From Spatial Continuity to Fragmentation: The Case of Russian Farming

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The continuous zone of settlement long considered a defining feature of Europe, is undergoing spatial framentation along its eastern periphery. Massive areas of rural depopulation have emerged in many regions of European Russia, including its heartland. As a result of farmland abandonment, no fewer than 20 million hectares of arable land are already deserted in European Russia, and more will be left behind in the foreseeable future. The ongoing spatial fragmentation results in two diverging structures, identified on the basis of a unique district-structured database: an emerging archipelago of commercial farming, and the so-called black holes, the likely loci of soon-to-be-abandoned land. While land abandonment is by no means a uniquely Russian phenomenon, one of its preconditions in Russia is that farmland was extended beyond environmentally reasonable limits. The rural depopulation naturally leads to the contraction of farmland. Because land that is likely to be retained under cultivation is a better match to people's actual ability to cultivate it, fewer resources are going to be wasted, and the overall efficiency of Russia's agriculture is likely to rise as a result. *Key Words: European Russia, land abandonment, rural depopulation, marginal land, differential urbanization, agriculture.*

> Enormous space came easily to the Russian people; what did not come easy to them is organizing this space into the world's largest state as well as maintaining and protecting order within it. The bulk of Russian people's energy was absorbed by these tasks. The magnitude of the Russian state faced Russians with almost unsolvable problems and kept them under inordinate strain. In the enormous business of creating and safeguarding their state, the Russian people exhausted their energy.
>
> —Nikolai Berdiaev (1918, 62)

The ongoing fragmentation of the formerly continuous belt of human settlement in Russia has recently been recognized by researchers (e.g., Dienes 2002; Ioffe et al. 2002). To be sure, spatial continuity of that belt was never absolute, particularly in its northern section where land under the plow is interspersed with forests. But as more and more land was plowed up, forests shrank into islands, and vast interurban space filled up with cropland. Scattered over this space and largely engaged in farming, Russia's rural population has been keeping Russia's ecumene in one piece. This article focuses on the European section of the country, with its 90 million hectares of arable land (out of 119 million hectares in the entire Russian Federation) and addresses the commencement of the opposite process: the conversion of a continuous agricultural space into a fragmented one, a kind of an archipelago.

Our immediate focus is on the abandonment of farmland. Two phenomena have combined to produce it: (a) the reversal of the centuries-long expansion of the Russian state; and (b) the continuing troubled performance of Russian farming. Following a brief discussion of these phenomena, we focus on the outward signs of overextension embedded in the spatial pattern of Russian agriculture. Considering the beginnings of land abandonment, we examine whether it should be attributed to rural demographics and/or market reform. A search for a reliable indicator of the changing extent of agricultural lands leads us to a time series of the area under crops. In an attempt to forecast *further* contraction we turn to areal variation in collective farm productivity, as the collective sector continues to be the major form of landholding and its productivity reflects the condition of the rural economy and social sphere at large. Processing a unique district-structured data set allows us to identify two diverging structures: the emerging archipelago of commercial farming, and the so-called black holes, the likely receptacles of soon-to-be-abandoned land.

Several previous case studies published in area-studies journals, and two book-length examinations (Ioffe and Nefedova 1997a, 2000), have developed the building blocks of our approach to Russian farming practices. Here we have extended these essentially area-studies pieces by taking a new, more geographic approach that includes: (1) utilization of a unique data set that

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provides complete geographic coverage of European Russia, (2) examination of the two extreme (though important) expressions of agricultural productivity—continued existence of commercial farming and its complete atrophy—rather than solely focusing on its spatial variation, and (3) relating the current transitions in the spatial morphology of Russian agriculture to existing theories and internationally tested approaches to production in marginal lands. This approach has enabled us to provide a more comprehensive reflection upon the current state of spatial fragmentation in what was formerly a continuous zone of human colonization and agricultural settlement covering roughly one-third of the territory of Europe. We conclude with a positive interpretation of farmland abandonment, a process that has so far elicited only negative reaction.

Spatial Pattern of Russian Colonization

The breakup of the Soviet Union signified an abrupt reversal in the centuries-long expansion of the Russian-Soviet state. Underlying this reversal are insufficiently examined aspects of Russia's expansion and contraction alike. Territorial acquisitions and losses[1] have not been their only outcomes. A peculiar inner structuring of the inhabited space has taken place as well, a phenomenon not quite replicated in other vast countries. For example, the outcome of Russia's expansion has been categorized as the dichotomy of the principal settlement belt (*glavnaya polosa rasseleniya*) and resource periphery (Dienes 2002), which embraces much of Siberia and the European north; however, that belt itself is far from uniform. Andrei Treivish set out to designate the so-called demoeconomic base in the European section of the former USSR. Within the confines of that base, the intensity of land use is on a par with urbanized regions of West Europe and with the North American megalopolis. The area (Figure 1) contains urban agglomerations with populations in excess of one hundred thousand, rural areas within one hour of major urban centers, and five-to-twenty-km-wide strips along major transportation routes. Although the land area of the base structure within Russia proper (535,000 square kilometers) is about the size of France, it accounts for only 13 percent of European Russia, but it is home to more than a half of its population, including three-fourths of its urbanites. The average population density within the confines of the base structure is close to two hundred people per square kilometer, which is about eight times as high as outside it.

In the U. S. and in Canada the densely packed heartlands and sparsely settled hinterlands are spatially disunited, but in Russia they interpenetrate. In both the U. S. and Canada, population densities and densities of transportation routes may be deceptively low on average. Within the areas where the vast majority of people live, however, the actual densities are not as far from the "European"[2] level as they are in Russia. Consequently, the notion that Russia's only hinterland is Siberia is spurious. In fact, a sense of remoteness is far more acute in quite a few localities 150–200 kilometers away from Moscow,[3] where the perception of living in the middle of nowhere belies the fact of the inhabitants' belonging in the Russian heartland.

"In the beginning of the 20th century, towns in central Russia were on average 60–85 km apart whereas in the Urals 150 km apart; for comparison, in much of Western Europe, towns were at 8–20 km from one another. There, a peasant used to make it on foot to the market and back during one day, whereas in Russia it took days in a horse-driven carriage" (Treivish 2002). The West Europe/European Russia ratio did not change much under the Soviets. Inferior roads exacerbated the enormity of Russia's open spaces, as did the fact that many small towns in Russia were (and still remain) nothing but large traditional villages with log houses, outside conveniences, and large kitchen gardens. Such towns have been neither major focal points nor growth poles for the surrounding countryside. Only larger cities (for the most part those in excess of 250,000 residents) have caused noticeable centripetal gradients in rural infrastructure and in land use intensity due to the spillover effects of urban investment, including urbanites' second homes. Even in European Russia, however, these cities are on average 314 kilometers apart, twice as much as in West Europe and in the eastern U. S. (Ioffe and Nefedova 1997a, 27).

When Russian scholars repeatedly point to an inadequate number of large cities (e.g., Lappo and Polian 1996, 11; Vishnevsky 1998, 138; *Gorod i derevnia* 2001, 11), what they mean is that the spheres of influence of the existing cities do not enfold much habitable space and scarcely overlap. There are significant gaps between these urban fields. Therein, secondary roads, rural utilities, and other life-support systems subsumed by the term "social infrastructure" are of particularly inferior quality. Like dough rolled out so thin it tears apart, these ruptures in the established bulk of human colonization have been expanding as the pace of rural population's decrease has intensified. Thus the very pattern of spatial development in Russia, with its sparsely situated cities, presaged the crumbling of the principal settlement belt. As the prime extra-urban land user, farming offers the exemplary activity setting for analysis of this process.

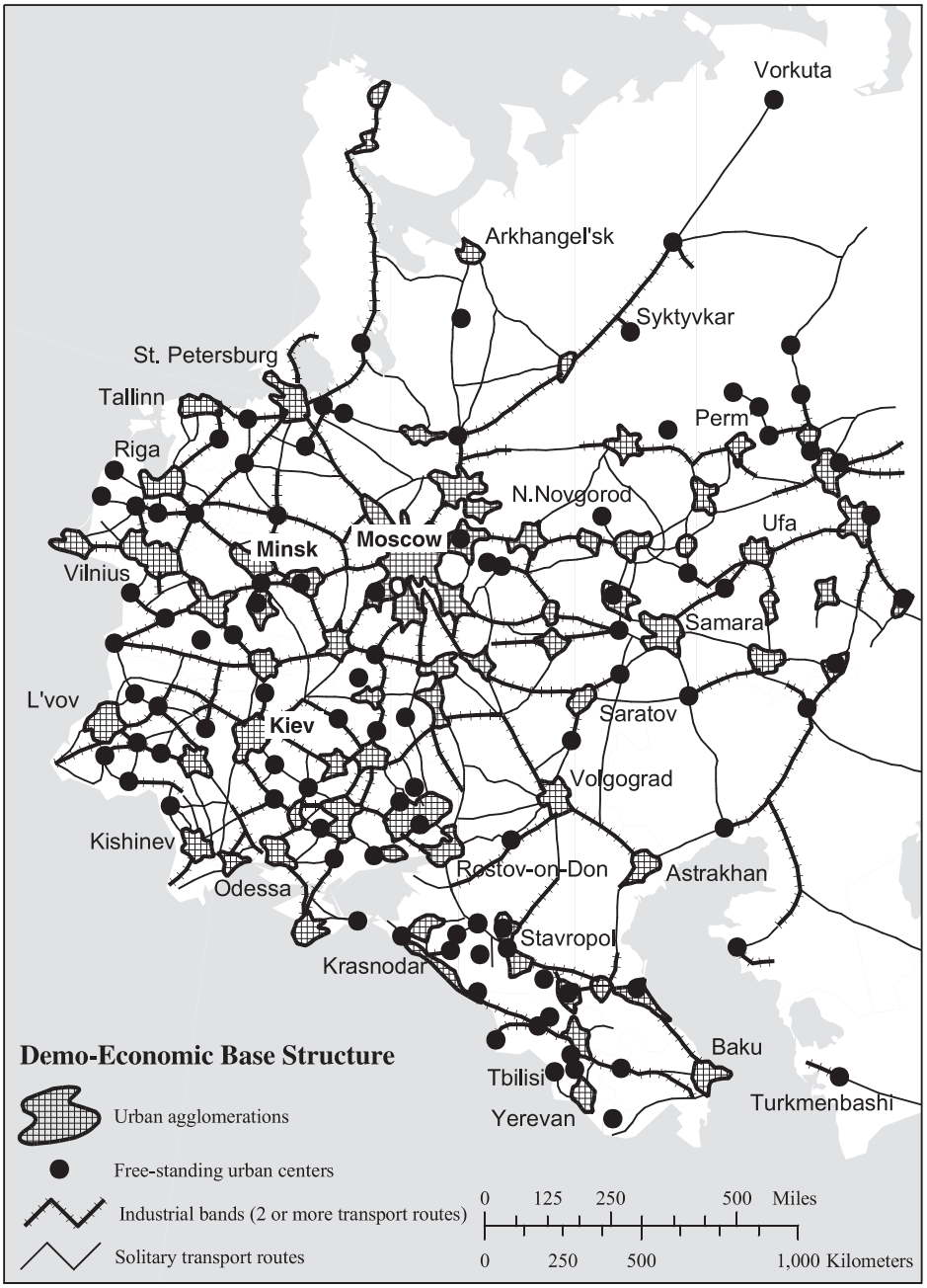

Figure 1. Demo-economic base structure in the European section of the former USSR. *Source:* Treivish (1987, 66).

Agricultural Colonization and Performance of Agriculture

Agricultural colonization was at the forefront of Russia's expansion at large; at its zenith, around the beginning of the twentieth century, about 75 percent of Russians were peasants (*Gorod i derevnia* 2001, 352).

A pithy saying of Piotr Semionov is a key to understanding the sociopolitical consequences of Russia's irrepressible expansion: "For Russia's premature striving for colonization, its peasantry paid its freedom" (Semionov 1892, 360). The immediate reference was to Russian peasants' seventeenth-century migrations from the Central Chernozem region to the newly opened lands in European Russia's south and southeast. The nobility's complaint about losing laborers led to Russian peasants' becoming legally attached to their lords' lands, thus introducing full-fledged bondage.

Semionov's reference to Russia's zeal for expansion as *premature* runs deeper, however. Whereas in West Europe, migration was in large measure conditioned by agrarian overpopulation, in Russia, these two phenomena

became linked only in the mid-1800s. Throughout the previous centuries, lower and high social strata alike were mobile for the simple reason that in Russia there had always been ample room for new developments. As a result, many areas in the Russian heartland experienced intermittent periods of relatively dense settlement and then abandonment (Kliuchevsky 1993, 53). What Giles Fletcher, English ambassador to Russia, saw in 1588–1589 south of Vologda, where scores of villages were deserted by their dwellers, amazed him because such mobility was unknown in West Europe at that time (ibid.). There, sedentary life without the possibility to expand cropland required the improvement of cultivation methods to keep up with the growing population. A side effect of this improvement was early diversification of economic activity. In Russia, migration to newly colonized lands offered a possibility to produce more food by plowing up more land without technological innovations. For example, a three-field system (three adjoining and unhedged fields sequentially assigned to winter grain, spring grain, and fallow), was known in West Europe already in the seventh century, reached its apogee in the eleventh to fifteenth centuries and then gave way to more sophisticated crop rotation systems. The same three-field system came to Russia only in the fourteenth to fifteenth centuries, six hundred years later than to West Europe and two hundred years later than to East-Central Europe (Treivish 1999). Yet even "at the beginning of the twentieth century a more primitive routine of cropping the land year after year to the point of exhaustion, and then leaving it unseeded for ten years or more, was still extensively employed in the far north and in the newly developing regions of the southeastern steppe" (Robinson 1957, 98).

"All of Russian history is the history of a country which is colonizing itself," wrote Vassily Kliuchevsky (1993, 128). The irony of that history is that the high and unpredictable pace of resettlement eventually began to threaten the existing economic order, and Russian peasants became ultimately riveted to land by law at a time (1649) when most of their West European counterparts were being set free because their sedentary life had already created economic preconditions for the release of farm labor. Belated bondage held back the development of Russia's urban market. In the late 1700s, when on the western flank of Europe the advent of industry took advantage of recently unleashed rural masses, peasant mobility in Russia became restricted in a most rigorous fashion. According to Kliuchevsky, "Up till the end of the first half of the 19th century the territorial expansion of the [Russian] state proceeded in inverse proportion to domestic freedoms" (ibid.).

The same avowedly "deterministic" reasoning, in which the "curse of open lands" helped explain Russia's socioeconomic backwardness, was employed by Russian Marxists, notably Georgy Plekhanov (Bassin 1993).[4] In fact, not just Plekhanov, but Vladimir Lenin himself contributed to this trend of thought by famously contrasting development in depth to development in breadth (Lenin 1956, 615–16, 653). According to Lenin, the former pertained to the advanced capitalism of West Europe, wherein "all land had been already occupied" and the latter distinguished the more archaic (imbued with vestiges of previous "social formations") capitalism of Russia. Lenin pointed out that development in breadth suppresses the decrease in rural population and that the only area in Russia that makes reasonable comparison to West European countries in terms of division of labor consists of eleven central regions, including the environs of Moscow and Saint Petersburg. According to Lenin, the possibility of agricultural colonization of new lands (the case of Russia) delayed the otherwise imminent resolution of capital-labor conflicts inherent in capitalism and explained the side-by-side existence of "the most advanced forms of industry and semi-medieval forms of agriculture" (ibid., 653).[5]

This largely intuitive, but heuristically potent, distinction between development in-depth and development in-breadth was introduced in regard to capitalism. But the corresponding East-West disparity in Europe's land use intensity survived the first coming of capitalism in Russia. Grigory Ioffe analyzed the time series of grain output and areas under crops published by Brian R. Mitchell (1992), Yuri Yanson (1880), and Boris Mironov (1991) and concluded that the yields' ratio between the two flanks of Europe, East (European Russia turned European USSR) and West (France and Germany), was relatively stable over the course of roughly a hundred years. At the very end of the nineteenth century, one weighted average hectare of arable land in France outproduced its counterpart in European Russia by a factor of 2.1; in 1986–1990 the proportion was 1:2.4. Germany, where at the turn of the century farming efficiency exceeded that in France, outproduced European Russia by a factor of 3.8; in the late 1980s, East and West Germanies, combined, outproduced the European section of the USSR by a factor of 2.5, or almost the same as France.[6] Livestock density comparisons, beginning with data collected long before the advent of communism, show an even more striking stability. As early as the 1870s, Germany exceeded European Russia in livestock per one hundred hectares of agricultural land by a factor of 3.3; 110 years later the proportion was exactly the

same. The superiority of France over Russia in this regard (a factor of about 1.6) also survived all the storms of the twentieth century.[7] Note that while farming productivity was, of course, growing on both flanks of Europe, the ratios between countries have either remained stable or changed somewhat in the Soviets' favor despite the supposedly damning influence of communism, for which agriculture reportedly used to be the first stumbling block (Ioffe 1991a, 334; Ioffe 1991b).

If some kind of stability persisted through "shocks" of the twentieth century such as the Communist revolution and two world wars, the shocks themselves ought to command attention, but so should formative features of the contrasted domains that remained unchanged.[8] The most lasting features of that kind draw from the pattern of spatial development, with such indicators as density of reliable transportation routes and interurban distances.

The west-east density gradients have been typical not just for Europe at large but also for its fragment, the European section of the former Soviet Union. Here, rural population density was generally lower in the east than in the west. Despite the official commitment to equity, the de facto agricultural investment policies of the Soviets internalized this spatial trend by deemphasizing thinly populated areas (Ioffe and Nefedova 2001a, 284). As a result, by the late 1970s, not only the Baltic republics and Ukraine but also Belarus (very poor before World War II) began to significantly outproduce European Russia per hectare of farmland (Ioffe 1990, 15–21). By the same token, quasi-Thunian rings with outwardly declining agricultural productivity (Figure 2) emerged around every major Russian city (Ioffe and Nefedova 1997a, 228, 229, 249, 258–65), reflecting equivalent population density differentials between peri-urban and outlying rural districts.

Today, the official share of agricultural employment in Russia is just 13 percent (*Trud i Zaniatost' v Rossii* 2001, 61), although it continues to dominate the countryside. In much of the Western world, the convergence of the notions of agriculture and of countryside has long disappeared, but to the Russian mindset, these notions still appear as all but perfect synonyms. More than half of all gainfully employed rural residents work for officially registered farms. If one adds rural retirees (30 percent of the entire rural population), teachers, and retailers, all of whom depend on their land parcels, it would appear that, one way or another, virtually all villagers are engaged in farming.

Filling much of the vast interurban space on the eastern flank of Europe, Russian agriculture has been in trouble from before, during, and since Soviet rule. While there has been no shortage of explanations for its numerous failures, these explanations have, for the most part, invoked incentives, ownership, spontaneous and enforced communal forms, management, legal issues, and other derivatives of Marxian social formations. Neither feudalism nor state socialism, however, nor, for that matter, market economy—with peasant commune, collective farm, and joint-stock company as their respective agricultural microcosms—has brought about the ultimate salvation of farming, the backbone of rural economy in Russia. Two world wars traumatized it, but the ongoing postcommunist transition has brought about production setbacks quite comparable to those caused by the wars. In terms of officially reported output, Russian agriculture is now 40 percent below its former level on the eve of the current economic reform (1990), the sown acreage has decreased 30 percent, and the number of cattle has decreased by 46 percent (*Sel' skoye khoziaistvo v Rossii* 2002, 66).

Far from denying the significance of aspatial explanatory frameworks (e.g., political economy, legal, managerial, technological, and so on) in Russian agriculture's travails, we intend to explore the idea of agricultural development constraints inherent in Russia's environment (physical and social alike) and its superabundant space. Low efficiency and poor outcomes have been the scourge of the Russian countryside irrespective of the dominant political-economic order, and they may, if only in part, derive from neglect of these objective constraints.

Symptoms of Overextension

Russian agricultural development began to show signs of overextension long before the advent of a market economy that followed the breakup of the Soviet Union. We see three such signs, two of which—the persistent west-east gradient of productivity and quasi-Thunian rings around Russian cities—have been already mentioned. Two others are massive encroachment into harsh physical environments, and working land in areas populated too thinly to support dominant technology and managerial practices.

"The large overall increase in Soviet agricultural output came primarily through expansion of the sown acreage" (ZumBrunnen 1997, 618). Indeed, cropland alone increased from 51.8 million hectares in 1922 (*Narodnoye khoziaistvo SSSR* 1982, 245) to 126.8 million in 1976 (*Narodnoye khoziaistvo SSSR* 1977, 303). "Not surprisingly, this expansion meant an ever-continuing push to use marginal farmland" (ZumBrunnen 1997, 618). Much of Soviet's area under cultivation is located under thermal conditions where no other country in the

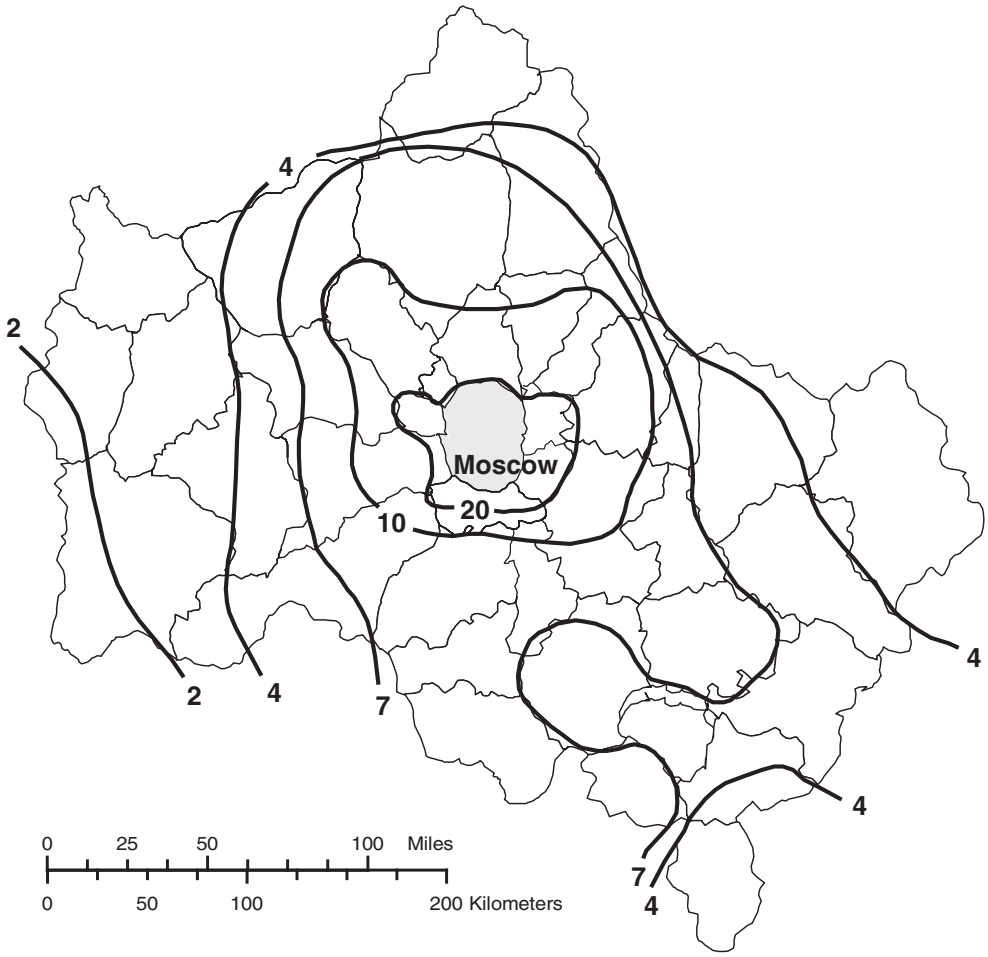

Figure 2. Gross agricultural output in Moscow region, in thousands of rubles per hectare of agricultural land, 1997–1998.

world (including Canada and Scandinavian countries) conduct crop farming (Field 1968). In his superb comparison of the agricultural land bases of the USSR and North America, Neal Field pointed out that "environmental quality must be weighed heavily in assessing the relative productivity of the agricultural land resources of the Soviet Union and North America (Field 1968, 11). One must be. . .cautious in attributing largely to the human factors differences in the per acre returns" (ibid.). In the USSR four-fifths of the cropland fell within the least productive thermal zone, that with less than two hundred degree-months (ibid., 9).[9]

To our knowledge, Field's (1968) analysis was never consulted by the political scientists and/or economists from among the students of the Soviet Union. Writing abundantly about the Soviet agricultural failures, they invariably attributed them to systemic political economy factors. In a major American tome devoted to Soviet agriculture (Stuart 1983), all thinkable aspects of it are scrutinized but one, the natural environment. This omission is all the more surprising given that, in the West, the general public has always pictured Russia as an exceptionally cold country. How can one explain this clash of stereotypes? For those who, like these authors, did not live in the West at the time, it is difficult to second-guess.[10] Be that as it may, a consensus developed among the students of Soviet agriculture that references to nature were just excuses.

The reality, however, defies clichés. While, by and large, Russia is a colder country than most of Europe and North America, 44 percent of European Russia's arable land (about forty million hectares) is located within moderate physical environments with 2,200–2,800 degree-days above 10 degrees Celsius, and 30 percent (twenty-seven million hectares) is located in warm-to-hot areas with 2,800–3,400 degree-days (Ioffe and Nefedova 2004). About forty-three million hectares of European Russia's agricultural land is of top quality, matched only by the eastern and central parts of the American Corn Belt. For comparison: prior to its 2004 expansion, the entire European Union, with a population more than three times as large as that of European Russia, possessed about seventy-five million hectares of arable land.

Consequently, there is a basis for believing that the Soviets continued to expand the area under cultivation in the habit of their predecessors just because there was still ample room for further expansion. A tacit assumption that low yields on land long in agricultural use are unavoidable might back the Soviets' devotion to agricultural expansion; however, depriving this land of much-needed investment, redirected instead to newly colonized areas, became a self-fulfilling prophecy in regard to yields. Indeed, when the state-run campaign to develop "virgin" steppes of Kazakhstan and Western Siberia was under way (after 1954), agriculture and rural settlement in Russia's heartland became particularly neglected (Ioffe 1990, 28–30). Still, farmland continued to follow the lead of industrial expansion into newly colonized resource areas and was maintained in large measure due to agricultural subsidies. Each region tried its best to supply itself with home-grown food.

The Rural Demography Factor

The 1900s were marked by speedy urbanization. In 1897, only 13 percent of Russia's population lived in urban places, but by the end of the twentieth century, 74 percent did. Like gigantic pumps, the growing cities absorbed rural migrants. As a result, European Russia's thinly populated area (with population density below ten people per square kilometer) doubled, having expanded by one million square kilometers. Today about 60 percent of European Russia (without the extreme north) is thinly populated. Together with the extreme north, the corresponding share is about 75 percent (Table 1). The outcome of this "social desertification" is comparable to Russia's territorial expansion, as both processes in fact produce superabundant land.

Now, settings with at least ten rural villagers per square kilometer are available either in the South or in peri-urban districts in European Russia's northern "Non-Chernozem" half. With its sparsely situated cities, much of the countryside has been drained of population. Altogether, areas with more than twenty-five people per square km contracted from 846 to 160 thousand square kilometers. Mass abandonment of rural villages became typical for the Non-Chernozem regions throughout and beyond Russia's heartland. In the outlying districts (located outside two-hour accessibility to regional capitals), most of the remaining dwellers cluster in central settlements of collective farms. Inferior roads and the contraction of the rural school network contributed to further atrophy of rank-and-file villages through out-migration of their younger and more dynamic residents. Those left behind are, for the most part, the elderly. Sixty percent of rural households in Central Russia now consist of one or two people.

In the early 1990s, the rural population of Russia suddenly began to grow. Initially (1991–1992), that growth was fictitious, produced entirely by reclassification (Table 2). Whereas, prior to 1991, outsize villages used to gain urban status, the reverse process commenced thereafter. Now small towns were keen on becoming villages (not so much due to depopulation as to lax rules of land allotment in the countryside). This process explains the change from minus to plus in the last column of Table 2. In 1992–1994, though, rural growth was genuine. The two factors behind the short-lived rural population growth were the removal of state controls over retail prices, which left many urbanites worried about feeding their families (some recent migrants from rural villages decided to return so they could live off their household plots), and the return migration from Central Asia and resource areas of Siberia. Most returnees from these regions were urbanites by birth and upbringing, yet they cast anchor in rural villages because few cities and towns offered them dwellings. For most of them, though, this was a mere stepping-stone to a nearby town. By the mid-1990s, the most painful stage in Russian capitalism's second coming was over, and so, from 1995 on, the rural population decline resumed as

Table 1. 1987–1989 Rural Population Density Change

Areal Type	Population Density in People per Sq. km	1897, Percent	1959, Percent	1989, Percent	1897–1989 Change in Thousand Sq. km
Uninhabited	<1	22.6	17.9	18.2	−174
Very sparsely settled	1–5	17.4	22.6	34.3	+697
Sparsely settled	5.1–10	11.3	19.2	23.2	+488
Moderately settled	10.1–25	27.5	27.6	19.8	−319
Densely settled	25.1–50	20.5	11.4	3.9	−686
Very densely settled	>50.1	0.7	1.3	0.6	−6
Total		100	100	100	0

Source: Based on data provided by D. N. Lukhmanov (*Gorod i derevnia* 2001, 229–48, 298–302).

Table 2. Russia's Rural Population Change from 1959 to 2000 (Thousands of People)

Year	Total Change	Natural Increase	Net Migration	Reclassification
1959	– 607.9	1045.4	– 1289.2	– 364.1
1979	– 557.1	121.8	– 525.6	– 153.3
1989	– 207.4	143.7	– 272.9	– 78.2
1990	– 58.0	88.0	– 72.6	– 73.4
1991	278.6	44.3	57.4	185.9
1992	721.2	– 30.2	289.5	461.9
1993	150.9	– 184.1	264.0	71.0
1994	64.9	– 227.3	272.4	19.8
1995	– 112.7	– 219.3	96.2	10.4
1996	– 146.6	– 239.0	34.2	58.8
1997	– 132.9	– 233.0	56.4	43.7
1998	– 194.8	– 206.9	44.5	– 32.4
1999	21.2	– 268.0	88.3	200.9
2000	– 241.3	– 277.7	– 1.6	38.0
2001	– 346.0	– 275.0	– 86.7	15.7

Source: Demographic Yearbook of the Russian Federation (1995, 19; 2001, 21) and *Chislennost' i migratsii* (2002, 17).

migration assumed its previous pattern: from the countryside to the city. By 2001, the outflow from the countryside had returned to its 1990 level (Table 2). In Russia as a whole, rural depopulation in a strict sense commenced only in 1992, when deaths began to outnumber births (Table 2), while in Central Russia and in the Northwest, this has been the case since as early as 1965–1967.

How has rural population change affected agriculture? In an environment of technological stagnation, capital (in this case agricultural implements, buildings, etc.) can substitute for manual labor, but only up to a point. Ioffe (1983) determined critical thresholds of the capital/labor ratio in Russia's agricultural regions (the Soviet equivalent being monetary value of fixed assets per worker). Whenever this threshold was exceeded as a result of additional investment, rural depopulation, or, as was most frequently the case, both factors, negative returns resulted. In other words, the marginal productivity of capital turned negative. Ironically, this happened precisely when rural investment began to reach Russia's heartland as a result of the implementation of the 1974 investment program, which was designed to boost agricultural productivity in the Non-Chernozem Zone. In the outlying areas (outside the two-hour isochrone to large cities), the threshold values of the capital/labor ratio were particularly low (Ioffe 1983, 84–85), so it did not make economic sense to invest in those areas under the existing technology and management forms.

Turning from labor-versus-capital to labor-versus-land comparative analysis, we face a paradox. While farmland no longer expanded after the 1970s (with the sole exception of the European north), it did not contract much either; what is more, its most sweeping shrinkage occurred when the long-lasting rural population decline slowed down, as it did in some regions, or reversed! For example, whereas the rural population of Central Russia and Volga-Vyatka almost halved from 1959 to 1989, farmland experienced a 10 percent decline. In the 1990s, the situation reversed: while the rural population of the same macroregions declined by 5 to 7 percent, farmland declined by yet another 10 percent—this time, however, in just ten years.

Why was this the case? Apparently, in addition to population change, some other factors have been at work.

Land Abandonment and Market Reforms

In 1970, Russia's total farmland[11] was 222 million hectares, of which 157 million were in European Russia. Throughout the twenty years from 1970 to 1990, fewer than two million hectares of arable land were lost in European Russia, whereas during one subsequent decade, more than ten million hectares were lost (Table 3). One can distinguish between two kinds of farmland contraction: (a) outer contraction resulting from population leaving the resource periphery (Siberia and the European north); and (b) inner contraction, whose nature is not straightforward, especially considering that rural population of European Russia was replenished by

Table 3. 1970–2001 Farmland Change

	2001 Area in Million ha		Change in Farmland in Million ha		Farmland at a Later Date as a Percentage of That at an Earlier Date		Change in Arable Land in Million ha		Arable Land at a Later Date as a Percentage of That at an Earlier Date	
	Farmland	Arable land	1970–1990	1990–2001	1970–1990	1990–2001	1970–1990	1990–2001	1970–2001	1990–2001
Russia Total	195.6	119.1	– 8.2	– 17.9	– 3.7	– 8.4	– 1.5	– 12.7	– 1.1	– 9.6
European Russia	136.3	89.0	– 7.6	– 13.2	– 4.8	– 8.8	– 1.9	– 10.7	– 1.9	– 10.7

Calculated by the authors based on the official editions of Goskomstat.

Table 4. Structure of Agricultural Land Use and Output in Russia

Land Users	1970	1980	1990	1995	2001
Percentage share in total farmland					
Large Collective Farms	98.2	98.2	98.1	81.7	81.9
Registered Family Farms	0	0	0	5.0	6.8
Household Farms	1.8	1.8	1.9	13.3	11.3
Percentage share in gross agricultural output					
Large Collective Farms	69	71	74	52	44
Registered Family Farms	0	0	0	2	4
Household Farms	31	29	26	46	52

Source: Calculated by the authors on the basis of Goskomstat's official statistics.

almost one million people during the first half of the 1990s.

Our calculations have shown that although the scale of farmland contraction in the extreme north of European Russia[12] and in Siberia has been impressive, their share in Russia's overall farmland abandonment is insignificant. For example, the extreme north accounts for only 3 percent of European Russia's farmland loss between 1970 and 2001. Together with Siberia, it accounts for 17 percent of the entire Russian Federation's loss of farmland during the same period. In such a way, the bulk of farmland contraction fits the inner category.

The 1990s saw market reforms, as a result of which the new "mode of production," private family farms, emerged and a growing proportion of the overall agricultural output is now produced by rural households themselves (Table 4). Yet at the same time, collective farms (or rather their modern incarnation, joint-stock companies) continue to be the major landholder (Nefedova 2003, 78–79). Their share of farmland has declined, but not as much as the reported share of output (Table 5).

Prior to reform, collective farms controlled 98 percent of farmland but were far from uniform in regard to productivity and revenues. In 1980, for example, 70 percent of Russia's collective farms produced at a loss, and just 20 percent of those farms produced 80 percent of the entire collective sector's output (Alexandrov 1993). Under the Soviet system of economic planning, unprofitable farms continued to obtain inputs. Moreover, despite the assurances of Russian reformers and Western observers of the early 1990s (Van Atta 1993), the collective farm sector has survived what was hailed as the collapse of communism.[13] In 1997, and from 1999 to 2002, this sector even recorded growth surpassing that of the two other modes of farming, household operations and registered family farm businesses.[14] As for registered private family farms, their share of output is meager. While recorded proportions of output may change, nothing portends any significant change in land-use proportions. In other words, the collective farm sector will most probably remain the largest landholder.

Consequently, the same demographic processes that supposedly influenced land abandonment prior to market reform continue to do so. The process is further accelerated, however, by the drastic reduction in state subsidies that kept unprofitable collective farms afloat for decades. Indeed, in 1996, 1997, 1998, and 2001, 79 percent, 82 percent, 88 percent, and 46 percent of all Russian collective farms (about 27,000 of them in 2000) produced at a loss, but the federal government's willingness to keep on writing off their debts is on the decline. Currently 14,000 collective farms (about 60 percent of their total number) have bank accounts frozen by the Government (Pletnev 2003). They are de facto bankrupt, even though a formal procedure of bankruptcy is still rarely applied in view of the collective farms' crucial role in rural welfare. Thus, drastic reduction of subsidies and agricultural investment could not but boost polarization of collective farms even further. In our view, this polarization has been one of the major factors of farmland abandonment in the 1990s.

Nevertheless, the recorded pace of farmland contraction has lagged far behind that of output (Table 5). We attribute this lag in part to agricultural land-use recording practices. Local authorities have been especially reluctant to report the reduction of arable land because assignments of agricultural machinery and subsidies

Table 5. 1985–2001 Dynamics of Agricultural Output and Land Use

	1990 as a Percentage of 1985	1995 as a Percentage of 1990	2001 as a Percentage of 1995
Gross output in constant prices	107.0	66.9	100.7
Gross output in constant prices, collective sector only	105.8	48.6	90.2
Farmland	97.9	98.0	93.5
Farmland in collective sector	97.6	81.6	90.0
Arable land total	98.4	96.8	93.4
Arable land in collective sector	98.2	87.5	87.6

Sources: Sel'skoye khoziaistvo v Rossii (1998, 31, 50) and *Sel'skoye khoziaistvo v Rossii* (2002, 33, 52).

Table 6. Rural Population and Cropland Dynamics across Russia's Macro-Regions

	Rural Population at a Later Date as a Percentage of That at an Earlier Date				Cropland at a Later Date as a Percentage of That at an Earlier Date			
	70/59	80/70	90/80	2000/90	70/60	80/70	90/80	00/90
Russia	87.8	83.8	94.7	101.2	101	102	94	73
European North	88.8	82.8	100.0	89.6	93	109	103	82
Northwest and Kaliningrad	81.5	84.2	95.3	99.3	98	107	97	68
Center	76.4	77.4	85.5	93.4	98	106	94	66
Volga-Viatka	77.7	78.5	84.0	95.0	96	110	95	76
Central Chernozem	84.6	75.9	83.8	96.5	109	97	94	76
Volga	90.0	81.8	96.1	97.7	103	100	90	68
North Caucasus	98.7	95.9	102.3	115.2	104	99	96	80
Ural	64.3	117.3	91.4	105.5	102	106	94	77
West Siberia	84.6	88.1	99.0	103.2	91	100	98	80
East Siberia	93.2	90.9	98.9	99.9	106	109	92	58
Far East	107.1	110.4	104.5	91.0	128	107	99	54

Source: Calculated by the authors on the basis of *Narodnoye khoziaistvo RSFSR* (1971, 161–68); *Regiony Rossii* (1999, 289–92); *Sel'skoye Khoziaistvo* (2000, 201–03); *Demographic Yearbook of the Russian Federation* (2002).

have traditionally been tied to the area of land under cultivation.

In Search of a Reliable Indicator

Time series of farmland and/or just arable land might seem enough to assess the dynamics and spatial pattern of agricultural land use, but they are insufficient. Distancing ourselves from a regional center, we often see former fields overgrown with broom sedge, blackberry briars, and, above all, young birch trees. Our observations, however, are rarely corroborated by statistics. The reassignment of cropland as pastures and meadows, and of pastures and meadows into fallow land and forest, has been going on for decades, and the actual change in land use may take up to ten years to be recorded. Regional land statistics do show some reduction in arable land throughout the 1990s, but usually no more than 7–8 percent, which is far short of our field observations.

A seemingly more reliable measure of land abandonment derives from the time series of area under crops. The latter is short of the arable land total, but is annually reported up the levels of the agricultural administration.[15] Cropland is the only component of farmland that did not decline prior to the 1980s. Its contraction accelerated in the 1990s.

Cropland is distributed among forty-six regions of European Russia fairly evenly, yet another, if indirect, indication of excessive involvement of infertile land. Hoover index measuring spatial concentration on the scale 0–100[16] oscillated between 26 and 28 throughout the entire period from 1960 to 2000. At the same time, there has been steady growth in spatial match between cropland and rural population. Measuring the evenness of cropland distribution relative to that of rural population at the start of each decade beginning from 1960 resulted in the following values of Hoover index: 21 in 1960, 20 in 1970, 19 in 1980, 17.5 in 1990, and 16 in 2000. Apparently, as rural depopulation has been progressing, the retention of land under cultivation hinges ever-increasingly on the sheer number of those still working land. The comparison of regional rural population and cropland declines (Table 6) seems to support this idea.

Indeed, a simple linear regression model (Table 7 and Figure 3) shows the reasonably high and increasing goodness of fit between rural population and cropland over time with a relatively stable elasticity (a_1), implying that change in rural population size is a predictor of sown acreage. Our task, however, is not merely to produce a blanket forecast of cropland reduction in

Table 7. Cropland (P, thousand hectares) as a Function of Rural Population (N, thousand people): Calibrating a Regression Model $LN\ P = a_o + a_1 LN\ N$

Year	Equation	R^2
1960	LN P = −.153+1.120 LN N	.607
1970	LN P = −.566+1.212 LN N	.663
1980	LN P = −.037+1.177 LN N	.678
1990	LN P = +.046+1.176 LN N	.712
2000	LN P = −.804+1.258 LN N	.814

Source: Calculated by the authors; sample: 43 regions of European Russia (excluded are Komi, Karelia, Ingush, Chechen, and Dagestan Republics and Moscow, Leningrad, and Astrakhan' Regions); coefficients are significant at the 0.05 level.

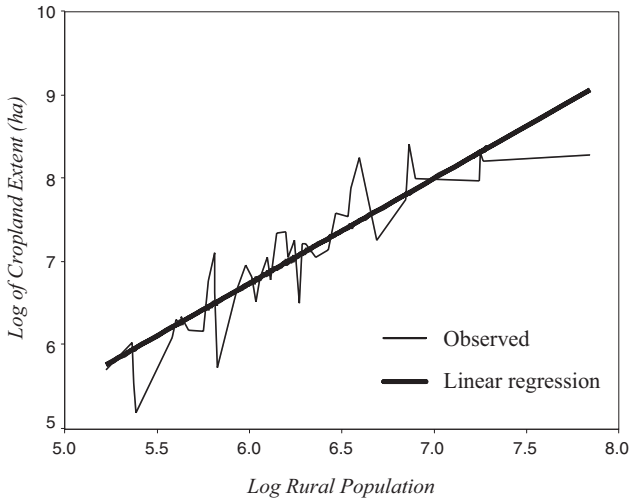

Figure 3. Observed versus estimated extent of cropland as dependent on rural population (in logarithms) by 46 regions of European Russia, 2000 (OLS Regression, $R^2 = .814$). *Source:* Calculation by authors.

European Russia, but to understand its evolving spatial pattern as well.

For this latter purpose, the dynamics of cropland are of limited, if any, use. First, although more believable than other indicators, there are justifiable doubts in their accuracy as well. Whereas in the early 1980s, regional differentials between cropland and arable land total ("cleared farmland" in John Fraser Hart's [1968] terminology) were small and in some regions nonexistent, by 1990, Russia's average differential had reached 11 percent and by 2000, 27 percent. From practicing agronomists in various regions, we learned that fallowing (or temporarily setting aside) up to 12 percent of arable land may be consistent with actual farming practices. So everything in excess of 12 percent was most probably abandoned land. Based on this arbitrary threshold, our rough approximation of arable land already abandoned in Russia is nearly twenty million hectares—the equivalent of the total arable land in France.[17] Abandoned farmland probably accounts for 10 percent of the entire land area of Central Russia and 15 percent of that in the Volga region. Because abandoned land is often misleadingly recorded as covered by perennial sown grasses, our estimate of land abandonment may be an understatement.

Second, a spatially disaggregated forecast of land abandonment ought to hinge on spatial patterns of factors and phenomena that effectively lead to it, not just on the extrapolation of previous statistics. Under current conditions, land abandonment is preceded by consistently low productivity, and rarely is land formerly in possession of a collective farm transferred in full to household or private farm use, for the simple reason that performance of all three sectors of Russian farming hinges upon identical constraints. If, for example, a collective farm languishes because there is nobody to work the land anymore, the same cause will eventually undermine household operations.

Our general assumption then is that land abandonment is an ultimate expression of exceedingly low agricultural productivity and perhaps some additional short-term, but drastic, change that pushes the farm downhill. Therefore, we place land contraction in the overall context of areal variation in productivity. To assess this variation, we need a properly structured database.

District-Structured Data Base

For our purposes, a rural district (*raion*) arguably represents an optimal level of spatial resolution.[18] The average district in European Russia is two thousand square kilometers in size and has about twenty collective farms. Obviously, districts vary in size, with smaller districts predictably located in more densely packed regions and closer to regional capitals. Virtually all districts are monocentric, and their borders conditioned by the topology of the transportation system and labor gravitation have been normally stable for several decades. District centers are invariably their largest settlements; in European Russia, one-third of them are towns, another third are settlements with an intermediate status of semi-urban townships, and the remaining third are large rural villages.

Our data set includes about sixty variables for 1267 districts of European Russia.[19] Districts of the far north with no crop farming were excluded from the set. Physiographically, the remaining districts fall into the Non-Chernozem Zone (NCZ; 682 districts) and the South (585 districts)[20] (Figure 4). The NCZ, a macroregion peculiarly identified for what it is not, features acidic and largely infertile spodosolic soils that form under coniferous and mixed forests. The soil cover in the South is more fertile, developing under forest steppe and steppe vegetation, and ranging from classic Chernozems to chestnut soils.

The principal human-made distinction between the NCZ and the South is the share of arable land. In the South, it ranges from 60 to 80 percent of most districts' total areas. In the NCZ, however, it ranges only from 10 percent to 40 percent, much of the rest being forest tracts, so fields and forests in the NCZ are interspersed. From the mid-1960s to the late 1980s, land improvement projects expanded fields at the expense of forests and marshes. The opposite process of spontaneous

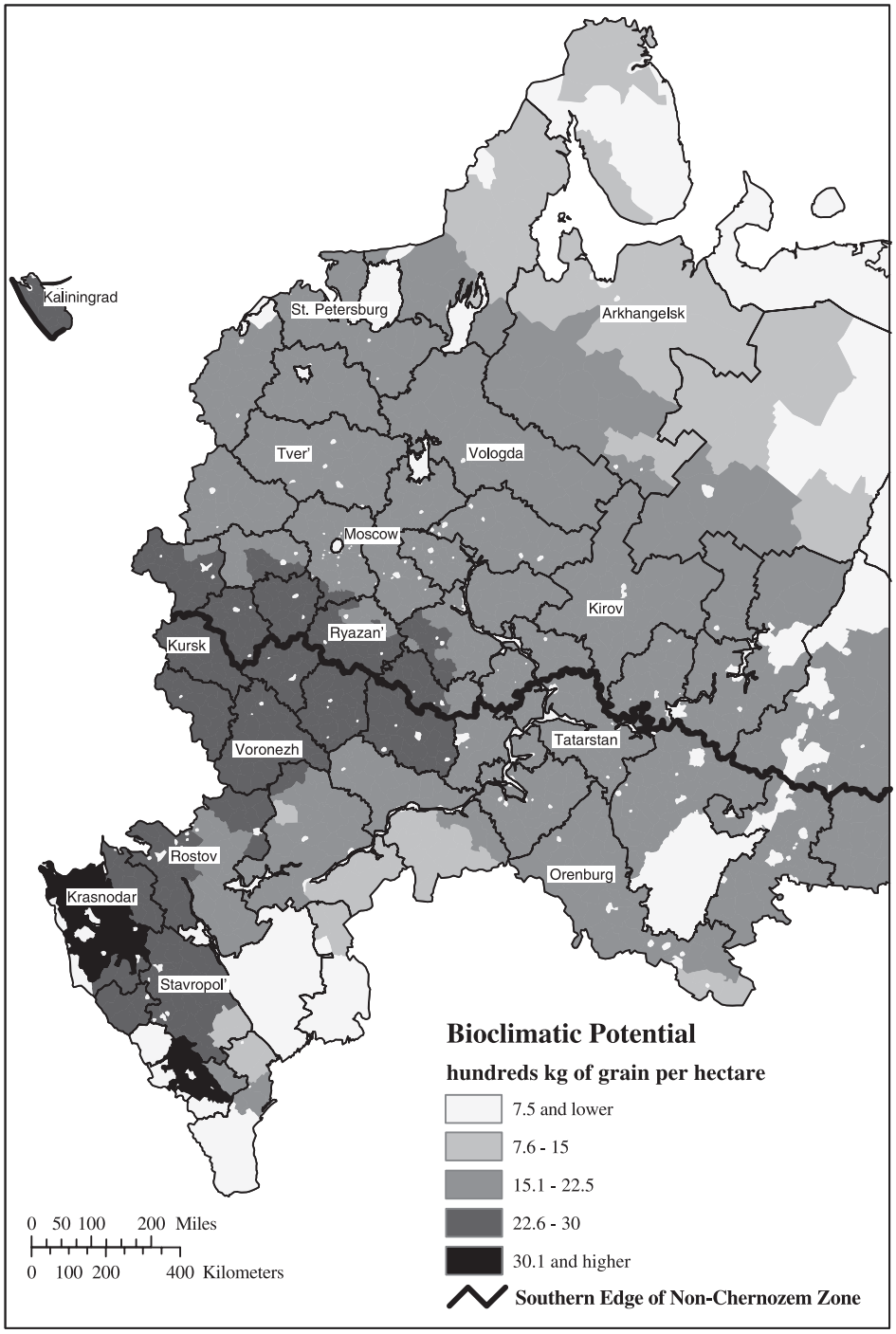

Figure 4. Bioclimatic potential (sustained grain yields on regionally representative parcels under natural conditions of soil type, heat, and moisture) by rural district of European Russia in hundreds of kilograms per hectare, 2000. *Source:* Based on *Prirodno-Sel'skokhoziaistvennoye Raionirovaniye Zemel'nogo Fonda SSSR* 1983.

secondary afforestation was winning the tug of war, however, affecting the outlying districts the most, so the junctions of the regions are visible on aerial photographs because of diminished open spaces.

For the purpose of this analysis, measures of average agricultural productivity and the dynamics of cattle head and cropland, as well as demographic, natural soil fertility, and location variables, are of particular importance.

Productivity, Cropland, and Cattle

A Russian collective farm is not just a production unit; it is also a community, a vehicle for collective survival (Nefedova 2003; Pallot and Nefedova 2003). Otherwise, most collectives that are economically bankrupt would be disbanded by now. Collective farms normally control social services administered to their

members and supply household farming operations with seeds, fertilizers, and veterinary aid. Shifting cattle from collective to household premises in times of need is often practiced as well. In many cases, there is a truly symbiotic relationship between the collective farm at large and the household farms of its members. The following indicators describe the overall output of collective farms in our data set: grain yields and milk yields per one cow for 1989–1991 and 1999–2001, and the 1998 gross agricultural output.

The choice of particular products, grain and milk, is motivated by their ubiquitous nature in Russia. Agricultural specialization is much less distinct in Russia than in the United States (Naumov and Rubanov 2001), and the Soviets' tendency to ensure regional self-sufficiency in food undercuts efforts to boost specialization. While some farms do not produce grain and/or milk, all districts do. Normally they assign about half of their cropland to grain (wheat, rye, corn, oats, and barley in descending order). Milk yield per cow is a more complex indicator compared with grain yield, as the former reflects the quantity and quality of feed, technological discipline, and the overall treatment of animals, all at the same time. The use of a monetary indicator of gross output controls for the actual variance in specialization.

All the above indicators correlate (Pearson correlations between the indicators' logarithms ranging from 0.49 to 0.66), but not as closely as to approve of disposing of any of them. What is noteworthy is that the statistically unnormalized (i.e., not divided by land) monetary measure of a district's agricultural output is associated with in-kind measures of productivity (per unit of land and per one cow). This correlation indicates economy of scale, as yields tend to be higher where large-scale operations exist.

In Russia, the estimate of natural soil fertility has traditionally been based on long-term records of grain yields on specially designated, regionally representative parcels of land that do not use irrigation, drainage, or any sophisticated cultivation methods. That is, they reflect the natural conditions of soil type, heat, and moisture, or what is referred to as the bioclimatic potential of the area. The respective pattern (Figure 4) is not nearly as mosaic as that of the actual yields (Figure 5), and the layout of biomes (coniferous forest, broadleaf forest, and steppe) and ecotones (mixed forest and forest steppe) shows through this pattern, with the highest potential yields predictably associated with the best endowed western margins of forest steppe and steppe. The comparison of Figures 4 and 5 suggests that in many areas the actual yield is short of the environmentally conditioned norm. Also, while the actual yields correlate with soil fertility ($R = .692$ in 1986–1990 and $R = .725$ in 1996–2000), there are apparently other powerful factors behind the pattern featured by Figure 5.

The average 1999–2001 grain yield in Russia was only 1.5 tons per hectare (t/ha). As Figure 5 shows, yields over 2.0 t/ha are received mostly in the South and in the peri-urban district of the NCZ. Such districts account for only 8 percent of European Russia's total land and 25 percent of its rural population. On the other hand, less than 1.0 t/ha is produced on 20 percent of land.[21]

The 2000 average milk yield per cow in Russia was a meager 2,138 kilograms.[22] Anecdotal evidence suggests that cows yielding this much are mistreated. Indeed, livestock specialists all across Russia claim that a "normal" food ration (by which they mean four meals a day totaling no less than 3.5 percent of a cow's body weight in daily consumption of dry matter and warm water) alone can ensure 3,000 kilograms of milk, while yields in excess of 4,000 kilograms require additional investment in pedigree cows, veterinary control, and feeding know-how. Yields over 4,000 kilograms are received only in thirty-seven districts (2 percent of European Russia's land), located for the most part in proximity to Moscow and Saint Petersburg. A reportedly "normal" threshold of 3,000 kilograms is achieved by about a hundred districts (10 percent of land and 20 percent of rural population). At the same time, on 40 percent of the land (30 percent of rural population), milk yields are below the average of 2,138 kilograms.

From 1990 to 2000, the contrasts in both grain yields and milk yields per cow (as measured by the ratio of standard deviation to the average) increased. In the NCZ as well as in the most arid eastern part of the South, the spatial expression of this increase has been a growing contrast between peri-urban and outlying districts. Overall, districts whose productivity had been higher in 1990 fared even better, relative to other districts, a decade later.

Using district-structured data allowed us to follow the processes of cropland change in a more detailed way as compared with regional analyses. From 1990 to 2000, cropland underwent spatial concentration. In European Russia at large, the Hoover index measuring the distribution of cropland between districts increased from 26 to 31 (on the 0–100 scale). In the NCZ, it increased from 36 to 41, and from 19 to 24 in the more fertile South. This growing concentration combined with the overall contraction of cropland is an unmistakable sign of land abandonment.

One of the most significant changes that Russian agriculture has undergone is a drastic decrease in live-

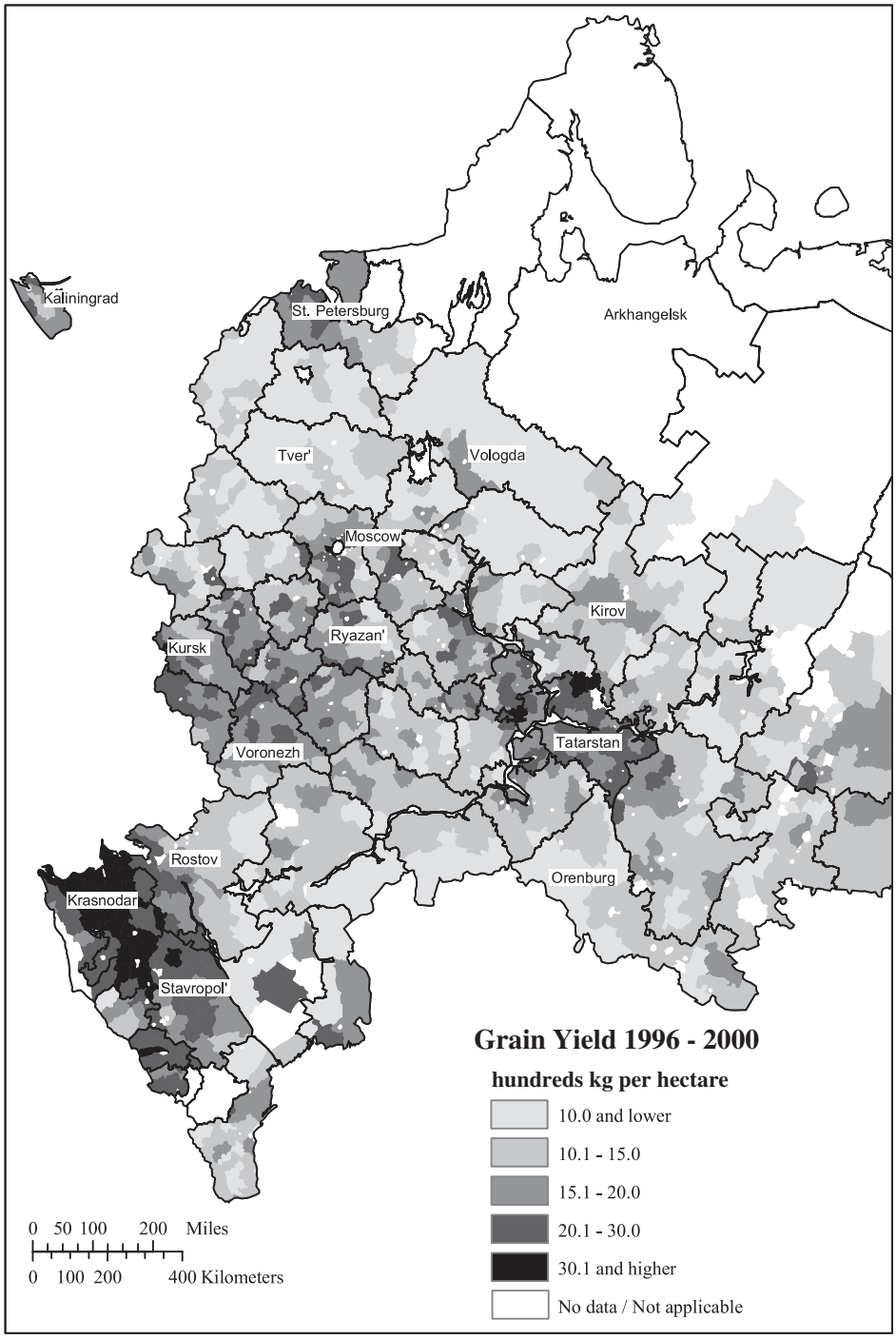

Figure 5. Average grain yields by rural district, hundreds of kilograms per hectare, 1996–2000.

stock. The number of cattle reached its peak (sixty million) in 1985–1987 and has been declining since then, especially since 1990. In 2002, only twenty-six million cattle remained, 46 percent of the 1990 cattle. Likewise, in 2002, only 40 percent of the 1990 number of pigs and 25 percent of sheep and goats remained on Russian farms. The collective sector has been the biggest loser: in 2002, it retained 35 percent of the 1990 number of cattle, 27 percent of pigs, and 2 percent of sheep (*Sel'skoye khoziaistvo v Rossii* 1998, 66; *Sel'skoye khoziaistvo v Rossii* 2002, 66). Apparently, the prereform herd of livestock could not be sustained with a dwindling pool of labor and perennial deficiency of animal feed. So when orders from above shed their rigor, as became the case in the chaos of the early 1990s, the collective farms disposed of many of their animals with relief. Growth in

cattle owned by households from 9.9 million in 1991 to 12 million in 1994 did not compensate for the reduction in the collective farm herd, and by 2002 the number of cattle on household farms had also declined (to 10.7 million) (*Sel'skoye khoziaistvo v Rossii* 1998, 68; *Sel'skoye khoziaistvo v Rossii* 2002, 69).

Productivity and Location

Variables describing location are distance from the provincial center, the order of neighborhood with that center (peri-urban districts are considered first-order neighbors),[23] and the urban population potential, which measures location of a given district relative to all cities of European Russia.[24] Whereas the first two variables are indicators of the districts' relative location (physical and topological respectively) within specific regions, the last measure describes location relative to the entire "urban field" of European Russia. Because regions and their constituent districts vary in size, the order of neighborhood proved to be especially useful for interregional comparisons and generalization. For example, Figures 6a and 6b show how productivity changes outward from a regional capital, and Figure 6c shows that decline in cattle in the NCZ occurred primarily in the outlying districts.

Productivity and Rural Demographics

The key demographic variables are rural population density outside the district centers and the percentage share of retirees. While in Russia most able-bodied villagers (and a considerable number of urbanites as well) work land to produce food, association with farming is somewhat less in district centers, where a considerable number of people work for district administration and local services and utilities.

In the more fertile South and in the NCZ's peri-urban districts, rural population density is higher than elsewhere (Figure 7). Such districts stand out in the South as well, but whereas in the South, they are, on average, three times as densely settled as outlying districts, the respective differential in the NCZ is twelve times! There is a fairly close correlation between rural population density and each of five indicators of agricultural productivity (Pearson's correlations ranging from 0.629 to 0.786 when using logarithmic scale). When fewer than five people live per one square kilometer, even one ton of grain per hectare is not achieved. Only districts with over fifteen people per square kilometer have milk yields in excess of 3000 kilograms per cow.

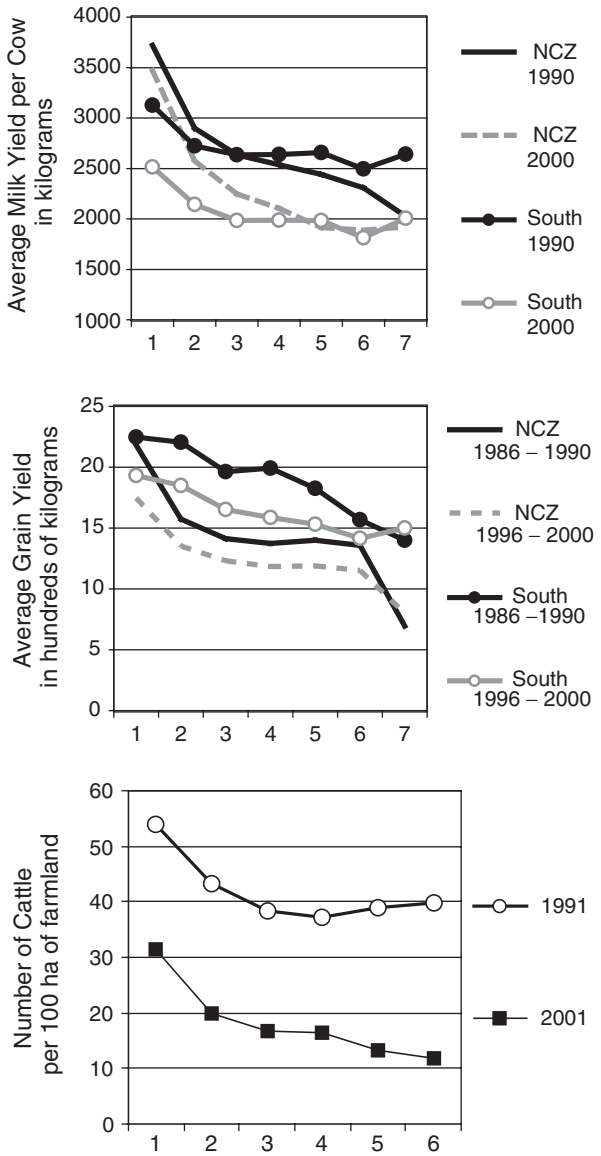

Figure 6. Spatial trends of selected agricultural indices (horizontal axes reflect the order of rural districts' neighborhood with the regional capital, from 1 to 7): (a) Average milk yield per cow in kg, (b) Average grain yield in hundreds of kilograms, (c) Number of cattle per 100 ha of farmland.

Retirees (women fifty-five years of age and older and men sixty years of age and older) account for 30–34 percent of the rural population in most regions, whereas children (birth to fifteen years of age) make up only 16–18 percent. The districts with the highest proportion of retirees are between Moscow and Saint Petersburg and in the regions south of Moscow.

Methodology and Results

Under the assumption that exceedingly low yields both at the beginning and the end of the 1990s would

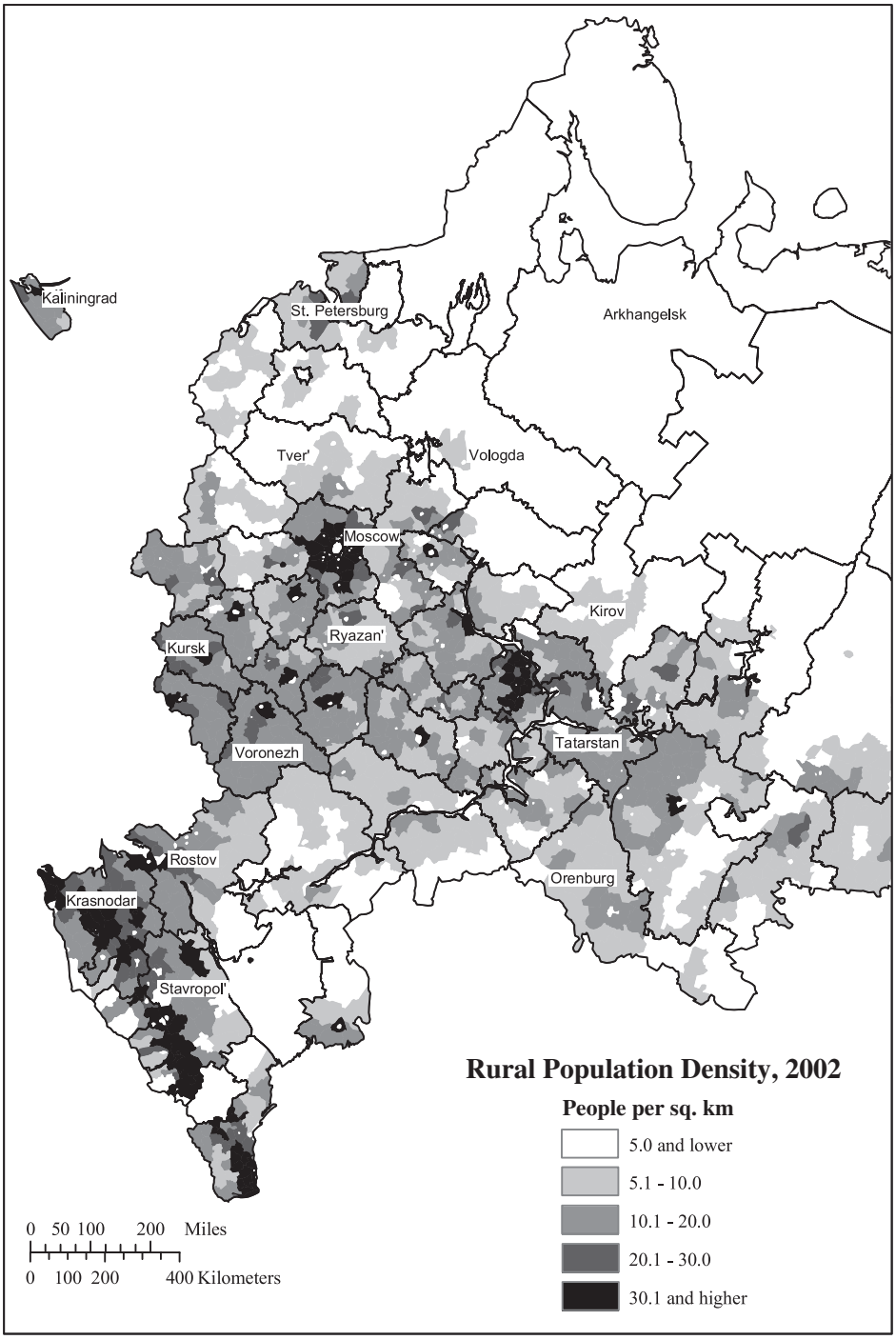

Figure 7. Rural population density by rural district, excluding population of district centers, people per sq. km, 2002.

most probably lead to land abandonment, we set out to quantify a single measure of agricultural productivity and examine the effect of several variables reflecting the social and physical environment of Russian districts on productivity. Because all the selected productivity variables correlate with one another and yet reflect different aspects and/or periods of time, principal component analysis allowed us to reduce all the five indicators to a single component capturing 80 percent of the total variance (Varimax rotation was used). Several islands of heightened productivity engage attention (Figure 8), the largest of which is in the western piedmont of North Caucasus (chiefly in Krasnodar Kray, also known as Kuban, Russia's premier agricultural region). Other

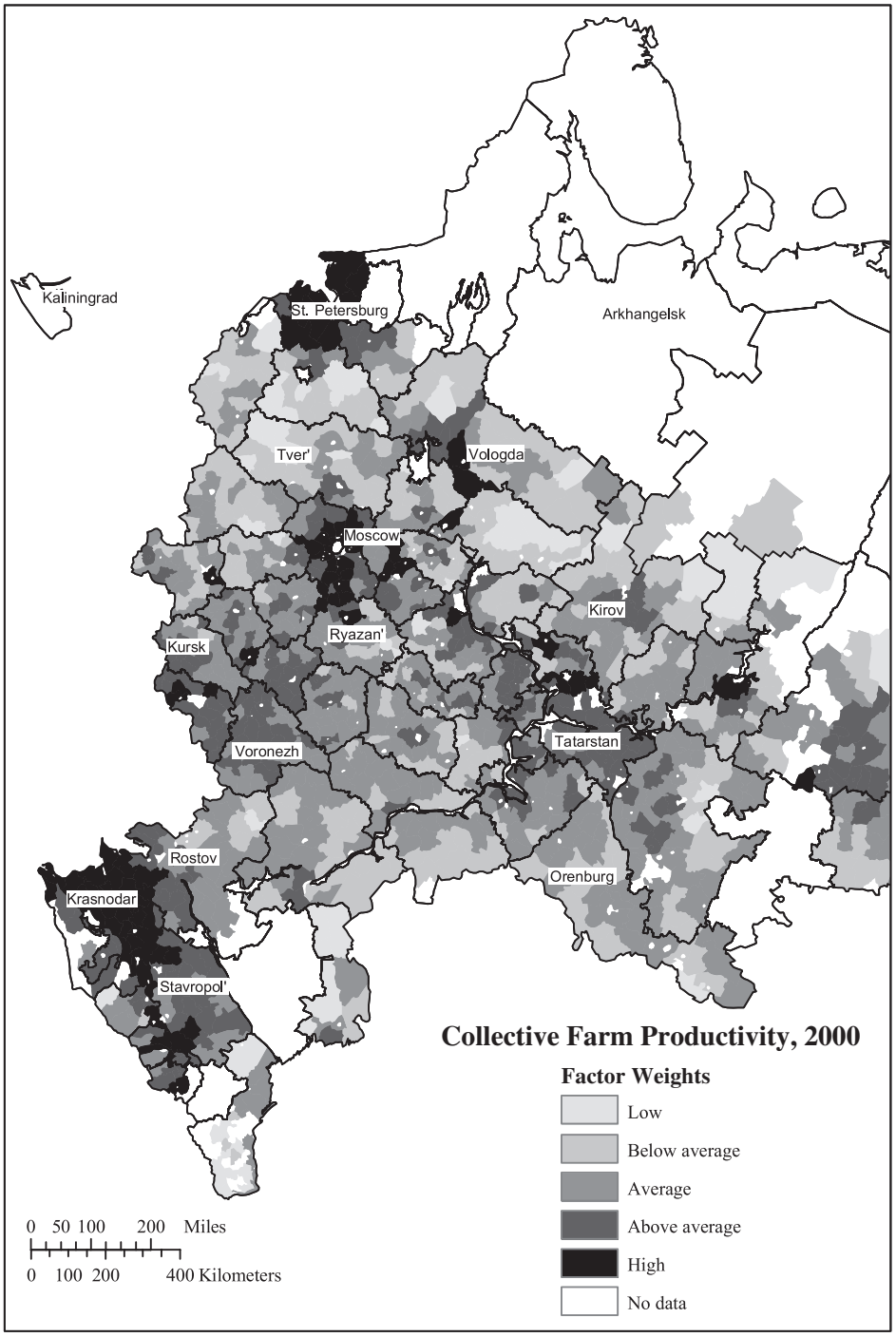

Figure 8. Collective farm productivity by rural district (factor weights).

islands encompass the western part of the Central Chernozem region (Belgorod) and the environs of Moscow, Saint Petersburg, Vologda, Yekaterinburg, and Perm.

Sorting out Pearson correlations between the productivity component and the selected "environmental" variables (Table 8) shows that in both the NCZ and the South, the closest correlate to productivity is rural population density. In the NCZ, urban population potential matters, as does natural soil fertility in the South. It is unclear, though, in what way they affect agricultural output for the most part. All the hypothesized dependencies (Figure 9a) include both direct and indirect (mediated) impacts on productivity. For example, location relative to major urban centers is likely to affect farm productivity indirectly, as more rural folks live in peri-urban districts. Direct influence cannot be excluded,

Table 8. Pearson Correlations between the Agricultural Productivity (Factor Weight) and Logarithms of Selected Characteristics of a Rural Setting

Characteristic	NCZ without Extreme North	South	European Russia without Extreme North
Urban Population Potential	.665	.297	.278
Rural Population Density Outside District Center	.625	.566	.722
Natural Soil Fertility	.449	.612	.394

Source: Calculations by the authors; coefficients are significant at the .05 level.

however; inasmuch as other potential mediators of the influence in question are not taken into account, the influence is categorized as "direct." This may mean, for example, that peri-urban farms are better managed than outlying ones and/or farmers working closer to major urban centers are better informed and motivated. Likewise, soil fertility may influence productivity both directly and indirectly. Higher productivity would result directly from better soils. On the other hand, more people tend to live on better soils because their household farms are more productive there, but more people per square kilometer means more employees for the collective farms as well.

Using an early version of the path analysis (Boudon 1965), we are able to calibrate a causative model reflected by Figure 9a. It boils down to solving a system of linear equations relative to ß-coefficients (standardized regression coefficients). The solutions are illustrated by Figures 9b and 9c; in both cases, the preponderance of mediated (indirect) influence of both soil fertility and pull of urban places is corroborated. Each of these factors affects productivity through rural population density. Therefore, rural population density (whether conditioned by the pull of major cities as in the NCZ or by soil fertility as in the South) is likely to be the principal factor that productivity of the collective farm sector hinges on.

While we can now claim with a good deal of certainty that retention of rural population is key to productivity in Russia's collective farm sector and, therefore, to retention of agricultural land, interpreting the productivity score on the basis of factor analysis is problematic, a well-known shortcoming of factor analysis technique (Jelinski and Wu 1996; Marceau 1999). Also, land abandonment is a process, whereas estimates of productivity reflect a steady state or an outcome.[25] Therefore, it would be desirable to arrive at a combined statistic (for each district) that would reflect both a steady state and a change instrumental in and indicative of the collective farm atrophy. Such a change, in our view, is the decrease in head of cattle. The

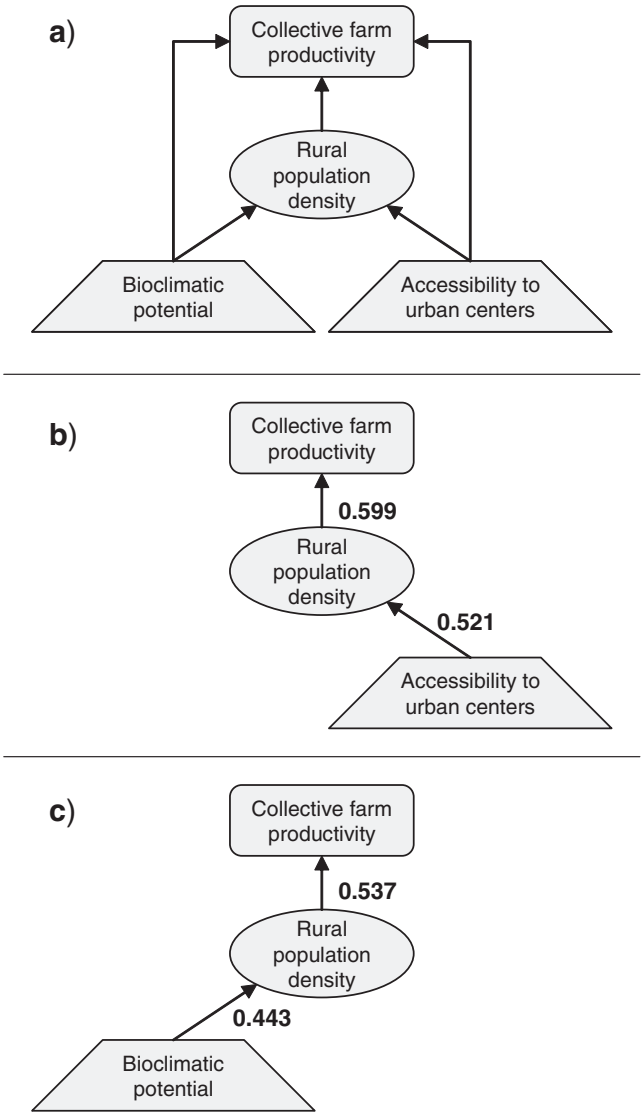

Figure 9. Modeling collective farm productivity: (a) Hypothetical causative model; (b) the model calibrated for NCZ; (c) the model calibrated for the South [in (b) and (c) links with $\beta < 0.4$ are removed]. Source: Calculations by authors.

cattle dynamics do not correlate with productivity and therefore cannot be part of a single component score. If, however, a district displays two characteristics—(a) it had exceedingly low productivity both at the beginning and end of the decade and (b) it disposed of much of its cattle *during* that decade, it is then most likely to end up losing much of its farmland in the near future.

Consequently, we set out to apply an ordinal scale to the aspects of productivity exceeding, or not exceeding, certain meaningful thresholds (both in the beginning and the end of the 1990s), and we attempted to combine ranking on productivity with that on decrease in cattle in a single score. Each district was assigned five steady-state

productivity values and one cattle dynamic value on the scale from 1 (worst) to 5 (best). In doing so, we took guidance from all Russian and regional averages as well as other significant benchmarks.[26] Districts with no single indicator exceeding 2 and, therefore, with the total on all indicators not possibly exceeding 10, were labeled the *black holes*. This descriptive label reflects the image many Russians habitually invoke when they think about investing in their country's collective farms. To them, it is like dropping money into a black hole (Nefedova 2003, 136–39). If at least one indicator for the district was assigned 3 (usually either grain or milk yields in the early 1990s) and so their total was 11, such a district was labeled *problem*. The black holes occupy 31 percent of European Russia (without its northernmost part) and are home to 17 percent of its rural population. The problem districts' shares in land area and rural population are 21 percent and 15 percent, respectively. It would be safe to say that in the districts of both groups, collective farming has effectively collapsed (for the black holes, this outcome is just more certain), and so further contraction of agricultural land is likely to take place there.

There are five amalgamations of black holes and problem areas (Figure 10). Two of them cover outlying districts in the NCZ, in its northwestern and northeastern sections. The nature of these effectively marginal lands is different. The northwestern periphery falls within the area of oldest colonization and moderate climate; however, it is the area with the most lasting drain on rural population into Saint Petersburg, Moscow, and other urban centers. The northeastern periphery, on the other hand, is physiographically marginal as well, with long and harsh winters. Yet another amalgamation of black holes, apparently not without influence of nature, consists of the swaths of arid steppe in the North Caucasus (part of the Rostov-Don region) and low Volga (parts of the Volgograd and Saratov regions and Kalmyk republic). The fourth amalgamation is an interrupted chain of peripheral districts stretching from Briansk in the west to Orenburg in the east. This is one of the best-endowed agricultural regions of Russia. To be sure, black holes are rare here, but problem districts abound. As in the northwestern NCZ, the nature of the malaise is apparently sociodemographic. Finally, the last amalgamation of the black holes is in the ethnic republics of North Caucasus (with the exception of Kabardino-Balkaria). This is the only region of European Russia where collapse of collective farming is not conditioned by rural depopulation.

The opposite pole is represented by what we call the emerging archipelago of Russia's commercial farming (Figure 11). It includes districts whose totals on all five indicators exceed 20 (only forty-two districts with 8 percent of European Russia's rural population on 2 percent of its land fit this distinction) as well as those with the total ranging from 15 to 20. The majority of the districts falling in these two groups are in the South; of those located in the NCZ, most are peri-urban or second-order neighbors of large cities. In European Russia, there are only six regions with 75–100 percent of their total land falling within this archipelago. These are Moscow, Leningrad, Kaliningrad Oblasts, Tatarstan, Krasnodar Kray, and Kabardino-Balkaria. On the other hand, the regions of Great Novgorod, Pskov, and Smolensk (all three are in the Russian heartland), as well as Komi-Permiak ethnic territory and Dagestan (environmentally marginal areas because of harsh winters and rugged terrain respectively), do not include any agriculturally successful districts at all.

Interpreting the Emerging Economic Landscape

Having assumed that farmland contraction coincides with, and in fact results from, persistently low productivity, we concluded that the main factor behind the latter is rural depopulation. As a crucial agricultural input, land is scaled down to match the diminished potential of labor. While depopulation has occurred in environmentally marginal and in some well-endowed areas as well, the former are affected by it more frequently than the latter. By the same token, the impact of physical factors is occasionally felt in the absence of depopulation, as is the case in the ethnic republics of North Caucasus where rugged terrain restrains farming operations. In what follows, we interpret the likely implications of these findings.

Human Capital in the Countryside: Quantity and Quality

Our field observations lead us to exercise caution in treating the number of rural folks per unit of land as the prime predictor of agricultural performance. While it is true that virtually all the black holes in the NCZ have fewer than ten people per ssquare kilometer, we encountered fairly successful collective farms in the outlying districts under still lower population densities (Ioffe and Nefedova 2001d). In all such cases, however, an unusually entrepreneurial personality of the leader stood behind the success. Such leaders are extremely scarce, however, and rank-and-file collective farmers without a drinking afflic-

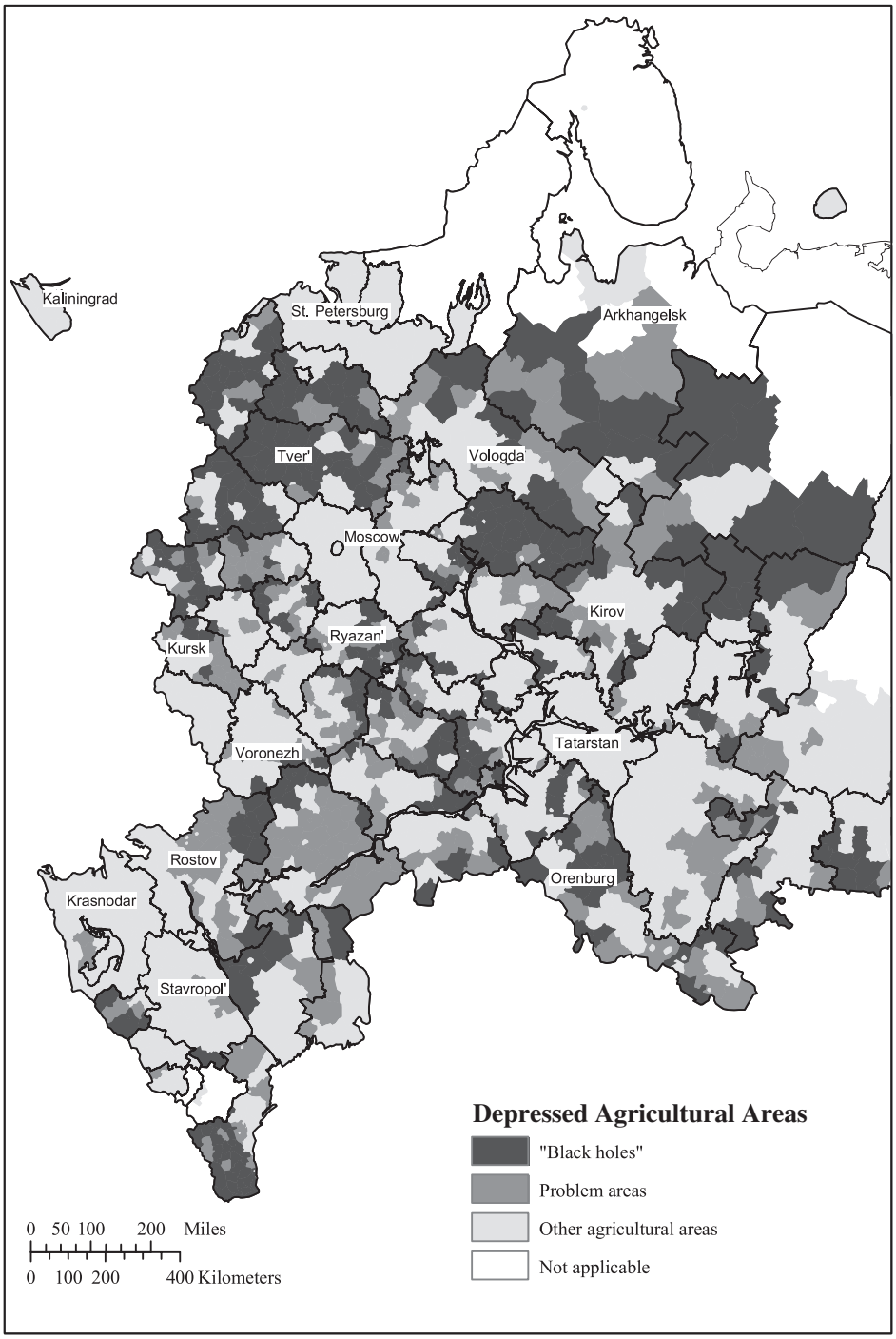

Figure 10. Depressed agricultural areas.

tion are no less uncommon. As a result, peculiar situations arise whereby local unemployment statistics occasionally fly in the face of one's assertion that labor is in short supply. The commonsense explanation of this paradox is that most of those unemployed are actually unemployable because of binge drinking.[27] Firing them under the old Soviet system of labor management was next to impossible. While it is quite possible now, finding a sober replacement is even more problematic than before.

In Russia, the long-lasting drain on rural and indeed free-standing small town populations has been aggravated by the self-selection of "movers" versus "stayers." Those most industrious, bright, dexterous, savvy, and least given to heavy drinking tended to leave for the city,

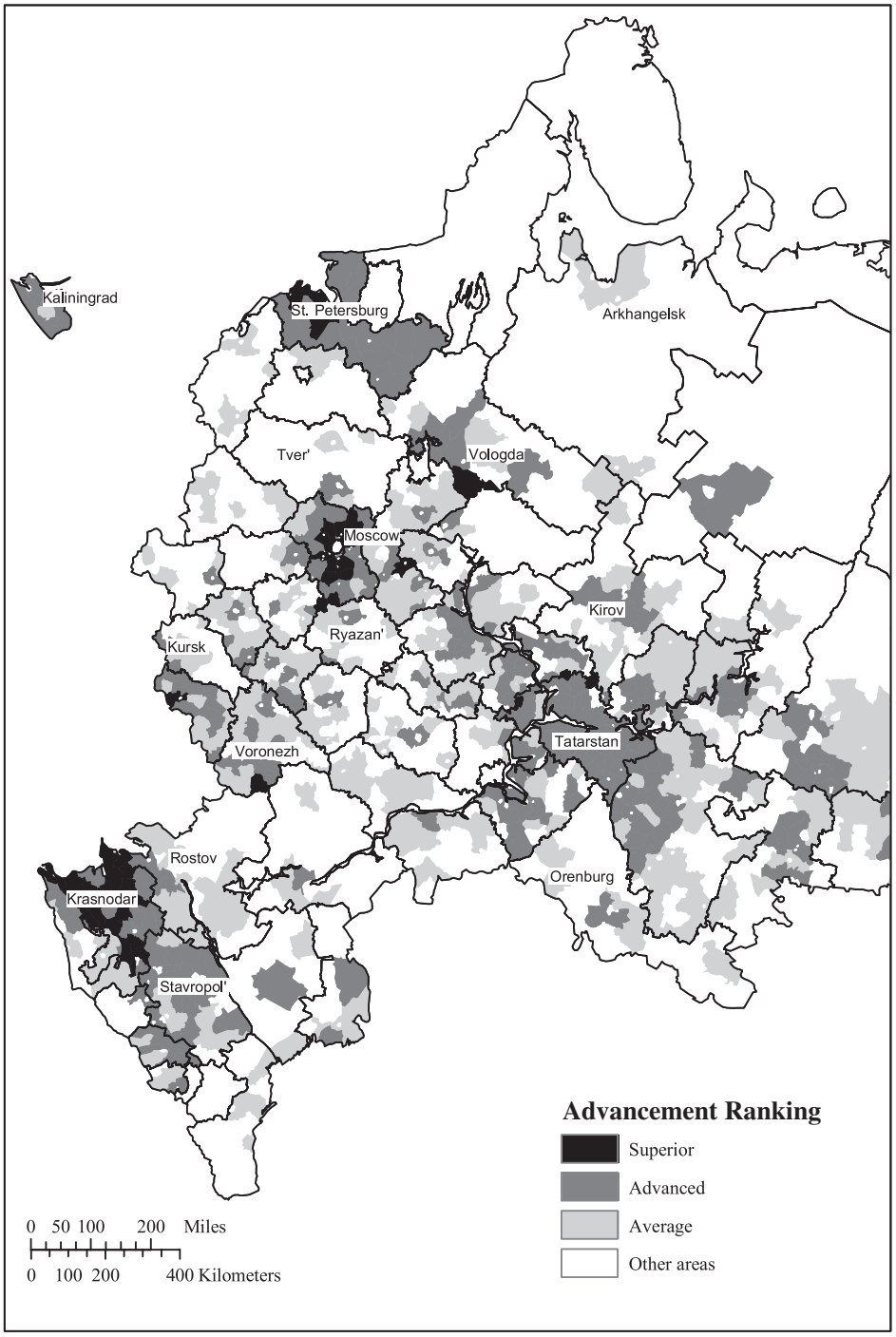

Figure 11. The emerging archipelago of commercial farming: grouping of rural districts by degree of agricultural advancement.

while the most passive and resigned tended to stay. As a result, a very distinctive population, not particularly receptive to innovation and change, is left in much of the countryside, especially in its outlying segments. The problem in question is by no means elusive. On the contrary, it is of monumental proportions. But while it strikes one during field trips, it has so far defied blunt qualifications and plain-language analyses. Consequently, if population numbers per unit of land appear to be the most meaningful predictor of agricultural productivity, this is apparently because there is much less areal variation in the spread of the aforementioned impairment than in the overall population density.

Another qualification concerns actual technological and managerial arrangements that mediate demand for labor. If private entrepreneurs could replace collective

farms, the demand for farm labor would be slashed so much that rural population densities of today would be considered appropriate and at times excessive. This speculation, however, constitutes wishful thinking simply because very few Russians are eager to become private farmers. Most probably, if such replacement takes place at all, it will be slow and partial, and it will have occurred long after much of the agricultural land in today's black holes is irretrievably abandoned. Only when these qualifications are taken into account can we continue to consider rural population density to be a reliable predictor of agricultural productivity and land retention/abandonment in Russia.

Rural Population Dynamics and Land Abandonment

As shown above, many collective farms have actually died as production units but still hold on to their land. Because of progressing depopulation and market conditions under which the state is unlikely to support these farms as generously as before, the clusters that we identified as black holes are likely areas of soon-to-be-abandoned farmland. Hereafter, the geography of commercial farming is likely to be linked more closely with the spatial pattern of rural population and with physical factors.

Russia's rural population is currently on the decline. According to the Goskomstat, Russia's equivalent of the U.S. Census Bureau, the 2015 rural population of European Russia will be 7.8 percent lower than it was in 2001 (*Predpolozhitel'naya* 2002, 24–26). Nothing portends the setback of this trend in the foreseeable future despite the fact that in 1991–1994 Russia actually saw rural population growth. An attempt by Nefedova and Treivish to fit Russia into the differential urbanization theory (Geyer and Kontuly 1993), which suggests that spatial distribution of population passes through a universal sequence of stages (generally speaking, from polarized growth to ultimate polarization reversal) revealed mixed results attributed largely to profound crisis events that Russia repeatedly underwent during the twentieth century (Nefedova and Treivish 2003, 86). The 1991–1994 "short-run towards the advanced polarization reversal or early counter-urbanization stages" (ibid.) was qualified as premature, and the most probable scenario for the next decade was denoted as "the advanced intermediate city stage" (ibid.), which, according to the differential urbanization theory, precedes counterurbanization. This stage does not spell widespread rural revival, particularly in a vast country such as Russia, although peri-urban and the best-endowed rural areas will most likely consolidate their past gains and develop further. What makes blanket rural revival highly improbable in Russia is a combination of exceedingly low birth rates and increasing demand for nonagricultural labor. As a result, the archipelagization of rural space in Russia will most likely deepen.

The steepest rural population decline (15.2 percent) is projected for the NCZ, and only a modest (3.1 percent) decrease is projected for the South. If these predictions materialize, then using the 2001 regression model (Table 7), European Russia's area under crops will have contracted by about 7.5 million hectares as a result. Considering the current share of cropland in the agricultural land total (47 percent), this is equivalent to losing an additional 16 million hectares of farmland. Obviously, the biggest losses will be in the NCZ. For example, in Tver' region (located between Moscow and Saint Petersburg), wherein the projected decrease in rural population is over 16 percent, more than 700,000 hectares are likely to be abandoned out of the current 2.1 million hectares in agricultural use.

This is a fairly credible prediction and, if anything, an understatement of foreseeable losses. Throughout the previous fifteen-year period, loss of farmland was commensurate with that predicted for the future. Further deterioration of the age structure of the rural population, however, which was not considered in the land abandonment forecast, is likely to impose its own toll as well. The predicted land abandonment is not likely to be compensated for by the alternative developments in the space between Moscow's and Saint Petersburg's burgeoning suburbs. The expanding gap between the agricultural hinterlands of Russia's two largest metropoli is perhaps the most graphic display of the emerging archipelago-like spatial pattern.

"Theoretical" Black Holes

As shown above, rural population density is a credible predictor of agricultural productivity, and harsh environment and poor accessibility to major urban centers help to mold the fragmented space of Russian agriculture. Apparently, if any causal agent of the uncovered areal variation in productivity extends beyond a certain threshold, the ensuing situation is fraught with land abandonment. This effectively means that a constraint is imposed upon farming that is insuperable under current conditions. Pinpointing the exact value of each such threshold would require more detailed analysis, but setting "rules" featured by Table 9 allowed us to identify the black holes by summing up ordinal variables assigned to each district. In contrast to the previously described way

Table 9. Designation of Theoretical Black Holes and Problem Districts

	Physical Environment		Demographics		Cities and Centers	
	Celsius Degree Days above 10 Degrees throughout the Vegetation Period	Ratio of Precipitation to Evaporation	Rural Population Density in People per sq. km	Percent of the Retirees in Rural Population	Order of Neighborhood with the Regional Capital	Size of the District Center (thousands people)
Black holes	<1,600	<0.33	<5	>36	6, 7, 8	<20
Problem districts	1,600–2,200	0.33–0.55	5–10	33–36	4, 5	20–50

of encircling the black holes "from below," that is, based on the actual farm productivity analysis, this way allows to encircle them "from above" on the basis of broadly defined environmental characteristics. The *theoretical black holes* thus obtained coincide with the *actual black holes* (Figure 12) in 70 percent of all cases. In the northwestern, northeastern, and southeastern zones, the match is nearly perfect. Also, the lack of predicted black holes matches the actual situation in Moscow, Leningrad, and the premier agricultural regions of the South. A poor match is recorded for the forest steppe area stretching from Kursk to mid-Volga; the actual situation here is worse than predicted. Curiously, as early as 1910, Veniamin Semionov-Tian-Shansky hailed this area as the "most ailing, economically and spiritually, part of Russia" (Semionov-Tian-Shansky 1910, 36). Here, the lack of what Wilbur Zelinsky called "propitious urban and economic milieus" (Zelinsky 1962, 504), that is, the inability of local towns to invigorate their hinterland, outweighs good soils and reasonably high population density. On the other hand, in Tatarstan and Bashkortostan, the actual situation is far better than predicted.[28]

Rural Russia between Generic and Singular

The eternal debate between the Russian Westernizers (aka democrats) and Slavophiles (aka national patriots) is centered on unique features of Russia. For the Westernizers, Russia is just out of phase with the West; it possesses some features that the West has long disposed of. For the Slavophiles, Russia's singularity is a genuine article; it is rooted in Russia's space, its oriental affinities, and its "inexplicable" soul. In regard to land abandonment and rural depopulation as its driving force, Russia's record is mixed. It does, in fact, face some of the same problems that the West has faced, yet in Russia's peculiar socioeconomic context, those problems look different.

Wilbur Zelinsky's theory of staggered growth and decline cycles in the U.S. rural population change (Zelinsky 1962) seems to fit Russia, though unlike the U. S., Russia's historic core is inland. However, just as the American Northeast experienced rapid agricultural progress and then rural attrition first and "soon after a concentric crest and trough of rural maximum and decline began to pulsate steadily outward toward the far corners of the country" (ibid., 523), so the junction of Russia's Center and Northwest led growth and decline while other regions went through the same phases later, with the actual time lag standing in direct proportion to distance from that junction.

In Russia, the overall rural population decline commenced earlier than in the U. S. (in the 1930s versus the 1950s), but later than in Western Europe. As in rural America, in Russia, "the redistribution of rural population is to a much higher degree the result of migration differentials than of differentials in vital rates" (ibid., 516). Moreover, much like in the U. S. before the advent of counterurbanization, there is a positive correlation between the pace of rural population decline and the percentage share of rural villagers in the total population of the area. In the 1970s and 1980s—when births still outnumbered deaths in the Russian countryside, but rural exodus was in full swing and rural population numbers shrank in every Russian region—many peri-urban places (but rural in their status) recorded population growth. Contrary to what might be expected, the agricultural contingent of peri-urban population was the fastest growing (Ioffe 1990, 90–91). These areas also enjoyed a higher quality of agricultural labor. The disruptive influence of urbanization on agriculture in the West as described by Western analysts (e.g., Bryant and Johnston 1992, 25–26) hardly fits the Russian context. Agriculture has, in fact, benefited from urbanization in most, if not all, Russian regions.

Whereas, in the West, exodus from farms was conditioned by rapidly advancing farm technology and by the powerful competition of areas with superior endowments, rural exodus in Russia went ahead of those advances and has gone far beyond their ability to substitute manual labor. The major cause of rural migration in Russia has been a striking differential in the quality of rural versus urban life, far above that which has been in any

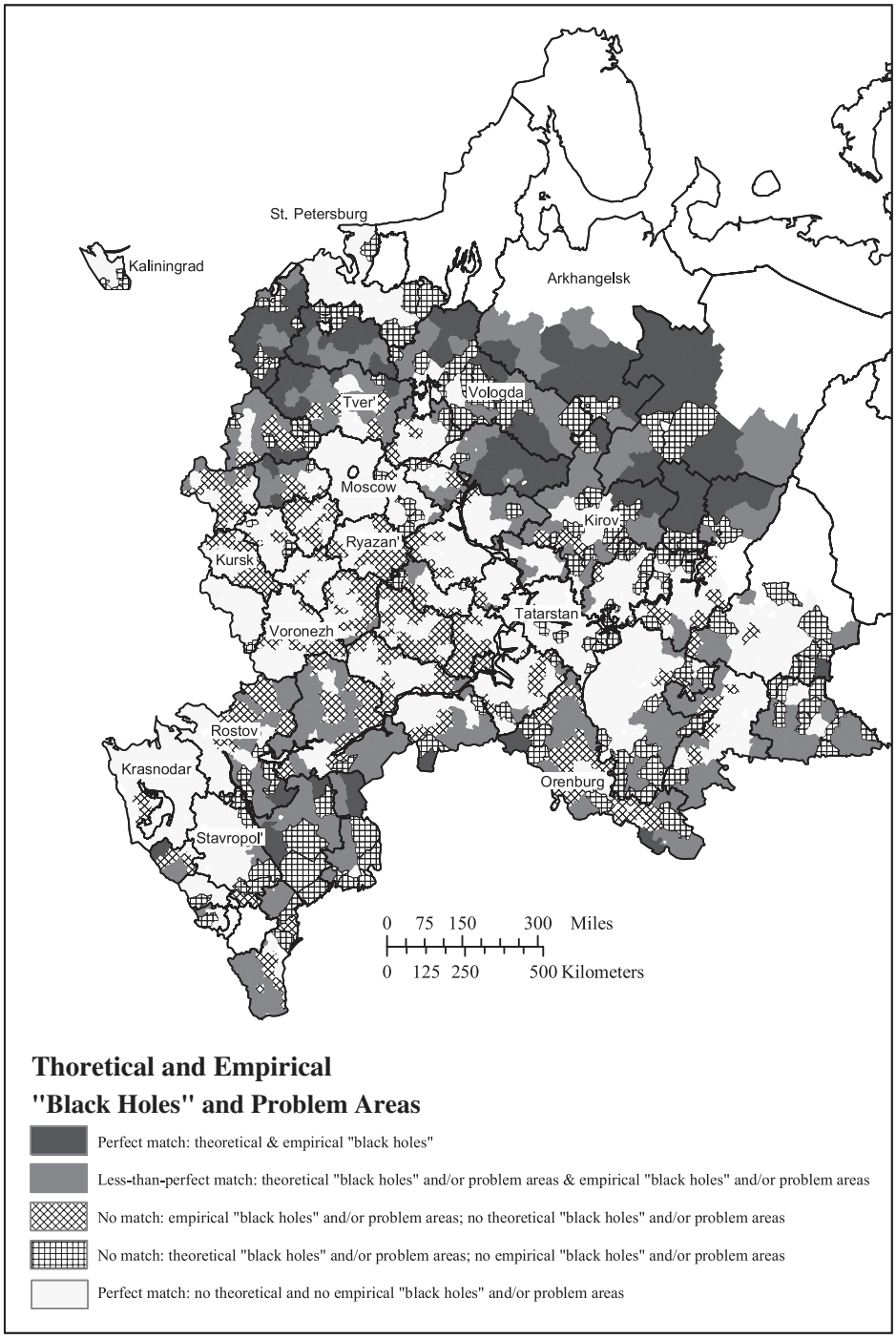

Figure 12. Theoretical and empirical black holes and problem areas.

economically advanced country. So it makes sense that where this differential has diminished, as in the Moscow and Leningrad regions, the pace of out-migration has lessened. To be sure, rural natives in much of these regions have long been replaced by newcomers from other regions. Rural population is also quite stable in Russia's Kaliningrad exclave and in the vicinity of every major Russian city. Elsewhere, we elaborated on the peculiarities of the Russian-style suburb, an entity highly dissimilar to its Western counterpart and possessing a vigorous agricultural component (Ioffe and Nefedova 2000).

Outside the one-hour accessibility range of Russia's regional capitals (in the cases of Moscow and Saint Petersburg, the range is wider), rural life is even more archaic today, and the gap between these backwater areas and those capitals is even wider than it was under

the Soviets. This advanced polarization of rural space has indefinitely postponed the prospect of mobility transition in Russia. Writing about rural migration in West Europe, where this transition has long occurred with people now flocking to smaller settlements outside urban fringes, a British author expressed the view that "effectively contemporary rural migrations reinforce what [has been] described as the post-war 'social avalanche which swept away the last traces of 'village life' and transformed life for everybody everywhere. . . .There is no point whatsoever in talking any longer about 'village life' and 'farm life.' It's just life" (Lewis 1998, 133). One can hardly come up with a description more at odds with what one actually finds in most of Russia.

At the same time, pockets of rural deprivation exist in the West's largest country, the U. S., notably in Appalachia, the lower Mississippi Valley, and in parts of the Southwest (Faruseth 1998, 233), so, at least, this situation offers some semblance of similarity with Russia. One is tempted to attribute it to "the curse of open lands," one of admittedly few bona fide similarities between Russian and American national settings.

The same ambiguity regarding general and unique features of Russia marks land abandonment. In West Europe, a similar process emerged as early as the 1950s and was labeled *Sozial Brache* (a social fallow) (Ruppert 1959). In later years, however, incentives encouraged West European farmers to set aside agricultural land in order to counter overproduction. Thus in 1993–1994, 4,605,000 hectares of arable land (more than 5 percent of the total) were set aside in the European Union (EU) (Ilbery and Bowler 1998, 72–73). At the same time, about one-third of the utilized agricultural area of the EU and 16 percent of all agricultural holdings were classed as "susceptible to marginalization." They are located in the Mediterranean countries and in Scotland, Ireland, and Wales (Brouwer et al. 2003).

Land retirement programs have also been in existence in the U.S., where they had more limited success. Overall, however, twenty-two million hectares of cleared farmland were lost in the thirty-one eastern states of the U. S. between 1950 and 1959, largely compensated by expansion in the western states (Hart 1968, 417–18). "The basic underlying cause for much land abandonment" during that period, as documented by John Fraser Hart, "is the restrictions which are imposed by physical environment" (ibid., 434–35). In other words, least endowed land was primarily abandoned. The same typified the period from 1949 to 1997, when 18.4 million hectares were lost, or about 400,000 hectares a year. Again, contrary to the American "news media [that has] an apparently insatiable appetite for news of disaster" (Hart 2001, 540), much abandoned land was land "that probably never should have been cultivated in the first place" (ibid., 536).

Similar trends characterize Canada, where, however, the degree of spatial coincidence between the best-endowed farmland and urban developments is a cause for national concern. Yet even here, more land was lost in areas with harsh environment, like Quebec's Gaspé peninsula, which physiographically resembles the Pskov and Great Novgorod regions of Russia. In Gaspé, 52 percent of farmland was abandoned from 1961 to 1976 (Lamoreux 1985).

All of these cases of land contraction, however, may be dismissed as misleading or taken from the wrong context simply because all of them took place under a condition that is conspicuously absent in Russia, overproduction. Herein is the source of patriotic outrage: Russia's farmland is being lost at the time when domestic demand for food is not met and imported food accounts for half of domestic consumption.

Absent overproduction, to put a positive spin on agricultural land contraction in Russia is indeed an uphill task. Apparently because of this difficulty, Russia's Westernizers rarely make agriculture the focus of their public pronouncements. Most of the agricultural discourse in Russia is, in fact, farmed out to national patriots, for whom abandonment of long-used farmland is nothing short of a sacrilege.

Few theorists have focused on historically variable demand for farmland. Rudolf Bićanić theorized a historical change in the relationship between land, labor, and capital in agriculture. In his turning-points theory, he envisioned the stage at which "reducing the cultivated area and increasing the volume of production will take place at the same time" (Bićanić 1972, 175–76). Bićanić's reasoning effectively draws from a supposedly organic match between trends in agricultural population (e.g., absolute increase and relative decrease, absolute decrease and relative decrease, and so on), types of agriculture (e.g., subsistence, marketing, entrepreneurial), and agricultural policies (e.g., life parity, price parity, and so on) For example, subsistence agriculture exists under absolute increase in agricultural population, and the goal of agricultural policies is life parity; absolute stagnation in rural population numbers is matched with marketing agriculture and price parity (ibid., 12). Such a match, wherein a production system develops in agreement with the dominant trend in population and policies are pursued in agreement with both, is what Bićanić deduced from the Western agrarian history. This is not, however, a universal rule.

In Russia, after the New Economic Policy was abandoned in the late 1920s, economic regulation of production systems was replaced with administrative coercion. This terminated the "preoccupation with price parity with the aim of stimulating agricultural production for the market" (ibid., 25), the concern that Bićanić deemed organic for the period when subsistence agriculture gives way to marketing agriculture. Forcible collectivization signified the second coming of bondage in Russia. The entire agricultural sector fell victim to Sturm-und-Drang industrialization. Because collectivization ensured persistently low yields, more and more land was required to compensate for them. Now as the market forces are unleashed once again, there is much confusion. It is hard for the layperson to distinguish between good land abandoned out of despair and inferior land that, using Hart's radical formulation, "never should have been cultivated in the first place."

Conclusion

In Russia, spatial polarization of populated space unfolds against the backdrop of initially sparse settlement. Its layout is different from the world's other vast countries, and so the outcome of polarization is different as well. Even the areas of oldest colonization, like those between Moscow and Saint Petersburg, are "torn apart" by distance. There are islands of dense settlement immersed in depopulated vastness, so the whole settlement pattern resembles an archipelago.

Agriculture, the most land-intensive activity, offers a particular vantage point on the ongoing process of spatial fragmentation. As metal filings realign when a magnetic field is introduced from without, so the fate of myriad local farms appears to be molded by powerful factors external to agriculture. In the NCZ, land at a distance from a large city is being abandoned, and so the environs of those cities come to look like agricultural oases. In the South, the spatial development is more even, but here, too, excessively arid land is being abandoned and peripheral districts in regions devoid of large urban centers are ailing even on good soils.

In Russia, the national-patriotic intellectual camp treats this situation as an unequivocal evil. Sundry conspiracy theories are spawned about outsiders and their agents of influence inside Russia purporting to undermine its soul by targeting its land-benefactress (*kormilitsa*), the cradle of that soul. To be sure, a view of abandoned villages and former cultivable fields overtaken by shrub and birch trees is as sad as Chekhov's image of a doomed cherry orchard. But when one analyzes the effects of spatial polarization on Russian agriculture, not only negatives come to mind. Expanding farmland just because there is room for further expansion has created a situation whereby working land is like biting off more than one can chew. In part because of that, Russia's farming practices are arguably further behind the economically advanced world than any other activities in which Russians and Westerners are engaged. Lenin's late nineteenth-century description of parallel existence of "the most advanced forms of industry and semi-medieval forms of agriculture" appears to linger in his native country. Also, Russia's aging rural population is in large measure unfit for innovations.

Up until 1991, huge subsidies were used to keep lethargic and retrograde collective farms afloat. Now that the state budget is thinner and the rural population is being depleted by the negative rate of natural increase and out-migration, further contraction of farmland is unavoidable. Yet this contraction may be a blessing in disguise. The most ailing rural communities dying out and the least productive farmland being abandoned may resemble pruning trees by cutting off dry and rotten twigs. For decades, both analysts and laypersons complained about the poor condition of Russian roads, rural roads in particular. Much improvement has been recorded since the 1970s, but it is still a drop in the bucket. Nothing short of an American and West European level of prosperity will provide paved road access to all, or even most of, the 150,000 or so rural villages in Russia. It is certainly more realistic to view this as a too-much-space than a too-few-roads problem. And if so, spatial contraction of farmland may actually be for the better. Not less but more food is likely to be produced on significantly contracted farmland, and fewer resources will be wasted. This is because the land that is likely to be retained under cultivation is a better match to the people's actual ability to cultivate it. Russia's domestic demand for food, coupled with its own unique perception of security threats,[29] will ensure a healthier investment climate on smaller and better-endowed lands. Already, vertically integrated corporate structures, both foreign (e.g., Danone, Campina, Ehrmann) and domestic (e.g., Wim-Bill-Dunn, AgroRos, Rusagro) vigorously involve the best farms in their operations (Ioffe and Nefedova 2001c). More positive signs develop with time. For example, Russia has resumed grain exports, and now the government is about to impose quotas on exports so that domestic prices on bread will not rise too high. We therefore believe that the positive effects of land abandonment in Russia will soon outweigh the negative effects. Even so, when all is said and done, the future of abandoned and soon-to-be abandoned land is waiting to be examined.

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Notes

1. According to the head of the Russian Federal Border Control Service, "the breakup of the USSR has shifted the border back to where it was in the 16th century." http://www.strana.ru/print/182141.html (accessed 28 May 2003).
2. Terry Jordan considered a dense transportation network to be one of the formative characteristics of Europeanness (Jordan-Bychkov and Bychkova-Jordan 2002). Jordan's view can be traced to some major West European (e.g., Alfred Hettner 1907) and Russian (e.g., Piotr Semionov 1892) scholars.
3. This sense of remoteness is poignantly captured in the poetic Russian diminutive "*glubinka*" (from *glubina* = depth) reserved for outlying areas. Of course, a sparse network of vibrant urban cores creates this perception in the first place, and the substandard condition of roads and other means of communication adds to it. In Russia, not just Siberia, whose space is torn apart by distances, areas of old colonization and settlement have not been served by an adequate number of urban centers. By "adequate," we mean able to cast the web of socioeconomic exchange that would integrate the surrounding rural areas.
4. In contrast to Bassin, though, whose main objective was to show that the environmental determinism does not have political identity of its own but just "can be used toward explicit ideological ends" by Marxists and right-wing conservatives alike, we tend to think that exonerating "geographical factors as causative agents" in a geographical publication is much like forcing an open door.
5. Full citation from the English translation: "The development of capitalism in depth in the old, long-inhabited territories is retarded because of the colonization of the outer regions. The solution of the contradictions inherent in, and produced by, capitalism is temporarily postponed because of the fact that capitalism can easily develop in breadth. For example, the simultaneous existence of the most advanced forms of industry and of semi-medieval forms of agriculture is undoubtedly a contradiction. Had Russian capitalism had nowhere to expand beyond the bounds of the territory already occupied at the beginning of the post-Reform period, this contradiction between capitalist large-scale industry and the archaic institutions in rural life (the tying of the peasants to the land, etc.) would have had to lead quickly to the complete abolition of these institutions, to the complete clearing of the path for agricultural capitalism in Russia. But the possibility (for the mill-owner) of seeking and finding a market in the outer regions in process of colonization, and the possibility (for the peasant) of moving to new territory, mitigates the acuteness of this contradiction and delays its solution" (Lenin 1956, 653).
6. Comparisons in crop harvesting took into account all cereals, potatoes, and sugar beets; their yields per hectare were attached weights equal to their respective percentage shares in sown area.
7. To calculate integral livestock density, animal unit mouths were used whereby cattle were assigned a statistical weight of 1.0; horses, 1.5; pigs, 0.25; sheep and goats, 0.1.
8. Here is a cognitively similar formula from another work on Russia: "Historians are understandably attracted to the various uprisings and rebellions which took place over the centuries in Russia. These are 'events' which left extensive paper trails, while the ordinary, everyday slavishness of Russians constituted a distinct nonevent. From a psychoanalytic viewpoint, however, the rule is no less interesting than the exception" (Rancour-Laferriere 1995, 11).
9. He also showed that in the USSR the best conditions were in the West (West Ukraine being the very best) and the worst conditions were in fact in parts of Russia. According to Field's thermal (degree-months) and moisture (percentage of potential evapotranspiration) ratings, Moscow is equivalent to Sault Ste. Marie, MI; and Rostov-Don, in the premier agricultural region of Russia, to Pierre, SD (Field 1968, 8). Both American locations are relatively marginal in the American agrarian ecumene.
10. The ideologically charged atmosphere of the Cold War may have overemphasized political-economic reasoning at the expense of something as politically neutral and eternal as natural environment. It might be that the stigma of environmental determinism, "this veritable geographic swearword" (Lewthwaite 1966, as cited in Bassin 1993, 3), was at fault as well. However, the fight with determinism was conducted within geography, while historians and other social scientists, who for the most part contributed to Sovietology, seem to have remained largely unaffected. For example, Richard Pipes's (1974) hallmark book *Russia under the Old Regime*, has a very strong environmental streak as conveyed in the book's opening chapter, "The Environment and its Consequences."
11. Total farmland includes arable land (cropland and fallow), as well as pastures and meadows.
12. The extreme north of European Russia includes Karelia, Komi, Archangel, and Murmansk regions.
13. Ioffe and Nefedova (1997b) expressed the view that the collectivization of agriculture in the Soviet Union would not have been successful without the formative communal experience of Russian peasantry. Today the significance of that experience cannot be overemphasized. With peasants now free to move out or join other modes of farming, staying on the collective farm is an opportunity to benefit from a certain safety net.
14. These data have to be taken with caution, as the percentage share of household operations in Russia's gross agricultural output may be significantly exaggerated. Whereas, prior to reforms, there was a tendency to inflate the collective farms' share of output and suppress that of household farming, there is an opposite trend right now. First, household operations are no longer deemed ideologically inappropriate. Second, their combined output record in every district is assessed on the basis of small samples encompassing no more than 0.5 percent of households. Third and most important, in today's Russia, the household farms' output is not subject to taxes, no matter whether the household produces for itself or for market. This, as a matter of fact, artificially suppresses the spread of registered family

farms, as their output, just as that of collective farms, is taxed, so there is a proclivity to conceal it.

15. Curiously, in the U. S., John F. Hart acknowledged that the census concept of total cropland is a better measure of effective agricultural land than is total farmland (Hart 2001, 525).
16. Hoover Index, $H_t = 0.5|\sum_{i=1}^{n}|p_{it} - a_i|100$(Long and Nucci 1997); in this particular case, $p_{i\ t}$ is the regional proportion of European Russia's land area and a_i is the regional proportion of European Russia's cropland. Included in this calculation are all regions of European Russia but the extreme north. $H_t = 0$ would mean perfectly even regional distribution of cropland, while $H_t = 100$ would mean concentration of the entire cropland within one region.
17. About one year after this assessment was first made (Ioffe and Nefedova 2001b), it was unexpectedly corroborated by Russian Minister of Agriculture, Alexei Gordeyev, who mentioned that "in Russia there are currently about 20 million hectares of abandoned arable land" (Sivkova 2003).
18. While the most salient features of agricultural variance (such as output, specialization, and agricultural resources) are visible through a more generalized lens involving oblasts and ethnic republics that we collectively refer to as "regions," these are too vast to capture the actual predictors of productivity. In European Russia, the size of the average region is 75,000 sq. km, and most such regions are monocentric, have noticeable internal contrasts in their capital cities' accessibility, and in soil fertility as well. Any data structured by these regions would therefore blur significant contrasts in what proved to be the major predictors of agricultural productivity in Russia. On the other hand, considering 27,000 collective farms with the average size of 5.4 thousand hectares, or 54 sq. km, including 2.5 thousand hectares of cropland, would involve a multitude of factors of largely random nature, including quality of agricultural managers. Therefore, aggregation of the data to the intermediate–district level seems to suit our needs the best.
19. The unique nature of this databank is in that in Russia, there are practically no centralized sources of district-structured data, published or unpublished. The only exception to this rule, a five-volume data book *Municipal Russia* (Lexin and Shvetsov 2001), is deficient in agricultural data. The collection of our data bank on the basis of regional data books was an exceedingly time-consuming and tedious task undertaken by Tatyana Nefedova.
20. Whereas, the "NCZ" is a verbatim translation from the Russian "Nechernozemnaya Zona," a set toponym denoting what the area in question does not possess (the Chernozem soils), the South is, for us, the most succinct way to label the entirety of the remaining districts.
21. For comparison, the reported 2000 average grain yield in the EU was 5.7 t/ha, 2.8 t/ha in Canada, and 2.5 t/ha in Poland (www.fao.org).
22. For comparison, the 2000 average milk yield per cow was 7,332 kg in Canada, 5,918 kg in the EU, and 4269 kg in Poland (www.fao.org).
23. On average, the order of neighborhood and physical distance from the respective district center to the regional capital is as follows: The centers of second-order neighbors are 65 km away from the regional capital; for the third-order neighbors, the average respective distance is 116 km; for the fourth-order neighbors it is 173 km; for the fifth-order neighbors the distance is 235 km; for the sixth-order neighbors, it is 300 km; and for the seventh-order neighbors, it is 394 km.
24. Population potential (V_i) is a measure of the nearness or accessibility of a given mass of people to a point; $V_i = \sum_{j=1}^{K} P_i/D_{ij}$, where i # j, P_i is population, in this case, of a city I, and D_{ij} is distance between the cities. On an isopleth map of urban population potential, each rural district was characterized by value of V in its centroid (Johnston et al. 1981, 264–65).
25. This seems to reflect a problem endemic to practical applications of well-known approaches to marginal situations in agriculture. "Perhaps the most commonly accepted definition of a marginal agricultural situation is one which is at the margin of economic viability. Agricultural marginalization could be considered to be a process driven by a combination of social, economic, political, and environmental factors, by which certain areas of farmland cease to be viable under an existing land use and socio-economic structure... Marginalization takes a variety of forms and occurs at different scales, ranging from the individual patch to land to sizeable regions. It could eventually lead to abandonment" (Brouwer et al. 2003). Note that starting out from a steady state (a "marginal agricultural situation"), the above definition then turns out to be process centered. A seemingly effortless metamorphosis becomes a problem when it comes to measurement and forecast.
26. For grain yields, districts receiving below 1 t/ha (that is, barely recovering the physical mass of seeds) were assigned 1; districts with yields in excess of 1 t/ha but below the regional average were assigned 2; those between the regional average and the bioclimatic potential benchmark (explained earlier) were assigned 3; those with yields above both the regional average and the bioclimatic "norm" were assigned 4; finally, 5 was assigned when grain yield was over 2.5 t/ha. Milk yields were estimated accordingly: districts receiving more than 4 t per cow (a technological benchmark) were assigned 5; those below 4 t but in excess of 3 t (which arguably ought to be received if a cow simply doesn't stay hungry and mistreated) were assigned 4; districts with less than 3 t per cow but in excess of Russia's average (2,138 kg) were assigned 3; those below average but in excess of 1.5 t were assigned 2; finally districts with milk yields below 1.5 t per cow were assigned 1. The ordinal scale for decrease in cattle was arranged in such a way: 1, if by 2000 only 20 percent of the 1990 number of cattle had remained; 2, if from 20 percent to 40 percent had been retained (40 percent is Russia's average for collective farms); 3, if 40 percent-60 percent; 4, if 60–100 percent; and 5, if more than 100 percent, i.e., increase in cattle head.
27. A couple of relevant observations develop this theme. During our three-week data collection trip in Kasimov district (Riazan oblast) in the summer of 2000, we could not come across a single adult male after 5 p.m. on a weekday who would not be blind drunk. There are seven collective farms in the district, six of which have been producing at a loss for years and, indeed, decades. These farms, however, are vehicles of collective survival. The chair of district administration acknowledged this when he said, "We cannot

disband them because people will go under as there is nothing but farmland around." During the summer of 2000, 140 rural villages of Pskov Oblast remained without electricity for weeks in a row because the locals pulled down wires and sold them as nonferrous scrap. Russia currently earns $500 million a year from its export. So with foreign trade denationalized, myriad illicit buyers are dispatched to different localities to recruit illicit sellers. In most cases, however, what is being dismantled by local "volunteers" is not crucial for everyday life support. In Pskov, one of the most depopulated Russian regions, they have apparently crossed that line. According to Governor Mikhailov of Pskov, between April and July 2000, as many as 800 people in his region perished pulling down wires! This is at least twice as many as those killed in combat in Chechnya during the same time (Ivanov 2000). For something like this to happen, one needs a particular social environment. We tend to think that events like those in Pskov (and they are by no means unique) overshadow much of the ongoing debate over the fate of agrarian reform in Russia, which focuses on the obstacles to reform of a political, legal, managerial, ownership, and fiscal nature. The quality of human capital available for commercial farming, while itself not entirely independent of externally imposed conditions, at any given point in time has the potential to thwart any reform initiative whatsoever.

28. Unlike the ethnic republics of North Caucasus, here, collective farms have not weakened, and the republics managed to retain more cattle than any other region of Russia. This has arguably become possible due to the regional leaders' wresting concessions from the federal government to withhold some lucrative corporate entities (such as oil refineries and automobile factories) in Tatarstan and Bashkortostan from federal taxation. Taxes were instead diverted into the regional funds and could successfully serve local, including rural needs.
29. One such perceived threat is associated with consuming too much imported food (Wegren, Belen'kiy, and Patsiorkovski 2003).

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