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FARM CONSOLIDATION IN THE NORTHERN AND CENTRAL STATES OF THE GREAT PLAINS

BRADLEY H. BALTENSPERGER

During the past half century, American agriculture has been revolutionized and rural America has been dramatically transformed. The industrial revolution had arrived in American agriculture in the 1840s when machines and animal power began replacing some hand tools wielded by humans. But not until the 1930s, when petroleum-driven machines rapidly displaced both animal and human power, did this revolution intensify sufficiently to have significant impacts on rural life and farm numbers. Since that time, reliance on farm-produced inputs—fertilizer, seed, energy—has given way to dependence on purchased factors of production. The commercial aspects of farming have nearly obliterated the subsistence components. Diversified farmers have been superseded by specialists.¹ This new phase of the agricultural revolution was accompanied by a host of economic and social

changes. Most notably, the percentage of the population directly involved in agriculture dwindled rapidly. In 1935 there were nearly 7 million farms in the United States. By 1974 only 2.3 million remained. Millions of rural Americans abandoned not only farms but also rural communities. Most of the land in abandoned farms was consolidated into surviving units, so the amount of land in farms remained nearly constant. Between 1935 and 1974, average farm size in the United States increased 183 percent, from 155 acres to 440 acres.² This article analyzes the factors that determined both the timing and the extent of farm consolidation in northern and central plains states.

FARM EXPANSION

One of the most important causes of farm expansion was mechanization. The combination of demand for labor in non-agricultural sectors of the economy and the growing availability of labor-saving farm technologies prompted farmers to purchase tractors and other machines.

Growth in non-farm employment, particularly in manufacturing, led to rapid increases

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in the cost of labor by the late 1930s. As wages rose, many rural residents chose to relocate and take manufacturing jobs. This reduced the number of bidders for agricultural land and held its price down. At the same time, the cost of labor increased more rapidly than the cost of capital inputs for farming.³ Low farm income meant that farmers could not use the labor savings generated by mechanization to reduce their own labor and increase their leisure time. The agricultural sector of the economy excelled at overproduction, so when output rose, prices declined and pressed on the costs of production. Prior to World War II, many production costs were internal to the farm and, therefore, could not be cut. Farmers were unable to have significant impacts on prices through political mechanisms. As the cost-price squeeze intensified, individual farmers found that adequate incomes could only be attained by spreading the fixed costs of machinery over more units of output, either by expanding the size of the farm or by increasing production per unit.⁴

Farm expansion was made possible by technological developments that permitted farmers to substitute capital for labor. Expansion became essential because larger farms offered a number of economies of scale. Larger farms were more efficient at converting inputs to output, at least up to a point. They also benefited from volume buying and selling, economies of functional specialization, and reduction of fixed costs relative to total output.⁵

Larger farms are better able to take advantage of government programs and policies, including tax laws, agricultural programs, and research and extension activities. Tax benefits accrue disproportionately to large farms through investment credit, differential taxation of capital gains, and cash-basis accounting. Cropland diversion programs, price supports, and commodity payments are all expansionary in their impact, though in varying degrees. Cropland diversion is particularly expansionary since operators of farms that are optimally organized prior to diversion may be

led to purchase or rent additional land to compensate for the diverted land and maintain efficiency. Many research activities of land-grant universities and agricultural experiment stations are directed toward new capital-intensive technologies that larger farms can afford.⁶

Larger farms have historically had greater access to capital and credit. Public sources of credit, such as the Farm Credit Administration, have generally been most available to those farmers with the greatest equity. Also, large farms often benefit from lower interest rates and a greater diversity of capital sources.⁷ Finally, larger farms are more sensitive to uncertainty and risk. Risk is reduced by land-saving technologies, such as fertilizer and pesticides, which make yields more predictable; by labor-saving technologies and larger equipment, which reduce the uncertainty of labor availability and provide greater freedom from the vagaries of weather; and by government programs, which reduce price fluctuations. Consequently, farmers have less need for diversification to reduce risk. For many types of enterprises, the resultant specialization is associated with increased size.⁸ The technological revolution in agriculture, the cost-price squeeze, and farm policies improved the economic environment for larger farms and made expansion the most promising means of providing adequate income for farmers.⁹

Farm expansion has often been viewed as a regionally uniform process, but expansionary forces were not of equal consequence everywhere. Water for irrigation was not ubiquitous; some crops were more responsive than others to massive doses of fertilizer; specialization occurred earlier in some areas, whereas diversified farming persisted in others; and large-scale mechanization was more compatible with some environments and crops than others. Substitution of capital for labor was more readily accomplished in crop production than in livestock operations. Availability of local non-farm employment, and hence the possibility of part-time off-farm work for farmers, also varied spatially.¹⁰ Spatial and environmental characteristics affected the im-

pact of the economic forces leading to farm expansion and consolidation.

The economic fortunes of farmers on the Great Plains fluctuated violently because of climatic variability.¹¹ As a result, the spatial-temporal pattern of farm enlargement was more varied and complex, and more closely related to ecological conditions, than elsewhere in the country. In particular, patterns of farm consolidation related to patterns of technology, climate, drought, land use, and farm type.

ENVIRONMENT AND TECHNOLOGY

In twentieth-century commercial agriculture, the narrowing gap between production expenses and commodity prices led farmers to seek increased income by expanding production. Prior to 1940, the only way to increase output without farm enlargement was to use available land more intensively. Pasture could be converted to crop production, or a crop with low output per acre could be replaced by one with greater output. Intensification occurred as horses were replaced by tractors, and land was freed from fuel production (oats, hay, pasture) and used for cash crops or feed crops. The alternative means of increasing production was to enlarge the farm by purchasing or renting additional land. To the extent that intensification could increase production, the likelihood of farm expansion and consolidation decreased.

Intensification of land use depended heavily on location and climatic conditions. In the more humid eastern counties of the Plains, the proportion of farm land used for crop production was relatively high. Farther west, where both precipitation and land value were lower, the proportion of cropland decreased. In wetter than normal years, western farmers could convert some marginal land to crop production. Farmers on the humid eastern edge of the Plains, with a smaller reserve, were less able to increase crop acreage through land use intensification. The relationship between crop yield and precipitation is curvilinear; with

increasing precipitation, yields increase at a decreasing rate.¹² Therefore, wet periods produced greater yield increases in the arid west than in the humid east, and eastern farmers had fewer alternatives to expansion than did western farmers.

As the components of modern industrial agriculture were gradually introduced to the Great Plains, a new alternative, "technological intensification," became available for farmers seeking additional production. Many land-saving technologies were available during the 1920s and 1930s, but not until after World War II were they widely and enthusiastically adopted. Hybrid corn did not fully diffuse to the plains states until the mid-1940s. In 1945, only six percent of all plains farmers used commercial fertilizer. By 1954, about a third did so. Irrigated acreage in the plains states nearly tripled between 1940 and 1978, mostly through the tapping of groundwater supplies.¹³ Although they were accompanied by increased costs, such technologies offered increased production with no need to convert pasture to cropland or to purchase or rent additional land.¹⁴ Those farmers best able to take advantage of intensifying technologies were the least likely to expand. Farmers in counties where corn was the principal crop had the least need to expand, as corn yields were especially affected by land-saving technologies. Western plains farmers, more dependent on cattle grazing, were less able to increase production per acre and were forced to turn to the expansion alternative.

Crop producers, however, were also better able to mechanize. Land acquisition and increased specialization allowed them to utilize machinery more efficiently in relationship to its fixed costs and to increase output.¹⁵ Expansion for range livestock producers was more likely to entail increased variable costs in the form of labor. Furthermore, most land-saving technologies decreased risk, which improved opportunities for large farms in crop-producing areas and increased total farm output, holding market prices down.

In drought years, yields on the western

Plains fell dramatically and some marginal cropland dropped out of production, necessitating expansion of western operations. In eastern counties, yields were less severely affected by drought, and little cropland was converted to pasture or other less-intensive uses. Eastern farmers were able to hold farm size stable by balancing decreased production against enhanced yields gained by technological intensification.

Several qualifications apply to these generalizations regarding anticipated patterns of expansion on the Great Plains. First, fluctuations in crop prices and production costs affected the strength of expansionary pressures.¹⁶ Compared to production costs, the prices farmers received were quite low during the 1930s, but they rose rapidly in the early 1940s and remained high until the end of the Korean War. Corn prices fell steadily during the remainder of the 1950s and leveled off through the 1960s, while production costs rose. Wheat prices, however, remained fairly high throughout the 1950s and then declined

precipitously in the early 1960s. Cattle prices oscillated more, with a low period in the mid-1950s, but then rose until, by 1970, they were as high as they had been 20 years earlier.¹⁷

Second, farmers able to take advantage of irrigation technologies had a means of dramatically increasing productivity that was somewhat independent of climatic conditions. In areas with large supplies of groundwater or served by surface irrigation projects, the rate of farm consolidation might have been considerably reduced, at least for a time, and the decrease in farm numbers would not be expected to be nearly so abrupt as elsewhere on the Great Plains.

Finally, a time lag exists between the advent or strengthening of expansionary pressures and actual farm enlargement.¹⁸ When conditions favoring expansion applied for only a short time—for example, a one year drought—few farmers would require additional land. However, a series of four or five drought years often stimulated major adjustments, though they were not immediately evident.

TABLE 1.
AVERAGE FARM SIZE IN ACRES.

Years	States							
	Kans.	Nebr.	S. Dak.	N. Dak.	Colo.	Wyom.	Mont.	Great Plains
1930	283	345	439	496	482	1469	940	454
1935	275	349	445	462	471	1610	939	454
1940	308	391	545	513	613	1866	1111	524
1945	344	427	626	590	761	2532	1557	630
1950	370	443	674	630	833	2729	1689	676
1954	416	471	719	676	942	3069	1859	741
1959	481	528	805	755	1162	3715	2213	856
1964	544	596	917	875	1284	4100	2437	972
1969	574	634	997	930	1313	4014	2522	1022
1974	605	683	1074	992	1408	4274	2665	1089
1978	640	723	1147	1033	1310	4182	2618	1126
1982	642	746	1179	1104	1237	3781	2568	1138
percent change, 1935-74								
	120	96	141	115	199	165	179	140

CONSOLIDATION PATTERNS ON THE GREAT PLAINS

The seven states of the northern and central Great Plains (Kansas, Nebraska, North and South Dakota, Colorado, Wyoming and Montana) contained more than 600,000 farms averaging 416 acres in 1935. After 40 years of technological revolution in agriculture, fewer than 300,000 farms remained, and average farm size had increased 160 percent to 1089 acres.¹⁹ Since 1974, average farm size on the Plains, as in the nation as a whole, has decreased slightly (Table 1). At the beginning of the great depression, average farm size by county on the Great Plains ranged from fewer than 120 acres in parts of eastern Kansas to more than 2,000 acres in the Nebraska Sandhills and in Wyoming. The consolidation process was far from uniform, either temporally or spatially.

In spite of severe economic dislocation and drought during the early 1930s, farm size on the Plains was stable. Lack of employment in urban areas precluded massive outmigration from the region's farms. Mechanization was not widespread because the cost of capital was higher than the cost of labor or the cost of horses.²⁰ However, areas where ranching predominates today showed high rates of farm consolidation (fig. 1). Average farm size increased by 10 percent in Wyoming and by more than 30 percent in some counties of the state. Similar changes occurred in central Montana and much of western South Dakota. In the more humid parts of the Plains, however, farm size was stable or actually decreased. Most counties in southeastern Colorado, northeastern South Dakota, and all of North Dakota reported more farms in 1935 than in 1930. Some of these counties experienced greater than 15 percent decreases in average farm size.

In the subsequent decade, 1935 to 1945, the effects of continuing drought and depression, with a time lag, combined to reduce farm numbers throughout the Plains. Average farm size increased 15 percent in the last half of the

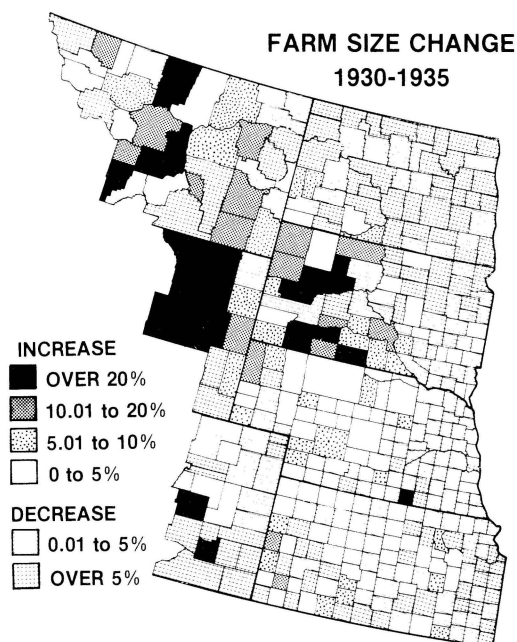


FIG. 1. Northern and central Great Plains.

1930s and grew another 20 percent by 1945. Yet, the greatest declines in farm numbers continued to occur in the western states and in the ranching areas of the four eastern states. For example, between 1940 and 1945, average farm size increased by 40 percent in Montana, 35 percent in Wyoming, and 24 percent in Colorado. In some counties in Colorado and South Dakota farm size doubled between 1935 and 1940. In Garfield County, Montana, average farm size nearly tripled between 1940 and 1945.

In the early 1940s, the cost of labor-saving technology relative to labor costs dropped abruptly and tractors were rapidly adopted across the Plains. In 1940, there were only six tractors for every ten Plains farms, but five years later there were nine. The stage was set for future farm expansion.²¹ Large increases in farm size diffused eastward to about the 100th meridian (fig. 2). West of that line, most counties had farm expansion rates above 15 percent in each five-year period. East of the line, increases were generally lower. Northeastern Nebraska and the eastern third of the

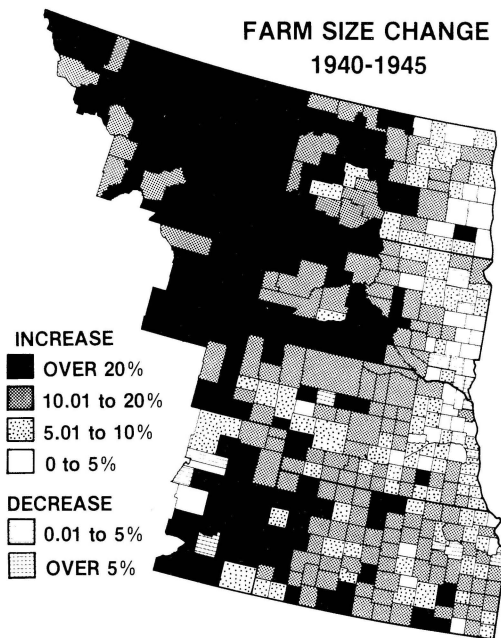


FIG. 2. Northern and central Great Plains.

Dakotas contained a number of counties with less than 1 percent increases in farm size per year.

The decade from 1945 to 1954 was a period of above average precipitation in nearly all areas of the Great Plains. Farm prices were also substantially higher than in the 1930s or the late 1950s. In spite of almost complete mechanization, the rate of consolidation dropped from 4 percent to 2 percent per year. Farm expansion persisted in the three western plains states, but the extreme changes of earlier periods were absent and virtually no correlation with average farm size existed. Moderate growth rates of 5 to 10 percent in five years were common throughout Kansas and the western Dakotas. Less than 5 percent growth characterized the eastern Dakotas and most of Nebraska during the late 1940s, but by the early 1950s only northeastern Nebraska and southeastern South Dakota retained these very low expansion rates (fig. 3). The least expansion overall was in Nebraska, where average farm size rose about 1 percent per year. This was a period of rapid irrigation devel-

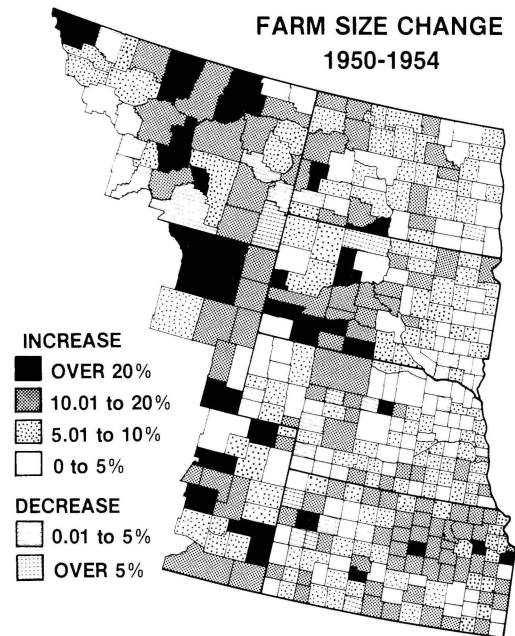


FIG. 3. Northern and central Great Plains.

opment, particularly in central Nebraska and western Kansas. Irrigated counties did not, however, stand out as areas of slower than average farm expansion. The only sizable decreases in average farm size were in upland counties in the suitcase farming region of western Kansas and eastern Colorado.²²

Farm consolidation rates rose substantially between 1954 and 1964. Average farm size on the Plains grew from 741 acres to 972 acres, an increase of 32 percent (nearly 3 percent per year). From 1954 to 1959 growth was somewhat more rapid in the three western states, but farm size in Kansas also grew by more than 15 percent. From 1959 to 1964, the most rapid increase was in North Dakota, followed by the other three subhumid states. Average farm size in Colorado, Wyoming, and Montana grew only 2 percent per year, slower than any period except the late 1940s.

The extremely rapid expansion in scattered counties in earlier years was rare between 1954 and 1964, but in most counties farm size grew more than 5 percent in five years. By the end of the period, the slowest consolidation rates

were in Wyoming and southern Montana, foreshadowing trends that diffused to most of the Plains after 1964. Interestingly, high prices for wheat relative to corn were apparently not translated into lower expansion rates in the wheat belts of Kansas, North Dakota, or Montana.

After 1964, rates of farm consolidation dropped off. Average farm size grew only about 1 percent per year between 1964 and 1978, then dropped to .25 percent per year. In no state did farms grow more than 2 percent per year, and in some years average size decreased slightly. Regional contrasts consistent with the general pattern of eastern and western expansion were again evident, though they began to dissipate toward the end of the period.

With the exception of two or three years in the mid-1950s, most of the Plains had experienced normal or better than normal rainfall for 20 years. This resulted in greater farm expansion in subhumid areas than in semiarid regions. Between 1964 and 1969, farm size decreased in Wyoming, southeastern Colorado, and parts of Montana and western Kansas. Annual expansion of 2 to 3 percent prevailed in eastern and central Nebraska, northeastern Kansas, and eastern North and South Dakota (fig. 4). A belt of low expansion rates (-1 percent to +1 percent annually) ran from east central Kansas through northeastern Colorado and the Nebraska panhandle into western North Dakota and northern Montana. Higher rates in crop producing regions were probably attributable in part to federal cropland diversion programs, which were clearly expansionary in their impacts.²³

In the early 1970s, the pattern was similar to that of the late 1960s, with moderate expansion rates covering the same areas, plus the eastern two-thirds of Kansas and western North Dakota. The belt of stable farm size now was limited to western Kansas, northeastern Colorado, the Nebraska panhandle and western South Dakota. During the late 1970s, lower rates of consolidation were the norm. Decreasing farm size was again evident in

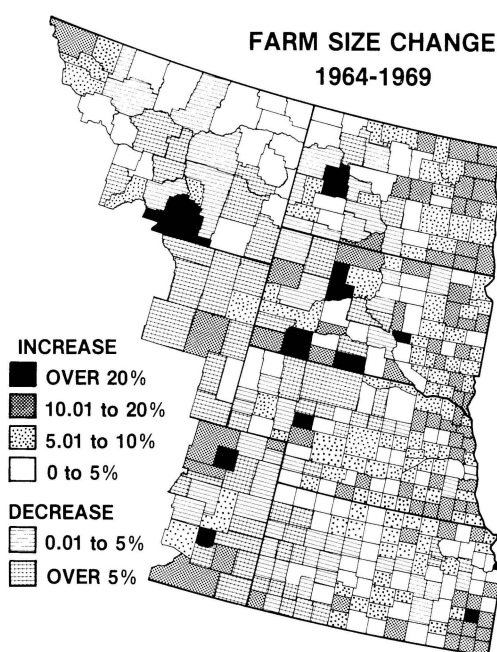


FIG. 4. Northern and central Great Plains.

much of Colorado and Wyoming, but farms in Nebraska, much of northern and eastern Kansas, and the eastern Dakotas continued to grow at moderate rates.

Between 1964 and 1978 the pattern of farm expansion was almost completely opposite the pattern that prevailed from 1930 to 1945. Greatest farm expansion took place on the humid eastern margins of the Plains, where growth had been slowest during the 1930s. Counties in ranching areas of the three western states, which had experienced rapid declines in farm numbers prior to 1945, now exhibited farm sizes that either increased very slowly or decreased. The positive correlation between farm size and expansion rates was replaced by negative coefficients. This pattern was still evident between 1978 and 1982, although the overall rate of expansion was only 1.1 percent. Farm size declined in most counties in the three western states. Wyoming farms decreased in size almost 10 percent. The four eastern states had varying degrees of consolidation, led by North Dakota, where average farm size grew by 70 acres (fig. 5).

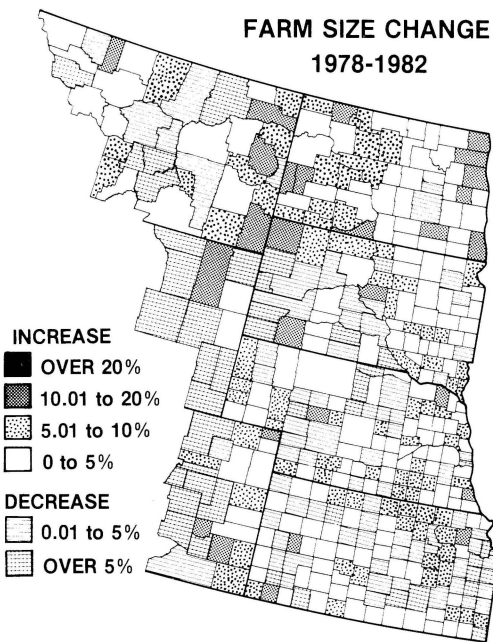


FIG. 5. Northern and central Great Plains.

Growth rates above 5 percent for the period were still found scattered about the Dakotas, in southeastern and northeastern Nebraska, and in north central Kansas.

Low growth rates since 1974 in nearly all counties on the Plains are attributable in part to rising prices for land and machinery, which made expansion more costly and encouraged the adoption of land-saving technologies.²⁴ The movement of industries into rural areas provided employment opportunities for many farmers who used wage labor to supplement low farm income from small operations. Part-time farming has become especially common in areas within commuting range of metropolitan areas. In Nebraska, rapid irrigation development seems to be associated with declining average farm size, although this does not apply to all irrigated counties, nor is there evidence that the effect is more than temporary.²⁵

CONCLUSION

Patterns of farm consolidation are not simple to explain. There was little relationship

between rates of expansion during any five year period and the subsequent period. With a fair degree of certainty, one could predict growth in the forty-nine-year period by knowing the growth rate for the first twenty years. However, the 1935-1954 rate was a very poor predictor of 1954-1982 change. Farm size provided a better estimate of expansion rates. Between 1935 and 1954, counties with the largest farms experienced the greatest consolidation (Table 2). High expansion rates after 1959 were associated with counties that had smaller farms (fig. 6).

Before 1954, farms grew most rapidly in Colorado, Wyoming, and Montana, and expansion occurred primarily in ranching areas and counties containing the largest farms. Kansas, eastern and central Nebraska, and the eastern Dakotas had much slower rates of farm consolidation. Drought in the 1930s and delayed reactions to it best explain this pattern. Low precipitation greatly reduced yields in semiarid regions and farmers were unable to intensify land use. Farm expansion was the only sure way to increase income. Crop yields in the more humid counties on the eastern margin of the Plains were not cut as much and farmers, through land-saving technologies and elimination of horses, were able to convert land to more intensive uses.

During the climatically favorable years

TABLE 2.
CORRELATION OF FARM SIZE AND
FARM EXPANSION RATES.

Period	Rate, First Year	Rate, Last Year
1930-1935	.23	.40
1935-1940	.30	.46
1940-1945	.47	.60
1945-1950	.10	.23
1950-1954	.14	.25
1954-1959	.00	.13
1959-1964	-.09	.02
1964-1969	-.34	-.21
1969-1974	-.07	.00
1974-1978	-.36	-.26
1978-1982	-.12	.00

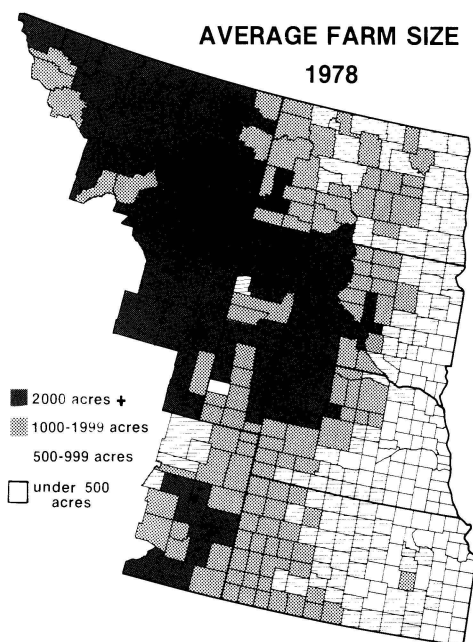


FIG. 6. Northern and central Great Plains.

after World War II, western plains farmers, who had already consolidated to a great extent, experienced increased yields. In some cases they were able to bring land back into crops. Yields did not increase as greatly for eastern plains farmers, and much of their reserve of less intensively used land had already been converted to crops. Higher investment per farm in labor-saving technologies encouraged operators to expand in order to reduce their fixed costs per acre yet increase output and income.

By the late 1970s, the effects of the technological revolution appeared complete. Most farms were highly capitalized and mechanized, reliant on external production inputs, and increasingly specialized. Economies of scale had been realized throughout the Plains and further expansion offered only minimal improvements in efficiency. Counties that continued to experience farm expansion appear to have been those where specialization occurred most recently. However, at present an increasing number of very small farm units are operated by persons whose principal occu-

pation is not farming, suggesting that the size of "real" farms is continuing to increase in many areas and may do so in the future.

Much remains to be explained about the patterns of farm consolidation on the Great Plains. The roles of farm type, crop and livestock mix, specialization, and patterns of adoption of land-saving and labor-saving technologies need to be examined more explicitly. The connection of climatic patterns to the role of technology in farm expansion offers a promising framework upon which to structure future research.

NOTES

1. John L. Shover, *First Majority-Last Minority: The Transforming of Rural Life in America* (DeKalb, Northern Illinois University Press, 1976); E. Higbee, *Farms and Farmers in an Urban Age* (New York: Twentieth Century Fund, 1963); A. Gordon Ball and Earl O. Heady, "Trends in Farm and Enterprise Size and Scale," A. Gordon Ball and Earl O. Heady, eds., *Size, Structure, and Future of Farms* (Ames: Iowa State University Press, 1972), pp. 40-58.

2. Except where noted, all data are taken from the U.S. Censuses of Agriculture. For the purposes of this study, the best single measure of farm consolidation is average farm size. A reasonable surrogate, number of farms, would also allow easy comparison of patterns of change, but not of static patterns. More complex measures of the distribution of farm sizes (e.g., standard deviations, Lorenz curves, percentage of farms larger than a certain size) would also be useful, particularly if the concern were with the changing structure of agricultural systems. However, these statistics either are not readily available, are too complex for easy interpretation, or are difficult to present cartographically for a large region through five decades. Moreover, use of measures of distribution would not significantly alter the overall patterns of farm consolidation—maps of average farm size and percentage of farms over 1000 acres, for example, show remarkably similar patterns. Only in situations where a very high proportion of farms are operated by part-time farmers or where large corporate farming operations have been developed would the question of distribution of farm sizes become paramount. Only about 25 percent of farm operators on the Great Plains list their principal occupation as other than farming—most of those are within commuting range of Kansas City, Denver, or Colorado Springs. Non-family corporate farming has become important in the region only since 1970 and then only in a few

locales—only 880 such farms were reported in 1982, according to the U.S. Census of Agriculture, 1982. Average farm size is the most meaningful single measure available to explicate patterns of farm consolidation.

3. Francis van Gigh and C. Leroy Quance, "The Overall Pattern of Production, Disappearance, Income, and Resource Use," Glenn L. Johnson and C. Leroy Quance, eds., *The Overproduction Trap in U.S. Agriculture* (Baltimore: The Johns Hopkins University Press, 1972), pp. 67-87; C. Leroy Quance, "Capital," Johnson and Quance, eds., *Overproduction Trap*, pp. 88-112; Venkareddy Chennareddy and Bob F. Jones, "Labor," Johnson and Quance, eds., *Overproduction Trap*, pp. 113-136.

4. C. Leroy Quance and Luther Tweeten, "Policies, 1930-1970," Ball and Heady, eds., *Size, Structure, and Future of Farms*, pp. 19-39; Richard D. Rodefeld, "The Causes of Change in Farm Technology, Size, and Organizational Structure," Richard D. Rodefeld, et al., eds., *Change in Rural America* (St. Louis: C. V. Mosby, 1978), pp. 217-237; B. F. Stanton, "Perspective on Farm Size," *American Journal of Agricultural Economics* 60 (1978): 727-737; Earl R. Swanson and Steven T. Sonka, "Technology and the Structure of U.S. Agriculture," U.S. Senate Committee on Agriculture, Nutrition, and Forestry, *Farm Structure: A Historical Perspective on Changes in the Number and Size of Farms* (Washington, D.C.: U.S. Government Printing Office, 1980), pp. 51-61; Earl O. Heady, et al., *Roots of the Farm Problem* (Ames: Iowa State University Press, 1965).

5. J. Patrick Madden, *Economies of Size in Farming* (Washington, D.C.: USDA Agricultural Economics Report 175, 1967); J. Patrick Madden and Earl J. Partenheimer, "Evidence of Economies and Diseconomies of Farm Size," Ball and Heady, eds., *Size, Structure, and Future of Farms*, pp. 91-107; Rodefeld, "Causes of Change"; Quance and Tweeten, "Policies, 1930-1970."

6. Don Paarlberg, *Farm and Food Policy: Issues of the 1980s* (Lincoln: University of Nebraska Press, 1980); Willard W. Cochrane and Mary E. Ryan, *American Farm Policy, 1948-1973* (Minneapolis: University of Minnesota Press, 1976); Quance and Tweeten, "Policies, 1930-1970"; Ball and Heady, "Trends in Size and Scale."

7. Rodefeld, "Causes of Change."

8. T. Kelley White, Jr. and George D. Irwin, "Farm Size and Specialization," Ball and Heady, eds., *Size, Structure, and Future of Farms*; Swanson and Sonka, "Technology and Structure"; Madden and Partenheimer, "Evidence of Economies and Diseconomies."

9. Wayne D. Rasmussen, "The Impact of Technological Change on American Agriculture, 1862-1962," *Journal of Economic History* 22 (1962):

578-591; Heady, et al., *Roots of the Farm Problem*; Peter Dorner, "Agriculture within the U.S. Economy: Integration and Interdependence," U.S. Senate Committee, *Farm Structure*, pp. 51-61; Swanson and Sonka, "Technology and Structure"; Philip M. Raup, "The Impact of Trends in the Farm Firm on Community and Human Welfare," in J. R. Brake, ed., *Emerging and Projected Trends Likely to Influence the Structure of Midwest Agriculture, 1970-1985* (Iowa City: University of Iowa Agricultural Law Center, Monograph No. 11, 1970).

10. Quance, "Capital"; Chennareddy and Jones, "Labor."

11. Gilbert C. Fite, *The Farmer's Frontier, 1865-1900* (New York: Holt, Rinehart and Winston, 1966); Leslie Hewes, "The Great Plains One Hundred Years after Major John Wesley Powell," Brian W. Blouet and Merlin P. Lawson, eds., *Images of the Plains* (Lincoln: University of Nebraska Press, 1975), pp. 203-214.

12. Louis D. Thompson, "Weather and Technology in the Production of Corn in the U.S. Corn Belt," *Agronomy Journal* 61 (1969): 453-456.

13. Robert E. Ankli, "Horses vs. Tractors on The Corn Belt," *Agricultural History* 54 (1980): 134-148; Zvi Griliches, "Hybrid Corn and the Economics of Innovation," *Science* 132 (26 July 1960); Heady, et al., *Roots of the Farm Problem*.

14. Gilbert C. Fite, "Great Plains Farming: A Century of Change and Adjustment," *Agricultural History* 51 (1977): 244-256.

15. White and Irwin, "Farm Size and Specialization."

16. Ball and Heady, "Trends in Size and Scale"; Swanson and Sonka, "Technology and Structure."

17. Dorner, "Agriculture within the U. S. Economy"; U.S. Bureau of the Census, *Historical Statistics of the United States* (Washington, D.C.: Government Printing Office, 1975).

18. Swanson and Sonka, "Technology and Structure."

19. See also Howard F. Gregor, *Industrialization of U.S. Agriculture: An Interpretative Atlas* (Boulder: Westview Press, 1982).

20. Heady, et al., *Roots of the Farm Problem*; Ankli, "Horses vs. Tractors."

21. Swanson and Sonka, "Technology and Structure"; U.S. Censuses of Agriculture.

22. Leslie Hewes, *The Suitcase Farming Frontier* (Lincoln: University of Nebraska Press, 1973).

23. Quance and Tweeten, "Policies, 1930-1970."

24. Swanson and Sonka, "Technology and Structure."

25. U.S. Censuses of Agriculture; Richard E. Lonsdale and H. L. Seyler, eds., *Nonmetropolitan Industrialization* (Washington: V. H. Winston and Sons, 1979).