable because the surveyors lacked authority over the rural population. Representatives of the landed gentry counted on informal agreements whereas peasants feared that the surveyors represented foreign interests. The two groups were pursuing different aims, yet they were united in their reluctance to accept outsiders interfering with local affairs.
- 35 The question concerning the appropriateness of landed property and economic profit remained a constant theme even after the caesura of 1917. David Darrow's article demonstrates that for more than half a century the reforms of Alexander II served as a benchmark for land use rights. In the revolutionary period, parties and experts from all political camps, and also peasants themselves referred to the category of *nadel* (allotment) that had passed into law with the abolition of serfdom in 1861 in order to define criteria for the allotment of land. Their proposals for providing a just rural order in line with objective criteria avowed the moral obligation of the state to secure land for the peasant population.
- 36 What was the proper and permitted extent of land to be allotted to the rural population for its own use? That question continued to be relevant even decades after collectivization. In her contribution, Katja Bruisch shows that agrarian discourse in the Soviet period was closely intertwined with changing notions of socialism. Household farming, a concession made by the Soviet state after the collectivization, came to be recognized as an integral part of the socialist village during the 1970s. The official turn toward subsidiary farming was legitimized by reference to the complementary function of household farming, which did not compete with collective or state-run enterprises. Moreover, Soviet leaders acknowledged private agriculture as an important part of the country's food production. The private use of land now seemed compatible with the socialist aspirations of the Soviet state.

Economic and political interests as determinants of expertise

- 37 The agency of experts fluctuated widely in the course of the 19th and 20th centuries. Even though they presented their knowledge as universally applicable, economic and political interests were always decisive factors in their reputation and influence.
- 38 Susan Smith-Peter presents a case study of how agricultural societies spread agrarian knowledge among the landed gentry. In the 1830s, the Moscow Agricultural Society began to promote the sugar beet industry by providing entrepreneurs with seed and technical expertise. However, economic factors and the natural environment proved more decisive than the support by scholarly societies. The sandy and loamy soils in Right-bank Ukraine were vast and entrepreneurs had access to free labor. As a result, the region evolved into a hub for sugar beet cultivation and processing in the Russian Empire.
- 39 Within the entanglement of science, economy and politics, new forums for exchanging knowledge developed and transcended the borders of the Russian Empire. In her article

on irrigation experts in Central Asia, Maya Peterson explores how transnationally generated knowledge was implemented in a concrete local setting. Focusing on the interplay between political and economic interests in the context of colonial expansion, Peterson shows that in the early 20th century, programs for irrigation were considered a key part of imperial policy. Hydraulic engineers worked closely with experts from the United States, whose experiences in the American West proved useful for the management of scarce water resources in Turkestan. Even as technical knowledge moved across continents, its application followed national interests. Russian experts, supported by the central government, used their knowledge to help cultivate cotton in the region and prepare the way for Russian settlers. Though the Tsarist government failed to transform the steppes and deserts of Central Asia into fertile landscapes, the dream outlasted the Russian Empire and opened numerous possibilities for hydraulic experts during Soviet rule.

- 40 Olessia Kirtchik explores how in the years of perestroika the rural economy became a major field of state politics. Different groups of agro-economic experts tried to push through their agendas with policymakers. While reform-minded economists favored the introduction of free-market incentives and the privatization of agriculture, experts within the classic institutions of Soviet agrarian science advocated the retention of collective farming. Kirtchik's contribution shows that expertise, irrespective of its technocratic appearance, frequently is embedded in a larger political agenda. Gorbachev's decision for close cooperation with the reform-oriented experts, too, was ultimately politically motivated.

Conflicts and constraints

- 41 Even as experts acquired a host of ways to apply their knowledge, success was anything but certain. Often, complex relationships between various actors and institutions as well as the interplay between man, technology and nature set narrow limits to the realization of their visions. For many experts, conflicts and constraints were therefore part and parcel of their professional experience.
- 42 As Stephen Brain shows in his article, institutional factors sometimes impeded the successful application of scientific expertise. The Tsarist government entrusted the Russian Army of the Don and the Vladikavkaz Railroad Company with afforestation in the steppe region to curb soil erosion in the 19th century. But the foresters who journeyed to the south of the Empire faced rigid regulations, often making it impossible to fulfill their task. In addition, soil conservation for the involved institutions, as Brain notes, was only of secondary importance. The afforestation programs achieved some short-term success, yet did little to contain erosion in the long run.
- 43 Along with institutional factors, power affected the influence of experts. In his article, Stephan Merl explores why a revolution in agricultural yields in the era of Stalin failed to materialize. Merl notes that Soviet specialists lacked the authority to implement their proposals despite repeated attempts in the 1920s and 1930s to rationalize farming by consolidating land and providing farms with high-grade seed. The centrally planned production targets for state grain supplies were not conducive to sustained increases in yields, when at the same time, agrarian experts were reprimanded whenever the harvests fell short of the quotas. The balance sheet of Stalin's policy was disastrous. The

rural population lost interest in their work and agriculture remained a lasting concern of the Soviet government.

- 44 In some cases, terror and repression obstructed rural modernization, as Christian Teichmann describes in his analysis of the Vakhsh River Valley project during the 1930s. Soviet planners had hoped that the construction of irrigation canals in the Soviet republic of Tadzhikistan would expand arable land for cultivating cotton. Yet the political atmosphere of Stalinism fomented mistrust amongst engineers, and many lost their lives during the reign of terror. In addition, insufficient food supplies and miserable living conditions—including malaria and typhus—debilitated the workforce. Moreover, the rivers could not be controlled effectively by the planners which caused uncontrolled flooding, eventually salinizing the earth. Instead of a blooming oasis, the project created a salty desert.

Research agenda of the special issue

- 45 Analyzing intellectual, social, technological, and natural conditions, the authors in this special issue show that rural orders are determined not only by human intentions and interactions, but also by the interplay of administrative procedures and cultural assignments. Since agriculture relies heavily on living resources (soil, plants and animals), the processes and results of rural modernization have often differed significantly from modern interventions in the urban and industrial sectors.⁸⁶ After the assemblages of land, soil, people and expertise are unraveled, Timothy Mitchell writes, “human agency appears less as a calculating intelligence directing social outcomes and more as the product of a series of alliances in which the human element is never wholly in control.”⁸⁷ This issue’s case studies prove that agriculture, as David Moon pointed out, provides “fertile ground for innovation in conceptualizing human-nature relationships.”⁸⁸
- 46 This special issue is devoted to exploring how great political caesurae like the collapse of the Russian and Soviet empires and the rise of Stalinism and perestroika reconfigured established fields of expertise. Political change often motivated experts to rethink their trajectories and to reconsider how their knowledge could be used. At the same time, the wide historical scope—from the early 19th century to the 1980s—uncovers continuities that outlasted those changes. Studying the development of rural expertise over a long timeframe thus helps to establish a more adequate narrative of the rise of modernity by reconsidering the impact of political turning points on the history of the Russian Empire and the Soviet Union.
- 47 The scientization of rural affairs was an international phenomenon, and expertise often developed and proliferated through transnational exchange. As the case studies show, however, the authority and the impact of experts always depended on the political and social structures in which they were embedded. Rural modernization was intrinsically linked to the decisive role of the state in the organization of technology, science and reason.⁸⁹ Addressing the complex relationship between national and international affiliations, the contributions in this special issue exemplify that the “fate of the expert” is “to operate somewhere between a universalist understanding of his or her expertise [...] and the politically or culturally defined requirement of the state.”⁹⁰
- 48 Instead of retelling the old story of agrarian backwardness, this special issue provides revealing insights into the rise of modernity in the Russian Empire and the Soviet

Union. The aim here is not so much to add to an incomplete picture as to open up new views on the role of experts in the transformation of rural regions. The articles help understand the agrarian paradox of Russian and Soviet history : On the one hand, the scientization of rural affairs was a prominent trend in the Russian Empire and the Soviet Union. The rise of knowledge and expertise was central to economic development, social progress and identity in rural regions, all of which shaped the thinking and acting of contemporaries. On the other hand, even as scientific experts and engineers promoted rural modernization the outcomes of their initiatives were ambiguous, ranging from complicated bureaucratic reforms to the failure of grandiose projects.

- 49 Rural modernization was never only an aim in itself. It was also a means through which to maintain or establish the power of the Tsarist and later the Soviet state in remote regions. In many cases, expertise served the larger political interests of internal colonization and empire-building. Conversely, the state could obstruct the work of experts when it feared the loss of influence in one of the most important areas of policy-making. Faced with this complex interplay of power, expertise and economy, rural modernization programs often fell short of expectations. In some cases, they even engendered tremendous social and ecological costs, leaving in their wake unfulfilled promises instead of scientifically and technologically driven progress.

NOTES

1. The idea for this special issue derives from the workshop “Managing Land, Soil and People : Environmental Knowledge and Expertise in Tsarist Russia and the Soviet Union (18th - 20th Century),” organized in March 2014 at the German Historical Institute (DHI), Moscow (see the conference report by Julia Herzberg : *Managing Land, Soil and People : Environmental Knowledge and Expertise in Tsarist and Soviet Russia, 14.03.2014 - 15.03.2014 Moscow*, in : *H-Soz-Kult*, 26 May 2014, <<http://www.hsozkult.de/conferencereport/id/tagungsberichte-5387>>). The workshop was a cooperative venture between the DHI Moscow, the Collaborative Research Cluster SFB 923 “Threatened Orders – Societies under Stress” at the University of Tuebingen and the French-German project “Contemporary Environmental History of the Soviet Union and its Successor States, 1970-2000. Ecological Globalization and Regional Dynamics” (Paris, Regensburg, and Tuebingen). We wish to express our gratitude to Cahiers du Monde Russe, in particular Valérie Mélikian, Sandra Dahlke, and Marc Elie, for including the special issue in the program of the journal and their outstanding support in implementing the project. Bill Templer and Christopher Gilley translated individual articles from German and Russian. We are gratefully indebted to the DHI Moscow and the SFB 923 for their generous financial support of the workshop and the special issue.

2. For an overview of attempts to remodel the world in accordance with science, technology and reason, see Michael Adas, *Machines As the Measure of Men : Science, Technology, and Ideologies of Western Dominance* (Ithaca – London : Cornell University Press, 1989) ; James C. Scott, *Seeing Like a State : How Certain Schemes to Improve the Human Condition Have Failed* (New Haven :

Yale University Press, 1998); Stanley D. Brunn, ed., *Engineering Earth: The Impacts of Megaengineering Projects*, 3 vols. (Dordrecht : Springer 2011).

3. Frank Uekötter, *Die Wahrheit ist auf dem Feld: Eine Wissensgeschichte der deutschen Landwirtschaft* (Göttingen : Vandenhoeck & Ruprecht, 2010), 18. Translation of the authors.

4. Michael E. Latham, *Modernization as Ideology: American Social Science and 'Nation Building' in the Kennedy Era* (Chapel Hill : University of North Carolina Press, 2000); Nils Gilman, *Mandarins of the Future: Modernization Theory in Cold War America* (Baltimore : Johns Hopkins University Press, 2003); David Ekbladh, *The Great American Mission: Modernization and the Construction of an American World Order* (Princeton : Princeton University Press, 2010. For rural modernization as an instrument of the British Empire see Joseph Morgan Hodge, *Triumph of the Expert: Agrarian Doctrines of Development and the Legacies of British Colonialism* (Athens : Ohio University Press, 2007).

5. Helga Schultz and Angela Harre, eds., *Bauerngesellschaften auf dem Weg in die Moderne: Agrarismus in Ostmitteleuropa 1880 bis 1960* (Wiesbaden : Harrassowitz, 2010); Eduard Kubú, Torsten Lorenz, Uwe Müller and Jiří Šouša, eds., *Agrarismus und Agrarreligionen im östlichen Mitteleuropa: Forschungsstand, Kontextualisierung, Thesen* (Berlin : Berliner Wissenschaftsverlag, 2013); Peter Moser and Tony Varley, eds., *Integration Through Subordination: The Politics of Agricultural Modernisation in Industrial Europe* (Turnhout : Brepols, 2013).

6. Meredith McKittrick, "Industrial Agriculture," in John R. McNeill and Erin Stewart Maudlin, eds., *Companion to Global Environmental History* (Chichester : Wiley-Blackwell, 2012), 411-432.

7. Deborah Fitzgerald, "Blinded by Technology: American Agriculture in the Soviet Union, 1928-1932," *Agricultural History*, 70, 3 (1996) : 459-486; Jenny Leigh Smith, *Works in Progress: Plans and Realities on Soviet Farms, 1930-1963* (New Haven, London : Yale University Press, 2014), ch. 2.

8. Deborah Fitzgerald, *Every Farm a Factory: The Industrial Ideal in American Agriculture* (New Haven : Yale University Press, 2003); Joseph Leslie Anderson, *Industrializing the Corn Belt: Agriculture, Technology, and Environment, 1945-1972* (DeKalb : Northern Illinois University Press, 2009).

9. Richard Manning, *Food's Frontier: The Next Green Revolution* (New York : North Point Press, 2000).

10. Cameron Muir, *The Broken Promise of Agricultural Progress: An Environmental History* (London, New York : Routledge, 2014).

11. On changing conceptions of rural modernity in the 19th and 20th century, see Uekötter, *Die Wahrheit ist auf dem Feld*; Giovanni Federico, *Feeding the World: An Economic History of Agriculture, 1800-2000* (Princeton : Princeton University Press, 2005); Andreas Dix and Ernst Lagenthaler, eds., *Grüne Revolutionen: Agrarsysteme und Umwelt im 19. und 20. Jahrhundert* (Innsbruck : Studien Verlag, 2006); Nick Cullather, *The Hungry World: America's Cold War Battle against Poverty in Asia* (Cambridge, MA : Harvard University Press, 2010); Jonathan Harwood, *Europe's Green Revolution and Others Since: The Rise and Fall of Peasant-Friendly Plant Breeding* (London : Routledge, 2012); Corinna R. Unger, "Agrarwissenschaftliche Expertise und ländliche Modernisierungsstrategien in der internationalen Entwicklungspolitik, 1920er bis 1980er Jahre," *Geschichte und Gesellschaft*, 41, 4 (2015) : 552-579.

12. Klaus Gestwa, *Proto-Industrialisierung in Russland: Wirtschaft, Herrschaft und Gewerbe in Ivanovo und Pavlovo, 1741-1932* (Göttingen : Vandenhoeck & Ruprecht, 1999), 222-225.

13. Paul R. Gregory, *Before Command: An Economic History of Russia from Emancipation to the First Five-Year Plan* (Princeton : Princeton University Press, 1994), 27-29; Barry K. Goodwin and Thomas J. Grennes, "Tsarist Russia and the World Wheat Market," *Explorations in Economic History*, 35, 4 (1998) : 405-430.

14. In five Soviet republics (Moldavia, Uzbekistan, Kyrgyzstan, Turkmenistan and Tadjikistan), the rural population exceeded 50 percent even in 1989, underscoring the unbroken dominance of the agrarian sector. See Thomas M. Bohn, "Bevölkerung und Sozialstruktur," in Stefan Plaggenborg, ed., *Handbuch der Geschichte Russlands. vol. 5 : 1945-1991* (Stuttgart: Anton Hiersemann, 2003), 595-657, here 621-623.
15. On the southern Russian steppe regions, see, for example, David Moon, *The Plough that Broke the Steppes : Agriculture and Environment on Russia's Grasslands, 1700-1914* (Oxford: Oxford University Press, 2013). Railroad construction especially played a key role in creating an integrated economic area and sphere of control. See Stephen G. Marks, *Road to Power : The Trans-Siberian Railroad and the Colonization of Asian Russia, 1850-1917* (Ithaca: Cornell University Press, 1991); Walter Sperling, *Der Aufbruch der Provinz : Die Eisenbahn und die Neuordnung der Räume im Zarenreich* (Frankfurt a. M.: Campus, 2011); Frithjof Benjamin Schenk, *Russlands Fahrt in die Moderne : Mobilität und sozialer Raum im Eisenbahnzeitalter* (Stuttgart: Franz Steiner, 2014).
16. George L. Yaney, *The Urge to Mobilize : Agrarian Reform in Russia, 1861-1930* (Urbana: University of Illinois Press, 1982); David A.J. Macey, *Government and Peasant in Russia, 1861-1906 : The Prehistory of the Stolypin Reforms* (DeKalb: Northern Illinois University Press, 1987).
17. Klaus Gestwa, *Die Stalinschen Großbauten des Kommunismus : Sowjetische Technik- und Umweltgeschichte, 1948-1967* (Munich: Oldenbourg, 2010); Stephen Brain, "The Great Stalin Plan for the Transformation of Nature," *Environmental History*, 15, 4 (2010) : 1-31; Andy Richard Bruno, *The Nature of the Soviet Power : An Arctic Environmental History* (Cambridge: Cambridge University Press, 2016); Christian Teichmann, *Macht der Unordnung : Stalins Herrschaft in Zentralasien, 1920-1950* (Hamburg: Hamburger Edition HIS, 2016).
18. The current public interest in questions of land utilization is reflected in the debate on so-called "land grabbing," where journalists have also expressed vehement views: Winfried Bommert, *Bodenrausch : Die globale Jagd nach den Äckern der Welt* (Frankfurt a. M.: Eichborn, 2012); Fred Pearce, *The Land Grabbers : The New Fight over Who Owns the Earth* (Boston: Beacon Press, 2012) Birgit Englert and Barbara Gärber, eds., *Landgrabbing : Landnahmen in historischer und globaler Perspektive* (Vienna: New Academic Press, 2014).
19. Andro Linklater, *Owning the Earth : The Transforming History of Land Ownership* (London: Bloomsbury, 2013).
20. R.C. Allen, *Enclosure and the Yeoman* (Oxford: Clarendon Press, 1992); J.M. Neeson, *Commoners : Common Right, Enclosure and Social Change in England, 1700 - 1820* (Cambridge: Cambridge University Press, 1993); Mark Overton, *Agricultural Revolution in England : The Transformation of the Agrarian Economy, 1500 - 1850* (Cambridge: Cambridge University Press, 1996), 147-168.
21. Alan Krell, *The Devil's Rope : A Cultural History of Barbed Wire* (London: Reaktion Books Ltd, 2002); Olivier Razac, *Barbed Wire : A Political History* (New York: The New Press, 2003).
22. Heinz-Dietrich Löwe, *Die Lage der Bauern in Russland 1880-1905 : Wirtschaftliche und soziale Veränderungen in der ländlichen Gesellschaft des Zarenreiches* (St. Katharinen: Scripta Mercaturae, 1987); Ben Eklof, ed., *The World of the Russian Peasant : Post-Emancipation Culture and Society* (Boston: Unwin Hyman, 1990); Cathy A. Frierson, *Peasant Icons : Representations of Rural People in Late Nineteenth-Century Russia* (New York: Oxford University Press, 1993); Heike Kathrin Litzinger, *Die Juristen und die Bauernfrage : Die Diskussion um das bäuerliche Grundeigentum in Russland von 1880 bis 1914* (Frankfurt am Main: Klostermann, 2007).
23. Leo Tolstoy, *How much Land does a Man need ?* (St. Lucia, Queensland: Locks' Press, 1986).
24. Judith Pallot, *Land Reform in Russia, 1906-1917 : Peasant Responses to Stolypin's Project of Rural Transformation* (London: Oxford University Press, 1999).

25. Orlando Figes, *Peasant War, Civil War : The Volga Countryside in Revolution, 1917-1921* (Oxford : Clarendon, 1989); Aaron B. Retish, *Russia's Peasants in Revolution and Civil War : Citizenship, Identity, and the Creation of the Soviet State, 1914-1922* (Cambridge : Cambridge University Press, 2008); Alessandro Stanziani, *L'économie en révolution : Le cas russe, 1870-1930* (P. : Édition Albin Michel, 1998), 183-206. Closely associated with land apportionment, conflicts also arose regarding the use of the forest; see Brian Bonhomme, *Forests, Peasants, and Revolutionaries : Forest Conservation and Organization in Soviet Russia, 1917-1929* (New York : Columbia University Press, 2005).
26. Zhores A. Medvedev, *Soviet Agriculture* (New York : Norton, 1987), 152-156; Neil J. Melvin, *Soviet Power and the Countryside : Policy Innovation and Institutional Decay* (Houndmills : Palgrave Macmillan, 2003), 5-7, 29-52; Auri C. Berg, *Reform in the Time of Stalin : Nikita Khrushchev and the Fate of the Russian Peasantry* (doctoral diss., University of Toronto, 2012).
27. Medvedev, *Soviet Agriculture*; Karl-Eugen Wädekin, *Privatproduzenten in der sowjetischen Landwirtschaft* (Cologne : Verlag Wissenschaft und Politik, 1967); Stefan Hedlund, *Private Agriculture in the Soviet Union* (London : Routledge, 1989). See also the article by Katja Bruisch in this special issue.
28. Federico, *Feeding the World*, 5-15.
29. Food and Agriculture Organization of the United Nations, *International Year of Soils 2015*, <<http://www.fao.org/soils-2015/en/>> (accessed 5 July 2015). In Germany, political NGOs and foundations have discovered the topic for themselves : Heinrich Böll Foundation ; Institute for Advanced Sustainability Studies, Potsdam, Germany, eds., *SOIL ATLAS 2015. Facts and Figures about Earth, Land and Fields*. <https://www.boell.de/sites/default/files/soilatlas2015_ii.pdf> (accessed 7 July 2015).
30. John R. McNeill, *Something New Under the Sun : An Environmental History of the Twentieth-Century World* (New York, London : W.W. Norton, 2001), 22. See also Benno Warkentin, ed., *Footprint in the Soil : People and Ideas in Soil History* (Amsterdam : Elsevier Science, 2006).
31. David R. Montgomery, *Dirt : The Erosion of Civilizations* (Berkeley : University of California Press, 2007), 3, 6. Similarly, John R. McNeill and Verena Winiwarter called the history of soil “the perhaps most neglected subject within environmental history.” See John R. McNeill and Verena Winiwarter, “Soils, Soil Knowledge and Environmental History : An Introduction,” in id., eds., *Soils and Societies : Perspectives from Environmental History* (Isle of Harris : White Horse Press, 2006), 4.
32. Susanne Stein and Klaus Gestwa, eds., *Gone with the Wind : Dust Storms and the Globalization of Anti-Wind Erosion Measures in the Twentieth Century*. Special Issue, *Global Environment*, 8, 2 (2015).
33. Moon, *The Plough that Broke the Steppe*; Jonathan D. Oldfield and Denis J.B. Shaw, *The Development of Russian Environmental Thought : Scientific and Geographical Perspectives on the Natural Environment* (London : Routledge, 2016), 48-77; Jan Arend, *Wie die russische Bodenkunde “klassisch” wurde : Wissenstransfer und Internationalität des Wissens in Agrarwissenschaften und agrarpolitischer Expertise 1880-1934* (doctoral diss., Ludwig-Maximilian University, Munich 2016). On the inappropriate land use by Russian peasants in the southern steppe regions and the ecological damage caused by this, see also Thomas M. Barrett, “The Land is Spoiled by Water : Cossack Colonization in the North Caucasus,” *Environment and History*, 5, 1 (1999) : 27-52.
34. Stephen Brain, *Song of the Forest : Russian Forestry and Stalinist Environmentalism, 1905-1953* (Pittsburgh : University of Pittsburgh Press, 2011), 148.
35. See Brain, *Song of the Forest*, 140-167; Denis J.B. Shaw, “Mastering Nature through Science : Soviet Geographers and the Great Plan for the Transformation of Nature, 1948-1963,” *Slavonic and East European Review*, 93, 1 (2015) : 120-146; Oldfield and Shaw, *Development of Russian*

Environmental Thought, 109-132 ; Klaus Gestwa, "Von der Katastrophe zum Kommunismus : Die Hungersnot 1946/47 und 'Stalins Großartiger Plan der Umgestaltung der Natur'," in Alfred Einfeld, Guido Hausmann and Dietmar Neutatz, eds., *Hungersnöte und Epidemien in Russland und in der Sowjetunion: Regionale, ethnische und konfessionelle Aspekte* (Essen : Klartext, forthcoming).

36. Medvedev, *Soviet Agriculture*, 144. For further details, see Gestwa, *Die Stalinschen Großbauten*.

37. Marc Elie, "The Soviet Dust Bowl and the Canadian Erosion Experience in the New Lands of Kazakhstan, 1950s-1960s," *Global Environment*, 8, 2 (2015) : 259-292.

38. Sandra Postel, *Pillar of Sand : Can the Irrigation Miracle Last ?* (New York : Norton, 1999), 40-64.

39. World Commission on Dams, ed., *Dams and Development : A New Framework for Decision-Making : The Report of the World Commission on Dams* (London : Earthscan, 2000), 137 ; Maude Barlow and Tony Clarke, *Blue Gold : The Fight to Stop the Corporate Theft of the World's Water* (New York : The New Press, 2002), 60.

40. Bo Libert, *The Environmental Heritage of Soviet Agriculture* (Wallingford : CAB International, 1995), 41-65. See also Christian Teichmann's contribution in this special issue. At the University of Tuebingen, Timm Schönfelder and Tommaso Trevisani are currently working on the menacing relationship between irrigation and salinization in South Russia, Uzbekistan and Kazakhstan since the 1950s.

41. On labor in agriculture see Federico, *Feeding the World*, 56-64. For a Marxist perspective, see now Martin Empson, *Land and Labour : Marxism, Ecology and Human History* (London : Bookmarks Publications, 2014).

42. Stephen Hoch, *Serfdom and Social Control in Russia. Petrovskoe : A Village in Tambov* (Chicago : University of Chicago Press, 1986) ; David Moon, *The Russian Peasantry, 1600-1930 : The World the Peasants Made* (London : Longman, 1999) ; David Moon, *The Abolition of Serfdom in Russia* (Harlow : Longman, 2001) ; Elise Kimerling Wirtschafter, *Russia's Age of Serfdom 1649-1861* (Malden : Blackwell, 2008) ; Tracy Dennison, *The Institutional Framework of Russian Serfdom* (Cambridge : Cambridge University Press, 2011).

43. Willard Sunderland, *Taming the Wild Field : Colonization and Empire on the Russian Steppe* (Ithaca : Cornell University Press, 2004) ; Nicholas B. Breyfogle, Abby Schrader and Willard Sunderland, eds., *Peopling the Russian Periphery : Borderland Colonization in Eurasian History* (New York : Routledge, 2007) ; Alexander Etkind, *Internal Colonization : Russia's Imperial Experience* (Cambridge : Polity, 2011).

44. Marks, *Road to Power*, 153-169 ; Dittmar Dahlmann, *Sibirien : Vom 16. Jahrhundert bis zur Gegenwart* (Paderborn : Ferdinand Schöningh, 2009), 195-201. Still very informative is Donald W. Treadgold, *The Great Siberian Migration : Government and Peasant in Resettlement from Emancipation to the First World War* (Princeton : Princeton University Press, 1957).

45. Sheila Fitzpatrick, *Stalin's Peasants : Resistance and Survival in the Russian Village after Collectivization* (New York : Oxford University Press, 1994) ; Mervyn Matthews, *The Passport Society : Controlling Movement in Russia and the USSR* (Boulder, CO : Westview Press, 1993) ; Gijs Kessler, "The Passport System and State Control over Population Flows in the Soviet Union, 1932-1940," *Cahiers du Monde russe*, 42, 2-4 (Avril-Décembre 2001) : 477-504 ; David R. Shearer, *Policing Stalin's Socialism : Repression and Social Order in the Soviet Union, 1924-1953* (New Haven : Yale University Press, 2009), 243-284.

46. On the history of the northern Kazakh camp complex KarLag, in which countless prisoners facilitated the expansion of regional agriculture, see Wladislaw Hedeler and Meinhard Stark, *Das Grab in der Steppe : Leben im Gulag. Die Geschichte eines sowjetischen "Besserungs-arbeitslagers" 1930-1959* (Paderborn : Ferdinand Schöningh, 2008) ; Steven A. Barnes, *Death and*

Redemption: The Gulag and the Shaping of Soviet Society (Princeton: Princeton University Press, 2011).

47. Martin McCauley, *Khrushchev and the Development of Soviet Agriculture: The Virgin Land Programme 1953-1962* (London: Macmillan, 1976); Michaela Pohl, *The Virgin Lands between Memory and Forgetting: People and Transformation in the Soviet Union, 1954-1960* (Doctoral diss., Indiana University, 1999); William C. Rowe, "Turning the Soviet Union into Iowa: The Virgin Lands Program in the Soviet Union," in Brunn, ed., *Engineering Earth*, vol. 1: 237-256; Paul R. Josephson et al., *An Environmental History of Russia* (Cambridge: Cambridge University Press, 2013), 146-152.

48. Bohn, *Bevölkerung und Sozialstruktur*, 621-623; Gestwa, *Die Stalinschen Großbauten*, 225-235; Vitalii S. Belozherov, Dmitrii Meshkov and Dietmar Neutatz, eds., *Migratsiia i prostranstvennaia mobil'nost' v sel'sko-gorodskom kontinuumе Rossii v XX veke: upravliaemost', adaptivnost' i strategii preodoleniia* [Migration and spatial mobility in the rural-urban continuum in Russia during the 20th century: Governability, adaptability and strategies for negotiation] (Stavropol': Izdatel'stvo Stavropol'skogo Universiteta, 2011); Judith Pallot, "Rural Depopulation and the Restoration of the Russian Village under Gorbachev," *Soviet Studies*, 42, 4 (Oct. 1990): 655-674.

49. Eric J. Engstrom et al., eds., *Figurationen des Experten: Ambivalenzen der wissenschaftlichen Expertise im ausgehenden 18. und frühen 19. Jahrhundert* (Frankfurt am Main: Peter Lang, 2005); Jakob Vogel, *Ein schillerndes Kristall: Eine Wissensgeschichte des Salzes zwischen Früher Neuzeit und Moderne* (Cologne: Böhlau, 2008); Eric H. Ash, ed., *Expertise: Practical Knowledge and the Early Modern State* (Chicago: University of Chicago Press, 2010); Björn Reich et al. eds., *Wissen, maßgeschneidert: Experten und Expertenkulturen im Europa der Vormoderne* (Munich: Oldenbourg, 2012); Hedwig Röckelein et al., eds., *Experten der Vormoderne zwischen Wissen und Erfahrung* (Berlin: Akademie-Verlag, 2012).

50. Martin Kohlrausch and Helmuth Trischler, *Building Europe on Expertise: Innovators, Organizers, Networkers* (Basingstoke: Palgrave Macmillan, 2014), 8.

51. Joris Vandendriessche, Evert Peeters and Kaat Wils, eds., *Scientists' Expertise as Performance: Between State and Society, 1860-1960* (London: Pickering & Chatto, 2015).

52. Sheila Jasanoff, *The Fifth Branch: Science Advisors as Policymakers* (Cambridge, MA: Harvard University Press, 1990).

53. Mitchell, *Rule of the Experts*; Kohlrausch and Trischler, *Building Europe on Expertise*; Thomas Etzemüller, ed., *Die Ordnung der Moderne: Social Engineering im 20. Jahrhundert* (Bielefeld: Transcript, 2009); Martin Kohlrausch, Katrin Steffen and Stefan Wiederkehr, "Expert Culture in Central Eastern Europe – Introduction," in idem, eds., *Expert Cultures in Central Eastern Europe: The Internationalization of Knowledge and the Transformation of Nation States since World War I* (Osnabrück: fibre Verlag, 2010), 9-30; Nico Stehr and Reiner Grundmann, *Experts: The Knowledge and Power of Expertise* (London, New York: Routledge, 2011).

54. Kohlrausch, Steffen and Wiederkehr, "Expert Culture in Central Eastern Europe," 20.

55. Margit Szöllösi-Janze, "Die institutionelle Umgestaltung der Wissenschaftslandschaft im Übergang vom späten Kaiserreich zur Weimarer Republik," in Rüdiger vom Bruch and Brigitte Kaderas, eds., *Wissenschaften und Wissenschaftspolitik: Bestandsaufnahmen zu Formationen, Brüchen und Kontinuitäten im Deutschland des 20. Jahrhunderts* (Stuttgart: Franz Steiner, 2002), 60-74, here 72. Translation of the authors. See also Uekötter, *Die Wahrheit liegt auf dem Feld*, 12-13.

56. Uekötter, *Die Wahrheit ist auf dem Feld*, 43-50; Stefan Brakensiek, "Das Feld der Agrarreformen um 1800," in Engstrom et al., eds., *Figurationen des Experten*, 101-122.

57. Denise Phillips and Sharon Kingsland, eds., *New Perspectives on the History of Life Sciences and Agriculture* (Heidelberg, New York: Springer, 2015).

58. Uekötter, *Die Wahrheit ist auf dem Feld*, 50-53, 133-181. See also Sarah Jansen, "Schädlinge" : Geschichte eines wissenschaftlichen und politischen Konstrukts, 1840-1920 (Frankfurt am Main : Campus, 2003); Thomas Wieland, "Wir beherrschen den pflanzlichen Organismus besser" : Wissenschaftliche Pflanzenzüchtung in Deutschland, 1889-1945 (Munich : Deutsches Museum, 2004).
59. Timothy Mitchell, *Rule of the Experts : Egypt, Techno-Politics, Modernity* (Berkeley : University of California Press, 2002).
60. Jonathan Oldfield, Julia Lajus and Denis J.B. Shaw, "Conceptualizing and Utilizing the Natural Environment : Critical Reflections from Imperial and Soviet Russia," *The Slavonic and East European Review*, 93, 1 (2015) : 1-15. The most comprehensive treatment of the genesis of agrarian scientific knowledge in the Russian Empire is Ol'ga Elina, *Ot tsarskikh sadov do sovetskikh polei : Istoriia sel'skokhoziaistvennykh opytnykh uchrezhdenii XVIII - 20-e gody XX veka* [From the Tsarist gardens to Soviet fields : The history of agricultural experimental stations from the 18th century to the 1920s] 2 vols. (M. : Egmont, 2008). See also the review articles by Brian Bonhomme, "Writing the Environmental History of the World's Largest State : Four Decades of Scholarship on Russia and the USSR," *Global Environment*, 12, 1 (December 2013) : 13-37; Randall Dills "Forest and Grassland : Recent Trends in Russian Environmental History," *Global Environment*, 12 (2013) : 38-61.
61. Lutz Raphael, "Die Verwissenschaftlichung des Sozialen als methodische und konzeptionelle Herausforderung für eine Sozialgeschichte des 20. Jahrhunderts," *Geschichte und Gesellschaft* 22, 2 (1996) : 165-193.
62. Paul R. Josephson, *Industrialized Nature : Brute Force Technology and the Transformation of the Natural World* (Washington : Island Press, 2002).
63. Ilya V. Gerasimov, *Modernism and Public Reform in Late Imperial Russia : Rural Professionals and Self-Organization, 1905-30* (Basingstoke : Palgrave Macmillan, 2009); Kimitaka Matsuzato, "The Fate of Agronomists in Russia : Their Quantitative Dynamics from 1911-1916," *Russian Review*, 55, 2 (1996) : 172-200; Yanni Kotsonis, *Making Peasants Backward : Agricultural Cooperatives and the Agrarian Question in Russia, 1861-1914* (New York : St. Martin's Press, 1999); Angelika Strobel, "Die Gesundung Russlands : Hygienepropaganda in der Provinz um 1910," *Jahrbücher für Geschichte Osteuropas*, 61, 4 (2013) : 531-551; Katja Bruisch, "Populismus, Profession und Politik : Agrarexperten im späten Zarenreich," in Tim Buchen and Malte Rolf, eds., *Eliten im Vielvölkerreich : Imperiale Biographien in Russland und Österreich-Ungarn, 1850-1918* (Berlin : De Gruyter, 2015), 240-260.
64. Julia Herzberg, *Gegenarchive : Bäuerliche Autobiographik zwischen Zarenreich und Sowjetunion* (Bielefeld : Transcript, 2013).
65. Gerasimov, *Modernism and Public Reform*, 11-24; Anastasia Fedotova, "The Beetle Question : The Growing Problem of Insect Infestations in South Russia in the Late Nineteenth Century," *The Slavonic and East European Review*, 93, 1 (2015) : 66-95.
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73. Kohlrausch, Steffen and Wiederkehr, "Expert Culture in Central Eastern Europe," 20.

74. On the rise of Trofim Lysenko, see Nikolaj Kremmentsov, *Stalinist Science* (Princeton : Princeton University Press, 1997), 158-183 ; Nils Roll-Hansen, *The Lysenko Effect : The Politics of Science* (New York : Humanity Books, 2005) ; Ethan Pollock, *Stalin and the Soviet Science Wars* (Princeton : Princeton University Press, 2006), 41-71 ; Ethan Pollock, "From Partiinost' to Nauchnost' and Not Quite Back Again : Revisiting the Lessons of the Lysenko Affair," *Slavic Review*, 68, 1 (2009) : 95-115.

75. Levina, Vavilov, Lysenko, Timofeev-Resovskii, 111-153 ; Melvin, *Soviet Power and the Countryside*, ch. 7 ; Marc Elie, "Formulating the Global Environment : Soviet Soil Scientists and the International Desertification Discussion, 1968-91," *Slavonic and East European Review*, 93, 1 (2015) : 181-204.

76. Melvin, *Soviet Power and the Countryside*, 26. See on this also Archie Brown, *The Gorbachev Factor* (Oxford : Oxford University Press, 1996), 43-47 ; as well as the contribution by Olessia Kirtchik in this special issue.

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78. On the dynamics of peasant agricultural production before the revolution see Michael Kopsidis, Katja Bruisch and Daniel W. Bromley, "Where is the Backward Russian Peasant? Evidence Against the Superiority of Private Farming, 1883-1913," *The Journal of Peasant Studies*, 42, 2 (2015) : 425-447.

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80. As in the formulation of Alec Nove, quoted in Chris Miller, "Gorbachev's Agricultural Agenda : Recollectivization and the Politics of Perestroika," *Kritika*, 17, 1 (2016) : 95-118, here 96. See also Dronin and Bellinger, *Climate Dependence and Food Problems*, 221-222.

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82. Mikhail Gorbachev, *Memoirs* (New York : Doubleday, 1996), 120.

83. Libert, *The Environmental Heritage of Soviet Agriculture* ; Viktor A. Kovda, "Kak pomoch' nashim chernozemam [How to help our Black-earth regions?]," *Nash Sovremennik*, 53, 7 (1985) : 122-128 ; Ihor Stebelsky, "Agricultural Development and Soil Degradation in the Soviet Union : Policies, Patterns, and Trends," in Fred Singleton, ed., *Environmental Problems in the Soviet Union and Eastern Europe* (Boulder, London : Rienner, 1987), 71-96.

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86. This point is emphasized by Moser and Varley, eds., *Integration Through Subordination*.

87. Mitchell, *Rule of the Experts*, 10.

88. David Moon, "The Steppe as Fertile Ground for Innovation in Conceptualizing Human-Nature Relationships," *Slavonic and East European Review*, 93, 1 (2015) : 16-38.

89. Ulrike Fell, *Profession und Nation : Die Ideologie der Chemie in Frankreich vom Zweiten Kaiserreich bis in die Zwischenkriegszeit* (Leipzig : Universitätsverlag, 2000) ; Alan J. Roche, *Nationalizing Science : Adolphe Wurtz and the Battle for French Chemistry* (Cambridge, MA : MIT Press, 2001) ; Ralph Jessen and Jakob Vogel, eds., *Wissenschaft und Nation in der europäischen Geschichte* (Frankfurt am Main : Campus, 2002) ; Mitchell G. Ash and Jan Surman, eds., *The Nationalization of Scientific Knowledge in the Habsburg Empire, 1848-1918* (Basingstoke : Palgrave Macmillan, 2012). Especially for agriculture Nadine Vivier, ed., *The State and Rural Societies : Policy and Education in Europe 1750-2000* (Turnhout : Brepols, 2008).

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