GLOBALIZATION, RAILWAYS, AND AGRICULTURE IN FRANCE AND GREAT BRITAIN, 1850 TO 1914

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Abstract

Powered by steamships, railways, and telegraphy, the pace and extent of globalization grew dramatically from the 1850s to the Great Depression. This was especially true in the realm of agriculture, when a huge increase in the production and export of American wheat and beef generated a long agrarian crisis in Europe (1876-1896) as prices fell sharply, forcing farmers, landlords, and governments to adjust to intensifying competition in foodstuffs. Meanwhile, however, railways helped create commercial markets on the industrial scale, sometimes by investing in port facilities, sometimes merely by offering rapid transport to the huge consumer markets of London and Paris. GIS and spatial analysis, will help demonstrate the geography and growth of some commercial markets in Great Britain and France.

O ritmo e a dimensão da globalização cresceram dramaticamente entre 1850 e a Grande Depressão, especialmente no que respeita à agricultura, em que um enorme aumento das exportações de carne e de trigo Americanos criaram uma longa crise agraria na Europa (1876-1896). Or preços caíram e obrigaram os
lavradores e os proprietários a ajustarem-se a uma intensa competição na produção alimentar. Entretanto os caminhos de ferro ajudaram a criar mercados comerciais com escala industrial, por vezes investindo em facilidades portuárias, outras vezes pela oferta de transporte rápido para os enormes mercados de Londres e Paris. Com a ajuda de SIG e de análise especial, demonstra-se a geografia e o crescimento de alguns mercados comerciais no Reino Unido e em França.
Globalization, Railways, and Agriculture in France and Great Britain, 1850 to 1914

Robert M. Schwartz and Thomas Thevenin

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Losses year after year and increasing competition indicate that the crops now grown are not sufficient to support the farmer. When he endeavours, however, to vary his method of culture, and to introduce something new, he is met at the outset by too great difficulties. ... The first [is] the extraordinary tithe ...; the second is really even more important—it is the deficiency of transit.¹

It is not too much to say that three parts of England are quite as much in need of opening up as the backwoods of America. When a new railroad track is pushed over [American] prairie and through primeval woods, settlements spring up beside it. When road trains [in Britain] run through remote hamlets, those remote hamlets will awake to a new life.

Richard Jefferies, “Steam on Country Roads,” 1884

After reflecting on American agriculture and railroads, Richard Jefferies, an agricultural journalist, saw one thing clearly: Britain must catch up. Goods trains in agrarian American, he wrote, stop not merely at stations but virtually anywhere along the line where there was grain and produce to pick up. The British farmer, alas, enjoys no such convenience. To get crops and produce to market is a struggle. First, he must cart them to a railway station—a slow journey of up to 10 miles; then, at the station, he faced a long wait, eventually surrendering “to the middleman to get his goods to market.” British trains went from town to town, but they needed to go to the farms and the crops.

Road trains, he argued, were the solution. These redesigned steam-powered trains would run not along rails but on country roads, stopping at each farm and “loading at the gate of the field” Railways, he granted, would still be essential for long-haul shipments, but the road trains would bring much desired change. With speedy transit at hand, farmers, he continued, will plant perishable fruits and vegetables on unused plots, the rural population will grow, and British farmers will recapture revenue now going to the Continent and America for imports. To break open rural isolation, daily road trains for passengers would connect villages with market towns. Remote hamlets would spring to life.

Casting his eye across the Channel at old rival France was no consolation. France was moving ahead of Britain, too.

We have lately seen the French devote an enormous sum to the laying down of rails in agricultural districts, to the making of canals, and generally to the improvement of internal communication in provinces but thinly populated. The industrious French have recognized that old countries, whose area is limited, can only compete with America, whose area is almost unlimited, by rendering transit easy and cheap. We in England shall ultimately have to apply the same fact.

Jefferies’ lament takes us back to a period of accelerating globalization in food stuffs, to crisis and adjustment in the international division of food produc-

2 Ibid, 231.
3 Ibid, 236.
4 Ibid., 239.
tion, and it sets the scene for something new: a comparative spatial history that bridges the gap between two research areas typically treated in isolation from one another, one on railways and the other on agriculture. What we discover is a better understanding change over space and time between rail transport and agricultural production. Although rural rail service was a boon to farming by opening distant urban markets, it also pinched farmers where it hurt, bringing intensifying international competition in foodstuffs to the farm gate. Still, even as competition grew and the agrarian depression of 1880s and 1890s struck agrarian economies, accessible rail transport often helped farmers adapt to new market conditions of the globalizing world of the late nineteenth century. Jefferies was unable to see this even though he accurately depicted the general crisis of confidence in European farming.

### HISTORICAL GIS AND SPATIAL HISTORY

Farmers of the period knew very well that their fortunes increasingly depended upon railways and their freight charges. Today, few scholars doubt that railways and agriculture were linked and interdependent, and yet historians concern themselves, almost exclusively, with one or the other subject. Rare exceptions to this offer valuable insights, which we can improve upon in several ways. GIS and spatial analysis make it possible to study larger and more complex bodies of evidence at different scales and over time. Here, our geo-referenced evidence comes from large databases on railways, population, and agriculture for Great Britain and France from the 1830s to 1930s. Another improvement is our use of a comparative approach to investigate patterns of change within and between states, the better to identify and explain both similarities and differences in countries that had differing political economies, a difference reflected in agricultural policy by British free trade and French protectionism. In this period of globalizing markets comparative history is all but indispensable for understanding the position of any geographical area and its producers in its relation to the shifting international division of labor—a need underscored by its absence in much of the literature on the agrarian depression of the late nineteenth.

Among historians of British agriculture there is a consensus that the depression in Britain was not a “general crisis” in agricultural output but one that

varied by region and that struck the cereal growing regions of the south and southeast much harder than elsewhere in England and Wales. Debate continues, however, as to whether or not British agriculture “failed” to meet the challenges of intensifying foreign competition. “Pessimists” point to the demise of large, more productive farms, a lack of innovation and entrepreneurial savvy, and the government’s complacent dependence on imports from the bountiful agricultural resources of the U.S. and Britain’s colonies. As more regional research is undertaken, “optimists” argue that resilience, not failure, characterized English farming in difficult circumstances. Whether optimist or not, the role of rural rail transport in response to the agrarian depression is in this literature usually absent or mentioned only in passing.

The same is true in research on French agriculture in the second half of the 19th century. By and large, studies of agricultural performance and the depression in particular concern themselves with the national level alone, and studies of specific regions are only beginning to appear. Meanwhile, debate over French agriculture echoes that over British farming. French “pessimists” marshal evidence old and new to demonstrate that French agriculture lagged behind Britain and most of Western Europe. Optimists respond with new data and argument


that the French system of small-farming was more rational and productive than commonly thought. Within France itself, a long-held generalization holds that in agriculture—as in industry—the country was divided between the developed north and the less developed south. On the issue of regional disparities new opportunities for comparative spatial history abound, thanks in part Jean-Claude Toutain’s work on regional variations in productivity growth from 1810-1990. One major finding was that north-south disparities narrowed after 1860s and that growth rates in the two regions converged at the end of the nineteenth and early twentieth centuries, owing in large part to the increased productivity of the wine and market-gardening sectors in the south. Toutain’s data and argument bring welcome attention to the issue of agricultural restructuring after 1860 and renewes debate. One recent article, for example argues, rather unpersuasively, that regional specialization of the kind that developed in Britain was largely absent in France from 1870 to 1914. In fact, the issue calls out for further research. In our larger work we answer the call, showing that the geographic restructuring of French agriculture was much facilitated by railway expansion. Although we do not pursue the broader patterns here, the analysis below of the Cote d’Or Department in Burgundy illustrates our approach.

With our problem in its historiographical frame, we can now consider tools and methods. How can our questions about spatial relationships and changes over time be systematically addressed? Time was when studying the influence of proximity in social relations was a hard row to hoe, and one had to limit either the size of the study area or the sample of data. Today, GIS and geographically-referenced data reduce these previous constraints and open new possibilities in spatial analysis using visualization, cartography, and spatial statistics. In this


case encoding the geographic coordinates in each unit of analysis makes it possible to calculate many different aspects of distance, proximity, accessibility, and transport cost when joined with GIS data on the development of railways and rail stations from the 1830s to 1930s. Using geo-referenced information on agricultural production and land use attached to British counties, registration districts, and parishes and to the corresponding units of French administration—departments, cantons, and communes—gives us comparable data at these several scales of geographic resolution.

Now we turn to specific questions. Which communities in a given rural area were 10 miles or further from a railway station, the condition Jeffries characterized as lamentable? Over the years which villages continued to fall into the “distant” category as opposed to those that, with rail expansion, came to be “near” a station, having five miles or fewer to get their crops to a shipping point? Further, how was proximity to rail transport related to change in the use of agricultural land, to the shift from arable farming to livestock and dairy farming? The combination of GIS and spatial analysis bring the examination of these complexities within reach.15

BACK TO THE STORY: THE AGRARIAN DEPRESSION AND THE RAILWAY SYSTEMS OF BRITAIN AND FRANCE

The Depression

Many of his contemporaries agreed with Jeffries’s concern with the inadequacies of Britain’s rural rail transport services. British services were woefully outmatched by those in the United States and might be overtaken by those in France as well. This insufficiency seriously undermined the British farmer’s ability to survive the agricultural depression and withstand intensifying international competition in food stuffs from America.16 The signs of difficulties

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emerged in the mid 1870s when a series of cool and rainy summers led to bad harvests and cattle diseases that reached a crisis point in 1879. In the same period the first wave of American grain exports arrived in Britain and other European counties, forcing the price of wheat in particular to lower and lower levels until a mild recovery began in the mid-1890s. From 1873 to 1882, American exports of wheat rose from 40 to 150 million bushels, displacing Russia as the chief exporter of cereal grains while the largest share came to Britain.\textsuperscript{17} Well before then English interest in American agriculture produced an outpouring of articles and reports, a fair number having been written by authors who had observed American farming first hand. The best known of them was James Caird, a Member of Parliament and the main force behind the establishment in 1866 of the annual collection of British agricultural statistics.\textsuperscript{18} Touring America in 1858, he described the Middle West “as the greatest track of fertile land on the globe.”\textsuperscript{19} In 1881 a Royal Commission was set up to study the agricultural depression in England and Wales. Recognizing the importance of American imports as one of the causes, it charged one of its members, John Clay, to gather evidence in the United States and report his findings. His report lauded the workings of American wheat production and American rail, calling it at one point “miraculous.”\textsuperscript{20} Other Europeans from France, Germany, Austria-Hungary, and Russia who came to study the American system agreed.\textsuperscript{21}

In France the Ministry of Agriculture’s interest rose to new heights in 1889, when the agricultural displays at the Universal Exposition in Paris caused astonishment at the prodigious agrarian capacities of the United States and other New World counties. In an 1891 report, the enviable efficiency of the American system was described in some detail. In the wheat trade good yields on enormous acreages, cheap transport, the American system of grain elevators—all worked harmoniously like a gigantic, well-designed machine. The rail system alone was as huge as the country, and its growth was remarkable. With 259,000 kilometers

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\textsuperscript{20} Supplementary report by Mr. John Clay, Jun., on American Agriculture, showing its influence on that of Great Britain, pp. 705-718, Royal Commission on Agriculture. Reports of the Assistant Commissioners. Southern district of England. Report by Mr. Little on Devon, Cornwall, Dorset and Somerset, (with summary of previous reports.), 1882.

\textsuperscript{21} Rothstein, “America and the British Wheat Market,” pp.412-16.
in operation in 1890, “the United States has more than 19 times as much railway line today as it did 30 years ago.” In 1890, the figures for the much smaller countries of France and Great Britain were about 38,000 kilometers and 30,000 kilometers, respectively.

**Railways and Rural Transport**

By 1890, railway expansion in England and Wales had preceded further than Jefferies was willing to admit. At the end of that the 1880s there were few rural registration districts—a market town and surrounding parishes—that lacked a station and some connection, however indirect, with the national system. Indeed, rail service began to reach the countryside in the late 1850s and 1860s, 20 years before Jefferies wrote “Steam on Country Roads.” Using the historical GIS on British railways and population yields a more precise description in graphical and cartographical displays. After calculating the distance (kilometers) from the center of each parish to the nearest railway station at a given date, a mean of the parish scores is calculated for each of 633 registration districts; then the district means for each date are classified by different levels of district population density and presented in a Figure 1A. The figure shows the pattern of increasing accessibility over the decades: except in the least populated districts, proximity to a railway station continued to increase until the turn of the 20th century, especially so for communities of modest population density (25 to 100 persons per square kilometer). Interestingly, Jefferies took this history so much for granted that he ignored it in his writings.

In his assessment of the British system, a major deficiency was the long distance between the farmer’s field and the railway station, citing a journey of up to 10 miles as not uncommon but regrettably inconvenient and outdated. Among the farmers he consulted, there were, no doubt, a goodly number who complained of this inconvenience. Still, had he travelled through French villages during the same period, he would learn that the complaints of British farmers were small potatoes indeed. In fact, a comparative study of British and French rail networks suggests a more positive story of rural railway development in England and Wales than Jefferies would have us believe. (See Figure IB)

In railway development France was a decade or more behind Britain. A country four times larger than England and Wales, France had a good deal more territory over which to lay down rails, to connect major cities and ports, and to reach

22 Ministry of Agriculture, Exposition universelle, Paris, 1889. Rapports du jury international. Groupe VIII. Agriculture, viticulture et pisciculture (Paris: Imprimerie nationale, 1892) : 99. The figure on American railroads in 1890 seems to be the figure for 1885, according to a later compilation by the U.S. publication. See Association of American Railroads, and Bureau of Railway Economics, Comparative Railway Statistics of the United States, the United Kingdom, France and Germany for 1900 and 1909 (Washington, D.C., 1911).

Figure 1 - Average accessibility of rail transport in Britain and France, 1850 to 1939, A. Great Britain; B. France

A. Average accessibility in the registration districts of England and Wales. Distance from District Center to Nearest Station, 1850-1920 by District Population Density

B. Average accessibility of rail transport in the cantons of France, 1860 to 1930. Distance from canton center to nearest station, 1860 to 1930, by cantonal population density.

Sources: Parish boundaries and associated population data from Ian Gregory; rail lines and stations taken from M.H. Cobb, The Railways of Great Britain, a Historical Atlas. 2 vols. (Shepperton: Ian Allan, 2003), as digitized under the direction of Jordi Martí Henneberg, University of Lleida, Spain.

Sources: Population figures from the Bulletin des lois de la République française, 1887: 204-48; rail lines and railway stations digitized from Carte des chemins de fer français, SNCF, 1944, Bibliothèque Nationale de France, Ge BB 368.
country towns and the some 30,000 rural communes in which the bulk of its population still lived and worked. Compared to Wales and the English Pennines, the uplands and mountains of the French south, the Pyrenees, and the Alps presented more formidable topographical and financial challenges. Moreover, the French pace of industrialization was relatively slow, agricultural productivity in two thirds of the country was low by British standards, and the nation’s defeat by Prussia in the war of 1870-71 had been a costly humiliation that siphoned off tax revenues to pay the new German Empire substantial reparations.

In 1878, in the aftermath of defeat and the French state’s desire to catch up with American and Britain, the government of the new Third Republic, much as Jefferies reported and praised, launched a huge project to expand the French rail system into the countryside. Named after its chief proponent, the Minister of Public Works, Charles Freycinet, the program, in addition to the expansion of main lines, included state subsidies to promote the growth of secondary lines designed to serve rural and agrarian communities.24 A decade later, in the 1890s, the projected expansion of “lines of local interest” got underway, and the pace of construction quickened, culminating in the 1920s. Railway accessibility in the relatively vast territory of rural France lagged, accordingly, behind Britain, but the gap continued to narrow after 1870. By 1900 villages in moderately populated cantons (between 25 and 50 persons per square kilometer) were on average within five kilometers of the nearest railway station. (See Figure IB.)

<table>
<thead>
<tr>
<th>Years</th>
<th>1870</th>
<th>1880</th>
<th>1890</th>
<th>1890</th>
<th>1900</th>
<th>1910</th>
<th>1912</th>
<th>1928</th>
<th>1930</th>
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</thead>
<tbody>
<tr>
<td>Main lines (km)</td>
<td>17,707</td>
<td>25,759</td>
<td>34,878</td>
<td>38,261</td>
<td>40,214</td>
<td>40,696</td>
<td>NA</td>
<td>42,400</td>
<td></td>
</tr>
<tr>
<td>Local lines (km)</td>
<td>293</td>
<td>2,187</td>
<td>3,515</td>
<td>7,642</td>
<td>15,347</td>
<td>17,653</td>
<td>20,291</td>
<td>20,202</td>
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</tbody>
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**Proximity to Railway Stations in rural Britain and France: Change over time and space**

Turning to spatial analysis, first of Britain and then of France, we use the GIS data on railways and parishes to map the distance from parish centers to the nearest stations at the end points of three different decades: the 1850s, the 1880s,

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and the 1900s. As shown in Figure 2, British farmers had less reason to complain in the 1880s than before, and by the first decade of the twentieth century, even less so, for by then there were only a few clusters of parishes where the nearest station was more than five kilometers (3.1 miles) away from the parish center—a good deal closer than the 10 mile isolation point mentioned by Jeffries. In other words, the majority of parishes in 1900 or earlier fell within what one farmer thought a maximum distance: beyond three miles from a station, he remarked, is “agricultural death.”

The high degree of accessibility existed also in Derbyshire and the midlands and in the south generally. Not surprisingly, in sparsely populated regions accessibility was more of a problem. In the peripheries of the country—in Denbighshire and Cardiganshire (Wales), the southwestern counties of Dorset, Devon, and Cornwall, and the northern county of Northumberland—there were numerous parishes where convenient access to rail stations was in doubt. And yet, even in Wales and the southwest, such inconvenience as existed in 1850 had been much reduced by the eve of the Great War.

Figure 2 - Proximity of railway stations in the parishes of England and Wales, 1850s to the 1900s.

Source: ibid.

25 The GIS databases we used for this article are described in note 1.
Proximity to a station, of course, was only one aspect of convenient shipping and passenger travel. Poor station facilities, high shipping rates and ticket prices, infrequent trains, delays, inefficient connections from branch to trunk lines—all produced higher costs and more aggravation for the farmer. In this respect, Jefferies was on the money. But in terms of distance, the accessibility of rural rail service had improved substantially since the late 1860s when Jefferies’ career as an agricultural journalist was beginning.

In France improvement of this kind came later and at the different scale of much larger territory. In the 1860s, when “iron roads” were reaching further into the British countryside and opening remote mining and agricultural districts, the sound of a whistling locomotive was almost unknown in rural France. The major arteries of the national system were in place, but the modernizing benefits of rail transport in agricultural regions, so active in the minds of visionaries and government planners, had yet to materialize in most of the country. As shown in Figure 3, the situation had changed for the better by the 1890s. Thirty years later

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Figure 3 - Proximity of railway stations in the communes of France, 1860s to the 1920s.

Railways and Agricultural Change

Source: *ibid.*, habitational centers of communes and departmental boundaries provided by Thomas Thevenin, Department of Geography, University of Burgundy.
in the 1920s the aims of the 1878 Freycinet program of railway expansion came to fruition and the size of the main and secondary networks reached its zenith. There were regions in the southern uplands and mountains still not well served, but in two-thirds of rural France it was no more than a half day’s walk to catch a train—less than that for horse-drawn wagons and, in the 1920s, even less for combustion-engine automobiles and trucks.

Gauging the benefits of rural railways for agriculture is a more complicated task. In Britain and France, farmers were as convinced as was Jefferies that their increasing losses resulted from the intensified international competition in agricultural products. From 1867 to 1892, wheat acreage in the United States expanded three fold, while in the whole of the United Kingdom from 1872 to 1895, it declined by more than half in response to the falling prices, caused mainly by American imports that arrived duty-free in open markets. Comparatively speaking, wheat production remained fairly stable in France and increased in Germany—two countries in which tariffs reduced foreign competition, as shown in Table 2.27

<table>
<thead>
<tr>
<th>Table 2. Wheat acreage in the United Kingdom, France, Germany, and the United States, 1867 to 1895</th>
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<td><strong>Country</strong></td>
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<tr>
<td>Germany</td>
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</tbody>
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Source: France, Ministère de l’Agriculture. Statistique Agricole de la France. Résultats généraux de l’enquête décrnale de 1892. Paris: Imprimerie nationale, 1897; 94-95. Statistics from Major F.G. Craigie, Director of Statistics of the Board of Agriculture (Great Britain), originating from his from Communication faite au Congrès de l’Institute internationale de statistique (Saint Petersburg, 3 September, 1897).

As the profitability of wheat cultivation declined, British and French cereal farmers, in regions of suitable climate and ecological conditions, looked increasingly to cattle raising and dairy farming to minimize losses, transforming crop-

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27 The figures should be taken as estimates of orders of magnitude. Worked up for presentation at the International Institute of Statistics in 1897 by P. G. Craigie, head of the Statistical Service of the British Board of Agriculture, the figures reflect the improvement in estimates made after 1850, which occurred in step with growing global competition, state interest in agricultural policy and what we now call food security, more accurate and comprehensive statistical collections by individual nation states, and greater European collaboration in collecting and sharing statistics via the International Institute and other bodies. Craigie’s estimates were accepted by the French Ministry of Agriculture as sufficiently accurate to publish them in its report on the state of French agriculture in 1897.
land to pasture and reducing their wage bills in the process. Profits from these activities were more likely in the offing because of the rising demand for meat, butter, and fresh milk in cities—a demand enlarged further as workers’ rising real incomes permitted the consumption of higher protein foods.28

**Britain and Dorset County**

Although railways, steamships, and telegraphy powered the globalization of foodstuffs and the increased competition that struck cereal farmers particularly hard, rail transit was nonetheless a crucial factor in the expansion and intensification of livestock and dairy farming. For dairy farmers in outlying counties such as Wiltshire, Dorset, and Derbyshire, rail transport permitted the shipment of fresh milk to London, Leeds, Manchester, and other cities. Similarly, cattle farmers in outlying counties stood to benefit because they could fatten their stock on site and then ship the animals to market by train, avoiding the traditional and less profitable practice sending store cattle on foot to grazers in fattening regions or to owners of feedlots. Four Welsh counties so affected were Anglesey, Denbighshire, Flintshire, and Pembrokeshire.29 Similar patterns held true for France.30

If railways helped British and French farmers adapt themselves to difficult circumstances during the Agrarian Depression of the 1880s and 1890s, then a review of specific evidence should help confirm or refine the proposition. Selecting two cases from our existing data, we take up the County of Dorset in England, and the Department of Cote-d’Or in France.31 In Dorset we use GIS data at the parish level from the returns of the agricultural census in 1871 and 1901 to map the density of cereal production and cattle at these two dates—the first before the agrarian crisis, the second, after its abatement. In both cases, the decline of


31 Although examining Wiltshire would take us to Jefferies’ back yard, the data needed for that county have not yet been added to our database.
wheat production stands out clearly. The intensification of dairy and beef-cattle farming, however, is less pronounced than might be expected when the returns for those two dates are used. Nonetheless, the decline in wheat farming was dramatic. In the parishes of central and upland Dorset, wheat acreage estimated in 1871 had fallen by one half or more in 1901, well in line with the national average. In the same period, the density of beef and dairy cattle remained stable overall and increased in two clusters of parishes noted on Figure 4.

Figure 4 - Changes in Cattle Raising and Wheat Farming, Dorset County, 1871 compared to 1901

Sources: National Archives, Kew, MAF 68, Ministry of Agriculture, Fisheries and Food and predecessors: Statistics Divisions: Parish Summaries of Agricultural Returns, Dorset County, 1871 and 1901; Parish boundaries provided by Ian Gregory, University of Lancaster.

In Dorset, we can dig deeper into the decline of wheat growing. There at the parish level, results from a geographically weighted regression model yield estimates of the degree to which change in wheat acreage, the independent variable, are explained by the interacting effects of the mean elevation of parish terrain and the distance from its center (centroid) to the closest railway station.32 The

32 GWR is arguably the tool of choice here and in other situations when the relationships under investigation are likely to vary across a study area, as was true of wheat growing in Dorset.
results show that 65 percent of the variation in wheat acreage over the decade 1881 to 1891 can be accounted for by rail accessibility and mean elevation.

The effect of proximate rail service was varied and complex, for it carried a negative or positive influence on changes in wheat acreage, depending upon location and the average elevation of the location. Taking station proximity alone, the main tendency was for wheat acreage to decline slightly as the distance of the nearest stations increased. But when joined with the effect of terrain elevation, that main tendency was inflected. As shown in Figure 5, the influence of station distance was negative in the areas shown in gray and positive in those shown black. From 1881 to 1891, in upland areas, where wheat production had been extensive, wheat acreage tended to increase or remain stable in parishes

Figure 5 - Spatially varying relationship between rail-station proximity and change in wheat acreage, 1881-1891, with terrain elevation below.
farther from stations; in the lowlands, in contrast, parishes closer to a station showed an increase in acreage compared to lowland parishes farther away. The evident complexity well reminds us that we are dealing with a complicated history of short and long term decisions by farmers of the period in the face of shifting markets, weather, and leasing conditions. This complexity calls for further study and the incorporation of other factors, such as travel distance or travel time along roads—as opposed the straight-line Cartesian distance—numbers of cattle and other competing agricultural activities and crops, the varied farming ecologies of the county, the freight-handling capacity of stations, and so forth.  

What about changes in livestock? Somewhat surprisingly, our analyses—using ordinary least-squares regression, GWR, and other spatial statistics—found no significant effect of rail accessibility on changes in the size of cattle heard over three decades from 1871 to 1891. This suggests—in keeping with the patterns displayed for cows in Figure 4—that the expansion of cattle raising in Dorset intensified rather than spreading widely over the county. Further, this intensification was determined by factors other than rail proximity in the 1870s and 1880s. If the parish returns for those years had distinguished dairy cows from beef cattle, we would likely find an effect of rail accessibility and dairy farming because the fresh milk trade depended upon railways to get their product to major urban markets.

**France: The Department of the Cote d’Or**

In France, the Cote-d’Or Department presents story with similarities and differences. There, as in France generally, the tariffs on wheat introduced in 1883 shielded cereal farming from international competition, giving cereal farmers a reprieve not enjoyed by their British counterparts. To examine this, we map the pertinent attributes: percentage change in wheat cultivation by canton (comparable to the British registration district) and the distance from the centers of communes (comparable to British parishes). In Figure 6 the gray lines connected to station nodes represent the closest distance from any given commune to a station. As for wheat acreage and cattle density, a strict comparison with Britain at the parish/commune level is not feasible because the data needed for the communes of Cote d’Or are incomplete. Our data pertain to the next higher French administrative of the canton (comparable to a British registration district).

Across the cantons of the Cote-d’Or, examining the percentage change in cereal production between 1881 and 1905 shows what one would expect. Protected by tariff, wheat production remained fairly stable from the 1880s to the mid-1890s, i.e., even during the great fall in wheat prices internationally. By 1905, however, the shift from wheat to cattle raising and to other uses of agricultural land was marked in all 33 cantons of the Department except those of Dijon and

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33 For our French GIS, Thomas Thevenin has recently created estimates of real travel costs from each commune in France to its nearest station, but they were not available at the time of writing.
Figure 6 - Percent change in wheat cultivation (in hectares) by canton in the Department of Côte-d’Or, 1892-1905, and proximity of communes to the nearest railway station, 1900-1909.

Sources: Archives Départementales de la Côte-d’Or, 6M 12. Ila31, Ila37, Ila50, Statistiques agricoles des communes et cantons, 1881, 1892, 1905; Carte des chemins de fer français, SNCF, 1944.

Beaune where the two largest cities of the department where located. Centered on the cities of Dijon and Beaune, the two cantons saw wheat production rise in that decade. (See Figure 6.) However, beyond the Dijon region and the major vine growing districts running from Dijon to Beaune, an increase in pasture and cattle numbers attests to the expansion and intensification of livestock farming. (See Figure 7)

When this information is combined with data on railway accessibility, the results suggest that rail service proximity was one factor that influenced changes in wheat production, not in the 1880s, as was true in Dorset, but in the 1890s.
By 1905, the building of branch lines and the opening of new stations in underserved areas, much as the Freycinet program had projected, was well underway. Consequently, more farmers in the Cote d’Or and elsewhere had rail service closer to hand. To describe the effect of improved accessibility, scatter plots depict the relationships between proximity to a station and the change in cereal production and cattle raising.\(^{34}\)

The decline of wheat cultivation and the proximity of rail transport were inversely related: from 1892 to 1905, the percentage decline in wheat (hectares) was greater as the distance to the nearest rail station increased.\(^{35}\) (See Figure

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\(^{34}\) The limited number of units (33) that comprise the Cote-d’Or cantonal database makes the application of GWR analysis unfeasible at this point in our research.

\(^{35}\) The average is the mean distance from each commune in a canton to the nearest station. This is a better measure than the distance from the center or seat of a canton alone because the accessibility of outlying communes would be ignored. It was a state priority to open a station in each cantonal seat (*chef-lieu*).
8.) As in parts of lowland Dorset, farmers closer to a station tended to reduce wheat production to a lesser extent than those who were farther away. Farmers at greater distance from rail transport more likely put their land and labor to uses more profitable than growing more wheat than needed for their own consumption. Even when wheat prices were protected, they were low by earlier standards. The additional cost of transporting wheat from remote farms was doubtless a disincentive. On the other hand, farmers close to the cities of Dijon and Beaune enjoyed a competitive advantage both in their proximity to rail service and to the largest regional markets for grain and flour. To meet the local demand for grain and flour, wheat farming in the plains around the two cities expanded.

In cattle raising, percentage changes from 1892 to 1905 ranged from positive increases to steep declines, and the relationship with mean distance from a commune to a station was inverse. (See Figure 9.) By and large, the greater accessibility (smaller distance), the greater the increase in livestock numbers; conversely, the lesser accessibility (greater distance), the smaller the smaller the density of cattle in 1905 as compared to 1891. This pattern was more pronounced in upland areas than in the plains. In contrast to the plains of Dijon and eastern Beaune where wheat farming was expanding, in the upland cantons of Chatillon-sur-Seine, Arnay-le-Duc, and Aignay-le-Duc cattle farming was
expanding significantly. In 1905 compared to 1892, upland farmers who were relatively close to a station (3 to 4 kilometers away) were typically raising more stock than those farther away. In so doing, they followed a national trend and depended upon rail transport to adjust the shifting conditions of markets for milk, beef cattle, and meat. In sum, in the Cote-d’Or at the turn of the century, the proximity to rail transport facilitated, to a varied degree, the shift from wheat cultivation to livestock farming.

The same advantage held more or less true in the French department of the lieu and in the English county of Derbyshire. In Dorset, the role of railways in farmers’ adjustments to difficult market conditions was significant, if complex, in wheat production. Whether these patterns held true in other French and British regions and in the two countries generally are matters next on our agenda.

CONCLUSION: A REFLECTION ON SPATIAL HISTORY

This article tries to illustrate how historical GIS, geographic thinking, and spatial statistics, in the good company of traditional forms of historical narrative and

analysis, are key ingredients in the making of spatial history. The story presented here of globalizing agricultural markets, intensifying international competition, the expansion of rail transportation, and agricultural change offers a sketch of a far-reaching historical transformation. Some important features, to be sure, are there thanks to GIS and spatial analysis. In spatial history, however, HGIS (historical GIS) works best as a junior partner. Given the data, it can help identify problems and facilitate their examination. But, like other tools in the historian’s kit, it cannot frame problems worth investigation. Nor does it generate interpretations and meanings. Its complexities carry a risk. Because the preparation of geo-referenced data and the learning of the technology can take a great deal of time, practitioners of HGIS often get caught up in the methods and give too little attention in their papers and publications to substantive results. We practitioners should do a better job interpreting and communicating our discoveries to make clearer why historical GIS is worth the effort.

A related imperative is to recognize both the limits of historical GIS and the importance of complementary sources and approaches. If GIS technology were to drive the investigation, one might easily overlook records documenting the lived experience of nineteenth-century farmers, their wives, sons, and daughters, the observations and opinions of journalists like Jefferies, or the testimony of farmers before the British and French investigations into agricultural and agrarian crisis. That would be a loss. On the positive side, the analysis of census records and agricultural statistics in a GIS can provide the broader patterns needed for situating case studies and rich qualitative evidence in their proper historical context.

Spatial history ought to be more than examining questions about geographic distributions over time, as when we use shaded thematic maps to show percentage change in wheat cultivation in Dorset and the Cote-d’Or. Identifying such spatio-temporal patterns is a good first step. To go further, spatial history should concern the study of spatial relationships and of spatial interconnectivity over time, i.e., the degree to which a change in one part of an inter-related system alters other parts in turn. For example, when, where, and to what extent did railway expansion affect agricultural production and land use? How did the arrival of rail transport in remote agrarian regions affect production and land use in those districts? In districts closer to major markets, districts that heretofore enjoyed the advantage of proximity to large and growing numbers of urban consumers? Or, as so concerned Jefferies, how did the expansion of rail transport in America affect farmers in Britain?

The geographer’s concept of “scale” and historian Marc Bloch’s conception of comparative history should also be components of spatial history.37

ing multiple scales of geographic resolution and their interrelationships brings out the interconnectivity of change—or persistence—at different levels of human activity and natural forces. In the case described here, interconnectivity was significant at the global, national, and local levels of activity. American farmers harvesting wheat in Nebraska and the Dakotas were ultimately influential in decisions about agricultural land use in Dorset County and in the Department of Cote-d’Or, just as bad weather and poor harvests in the American Great Plains could result in higher wheat prices in Liverpool. In the 1890s, as American wheat farmers themselves came to suffer from falling prices, they came to believe that the Liverpool market set the low prices that threatened their livelihoods.

Another task in spatial history is to tease out links between temporal and spatial change. Although only briefly treated here, the expansion of rail transport and its effects on agriculture is a revealing example of change moving across territory and time. Another imperative, to repeat, is to open the conversation about spatial history to a wider audience than specialists in historical GIS. The opening offered here, imperfect as it is, starts by framing the problem through the eyes of a contemporary observer and then continues by incorporating GIS-related findings into an accessible narrative about historical change. Narrative, after all, remains the lingua franca of most of historians and readers of history.

Finally, there is the urgent task of interesting historians in spatial relationships and renewing their regard for geographical thinking. This does not require GIS, and to presume that it does may be more hindrance than aid. A salutary reminder in this regard is to recall the insistent belief shared by some geographers and historians in the 1960s and 1970s that quantitative methods were the keys to the kingdom.

As concerns the promise of interconnected spatial history, Richard Jefferies, in some sense, showed us a way forward. A keen observer of agricultural change in Britain and abroad, he recognized both the international connection between American and British farmers, and the regional and local significance of rapid and convenient transportation in the age of growing globalization. True, as an advocate for British farming interests he was apt to stretch the truth in his characterizations of American and French rivals and of the inadequacies of rural rail

38 Melanie Finn, “Effects of Local Weather on a Global Market,” unpublished seminar paper, (Mount Holyoke College, South Hadley, Massachusetts, December 2009): 12-14, demonstrates the likelihood that drought and poor wheat harvests in Nebraska in the early 1870s led to wheat price increases in Liverpool, England.


40 Geographic information scientists are currently exploring ways to formally incorporate time in GIS. On this see May Yuan, “Adding time into Geographic Information System,” in The Handbook of Geographic Information Science, ed. A. Stewart; Wilson Fotheringham, John P., Blackwell Companions to Geography (Maiden, MA: Blackwell 2008), 169-84.
service in Britain—all the better to rally ingenuity and resolve to restore British agriculture to its proper place in the world. Although he overstated the travail of moving crops from farm gate to station platform, he anticipated the day when gasoline powered trucks and automobiles would ply the roads of rural Britain. An ardent observer of Britain’s agrarian world in international perspective, he was a visionary, too.
REFERENCES


